Docket #1218 Date Filed: 5/1/2024

IN THE UNITED STATES BANKRUPTCY COURT
SOUTHERN DISTRICT OF TEXAS
HOUSTON DIVISION

In re: **WESCO AIRCRAFT HOLDINGS, INC.**, *et al.*, Debtors.[1]	Chapter 11 Case No. 23-90611 (MI) (Jointly Administered)
WESCO AIRCRAFT HOLDINGS, INC., *et al.*, Plaintiffs, *v.* **SSD INVESTMENTS LTD.**, *et al.*, Defendants.	Adv. Pro. No. 23-03091 (MI)
WESCO AIRCRAFT HOLDINGS, INC., *et al.*, Plaintiffs, v. **SSD INVESTMENTS LTD.,** *et al.*, Defendants.	
SSD INVESTMENTS LTD., *et al.*, Counterclaim Plaintiffs, v. **WESCO AIRCRAFT HOLDINGS, INC.,** *et al.*, Counterclaim Defendants.	
LANGUR MAIZE, L.L.C., Crossclaim Plaintiff, v. **PLATINUM EQUITY ADVISORS, LLC,** *et al.*, Crossclaim Defendants.	
LANGUR MAIZE, L.L.C., Third-Party Plaintiff, v. **UNNAMED PLATINUM FUNDS c/o PLATINUM EQUITY ADVISORS, LLC**, *et al.*, Third-Party Defendants.	
LANGUR MAIZE, L.L.C., Counterclaim Plaintiff, v. **WESCO AIRCRAFT HOLDINGS, INC.**, *et al.*, Counterclaim Defendants.	

[1] The Debtors operate under the trade name Incora and have previously used the trade names Wesco, Pattonair, Haas, and Adams Aviation. A complete list of the Debtors in these chapter 11 cases, with each one's federal tax identification number and the address of its principal office, is available on the website of the Debtors' noticing agent at http://www.kccllc.net/Incora/. The service address for each of the Debtors in these cases is 2601 Meacham Blvd., Ste. 400, Fort Worth, TX 76137.

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THE OFFICIAL COMMITTEE OF UNSECURED CREDITORS'
WITNESS AND EXHIBIT LIST FOR MAY 3, 2024

The Official Committee of Unsecured Creditors in the above-captioned case (the "**Committee**"), hereby submits this list of witnesses and exhibits (the "**Witness and Exhibit List**") for the trial (the "**Trial**") to be held on May 3, 2024, at 10:30 a.m. (Central), before the Honorable Marvin Isgur, United States Bankruptcy Judge, 515 Rusk Street, Courtroom 4, Houston, Texas 77002.

The Committee designates the following witnesses and exhibits that may be offered at Trial:

WITNESSES

1. Joseph Denham
2. Any expert(s) to address issues raised by outstanding standing motions to be tried as part of Adversary Proceeding
3. Any witness listed, offered, or called by any other party
4. Any witness necessary to authenticate a document
5. Any witness required for rebuttal or impeachment

EXHIBITS[2]

Exhibit No.	ECF No.	Description	Offered	Objection	Admitted	Date
UCC-92		Excel spreadsheet listing trading data for 2024 Secured from 12/28/21 to 4/29/2022 from FINRA and Bloomberg. (WESCO_UCC00000002)				N/A
UCC-93		AAR Corp 8K Dec 21 (WESCO_UCC00000003-17)				12/21/2021
UCC-94		AAR Corp 10Q 3Q22 (WESCO_UCC00000018-49)				3/22/2022

[2] The exhibits and list of witnesses in this Witness and Exhibit List supplement the Committee's previously filed witness and exhibit lists. For ease of reference, the Committee is omitting exhibit nos. UCC-1 – UCC-91. A full list of previously filed exhibits can be found in *The Official Committee of Unsecured Creditors' Fourth Supplemental Witness and Exhibit List for Trial that Started on January 25, 2024* [Docket No. 776].

UCC-95		AAR Corp. – 8K Q1'22 Report (WESCO_UCC00000050-61)				9/23/2021
UCC-96		AAR Corp. 8-K – Q2'22 Report (WESCO_UCC00000062-73)				12/21/2021
UCC-97		AAR Corp. 8-K – Q4'21 Report (WESCO_UCC00000074-87)				7/20/2021
UCC-98		AAR Corp. 8-K – Q3'22 Report (WESCO_UCC00000088-101)				3/22/2022
UCC-99		AAR Corp. 2021 10-K (WESCO_UCC00000102-223)				7/20/2021
UCC-100		AAR Corp. Q1'22 10-Q (WESCO_UCC00000224-269)				9/23/2021
UCC-101		AAR Corp. Q2'22 10-Q – (WESCO_UCC00000270-317)				12/21/2021
UCC-102		Barnes Group Inc. – 8K Q1'21 Report (WESCO_UCC00000317-334)				4/30/2021
UCC-103		Barnes Group Inc. – 8-K Q2'21 Report (WESCO_UCC00000335-353)				7/30/2021
UCC-104		Barnes Group Inc. – 8K Q3'21 Report (WESCO_UCC00000354-372)				10/29/2021
UCC-105		Barnes Group Inc. – Q4'21 Report (WESCO_UCC00000373-384)				2/18/2022
UCC-106		Barnes Group Inc. 2021 10K (WESCO_UCC00000385-545)				2/22/2022
UCC-107		Barnes Group Inc. Q1'21 10-Q (WESCO_UCC00000546-603)				4/30/2021
UCC-108		Barnes Group Inc. Q2'21 10-Q (WESCO_UCC00000604-665)				7/30/2021
UCC-109		Barnes Group Inc. Q3'21 10-Q (WESCO_UCC00000666-728)				10/29/2021
UCC-110		Curtiss-Wright Corp. - Q1'22 8-K Report (WESCO_UCC00000729-747)				3/31/2022
UCC-111		Curtiss-Wright Corp. – Q2'22 8K Report (WESCO_UCC00000748-767)				8/3/2022
UCC-112		Curtiss-Wright Corp. – Q3'22 10-Q (WESCO_UCC00000768-821)				11/3/2022

UCC-113		Curtiss-Wright Corp. - Q4'22 8-K Report (WESCO_UCC00000822-844)				2/21/2023
UCC-114		Curtiss-Wright Corp. 8-K Q3'22 Report (WESCO_UCC00000845-867)				11/2/2022
UCC-115		Curtiss-Wright Corp. 2022 10-K (WESCO_UCC00000868-1011)				2/22/2023
UCC-116		Curtiss-Wright Corp. Q1'22 10-Q (WESCO_UCC00001012-1057)				5/5/2022
UCC-117		Curtiss-Wright Corp. Q2'22 10-Q (WESCO_UCC00001058-1109)				8/4/2022
UCC-118		Genuine Parts & Co. 2021 10K (WESCO_UCC00001110-1248)				2/12/2022
UCC-119		Genuine Parts Co. Q1'21 10-Q (WESCO_UCC00001249-1285)				4/22/2021
UCC-120		Genuine Parts Co. Q2'21 10-Q (WESCO_UCC00001286-1328)				7/22/2021
UCC-121		Genuine Parts Co. Q3'21 10-Q (WESCO_UCC00001329-1369)				10/21/2021
UCC-122		Kaman 10K 2021 (WESCO_UCC00001370-1503)				2/24/2022
UCC-123		Kaman Corp. – 8-K Q1'21 Report (WESCO_UCC00001504-1523)				5/4/2021
UCC-124		Kaman Corp. – 8-K Q2'21 Report (WESCO_UCC00001524-1545)				8/5/2021
UCC-125		Kaman Corp. – 8-K Q3'21 Report (WESCO_UCC00001546-1565)				11/2/2021
UCC-126		Kaman Corp. – 8-K Q4'21 (WESCO_UCC00001566-1589)				2/24/2022
UCC-127		Kaman Corp. – Q1'21 10-Q (WESCO_UCC00001590-1655)				5/4/2021
UCC-128		Kaman Corp. – Q2'21 10-Q (WESCO_UCC00001656-1726)				8/5/2021
UCC-129		Kaman Corp. – Q3'21 10-Q (WESCO_UCC00001727-1799)				11/2/2021

UCC-130		PowerPoint Presentation regarding Kaman: J.P. Morgan Industrials Conference (WESCO_UCC00001800-1827)				3/17/2022
UCC-131		Moog 10Q Q1'22 (WESCO_UCC00001828-1876)				1/28/2022
UCC-132		MOOG FY22 Q1 Supplemental (WESCO_UCC00001877-1880)				1/28/2022
UCC-133		Moog, Inc. – Q2'21 10-Q (WESCO_UCC00001881-1939)				4/30/2021
UCC-134		Moog, Inc. – Q3'21 10-Q (WESCO_UCC00001940-2000)				7/30/2021
UCC-135		Moog, Inc. 2021 10-K (WESCO_UCC00002001-2138)				11/15/2021
UCC-136		Moog Press Release (WESCO_UCC00002139)				1/28/2022
UCC-137		Moog Q1 Press Release (WESCO_UCC00002140-2148)				1/28/2022
UCC-138		MSC Industrial Direct Co., Inc. Q1'22 10-Q – (WESCO_UCC00002149-2182)				12/22/2021
UCC-139		MSC Industrial Direct Co., Inc. Q2'21 10-Q (WESCO_UCC00002183-2221)				4/7/2021
UCC-140		MSC Industrial Direct Co., Inc. Q3'21 10-Q (WESCO_UCC00002222-2262)				7/7/2021
UCC-141		MSC Industrial Direct Co., Inc.2021 10-K (WESCO_UCC00002140-2343)				10/20/2021
UCC-142		Q1'22 10Q_MSC Industrial Direct Co (WESCO_UCC00002344-2377)				12/22/2021
UCC-143		Triumph Group Inc. – 8-K Q1'22 Report (WESCO_UCC00002378-2394)				8/4/2021
UCC-144		Triumph Group Inc. – 8-K Q2'22 Report (WESCO_UCC00002395-2413)				11/9/2021
UCC-145		Triumph Group Inc. – 8-K Q3'22 Report (WESCO_UCC00002414-2429)				2/9/2022
UCC-146		Triumph Group Inc. – 8-K Q4'21 Report (WESCO_UCC00002430-2445)				5/20/2021

UCC-147		Triumph Group Inc. – 2021 10-K (WESCO_UCC00002446-2566)				5/20/2021
UCC-148		Triumph Group Inc. – Q1'22 10-Q (WESCO_UCC00002567-2618)				8/4/2021
UCC-149		Triumph Group Inc. – Q2'22 10-Q (WESCO_UCC00002619-2686)				11/8/2021
UCC-150		Triumph Group Inc. – Q3'22 10-Q (WESCO_UCC00002687-2745)				2/8/2022
UCC-151		W.W. Grainger Inc. - Q1'21 10-Q (WESCO_UCC00002746-2787)				4/30/2021
UCC-152		W.W. Grainger Inc. Q2'21 10-Q (WESCO_UCC00002788-2837)				7/30/2021
UCC-153		W.W. Grainger Inc. Q3'21 10-Q (WESCO_UCC00002838-2892)				10/29/2021
UCC-154		WW Grainger 10K FY2021 (WESCO_UCC00002893-2970)				2/23/2022
UCC-155		RBC Capital Markets report titled "AAR Corp: Fiscal3Q22 reflects steady improvement, management sees FY23 top-line inflection." (WESCO_UCC00002971-87)				3/22/2022
UCC-156		Truist report titled "AAR Corp. (AIR): Strong Margin Performance; USM Inflection Appears to be Coming into Focus." (WESCO_UCC00002988-96)				12/20/2022
UCC-157		Truist report titled "AAR Corp. (AIR): Previewing F3Q22 Results; Look for Modest Topline Headwinds." (WESCO_UCC00002997-3005)				3/14/2022
UCC-158		Oppenheimer report titled, "Barnes Group Inc." (WESCO_UCC00003006-19)				4/29/2022
UCC-159		Truist report titled, "Barnes Group Inc. (B)" (WESCO_UCC00003020-29)				4/29/2022
UCC-160		UBS report titled, "Barnes Group Inc" (WESCO_UCC00003030)				2/21/2022
UCC-161		Truist report titled, "Curtiss-Wright Corporation (CW)" (WESCO_UCC00003031-40)				2/24/2022

UCC-162		UBS report titled, "Curtiss-Wright Corp" (WESCO_UCC00003041)				2/24/2022
UCC-163		William Blair report titled, "Curtiss-Wright Corporation" (WESCO_UCC00003042-55)				2/24/2022
UCC-164		CSG-CIMB report titled, "Genuine Parts Company (GPC-NYSE)" (WESCO_UCC00003056-68)				3/28/2022
UCC-165		Guggenheim report titled, "GPC – 4Q21 Recap – Auto & Industrial Organic Growth Outlook Positive, Margin Outlook More Muted – Remain NEUTRAL" (WESCO_UCC00003069-74)				2/22/2022
UCC-166		JPMorgan report titled, "Genuine Parts Company" (WESCO_UCC00003075-87)				2/18/2022
UCC-167		Raymond James report titled, "Genuine Parts Company (GPC-NYSE)" (WESCO_UCC00003088-96)				3/28/2022
UCC-168		Wedbush report titled, "Genuine Parts Company (GPC)" (WESCO_UCC00003097-3108)				2/18/2022
UCC-169		JPMorgan report titled, "Kaman Corp: The $600mn Question" (WESCO_UCC00003109-118)				8/13/2019
UCC-170		JPMorgan report titled, "Kaman Corp: First look at Q4 Earnings" (WESCO_UCC00003119-126)				2/24/2022
UCC-171		JPMorgan report titled, "Kaman Corp: JPM Industrials Conference Takeaway" (WESCO_UCC00003127-133)				3/16/2022
UCC-172		JPMorgan report titled, "Kaman Corp: First look at Q1 Earnings" (WESCO_UCC00003134-140)				5/02/2022
UCC-173		JPMorgan report titled, "Kaman Corp: Touching Up Estimates For Better Margins" (WESCO_UCC00003141-151)				11/10/2021
UCC-174		Truist report titled, "Moog Inc. (MOG.A)" (WESCO_UCC00003152-160)				1/28/2022
UCC-175		Truist report titled, "Moog Inc. (MOG.A)" (WESCO_UCC00003161-169)				4/29/2022

UCC-176		Jefferies report titled, "MSC Industrial" (WESCO_UCC00003170-179)				12/22/2021
UCC-177		JPMorgan report titled, "MSC Industrial Direct" (WESCO_UCC00003180-189)				1/14/2022
UCC-178		Loop Capital Markets report titled, "MSC Industrial Direct Co., Inc. (MSM - $8397)" (WESCO_UCC00003190-200)				12/22/2021
UCC-179		Raymond James report titled, "MSC Industrial Direct Co., Inc. (MSM-NYSE): Company Brief" (WESCO_UCC00003201-208)				1/06/2021
UCC-180		Raymond_James report titled, "MSC Industrial Direct Co., Inc. (MSM-NYSE): Company Brief" (WESCO_UCC00003209-217)				12/22/2021
UCC-181		Raymond_James report titled, "MSC Industrial Direct Co., Inc. (MSM-NYSE): Company Comment" (WESCO_UCC00003218-233)				12/22/2021
UCC-182		Barclays report titled, "Triumph Group Inc" (WESCO_UCC00003234-3243)				2/09/2022
UCC-183		Jefferies report titled, "Triumph Group, Inc." (WESCO_UCC00003244-3271)				2/13/2022
UCC-184		Jefferies report titled, "Triumph Group, Inc." (WESCO_UCC00003272-3295)				2/05/2023
UCC-185		Jefferies report titled, "Triumph Group, Inc." (WESCO_UCC00003296-3310)				3/02/2023
UCC-186		JPMorgan report titled, "Triumph Group" (WESCO_UCC00003311-3319)				2/09/2022
UCC-187		Truist report titled, "Triumph Group, Inc. (TGI)" (WESCO_UCC00003320-3328)				5/18/2022
UCC-188		JPMorgan report titled, "WW Grainger" (WESCO_UCC00003329-3339)				2/11/2022
UCC-189		Oppenheimer report titled, "W.W. Grainger, Inc." (WESCO_UCC00003340-3351)				3/15/2022
UCC-190		Raymond_James report titled, "W.W. Grainger, Inc. (GWW-NYSE)" (WESCO_UCC00003352-3366)				2/30/2022

UCC-191		RBC Capital Markets report titled, "W.W. Grainger, Inc." (WESCO_UCC00003367-3380)				2/04/2022
UCC-192		UBS report titled, "W.W. Grainger Inc." (WESCO_UCC00003381)				2/03/2022
UCC-193		Wolfe Research report titled, "W.W. Grainger (GWW)" (WESCO_UCC00003382-3400)				4/19/2022
UCC-194		Excel spreadsheet titled, "(Regional Risk Premium) Revenue by Geography Q1'22 (2024.02.29)" (WESCO_UCC00003401)				2/29/2024
UCC-195		Excel spreadsheet titled, "2.1.1.2 E.4 PEO Incora Geography P&L, Adj EBITDA, & CF 2022 Monthly" (WESCO_UCC00003402) **FILED UNDER SEAL**				N/A
UCC-196		Screen Capture titled, "Equity Risk Premium Bloomberg" (WESCO_UCC00003403)				3/28/2022
UCC-197		Damodaran (NYU) Corporate Marginal Tax Rates – By Country (WESCO_UCC00003404-3407)				1/2024
UCC-198		Excel spreadsheet titled, "Regional_Risk_Premium_by_Country" (WESCO_UCC00003408)				N/A
UCC-199		Screen Capture titled, "Equity Risk Premium Kroll" (WESCO_UCC00003409)				N/A
UCC-200		Screen Capture titled, "Risk Free Rate Kroll" (WESCO_UCC00003410)				N/A
UCC-201		Screen Capture titled, "Size Premium Kroll" (WESCO_UCC00003411)				N/A
UCC-202		Congressional Budget Office, Long-Term Implications of the 2021 Future Years Defense Program, September 2020 (WESCO_UCC00003412-3434)				9/2020
UCC-203		Congressional Budget Office, The Long Term Budget Outlook, July 2022 (WESCO_UCC00003435-3503)				7/2022

UCC-204		FAA Aerospace Forecast Fiscal Years 2022-2042 (WESCO_UCC00003504-3647)				6/28/2022
UCC-205		CVC article titled, "Proposed sale of Ontic for $1,365 million to CVC Fund VII" (WESCO_UCC00003648-3652)				7/30/2019
UCC-206		Fitch Ratings article titled, "Fitch Affirms TransDigm at 'B' on Announcement of Esterline Acquisition" (WESCO_UCC00003653-3663)				10/11/2018
UCC-207		Presentation titled, "TransDigm's Acquisition of Esterline Technologies" (WESCO_UCC00003664-3672)				10/10/2018
UCC-208		Reuters article titled, "Esterline Technologies exploring potential sale – sources" (WESCO_UCC00003673-3682)				7/20/2018
UCC-209		JefferiesLLC Equity Research: TRANS(digm) forming Into Deal Close (WESCO_UCC00003683-3702)				11/21/2018
UCC-210		Business Wire article titled, "Kaman Completes Sale of Distribution Segment to Littlejohn & Co." (WESCO_UCC00003703)				8/26/2019
UCC-211		Kaman Investor Presentation: Sale of Distribution (WESCO_UCC00003704-3713)				6/26/2019
UCC-212		Mergermarket article titled, "Ontic sale result of PE-heavy auction, sources say" (WESCO_UCC00003714-3715)				8/08/2019
UCC-213		PRNewsire article titled, "TransDigm to Acquire Esterline Technologies in $4 Billion All Cash Transaction" (WESCO_UCC00003716-3721)				10/10/2018
UCC-214		Esterline 10K Filed Nov-2018 (WESCO_UCC00003722-3819)				11/21/2018
UCC-215		Esterline Schedule 14A (WESCO_UCC00003820-3956)				11/07/2018
UCC-216		KLX - Definitive Merger Agreement (WESCO_UCC00003957-4287)				7/25/2018
UCC-217		KLX Aerospace Schedule 14A (WESCO_UCC00004288-4605)				6/26/2018

UCC-218		Merger Agreement Esterline (WESCO_UCC00004606-4730)				10/09/2018
UCC-219		Wesco Aircraft Holdings, Inc Schedule 14A (WESCO_UCC00004731-4999) **FILED UNDER SEAL**				9/13/2019
UCC-220		PowerPoint Presentation regarding Incora Noteholder Presentation (WESCO_UCC00005000-5040) **FILED UNDER SEAL**				3/2023
UCC-221		PowerPoint Presentation regarding Incora Cleansing Presentation (WESCO_UCC00005041-5057) **FILED UNDER SEAL**				3/29/2022
UCC-222		PowerPoint Presentation regarding Incora Business Plan Overview (WESCO_UCC00005058-5080) **FILED UNDER SEAL**				2/26/2024
UCC-223		Excel spreadsheet titled, "Business_Plan_Output_Wesco_2004_0041404" (WESCO_UCC00005081) **FILED UNDER SEAL**				N/A
UCC-224		ECF No. 13, Declaration of Raymond Carney in Support of Chapter 11 Petitions and First Day Motions (WESCO_UCC00005082-5170)				6/01/2023
UCC-225		Excel spreadsheet titled, "Preservation_Case_Wesco_2004_0041384" (WESCO_UCC00005071) **FILED UNDER SEAL**				N/A
UCC-226		Excel spreadsheet titled, "Project Boost_Diligence (S&U March 2022)" (WESCO_UCC00005072) **FILED UNDER SEAL**				N/A
UCC-227		Feb. 20, 2022 Board Meeting Minutes for Wolverine Intermediate Holding Corporation and associated materials WESCO_QE_2004_00031864 (WESCO_UCC00005073-5094) **FILED UNDER SEAL**				2/20/2022

UCC-228		Mar. 24, 2022 Board Meeting Minutes for Wolverine Intermediate Holding Corporation and associated materials WESCO_QE_UCC_2004_00032032 (WESCO_UCC00005085-5114) **FILED UNDER SEAL**				3/24/2022
UCC-229		Moody's Investors Report titled, "Sector In-Depth: Corporates – North America" (WESCO_UCC00005115-5132)				10/06/2022
UCC-230		S&P Global Report titled, "Industry Top Trends 2022: Aerospace and Defense" (WESCO_UCC00005133-5145)				1/25/2022
UCC-231		FINRA Fixed Income Data for 2027 Notes (Denham Exhibit 11)				4/26/2024
UCC-232		Expert Report of Joseph Denham **FILED UNDER SEAL**				2/29/2024
UCC-233		Trial Demonstrative 1 **FILED UNDER SEAL**				N/A
UCC-234		Trial Demonstrative 2 **FILED UNDER SEAL**				N/A
UCC-235		Trial Demonstrative 3 **FILED UNDER SEAL**				N/A
UCC-236		Trial Demonstrative 4 **FILED UNDER SEAL**				N/A
UCC-237		Trial Demonstrative 5 **FILED UNDER SEAL**				N/A
UCC-238		Trial Demonstrative 6 **FILED UNDER SEAL**				N/A
UCC-239		Trial Demonstrative 7 **FILED UNDER SEAL**				N/A
UCC-240		Trial Demonstrative 8 **FILED UNDER SEAL**				N/A
UCC-241		Trial Demonstrative 9 **FILED UNDER SEAL**				N/A
UCC-242		Trial Demonstrative 10 **FILED UNDER SEAL**				N/A

UCC-243		Trial Demonstrative 11 **FILED UNDER SEAL**				N/A
UCC-244		Trial Demonstrative 12 **FILED UNDER SEAL**				N/A
UCC-245		Trial Demonstrative 13 **FILED UNDER SEAL**				N/A
UCC-246		Trial Demonstrative 14 **FILED UNDER SEAL**				N/A
UCC-247		Trial Demonstrative 15 **FILED UNDER SEAL**				N/A
UCC-248		Trial Demonstrative 16 **FILED UNDER SEAL**				N/A
UCC-249		Trial Demonstrative 17 **FILED UNDER SEAL**				N/A
UCC-250		Trial Demonstrative 18 **FILED UNDER SEAL**				N/A
UCC-251		Trial Demonstrative 19 **FILED UNDER SEAL**				N/A
UCC-252		Trial Demonstrative 20 **FILED UNDER SEAL**				N/A
UCC-253		Trial Demonstrative 21 **FILED UNDER SEAL**				N/A
UCC-254		Trial Demonstrative 22 **FILED UNDER SEAL**				N/A
UCC-255		Trial Demonstrative 23 **FILED UNDER SEAL**				N/A
		Any pleading on file in these cases				
		Any exhibits listed, designated, or offered by any other party				
		Any exhibits necessary for rebuttal				

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The Committee reserves the right to modify, amend or supplement this Witness and Exhibit List and to offer any exhibit on any other parties' exhibit list. The Committee reserves the right to ask the Court to take judicial notice of pleadings, orders, transcripts, and/or other documents filed in or in connection with these Cases, and to offer rebuttal exhibits. Designation of any exhibit above does not waive any objections the Committee may have to any exhibit listed on any other party's exhibit list.

Dated: May 1, 2024

Respectfully submitted,

MCDERMOTT WILL & EMERY LLP

<u>/s/ Charles R. Gibbs</u>
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- *and* -

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CERTIFICATE OF SERVICE

I certify that on May 1, 2024, I caused a copy of the foregoing document to be served by the Electronic Case Filing System for the United States Bankruptcy Court for the Southern District of Texas.

/s/ Charles R. Gibbs
Charles R. Gibbs

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Moog Inc. (MOG.A)

Outlook Reaffirmed But Cash Generation will be a Watch Item

What's Incremental To Our View

We maintain our BUY rating and $88 PT on MOGA post F1Q22. Mixed results were accompanied by a reaffirmed FY22 outlook, although MOG.A now expects adj FCF conversion to be weak at ~44%. Elevated investment, capex, the wind-down of COVID cash tailwinds, and extended credit terms are all proving to be cash headwinds. Margins were pressured by inflation-related costs and supply chain disruptions but should expand in the coming periods. Trading at 13x our CY23 EPS estimate we believe MOG.A shares screen well in the current rising rate/growth pressured environment using our DCF sensitivity analysis.

F1Q22 Results Recap: Total revenues of $724M beat the consensus estimate of $708M and increased 5.8% YOY. By segment, Aircraft Controls revenue of $303M grew 6% YOY and beat consensus of $294M. Space and Defense revenue increased 10% YOY, beating the Street's $200M estimate at $208M. Industrial Systems revenue of $213M fell short of the $226M Street estimate but grew 2% YOY. Total corporate adj. operating margins of 9.1% dipped 130bps YOY and were down 70bps seq'l. Aircraft control segment adj. operating margins of 8.5% were down 120bps YOY and down 30bps seq'l. Space and defense adjusted operating margins of 11% were down 120bps YOY but up 40bps seq'l. Industrial systems adj. operating margins of 8.1% were down 140bps YOY and down 230bps seq'l. Adjusted EPS of $1.11 fell a penny short of the Street's $1.12 estimate. Adjusted FCF of $31M significantly missed the Street's $98M estimate.

F1Q22 Key Takeaways:

- **Margins still pressured, internal investments a watch item.** Operating margins dipped 130 bps YOY with declines of over 100 bps in all segments. Management called out a variety of headwinds, including a tight labor market, supply chain constraints, and continued low throughput in Commercial Aero, noting the segment is relatively exposed to wide body aircraft that have not yet recovered. Additionally, management indicated that it is focused on using capital on internal investments aimed at creating long-term value, through investments in new products and technologies, as well as upgraded infrastructure and facilities, which we believe will weigh on margins to a degree near-term. We do anticipate that margins will begin to improve on a seq'l and YOY basis in fiscal 2Q.
- **Inflationary environment likely to be an additional headwind to margins.** MOG.A provided fiscal 2Q EPS guidance of $1.30 +/- $0.15, in our view a wide range that reflects ongoing uncertainty about the impact of supply chain constraints and cost inflation on near-term earnings. MOG.A noted that it has little power to pass higher costs through in pricing on the aerospace side, both for OE and aftermarket, and would generally only be able to pass costs through on the military side with a lag as contracts are negotiated annually. We believe the company has more power to raise prices in its industrial business, which represents ~30% of sales.

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SEE PAGE 7 FOR REQUIRED DISCLOSURE INFORMATION

Buy

Price Target: $88.00
Prior: $88.00

Price (Jan. 27, 2022)	$72.99
52-Wk Range	$91.54-$67.77
Market Cap ($M)	$2,359
ADTV	83,812
Shares Out (M)	32.3
Short Interest Ratio/% Of Float	2.0%
Dividend/Yield	$1.00/1.4%
TR to Target	21.9%
Enterprise Value ($M)	$3,027.9

Cash & Equivalents ($M)	$106.7
Total Debt ($M)	$775.6

	2021A	2022E		2023E	
		Curr.	Prior	Curr.	Prior
EPS					
1Q	$1.17	$1.11A	$1.11	$1.27	$1.18
2Q	$1.51	$1.21	$1.30	$1.44	$1.45
3Q	$1.12	$1.37	$1.37	$1.51	$1.52
4Q	$1.17	$1.56	$1.47	$1.63	$1.65
FY	$4.97	$5.24	$5.24	$5.84	$5.80
Consensus EPS					
FY	--	$5.50		$5.93	
EPS					
CY	--	$5.41	$5.31	--	
P/E	--	13.5x		12.5x	
FYE Sep					

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- **Cash generation guidance for FY22 is underwhelming in our view.** MOG.A's prior GAAP FCF guidance of $178M is unchanged but the adj FCF guidance of $78M removes the $100M benefit of A/R securitization. The company expects cash generation in FY22 to benefit from ~$100M of customer advances and underlying adj FCF is admittedly weak in our view. Management indicated that the prior cash flow benefits tied to COVID-related relief are unwinding which, when coupled with elevated capex, investment and extended credit terms, are creating the pressure.

Estimates largely unchanged. We are making minimal changes to our FY22/23 estimates, detailed below:

	2022E		2023E	
MOG.A Truist Securities Ests	**New**	**Prior**	**New**	**Prior**
$ in millions except per-share items				
Revenue	**$3,025.5**	**$3,009.4**	**$3,157.4**	**$3,137.7**
Consensus	$3,027.7		$3,143.1	
FY EPS	**$5.24**	**$5.24**	**$5.84**	**$5.80**
CY EPS	**$5.41**	**$5.31**	**n/a**	**n/a**
Consensus	$5.50		$5.93	
FY Trading P/E Multiple	**14.5x**	**14.5x**	**13.0x**	**13.1x**
CY Trading P/E Multiple	**14.1x**	**14.3x**	**n/a**	**n/a**
Price Target	$88.00	$88.00	$88.00	$88.00
Implied FY P/E Multiple	**16.8x**	**16.8x**	**15.1x**	**15.2x**

Source: Company filings, FactSet, Truist Securities research and estimates

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Moog Inc. Class A (NYSE:MOG.A)

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($MM, except per-share data)
Source: Company filings and Truist Securities research and estimates
"Required Disclosures" are on the last tab of the workbook

Last Updated: 1/28/2022

Income Statement (in millions, except per share values)	F2014	F2015	F2016	F2017	F2018	F2019	F2020	Dec	Mar	Jun	Sep	F2021	Dec	MarE	JunE	SepE	F2022E	F2023E
Total Revenue	**2,648.385**	**2,525.532**	**2,411.938**	**2,761.220**	**2,709.468**	**2,904.663**	**2,884.554**	**683.954**	**736.402**	**707.352**	**724.285**	**2,851.993**	**724.086**	**756.423**	**752.749**	**792.281**	**3,025.540**	**3,157.358**
Cost of Sales	1,850.809	1,788.828	1,700.354	1,766.002	1,936.481	2,088.831	2,118.150	494.311	536.493	516.750	528.716	2,076.270	531.206	529.496	519.397	546.674	2,126.773	2,178.577
Gross Profit	**797.576**	**736.704**	**711.584**	**995.218**	**772.987**	**815.832**	**766.404**	**205.186**	**220.921**	**212.206**	**195.569**	**833.881**	**192.880**	**226.927**	**233.352**	**245.607**	**898.766**	**978.781**
Research & Development Expense	139.462	132.271	147.336	144.646	130.186	126.453	110.865	28.008	30.453	33.095	33.972	125.528	27.708	49.700	47.950	48.970	174.329	203.613
S,G,&A (includes corporate & other)	403.487	371.498	339.961	356.141	393.759	404.653	397.947	99.603	105.131	100.597	106.697	412.028	111.797	115.968	117.396	119.891	465.052	486.660
Total Operating Expenses	*542.949*	*503.769*	*487.297*	*500.787*	*523.945*	*531.106*	*508.812*	*146.395*	*150.164*	*155.372*	*144.285*	*537.556*	*123.475*	*165.668*	*165.346*	*168.861*	*639.381*	*690.273*
Operating Income (includes all expenses)	**231.436**	**212.797**	**207.467**	**216.262**	**220.075**	**273.027**	**44.314**	**58.791**	**70.757**	**56.834**	**51.284**	**237.666**	**69.405**	**61.259**	**68.006**	**76.746**	**275.416**	**288.508**
Interest Expense	12.513	28.967	34.605	34.551	36.238	39.269	38.897	8.420	8.629	8.239	8.604	33.892	7.982	9.000	9.000	9.000	34.982	36.000
Other	(1.389)	3.801	(3.372)	14.473	29.708	11.699	190.570	3.241	(6.432)	0.076	3.616	0.501	(16.030)	3.250	3.250	3.250	(6.280)	13.000
Earnings Before Income Taxes	**218.923**	**183.830**	**172.862**	**181.711**	**183.837**	**233.758**	**5.417**	**50.371**	**62.128**	**48.595**	**42.680**	**203.774**	**61.423**	**52.259**	**59.006**	**67.746**	**240.434**	**252.508**
Provision for Income Taxes	60.725	51.951	49.227	41.301	87.209	54.010	(3.788)	12.529	13.440	12.473	8.112	46.554	15.158	13.326	15.047	17.614	61.144	65.652
Net Income attributable to common/noncontrolling	**-**	**-**	**123.635**	**140.410**	**96.628**	**179.748**	**9.205**	**37.842**	**48.688**	**36.122**	**34.568**	**157.220**	**46.265**	**38.933**	**43.960**	**50.132**	**179.289**	**186.856**
Net earnings attributable to noncontrolling	-	-	(3.112)	(0.870)	0.121	-	-	-	-	-	-	-	-	-	-	-	-	-
Net Income	**158.198**	**131.879**	**126.747**	**141.280**	**96.507**	**179.748**	**9.205**	**37.842**	**48.688**	**36.122**	**34.568**	**157.220**	**46.265**	**38.933**	**43.960**	**50.132**	**179.289**	**186.856**
Weighted average shares - diluted	44.952	39.335	36.529	36.230	36.052	35.179	33.438	32.237	32.325	32.355	32.325	32.311	32.188	32.158	32.128	32.098	32.143	32.023
Diluted EPS	**$3.52**	**$3.35**	**$3.47**	**$3.90**	**$4.56**	**$5.11**	**$4.68**	**$1.17**	**$1.51**	**$1.12**	**$1.17**	**$4.97**	**$1.11**	**$1.21**	**$1.37**	**$1.56**	**$5.24**	**$5.84**
EBITDA Reconciliation																		
Operating Income	**231.436**	**212.797**	**207.467**	**216.262**	**220.075**	**273.027**	**44.314**	**58.791**	**70.757**	**56.834**	**58.184**	**237.666**	**69.405**	**61.259**	**68.006**	**76.746**	**275.416**	**288.508**
Depreciation and Amortization	109.259	103.609	98.732	90.167	88.572	85.260	86.972	21.488	22.570	22.748	23.353	90.159	22.692	23.000	23.000	23.000	91.692	95.200
EBITDA	**340.695**	**316.406**	**306.199**	**306.429**	**308.647**	**358.287**	**131.286**	**80.279**	**93.327**	**79.582**	**81.537**	**327.825**	**92.097**	**84.259**	**91.006**	**99.746**	**367.108**	**383.708**
Stock compensation expense	7.189	5.074	3.271	4.582	5.804	6.464	5.661	2.502	2.127	1.791	1.041	7.461	2.658	1.000	1.000	1.000	5.658	4.000
EBITDAS	**347.884**	**321.480**	**309.470**	**311.011**	**314.451**	**364.751**	**136.947**	**82.781**	**95.454**	**81.373**	**82.578**	**335.286**	**94.755**	**85.259**	**92.006**	**100.746**	**372.766**	**387.708**
EBITDA/Share	$7.58	$8.04	$8.38	$8.46	$8.56	$10.18	$3.93	$2.49	$2.89	$2.46	$2.52	$10.15	$2.86	$2.62	$2.83	$3.11	$11.42	$11.98
EBITDAS/Share	$7.74	$8.17	$8.47	$8.58	$8.72	$10.37	$4.10	$2.57	$2.95	$2.51	$2.55	$10.38	$2.94	$2.65	$2.86	$3.14	$11.60	$12.11
Margins																		
Corporate Gross Margin	30.1%	29.2%	29.5%	36.0%	28.5%	28.1%	26.6%	30.0%	30.0%	30.0%	30.0%	29.2%	30.0%	30.0%	31.0%	31.0%	29.7%	31.0%
Research and Development	5.3%	5.2%	6.1%	5.2%	4.8%	4.4%	3.8%	4.1%	4.1%	4.7%	4.7%	4.4%	3.8%	6.6%	6.4%	6.2%	5.8%	6.4%
SG&A	15.2%	14.7%	14.1%	12.9%	14.5%	13.9%	13.8%	14.6%	14.3%	14.2%	14.7%	14.4%	15.4%	15.3%	15.6%	15.1%	15.4%	15.4%
Operating Expenses	20.5%	19.9%	20.2%	18.1%	19.3%	18.3%	17.6%	21.4%	20.4%	22.0%	19.9%	18.8%	17.1%	21.9%	22.0%	21.3%	21.1%	21.9%
Operating Margin (GAAP)	8.7%	8.4%	8.6%	7.8%	8.1%	9.4%	1.5%	8.6%	9.6%	8.0%	7.1%	8.3%	9.6%	8.1%	9.0%	9.7%	9.1%	9.1%
EBITDA Margin	12.9%	12.5%	12.7%	11.1%	11.4%	12.3%	4.6%	11.7%	12.7%	11.3%	11.3%	11.5%	12.7%	11.1%	12.1%	12.6%	12.1%	12.2%
Net Margin	6.0%	5.2%	5.3%	5.1%	3.6%	6.2%	0.3%	5.5%	6.6%	5.1%	4.8%	5.5%	6.4%	5.1%	5.8%	6.3%	5.9%	5.9%
Tax Rate	27.7%	28.3%	28.5%	22.7%	47.4%	23.1%	-69.9%	24.9%	21.6%	25.7%	19.0%	22.8%	24.7%	25.5%	25.5%	26.0%	25.4%	26.0%
Growth Rates																		
Total Revenue, yr/yr	**1.5%**	**-4.6%**	**-4.5%**	**14.5%**	**-1.9%**	**7.2%**	**-0.7%**	-9.4%	-3.8%	7.6%	2.5%	**-1.1%**	5.9%	2.7%	6.4%	9.4%	**6.1%**	**4.4%**
Revenue Seq'l	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	-3.2%	7.7%	-3.9%	2.4%	0.0%	0.0%	4.5%	-0.5%	5.3%	0.0%	0.0%
Gross Profit, yr/yr	1.8%	-7.6%	-3.4%	39.9%	-22.3%	5.5%	-6.1%	-2.9%	6.2%	24.3%	10.9%	8.8%	-6.0%	2.7%	10.0%	25.6%	7.8%	8.9%
Research & Development, yr/yr	3.6%	-5.2%	11.4%	-1.8%	-10.0%	-2.9%	-12.3%	-0.7%	14.1%	20.8%	18.9%	13.2%	-1.1%	63.2%	44.9%	44.1%	38.9%	16.8%
Selling, General and Administrative yr/yr	1.7%	-7.9%	-8.5%	4.8%	10.6%	2.8%	-1.7%	1.3%	-2.0%	3.8%	11.8%	3.5%	12.2%	10.3%	16.7%	12.4%	12.9%	4.6%
Operating Income, yr/yr	20.6%	-8.1%	-2.5%	4.2%	1.8%	24.1%	-83.8%	-23.8%	-1.4%	-447.2%	-156.5%	436.3%	18.1%	-13.4%	19.7%	49.6%	15.9%	4.8%
EBITDA, yr/yr	13.5%	-7.1%	-3.2%	0.1%	0.7%	16.1%	-63.4%	-18.7%	-0.5%	1296.7%	-217.4%	149.7%	14.7%	-9.7%	14.4%	22.3%	12.0%	4.5%
Net Income, yr/yr	31.3%	-16.6%	-3.9%	11.5%	-31.7%	86.3%	-94.9%	-24.4%	-2.1%	-350.4%	-144.3%	1608.0%	22.3%	-20.0%	21.7%	45.0%	14.0%	4.2%
Diluted EPS, yr/yr	33.8%	-4.7%	3.5%	12.4%	16.9%	12.1%	-8.3%	-18.4%	2.0%	20.0%	43.5%	6.0%	-5.9%	-19.6%	22.6%	33.6%	5.6%	11.3%

Source: Company filings and Truist Securities research and estimates

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Moog Inc. Class A (NYSE:MOG.A)

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($MM, except per-share data)

Segment Data *(in millions, except per share values)*	F2014	F2015	F2016	F2017	F2018	F2019	F2020	Dec	Mar	Jun	Sep	F2021	Dec	MarE	JuneE	SepE	F2022E	F2023E
Segment Revenue																		
Aircraft Controls	1,117.800	1,086.300	1,063.718	1,124.885	1,193.440	1,302.750	1,205.336	286.774	304.361	272.131	297.972	1,161.274	303.317	314.031	295.366	326.492	1,239.189	1,294.565
Space and Defense Controls	394.500	381.600	366.091	529.203	580.750	683.412	769.843	188.162	206.168	204.887	200.018	799.400	207.856	217.616	223.618	229.942	879.075	915.775
Industrial Systems	591.000	521.600	514.984	843.436	935.178	918.242	908.802	209.018	225.873	230.334	226.295	891.300	212.913	224.777	233.765	235.848	907.290	947.018
Total Segment Revenue	**2,722.331**	**2,525.536**	**2,411.937**	**2,761.220**	**2,709.468**	**2,904.663**	**2,884.554**	**683.954**	**736.402**	**707.352**	**724.285**	**2,851.993**	**724.086**	**756.423**	**752.749**	**792.281**	**3,025.540**	**3,157.358**
Segment Growth - YoY:																		
Aircraft Controls	5.5%	-2.8%	-2.1%	5.8%	6.1%	9.2%	-7.5%	-15.6%	-10.9%	9.1%	8.4%	-3.7%	5.8%	3.2%	8.5%	9.6%	6.7%	4.5%
Space and Defense Controls	-0.4%	-3.3%	-4.1%	44.6%	9.7%	17.7%	12.6%	1.0%	6.8%	11.4%	-3.4%	3.8%	10.5%	5.6%	9.1%	15.0%	10.0%	4.2%
Industrial Systems	-0.2%	-11.7%	-1.3%	63.8%	10.9%	-1.8%	-1.0%	-8.6%	-2.2%	2.7%	0.6%	-1.9%	1.9%	-0.5%	1.5%	4.2%	1.8%	4.4%
Total Segment Growth	**-**	**-7.2%**	**-4.5%**	**14.5%**	**-1.9%**	**7.2%**	**-0.7%**	**-9.4%**	**-3.8%**	**7.6%**	**2.5%**	**-1.1%**	**5.9%**	**2.7%**	**6.4%**	**9.4%**	**6.1%**	**4.4%**
Segment Revenue as a % of Total:																		
Aircraft Controls	41%	43%	44%	41%	44%	45%	42%	42%	41%	38%	41%	41%	42%	42%	39%	41%	41%	41%
Space and Defense Controls	14%	15%	15%	19%	21%	24%	27%	28%	28%	29%	28%	28%	29%	29%	30%	29%	29%	29%
Industrial Systems	22%	21%	21%	31%	35%	32%	32%	31%	31%	33%	31%	31%	29%	30%	31%	30%	30%	30%
Total	***100%***	***100%***	***100%***	***109%***	***100%***	***100%***	***100%***	***100%***	***100%***	***100%***	***100%***	***100%***	***100%***	***100%***	***100%***	***100%***	***100%***	***100%***
Segment Operating Income:																		
Aircraft Controls	115.726	100.006	97.508	114.016	128.978	139.701	32.436	27.922	22.018	20.545	26.193	96.678	41.915	31.403	31.013	35.914	140.246	135.158
Space and Defense Controls	26.119	33.236	42.420	46.525	67.076	88.990	101.554	23.046	26.652	21.339	17.296	88.333	21.299	22.850	25.716	28.168	98.033	103.098
Industrial Systems	58.109	45.021	48.542	78.157	62.934	109.451	79.916	19.898	23.813	23.004	19.233	85.948	17.191	19.106	23.377	24.764	84.438	97.252
Total Segment Operating Income	**275.718**	**245.509**	**238.244**	**291.152**	**258.988**	**338.142**	**213.906**	**70.866**	**72.483**	**64.888**	**62.722**	**270.959**	**80.405**	**73.359**	**80.106**	**88.846**	**322.716**	**335.508**
Segment Operating Margin:																		
Aircraft Controls	10.4%	9.2%	9.2%	10.1%	10.8%	10.7%	2.7%	9.7%	7.2%	7.5%	8.8%	8.3%	13.8%	10.0%	10.5%	11.0%	11.3%	10.4%
Space and Defense Controls	6.6%	8.7%	11.6%	8.8%	11.5%	13.0%	13.2%	12.2%	12.9%	10.4%	8.6%	11.0%	10.2%	10.5%	11.5%	12.3%	11.2%	11.3%
Industrial Systems	9.8%	8.6%	9.4%	9.3%	6.7%	11.9%	8.8%	9.5%	10.5%	10.0%	8.5%	9.6%	8.1%	8.5%	10.0%	10.5%	9.3%	10.3%
Total Segment Operating Income	**10.1%**	**9.7%**	**9.9%**	**10.5%**	**9.6%**	**11.6%**	**7.4%**	**10.4%**	**9.8%**	**9.2%**	**8.7%**	**9.5%**	**11.1%**	**9.7%**	**10.6%**	**11.2%**	**10.7%**	**10.6%**

Source: Company filings and Truist Securities research and estimates

WESCO_UCC00003155

Moog Inc. Class A (NYSE:MOG.A)

TRUIST
Truist Securities

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($MM, except per-share data)

Balance Sheet *(in millions, except per share values)*	F2014	F2015	F2016	F2017	F2018	F2019	F2020	Dec	Mar	Jun	Sep	F2021	Dec	MarE	JunE	SepE	F2022E	F2023E
Cash and Cash Equivalents	231.292	309.853	325.128	368.073	125.584	92.548	85.072	98.334	91.012	91.658	100.914	100.914	106.726	182.155	111.807	111.202	111.202	184.366
Receivables	780.874	698.419	688.388	727.740	793.911	957.287	855.535	872.843	922.092	896.998	945.929	945.929	891.588	817.755	885.588	880.312	880.312	894.711
Inventories	517.056	493.360	479.040	489.127	512.522	534.974	623.043	646.627	636.580	632.359	613.095	613.095	597.444	661.871	659.552	716.949	716.949	692.181
Deferred income taxes	92.390	91.210	92.903	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Prepaid expenses and other current assets	42.452	34.653	34.688	41.499	44.404	44.164	49.837	47.119	48.278	49.513	58.842	58.842	63.711	59.430	64.348	60.025	60.025	61.231
Total Current Assets	**1,664.064**	**1,627.495**	**1,620.147**	**1,626.439**	**1,476.421**	**1,628.973**	**1,613.487**	**1,664.923**	**1,697.962**	**1,670.528**	**1,718.780**	**1,718.780**	**1,659.469**	**1,721.211**	**1,721.295**	**1,768.488**	**1,768.488**	**1,832.489**
Property, plant and equipment	555.348	536.756	522.369	522.991	552.865	586.767	600.498	609.358	628.550	639.202	645.778	645.778	663.498	684.498	705.498	726.498	726.498	810.498
Operating lease right of use assets							68.393	68.772	65.410	62.507	60.355	60.355	62.657	62.657	62.657	62.657	62.657	62.657
Goodwill	757.852	737.212	740.162	774.268	797.217	784.240	821.856	866.366	860.239	860.268	851.605	851.605	842.042	840.042	838.042	836.042	836.042	826.442
Intangible assets	178.070	143.723	113.560	108.818	95.537	79.646	85.046	117.717	114.820	111.867	106.095	106.095	102.220	100.220	98.220	96.220	96.220	86.620
Deferred income taxes	-	-	-	26.558	17.328	19.992	18.924	20.524	18.808	18.467	17.769	17.769	18.239	18.239	18.239	18.239	18.239	18.239
Other Assets	53.118	41.285	45.621	31.518	24.680	14.619	17.627	18.888	20.051	20.471	32.787	32.787	36.480	36.845	37.213	37.585	37.585	39.111
Total Assets	**3,208.452**	**3,086.471**	**3,041.859**	**3,090.592**	**2,964.048**	**3,114.237**	**3,225.831**	**3,366.548**	**3,405.840**	**3,383.310**	**3,433.169**	**3,433.169**	**3,384.605**	**3,463.712**	**3,481.164**	**3,545.730**	**3,545.730**	**3,676.056**
Short-term borrowings	103.660	0.083	1.379	0.089	3.623	-	-	-	-	-	-	-	-	-	-	-	-	-
Current portion of long-term debt	5.262	0.034	0.167	0.295	0.365	0.249	0.350	69.148	71.652	56.062	80.365	80.365	0.367	0.367	0.367	0.367	0.367	0.367
Accounts payable	162.667	165.973	144.450	170.878	213.982	257.677	176.868	173.256	175.061	162.890	200.602	200.602	178.158	235.332	225.825	257.258	257.258	268.729
Accrued salaries, wages and commissions	141.096	125.270	126.319	148.406	147.765	143.765	109.510	102.138	99.223	111.159	112.703	112.703	90.965	90.965	90.965	90.965	90.965	90.965
Customer advances	145.500	167.423	167.514	159.274	151.687	137.242	203.338	234.480	256.080	259.425	263.686	263.686	367.873	367.873	367.873	367.873	367.873	367.873
Contract loss reserves	35.984	30.422	32.543	43.214	42.258	57.556	-	-	-	-	-	-	-	-	-	-	-	-
Other accrued liabilities	128.635	116.300	116.860	107.278	120.944	131.169	220.488	234.840	225.915	216.625	212.005	212.005	207.375	208.375	209.375	210.375	210.375	214.375
Total Current Liabilities	**722.804**	**605.505**	**589.232**	**629.434**	**680.624**	**727.658**	**710.554**	**813.862**	**827.931**	**806.161**	**869.361**	**869.361**	**844.738**	**902.912**	**894.405**	**926.838**	**926.838**	**942.309**
Long-term debt	765.114	1,075.067	1,010.304	956.653	858.836	832.984	929.982	898.078	896.955	863.682	823.355	823.355	775.262	769.262	763.262	757.262	757.262	733.262
Senior subordinated notes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Long-term pension and retirement obligations	288.216	348.239	401.747	271.272	117.471	160.034	183.366	189.081	180.112	181.400	162.728	162.728	161.285	161.285	161.285	161.285	161.285	161.285
Deferred income taxes	83.931	60.209	42.171	13.320	46.477	40.528	40.474	47.829	48.778	54.168	64.642	64.642	74.352	74.352	74.352	74.352	74.352	74.352
Other long-term liabilities	0.972	2.919	4.343	5.609	35.654	30.552	118.372	114.454	113.607	110.694	112.939	112.939	104.545	104.545	104.545	104.545	104.545	104.545
Total Liabilities	**1,861.037**	**2,091.939**	**2,047.797**	**1,876.288**	**1,739.062**	**1,791.756**	**1,982.748**	**2,063.304**	**2,067.383**	**2,016.105**	**2,033.025**	**2,033.025**	**1,960.182**	**2,012.356**	**1,997.849**	**2,024.282**	**2,024.282**	**2,015.753**
Non-controlling Interest	-	-	5.651	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Common Stock - Class A	43.628	43.667	43.667	43.704	43.785	43.795	43.799	43.802	43.802	43.802	43.803	43.803	43.803	43.803	43.803	43.803	43.803	43.803
Common Stock - Class B	7.652	7.613	7.613	7.576	7.495	7.485	7.481	7.478	7.478	7.478	7.477	7.477	7.477	7.477	7.477	7.477	7.477	7.477
Additional paid-in capital	463.965	456.512	465.762	492.246	502.257	510.546	472.645	505.038	519.006	519.636	509.622	509.622	518.857	520.857	522.857	524.857	524.857	532.857
Retained earnings	1,447.911	1,579.794	1,706.539	1,847.819	1,973.514	2,133.328	2,112.734	2,142.566	2,183.218	2,211.305	2,237.848	2,237.848	2,276.082	2,306.015	2,340.974	2,382.106	2,382.106	2,532.962
Treasury shares	(360.445)	(701.771)	(741.700)	(739.157)	(738.494)	(769.569)	(990.783)	(1,000.795)	(1,000.389)	(1,007.754)	(1,007.506)	(1,007.506)	(1,023.086)	(1,028.086)	(1,033.086)	(1,038.086)	(1,038.086)	(1,058.086)
Stock Employee Compensation Trust	(48.458)	(44.211)	(49.463)	(89.919)	(118.449)	(111.492)	(64.242)	(78.597)	(85.034)	(85.314)	(79.776)	(79.776)	(82.721)	(82.721)	(82.721)	(82.721)	(82.721)	(82.721)
Supplemental Retirement Plan Trust	-	(5.337)	(8.946)	(12.474)	(72.941)	(71.546)	(53.098)	(65.986)	(70.047)	(69.448)	(63.764)	(63.764)	(66.094)	(66.094)	(66.094)	(66.094)	(66.094)	(66.094)
Accumulated other comprehensive loss	(206.838)	(341.735)	(435.061)	(335.491)	(372.181)	(420.066)	(285.453)	(250.262)	(259.577)	(252.500)	(247.560)	(247.560)	(249.895)	(249.895)	(249.895)	(249.895)	(249.895)	(249.895)
Total Shareholders Equity	**1,347.415**	**994.532**	**988.411**	**1,214.304**	**1,224.986**	**1,322.481**	**1,243.083**	**1,303.244**	**1,338.457**	**1,367.205**	**1,400.144**	**1,400.144**	**1,424.423**	**1,451.356**	**1,483.315**	**1,521.447**	**1,521.447**	**1,660.303**
Total Liabilities & Shareholders Equity	**3,208.452**	**3,086.471**	**3,041.859**	**3,090.592**	**2,964.048**	**3,114.237**	**3,225.831**	**3,366.548**	**3,405.840**	**3,383.310**	**3,433.169**	**3,433.169**	**3,384.605**	**3,463.712**	**3,481.164**	**3,545.730**	**3,545.730**	**3,676.056**
Total cash	231.292	309.853	325.128	368.073	125.584	92.548	85.072	98.334	91.012	91.658	100.914	100.914	106.726	182.155	111.807	111.202	111.202	184.366
Total debt	(874.036)	(1,075.184)	(1,011.850)	(957.037)	(862.824)	(833.233)	(930.332)	(967.226)	(968.607)	(919.744)	(903.720)	(903.720)	(775.629)	(769.629)	(763.629)	(757.629)	(757.629)	(733.629)
Net cash (debt)	**(642.744)**	**(765.331)**	**(686.722)**	**(588.964)**	**(737.240)**	**(740.685)**	**(845.260)**	**(868.892)**	**(877.595)**	**(828.086)**	**(802.806)**	**(802.806)**	**(668.903)**	**(587.474)**	**(651.822)**	**(646.427)**	**(646.427)**	**(549.263)**
Blended average interest rate	1.4%	2.7%	3.4%	3.6%	4.2%	4.7%	4.2%	3.5%	3.6%	3.6%	3.8%	3.8%	4.1%	4.7%	4.7%	4.8%	4.6%	4.9%
Net cash (debt) per share	$ (14.30)	$ (19.46)	$ (18.80)	$ (16.26)	$ (20.45)	$ (21.05)	$ (25.28)	$ (26.95)	$ (27.15)	$ (25.59)	$ (24.84)	$ (24.85)	$ (20.78)	$ (18.27)	$ (20.29)	$ (20.14)	$ (20.11)	$ (17.15)
Net working capital per share	$ 20.94	$ 25.98	$ 28.22	$ 27.52	$ 22.07	$ 25.62	$ 27.00	$ 26.40	$ 26.91	$ 26.71	$ 26.28	$ 26.29	$ 25.31	$ 25.45	$ 25.74	$ 26.22	$ 26.18	$ 27.80
Tangible book per share	$ 9.15	$ 2.89	$ 3.69	$ 9.14	$ 9.22	$ 13.04	$ 10.05	$ 9.90	$ 11.24	$ 12.21	$ 13.69	$ 13.69	$ 14.92	$ 15.89	$ 17.03	$ 18.36	$ 18.33	$ 23.33
Book value per share	$ 29.97	$ 25.28	$ 27.06	$ 33.52	$ 33.98	$ 37.59	$ 37.18	$ 40.43	$ 41.41	$ 42.26	$ 43.31	$ 43.33	$ 44.25	$ 45.13	$ 46.17	$ 47.40	$ 47.33	$ 51.85
Debt to equity with pension								0.89	0.86	0.81	0.76		0.66	0.64	0.62	0.60		
Net Debt to Total Capitalization	28.9%	37.0%	34.3%	27.1%	35.3%	34.4%	38.9%	38.3%	38.0%	36.2%	34.8%	34.8%	30.4%	26.5%	29.0%	28.4%	28.4%	22.9%
LTD-to-Capital								0.40	0.39	0.38	0.36		0.35	0.35	0.34	0.33		
Debt to ttm EBITDA								10.48	10.45	5.99	3.19		2.70	2.76	2.65	2.50		
Net Debt to EBITDA	1.9	2.4	2.2	1.9	2.4	2.1	6.4					2.4					1.8	1.4
Current ratio								2.05	2.05	2.07	1.98		1.96	1.91	1.92	1.91		
A/R Turnover								3.17	3.28	3.11	3.14		3.15	3.70	3.40	3.60		
A/R DSOs								115.30	111.21	117.33	116.09		115.78	98.65	107.35	101.39		
A/P Turnover								11.29	12.32	12.23	11.64		11.22	9.00	9.20	8.50		
Inventory Turnover								3.11	3.34	3.26	3.40		3.51	3.20	3.15	3.05		
Return on sales								5.5%	6.6%	5.1%	4.8%		6.4%	5.1%	5.8%	6.3%		

Source: Company filings and Truist Securities research and estimates

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Moog Inc. Class A (NYSE:MOG.A)

TRUIST
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($MM, except per-share data)

Cash Flow Statement *(in millions, except per share values)*	F2013	F2014	F2015	F2016	F2017	F2018	F2019	F2020	Dec	Mar	Jun	Sep	F2021	Dec	MarE	JunE	SepE	F2022E	F2023E
Cash flows from operations:																			
Net Income	120.497	158.198	131.883	123.635	140.410	96.628	179.748	9.205	37.842	48.688	36.122	34.568	157.220	46.265	38.933	43.960	50.132	179.289	186.856
Depreciation	75.000	78.078	78.610	77.407	71.363	71.231	71.926	74.243	18.647	18.975	19.184	19.865	76.671	19.290	19.000	19.000	19.000	76.290	76.000
Amortization	33.073	31.181	24.999	21.325	18.804	17.341	13.334	12.729	2.841	3.595	3.564	3.488	13.488	3.402	4.000	4.000	4.000	15.402	19.200
Deferred income taxes	(8.216)	5.021	12.991	4.248	10.758	30.613	(4.598)	(40.845)	(0.139)	(1.048)	5.348	4.001	8.162	7.895	1.000	1.000	1.000	10.895	4.000
Equity-based compensation	6.620	7.189	5.074	3.271	4.582	5.804	6.464	5.661	2.502	2.127	1.791	1.041	7.461	2.658	1.000	1.000	1.000	5.658	4.000
Impairment of long-lived assets		-	-	-	-	34.455	-	60.547	-	-	-	-	-	-	-	-	-	-	-
Redemption of senior subordinated notes	-	8.002	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Provisions for non-cash losses on contracts	38.200	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Other	7.620	7.260	7.826	13.440	17.898	-	4.239	130.960	1.544	(4.659)	0.334	5.026	2.245	(13.947)				(13.947)	-
						-	-	-					-					-	-
Decrease/(increase) in accounts receivable	(58.368)	23.707	60.616	1.672	(44.558)	(67.621)	(82.818)	111.525	3.664	(51.361)	26.368	(52.130)	(73.459)	38.941	73.833	(67.832)	5.275	50.217	(14.399)
Decrease/(increase) in inventory	(6.871)	23.666	3.821	12.644	(5.999)	(32.451)	(96.652)	(99.015)	(4.058)	13.359	0.208	10.067	19.576	7.179	(64.427)	2.319	(57.397)	(112.326)	24.768
Increase/(decrease) in accounts payable and accrued expenses	10.543	(17.783)	8.107	(21.821)	25.740	39.440	52.499	(84.065)	(7.510)	2.422	(12.442)	38.050	20.520	(20.833)	57.174	(9.507)	31.433	58.267	11.471
Increase/(decrease) in customer advances	32.437	(0.304)	24.112	2.903	(7.054)	(10.998)	(14.432)	65.680	29.712	21.637	3.065	4.884	59.298	105.548	-	-	-	105.548	-
Increase/(decrease) in accrued expenses	1.053	7.685	(6.525)	(0.727)	16.901	11.466	3.014	(3.516)	6.989	(8.788)	5.302	(1.213)	2.290	(26.914)	-	-	-	(26.914)	-
Increase/(decrease) in accrued income tax	-	6.273	(9.986)	4.481	(4.686)	4.227	6.749	(17.964)	8.831	3.860	2.085	(10.123)	4.653	5.173	-	-	-	5.173	-
Increase/(decrease) in pension and post retirement liabilities	8.174	(43.612)	(15.048)	(29.708)	(29.029)	(123.500)	27.329	33.305	5.022	(1.176)	4.534	4.123	12.503	4.501	-	-	-	4.501	-
Increase/(decrease) other assets and liabilities	(8.485)	(7.459)	8.066	3.086	2.650	25.772	14.621	20.727	(11.792)	(4.359)	(2.250)	0.999	(17.402)	(21.973)	3.916	(5.286)	3.951	(19.392)	(2.733)
Total Adjustments	*130.780*	*128.904*	*202.663*	*92.221*	*77.370*	*5.779*	*1.675*	*269.972*	*56.253*	*(5.416)*	*57.091*	*28.078*	*136.006*	*110.920*	*95.496*	*(55.307)*	*8.263*	*159.372*	*122.308*
Net Cash Provided by Operating Activities	**251.277**	**287.102**	**334.546**	**215.856**	**217.780**	**102.407**	**181.423**	**279.177**	**94.095**	**43.272**	**93.213**	**62.646**	**293.226**	**157.185**	**134.429**	**(11.347)**	**58.395**	**338.661**	**309.164**
Cash flows from investing activities:																			
Acquisitions of businesses	(69.157)	-	-	(11.016)	(40.545)	(48.382)	-	(54.265)	(77.708)	0.108	-	-	(77.600)	-	-	-	-	-	-
Purchases of PPE	(93.174)	(78.771)	(80.693)	(67.208)	(75.798)	(94.517)	(118.422)	(88.284)	(20.309)	(37.710)	(30.554)	(40.161)	(128.734)	(37.059)	(40.000)	(40.000)	(40.000)	(157.059)	(160.000)
Other	(11.067)	(8.124)	13.095	(0.994)	6.820	1.257	2.702	(3.644)	1.604	0.291	1.720	11.562	15.177	37.336	-	-	-	37.336	-
Net Cash Used for Investing Activities	**(173.398)**	**(86.895)**	**(67.598)**	**(79.218)**	**(109.523)**	**(141.642)**	**(115.720)**	**(146.193)**	**(96.413)**	**(37.311)**	**(28.834)**	**(28.599)**	**(191.157)**	**0.277**	**(40.000)**	**(40.000)**	**(40.000)**	**(119.723)**	**(160.000)**
Cash flows from financing activities:																			
Net (repayments of) proceeds from notes payable	16.124	(0.977)	(3.570)	-	(1.280)	3.618	(3.653)	-	-	-	-	-	-	-	-	-	-	-	-
Proceeds from revolving lines of credit	897.162	361.135	428.130	324.670	255.622	568.550	971.658	1,151.550	271.700	231.500	150.300	146.450	799.950	215.200	80.000	80.000	80.000	455.200	320.000
Payments on revolving lines of credit	(782.617)	-	(518.130)	(409.670)	(305.512)	(678.660)	(998.726)	(1,187.159)	(235.700)	(232.000)	(184.286)	(186.950)	(838.936)	(263.476)	(85.000)	(85.000)	(85.000)	(518.476)	(340.000)
Payments on finance lease obligations									(0.488)	(0.554)	(0.546)	(0.568)	(2.156)	(0.505)					
Proceeds from issuance of long term debt	-	-	-	20.000	-	15.000	-	15.128	25.100	14.700	2.500	36.400	78.700	-	-	-	-	-	-
Payments on long term debt	(3.113)	(3.256)	(5.259)	(10.098)	(0.168)	(25.922)	(0.411)	(74.470)	(27.586)	(12.317)	(15.988)	(12.189)	(68.080)	(80.060)	(1.000)	(1.000)	(1.000)	(83.060)	(4.000)
Payment of dividends		-	-	-	-	(17.889)	(34.857)	(25.210)	(8.010)	(8.036)	(8.035)	(8.025)	(32.106)	(8.031)	(9.000)	(9.000)	(9.000)	(35.031)	(36.000)
Payments on senior subordinated notes	(187.000)	(191.575)	-	-	-	-	-	(300.000)	-	-	-	-	-	-	-	-	-	-	-
Payment of premium on redemption of sr. sub notes	-	(6.945)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Proceeds from senior sub notes	-	-	294.430	-	-	-	-	491.769	-	-	-	-	-	-	-	-	-	-	-
Proceeds from sale of treasury stock	10.725	-	11.436	4.574	3.797	4.560	(40.955)	7.014	-	4.230	0.373	6.263	10.866	2.144	1.000	1.000	1.000	5.144	4.000
Proceeds from sale of stock held by SECT	0.781	-	7.395	28.048	0.867	4.714	5.268	24.721	0.274	-	0.405	-	0.679	2.075	2.000	2.000	2.000	8.075	8.000
Purchase of outstanding shares for treasury	-	(272.876)	(363.848)	(44.933)	(8.643)	(8.218)	13.990	(232.290)	(11.674)	(7.170)	(7.858)	(4.971)	(31.673)	(16.657)	(5.000)	(5.000)	(5.000)	(31.657)	(20.000)
Purchase/Sale of stock held by SERP	-	-	(7.328)	(2.300)	-	(55.000)	4.293	-	-	-	-	-	-	-	-	-	-	-	-
Purchase of stock held by SECT	(9.676)	-	(15.151)	(28.799)	(18.685)	(30.358)	(15.288)	(6.774)	(0.655)	(1.904)	(0.976)	(0.704)	(4.239)	(2.275)	(2.000)	(2.000)	(2.000)	(8.275)	(8.000)
Excess tax benefits from equity-based pmt arrangements	1.089	2.910	5.996	0.598	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Other	(3.949)	(6.821)	(0.100)	(1.950)	(1.656)	(1.964)	-	(5.878)	-	-	-	-	-	-	-	-	-	-	-
Net Cash provided by Financing Activities	**(72.088)**	**(118.405)**	**(165.899)**	**(119.860)**	**(75.658)**	**(221.569)**	**(98.681)**	**(142.766)**	**12.961**	**(11.551)**	**(64.111)**	**(24.294)**	**(86.995)**	**(151.585)**	**(19.000)**	**(19.000)**	**(19.000)**	**(208.585)**	**(76.000)**
Net effect of exchange-rate changes on cash	2.458	(7.600)	(22.388)	(3.751)	10.433	1.541	(2.180)	2.306	2.619	(1.732)	0.378	(0.497)	0.768	(0.065)	-	-	-	(0.065)	-
Cash and Cash Equivalents at Beginning of Period	**148.841**	**157.090**	**231.292**	**330.912**	**343.937**	**386.969**	**127.706**	**92.548**	**85.072**	**98.334**	**91.012**	**91.658**	**85.072**	**100.914**	**106.726**	**182.155**	**111.807**	**100.914**	**111.202**
Net Increase (Decrease) in Cash and Cash Equivalents	*8.249*	*74.202*	*78.661*	*13.025*	*43.032*	*(259.263)*	*(35.158)*	*(7.476)*	*13.262*	*(7.322)*	*0.646*	*9.256*	*15.842*	*5.812*	*75.429*	*(70.347)*	*(0.605)*	*10.288*	*73.164*
Cash and Cash Equivalents at End of Period	**157.090**	**231.292**	**309.853**	**343.937**	**386.969**	**127.706**	**92.548**	**85.072**	**98.334**	**91.012**	**91.658**	**100.914**	**100.914**	**106.726**	**182.155**	**111.807**	**111.202**	**111.202**	**184.366**
Operating Cash Flow	**251.277**	**287.102**	**334.546**	**215.856**	**217.780**	**102.407**	**181.423**	**279.177**	**94.095**	**43.272**	**93.213**	**62.646**	**293.226**	**157.185**	**134.429**	**(11.347)**	**58.395**	**338.661**	**309.164**
Capital Expenditures	(93.174)	(78.371)	(80.693)	(67.208)	(75.798)	(94.517)	(118.422)	(88.284)	(20.309)	(37.710)	(30.554)	(40.161)	(128.734)	(37.059)	(40.000)	(40.000)	(40.000)	(157.059)	(160.000)
Free Cash Flow	**158.103**	**200.718**	**253.853**	**148.648**	**141.982**	**7.890**	**63.001**	**190.893**	**73.786**	**5.562**	**62.659**	**22.485**	**164.492**	**120.126**	**94.429**	**(51.347)**	**18.395**	**181.602**	**149.164**
Adjustment		-	-	-	-	118.938		(24.978)	-	1.176	(4.534)	(4.123)	(7.481)	(89.000)	(11.000)	-	-	(100.000)	-
Adj. Operating Cash Flow		287.102	334.546	215.856	217.780	221.345	181.423	254.199	94.095	44.448	88.679	58.523	285.745	68.185	123.429	(11.347)	58.395	238.661	309.164
Adj Free Cash Flow		**200.718**	**253.853**	**148.648**	**141.982**	**126.828**	**63.001**	**165.915**	**73.786**	**6.738**	**58.125**	**18.362**	**157.011**	**31.126**	**83.429**	**(51.347)**	**18.395**	**81.602**	**149.164**
FCF Conversion	131.2%	126.9%	192.5%	117.3%	100.5%	8.2%	35.0%	2073.8%					104.6%					101.3%	79.8%
Operating Cash Flow Per Share	$5.48	$6.39	$8.51	$5.91	$6.01	$2.84	$5.16	$8.35	$2.92	$1.34	$2.88	$1.94	$9.08	$4.88	$4.18	-$0.35	$1.82	$10.54	$9.65
Free Cash Flow per Share	$3.45	$4.47	$6.45	$4.07	$3.92	$3.52	$1.79	$5.71	$2.29	$0.17	$1.94	$0.70	$5.09	$3.73	$2.94	-$1.60	$0.57	$5.65	$4.66

Source: Company filings and Truist Securities research and estimates

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Company Description

Moog Inc. (MOG.A) is a designer, manufacturer, and systems integrator of high performance precision motion, fluid controls, and control systems for applications in aerospace and defense, and industrial markets. In the defense market, products include flight controls for military aircraft, stabilization and automatic ammunition loading controls for armored combat vehicles, tactical and strategic missile steering controls and gun aiming controls. In the commercial aircraft market - primary and secondary flight controls for commercial aircraft. In the commercial space market - satellite positioning controls and thrust vector controls for space launch vehicles. In the industrial market, injection molding, metal forming, material and automotive testing and pilot training simulators. In the energy market - wind energy, power generation and oil and gas exploration. Lastly, in the medical market - enteral clinical nutrition and infusion therapy pumps, CT scanners and ultrasonic sensors and surgical handpieces.

Investment Thesis

While we expect that modest commercial aerospace headwinds will likely continue to impact the company over the next 12-24 months, we believe the company's ~50% defense/space exposure will provide stability and modest growth while its ~30% industrial exposure will act as a cyclical growth engine. Operating margins have already been depressed in the company's primary aircraft control segment and despite potential revenue pressures we believe operational improvements will drive margin expansion. We rate MOG.A shares BUY.

Valuation and Risks

To derive our $88 price target, we apply a P/E multiple of 15x to our FY 2023 EPS estimate of $5.84, compared to the five-year historical forward P/E average of 15.5x and the peer group average of ~20x.

Risks to our rating and price target include cyclical nature of the commercial aerospace industry, continued elevated R&D spending tied to new platforms, changes in U.S. Defense spending patterns, general changes to the global macro environment that may influence the company's industrial products, and risk of program cuts or cancellations.

Analyst Certification

I, Michael Ciarmoli , hereby certify that the views expressed in this research report accurately reflect my personal views about the subject company(ies) and its (their) securities. I also certify that I have not been, am not, and will not be receiving direct or indirect compensation in exchange for expressing the specific recommendation(s) in this report.

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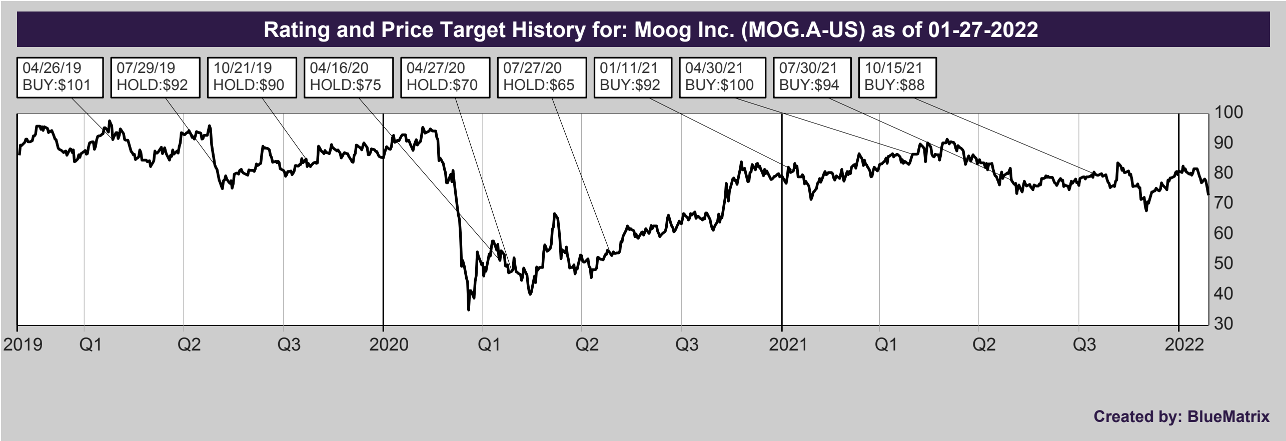

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Hold	208	27.15%	Hold	65	31.25%
Sell	1	0.13%	Sell	0	0.00%

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Equity Research

April 29, 2022

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Stock Rating	**HOLD** *Unchanged*
Price Target	**$88.00** *Unchanged*

TR to Target	5.0%
Price (Apr. 28, 2022)	$84.73
52-Wk Range	$91.54-$67.77
Market Cap ($M)	$2,738
ADTV	99,508
Shares Out (M)	32
Short Interest Ratio/% Of Float	2.0%
Dividend/Yield	$1.00/1.2%
Enterprise Value ($M)	$3,449
Cash & Equivalents ($M)	$122
Total Debt ($M)	$833

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Reasons for this report

- ✓ EPS Recap Report
- ✓ Updating Estimates

Moog Inc. (MOG.A)

More Restructuring and Rightsizing But Margins Trajectory Remains Steady

We maintain our HOLD rating/$88 PT on MOGA post F2Q22 and remain comfortable with our recent decision to downgrade the shares earlier this month (4/19). Results were mixed and cash generation continues to rely on receivable scrutinization as core FCF conversion remains at a depressed 44%. Mgmt reaffirmed all aspects of its outlook while taking ~$19M of charges in the aircraft control segment given lower-for-longer wide-body rates. Op margins are expected to expand modestly YOY in FY22 but supply chain, inflation, and raw materials remain watch items, especially in MOGA's LT support contracts.

2Q22 Earnings Recap:
Total revenues of $771M increased 5% YOY but fell short of the Street's estimate of $758M. By segment, Aircraft Controls revenue inched up 2% YOY to $311M but fell just short of the Street's $314M estimate, Space & Defense revenue increased 8% YOY to $223M and beat consensus of $217.6M, and Industrial Systems grew 10% YOY to $236M, ahead of the Street's $227M estimate. Total adj. operating margin was 10.6%, up 80bps YOY; Aircraft controls adj. operating margin of 10% increased 280bps YOY; and Space & Defense adj. operating margin of 11.6% declined 130bps YOY. Adj. EPS of $1.49 beat the consensus $1.31 and was up 12% YOY. FCF burn of ($14M) was a steep reversal YOY from $6M, even more so from $120M seq'l. and disappointed compared to the Street's $54M estimate.

Changes in aircraft control more volume than operational improvement driven. The $25M in restructuring and impairment charges, most notably the $19M portion within the Aircraft Control segment is purely related to an adjustment in capacity for a longer recovery of commercial aero wide-body end-markets. The reduction in capacity reflects updated expectations of a lower run-rate for the foreseeable future, specifically related to the 787 and A350 program. MOGA had been sized to support rates of 14 and 10/month respectively on these programs. MOGA is producing the 787 at a rate of 4/month (an agreement between MOGA and BA to build above current production levels) with the inventory build being reflected in accounts receivable per contract terms. While this contract structure does provide stability, it also constrains the ability to push through any inflationary pressures moving forward and does beg the question of what a potential inventory draw down may look like if the program stays at depressed rates.

Defense expected to hold steady going forward. The company called out a variety of new programs likely to drive growth in the future, but a muted trajectory on the F-35 program will likely act as a drag against these forward catalysts. The Russian-Ukraine conflict, and ensuing recapitalization of defense by NATO are not expected to have a particularly significant impact on top line revenue for MOG.A, despite minor exposure on a variety of programs likely to receive a boost from the current environment. New programs of interest for the segment include the potential FLRAA win for Textron which would become a large catalyst program for MOGA; the flexible turret for the SHORAD program for which they see potential retrofit market demand in addition to new applications; and their satellite bus initiatives.

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EPS	2021A	2022E			2023E		
FYE Sep		New	Old	Cons	New	Old	Cons
Q1	$1.17	$1.11	--	--	$1.26	*$1.27*	--
Q2	$1.51	$1.49	*$1.21*	--	$1.47	*$1.44*	--
Q3	$1.12	$1.38	*$1.37*	--	$1.54	*$1.51*	--
Q4	$1.17	$1.43	*$1.56*	--	$1.56	*$1.63*	--
Year	$4.97	$5.40	*$5.24*	$5.50	$5.83	*$5.84*	$6.05

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Commercial aero contracting environment remains a watch item for us. MOGA's two major programs, the 787 and A350, are effectively covered by life of program contracts with rigid OEM pricing agreements. While some escalators are in place to help mitigate inflation, we believe these OEM contracts/programs going forward will likely not allow for upward revisions on pricing. Wthin the aftermarket, where MOGA has entered into LT total support programs directly with airlines (i.e. power by the hour), we also suspect MOGA will have little success passing through price increases given the nature of these contracts. The company has been actively buying up its own used and serviceable material to control its offerings in the marketplace but net-net we see MOGA being in a more difficult situation versus peers to pass through higher costs, especially in the aftermarket.

FY22 estimates increase on F2Q22 beat; FY23 holds steady. For FY23 we have increased our EPS est. to $5.40 due primarily to the quarterly beat. Our FY23 EPS estimate dips a penny to $5.83.

	2022E		2023E	
MOG.A Truist Securities Ests	**New**	**Prior**	**New**	**Prior**
$ in millions except per-share items				
Revenue	**$3,029.7**	**$3,025.5**	**$3,162.6**	**$3,157.4**
Consensus	$3,031.7		$3,163.8	
FY EPS	**$5.40**	**$5.24**	**$5.83**	**$5.84**
CY EPS	**$5.56**	**$5.41**	**n/a**	**n/a**
Consensus	$5.50		$5.98	
FY Trading P/E Multiple	**15.4x**	**15.9x**	**14.3x**	**14.3x**
CY Trading P/E Multiple	**15.0x**	**15.4x**	**n/a**	**n/a**
Price Target	$88.00	$88.00	$88.00	$88.00
Implied FY P/E Multiple	**16.3x**	**16.8x**	**15.1x**	**15.1x**

Source: Company filings, FactSet, Truist Securities research and estimates

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Moog Inc. Class A (NYSE:MOG.A)

TRUIST
Truist Securities

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($MM, except per-share data)
Source: Company filings and Truist Securities research and estimates
“Required Disclosures” are on the last tab of the workbook

Last Updated: 4/29/2022

Income Statement *(in millions, except per share values)*	F2014	F2015	F2016	F2017	F2018	F2019	F2020	Dec	Mar	Jun	Sep	F2021	Dec	Mar	JunE	SepE	F2022E	F2023E
Total Revenue	**2,648.385**	**2,525.532**	**2,411.938**	**2,761.220**	**2,709.468**	**2,904.663**	**2,884.554**	**683.954**	**736.402**	**707.352**	**724.285**	**2,851.993**	**724.086**	**770.787**	**767.356**	**767.511**	**3,029.740**	**3,162.634**
Cost of Sales	1,850.809	1,788.828	1,700.354	1,766.002	1,936.481	2,088.831	2,118.150	494.311	536.493	516.750	528.716	2,076.270	531.206	556.070	529.475	529.583	2,146.334	2,182.218
Gross Profit	**797.576**	**736.704**	**711.584**	**995.218**	**772.987**	**815.832**	**766.404**	**205.186**	**220.921**	**212.206**	**195.569**	**833.881**	**192.880**	**213.012**	**237.880**	**237.929**	**881.701**	**980.417**
Research & Development Expense	139.462	132.271	147.336	144.646	130.186	126.453	110.865	28.008	30.453	33.095	33.972	125.528	27.708	30.720	49.248	48.613	156.289	203.975
S,G,&A (includes corporate & other)	403.487	371.498	339.961	356.141	393.759	404.653	397.947	99.603	105.131	100.597	106.697	412.028	111.797	111.019	120.573	119.018	462.408	487.437
Total Operating Expenses	*542.949*	*503.769*	*487.297*	*500.787*	*523.945*	*531.106*	*508.812*	*146.395*	*150.164*	*155.372*	*144.285*	*537.556*	*123.475*	*166.036*	*169.822*	*167.631*	*618.697*	*691.411*
Operating Income (includes all expenses)	**231.436**	**212.797**	**207.467**	**216.262**	**220.075**	**273.027**	**44.314**	**58.791**	**70.757**	**56.834**	**51.284**	**237.666**	**69.405**	**46.976**	**68.059**	**70.297**	**254.737**	**289.005**
Interest Expense	12.513	28.967	34.605	34.551	36.238	39.269	38.897	8.420	8.629	8.239	8.604	33.892	7.982	8.263	9.000	9.000	34.245	36.000
Other	(1.389)	3.801	(3.372)	14.473	29.708	11.699	190.570	3.241	(6.432)	0.076	3.616	0.501	(16.030)	24.297	3.250	3.250	14.767	13.000
Earnings Before Income Taxes	**218.923**	**183.830**	**172.862**	**181.711**	**183.837**	**233.758**	**5.417**	**50.371**	**62.128**	**48.595**	**42.680**	**203.774**	**61.423**	**38.713**	**59.059**	**61.297**	**220.492**	**253.005**
Provision for Income Taxes	60.725	51.951	49.227	41.301	87.209	54.010	(3.788)	12.529	13.440	12.473	8.112	46.554	15.158	9.626	14.765	15.324	54.873	65.781
Net Income attributable to common/noncontrolling	**-**	**-**	**123.635**	**140.410**	**96.628**	**179.748**	**9.205**	**37.842**	**48.688**	**36.122**	**34.568**	**157.220**	**46.265**	**29.087**	**44.294**	**45.973**	**165.619**	**187.224**
Net earnings attributable to noncontrolling	-	-	(3.112)	(0.870)	0.121	-	-	-	-	-	-	-	-	-	-	-	-	-
Net Income	**158.198**	**131.879**	**126.747**	**141.280**	**96.507**	**179.748**	**9.205**	**37.842**	**48.688**	**36.122**	**34.568**	**157.220**	**46.265**	**29.087**	**44.294**	**45.973**	**165.619**	**187.224**
Weighted average shares - diluted	44.952	39.335	36.529	36.230	36.052	35.179	33.438	32.237	32.325	32.355	32.325	32.311	32.188	32.121	32.146	32.166	32.155	32.091
Diluted EPS	**$3.52**	**$3.35**	**$3.47**	**$3.90**	**$4.56**	**$5.11**	**$4.68**	**$1.17**	**$1.51**	**$1.12**	**$1.17**	**$4.97**	**$1.11**	**$1.49**	**$1.38**	**$1.43**	**$5.40**	**$5.83**
EBITDA Reconciliation																		
Operating Income	**231.436**	**212.797**	**207.467**	**216.262**	**220.075**	**273.027**	**44.314**	**58.791**	**70.757**	**56.834**	**58.184**	**237.666**	**69.405**	**46.976**	**68.059**	**70.297**	**254.737**	**289.005**
Depreciation and Amortization	109.259	103.609	98.732	90.167	88.572	85.260	86.972	21.488	22.570	22.748	23.353	90.159	22.692	22.359	23.000	23.000	91.051	95.200
EBITDA	**340.695**	**316.406**	**306.199**	**306.429**	**308.647**	**358.287**	**131.286**	**80.279**	**93.327**	**79.582**	**81.537**	**327.825**	**92.097**	**69.335**	**91.059**	**93.297**	**345.788**	**384.205**
Stock compensation expense	7.189	5.074	3.271	4.582	5.804	6.464	5.661	2.502	2.127	1.791	1.041	7.461	2.658	1.920	1.000	1.000	6.578	4.000
EBITDAS	**347.884**	**321.480**	**309.470**	**311.011**	**314.451**	**364.751**	**136.947**	**82.781**	**95.454**	**81.373**	**82.578**	**335.286**	**94.755**	**71.255**	**92.059**	**94.297**	**352.366**	**388.205**
EBITDA/Share	$7.58	$8.04	$8.38	$8.46	$8.56	$10.18	$3.93	$2.49	$2.89	$2.46	$2.52	$10.15	$2.86	$2.16	$2.83	$2.90	$10.75	$11.97
EBITDAS/Share	$7.74	$8.17	$8.47	$8.58	$8.72	$10.37	$4.10	$2.57	$2.95	$2.51	$2.55	$10.38	$2.94	$2.22	$2.86	$2.93	$10.96	$12.10
Margins																		
Corporate Gross Margin	30.1%	29.2%	29.5%	36.0%	28.5%	28.1%	26.6%	30.0%	30.0%	30.0%	30.0%	29.2%	30.0%	30.0%	31.0%	31.0%	29.1%	31.0%
Research and Development	5.3%	5.2%	6.1%	5.2%	4.8%	4.4%	3.8%	4.1%	4.1%	4.7%	4.7%	4.4%	3.8%	4.0%	6.4%	6.3%	5.2%	6.4%
SG&A	15.2%	14.7%	14.1%	12.9%	14.5%	13.9%	13.8%	14.6%	14.3%	14.2%	14.7%	14.4%	15.4%	14.4%	15.7%	15.5%	15.3%	15.4%
Operating Expenses	20.5%	19.9%	20.2%	18.1%	19.3%	18.3%	17.6%	21.4%	20.4%	22.0%	19.9%	18.8%	17.1%	21.5%	22.1%	21.8%	20.4%	21.9%
Operating Margin (GAAP)	8.7%	8.4%	8.6%	7.8%	8.1%	9.4%	1.5%	8.6%	9.6%	8.0%	7.1%	8.3%	9.6%	6.1%	8.9%	9.2%	8.4%	9.1%
EBITDA Margin	12.9%	12.5%	12.7%	11.1%	11.4%	12.3%	4.6%	11.7%	12.7%	11.3%	11.3%	11.5%	12.7%	9.0%	11.9%	12.2%	11.4%	12.1%
Net Margin	6.0%	5.2%	5.3%	5.1%	3.6%	6.2%	0.3%	5.5%	6.6%	5.1%	4.8%	5.5%	6.4%	3.8%	5.8%	6.0%	5.5%	5.9%
Tax Rate	27.7%	28.3%	28.5%	22.7%	47.4%	23.1%	-69.9%	24.9%	21.6%	25.7%	19.0%	22.8%	24.7%	24.4%	25.0%	25.0%	24.9%	26.0%
Growth Rates																		
Total Revenue, yr/yr	**1.5%**	**-4.6%**	**-4.5%**	**14.5%**	**-1.9%**	**7.2%**	**-0.7%**	-9.4%	-3.8%	7.6%	2.5%	**-1.1%**	5.9%	4.7%	8.5%	6.0%	**6.2%**	**4.4%**
Revenue Seq'l	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	-3.2%	7.7%	-3.9%	2.4%	0.0%	0.0%	6.4%	-0.4%	0.0%	0.0%	0.0%
Gross Profit, yr/yr	1.8%	-7.6%	-3.4%	39.9%	-22.3%	5.5%	-6.1%	-2.9%	6.2%	24.3%	10.9%	8.8%	-6.0%	-3.6%	12.1%	21.7%	5.7%	11.2%
Research & Development, yr/yr	3.6%	-5.2%	11.4%	-1.8%	-10.0%	-2.9%	-12.3%	-0.7%	14.1%	20.8%	18.9%	13.2%	-1.1%	0.9%	48.8%	43.1%	24.5%	30.5%
Selling, General and Administrative yr/yr	1.7%	-7.9%	-8.5%	4.8%	10.6%	2.8%	-1.7%	1.3%	-2.0%	3.8%	11.8%	3.5%	12.2%	5.6%	19.9%	11.5%	12.2%	5.4%
Operating Income, yr/yr	20.6%	-8.1%	-2.5%	4.2%	1.8%	24.1%	-83.8%	-23.8%	-1.4%	-447.2%	-156.5%	436.3%	18.1%	-33.6%	19.7%	37.1%	7.2%	13.5%
EBITDA, yr/yr	13.5%	-7.1%	-3.2%	0.1%	0.7%	16.1%	-63.4%	-18.7%	-0.5%	1296.7%	-217.4%	149.7%	14.7%	-25.7%	14.4%	14.4%	5.5%	11.1%
Net Income, yr/yr	31.3%	-16.6%	-3.9%	11.5%	-31.7%	86.3%	-94.9%	-24.4%	-2.1%	-350.4%	-144.3%	1608.0%	22.3%	-40.3%	22.6%	33.0%	5.3%	13.0%
Diluted EPS, yr/yr	33.8%	-4.7%	3.5%	12.4%	16.9%	12.1%	-8.3%	-18.4%	2.0%	20.0%	43.5%	6.0%	-5.9%	-1.0%	23.4%	22.3%	8.8%	8.0%

Source: Company filings and Truist Securities research and estimates

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Moog Inc. Class A (NYSE:MOG.A)

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($MM, except per-share data)

Segment Data *(in millions, except per share values)*	F2014	F2015	F2016	F2017	F2018	F2019	F2020	Dec	Mar	Jun	Sep	F2021	Dec	Mar	JunE	SepE	F2022E	F2023E
Segment Revenue																		
Aircraft Controls	1,117.800	1,086.300	1,063.718	1,124.885	1,193.440	1,302.750	1,205.336	286.774	304.361	272.131	297.972	1,161.274	303.317	311.268	314.910	317.073	1,246.614	1,303.625
Space and Defense Controls	394.500	381.600	366.091	529.203	580.750	683.412	769.843	188.162	206.168	204.887	200.018	799.400	207.856	223.349	224.050	223.039	878.414	914.987
Industrial Systems	591.000	521.600	514.984	843.436	935.178	918.242	908.802	209.018	225.873	230.334	226.295	891.300	212.913	236.170	228.396	227.399	904.622	944.022
Total Segment Revenue	**2,722.331**	**2,525.536**	**2,411.937**	**2,761.220**	**2,709.468**	**2,904.663**	**2,884.554**	**683.954**	**736.402**	**707.352**	**724.285**	**2,851.993**	**724.086**	**770.787**	**767.356**	**767.511**	**3,029.740**	**3,162.634**
Segment Growth - YoY:																		
Aircraft Controls	5.5%	-2.8%	-2.1%	5.8%	6.1%	9.2%	-7.5%	-15.6%	-10.9%	9.1%	8.4%	-3.7%	5.8%	2.3%	15.7%	6.4%	7.3%	4.6%
Space and Defense Controls	-0.4%	-3.3%	-4.1%	44.6%	9.7%	17.7%	12.6%	1.0%	6.8%	11.4%	-3.4%	3.8%	10.5%	8.3%	9.4%	11.5%	9.9%	4.2%
Industrial Systems	-0.2%	-11.7%	-1.3%	63.8%	10.9%	-1.8%	-1.0%	-8.6%	-2.2%	2.7%	0.6%	-1.9%	1.9%	4.6%	-0.8%	0.5%	1.5%	4.4%
Total Segment Growth	**-**	**-7.2%**	**-4.5%**	**14.5%**	**-1.9%**	**7.2%**	**-0.7%**	**-9.4%**	**-3.8%**	**7.6%**	**2.5%**	**-1.1%**	**5.9%**	**4.7%**	**8.5%**	**6.0%**	**6.2%**	**4.4%**
Segment Revenue as a % of Total:																		
Aircraft Controls	41%	43%	44%	41%	44%	45%	42%	42%	41%	38%	41%	41%	42%	40%	41%	41%	41%	41%
Space and Defense Controls	14%	15%	15%	19%	21%	24%	27%	28%	28%	29%	28%	28%	29%	29%	29%	29%	29%	29%
Industrial Systems	22%	21%	21%	31%	35%	32%	32%	31%	31%	33%	31%	31%	29%	31%	30%	30%	30%	30%
Total	***100%***	***100%***	***100%***	***109%***	***100%***	***100%***	***100%***	***100%***	***100%***	***100%***	***100%***	***100%***	***100%***	***100%***	***100%***	***100%***	***100%***	***100%***
Segment Operating Income:																		
Aircraft Controls	115.726	100.006	97.508	114.016	128.978	139.701	32.436	27.922	22.018	20.545	26.193	96.678	41.915	12.441	33.380	33.927	121.663	136.141
Space and Defense Controls	26.119	33.236	42.420	46.525	67.076	88.990	101.554	23.046	26.652	21.339	17.296	88.333	21.299	24.075	25.766	27.322	98.462	102.978
Industrial Systems	58.109	45.021	48.542	78.157	62.934	109.451	79.916	19.898	23.813	23.004	19.233	85.948	17.191	20.723	21.012	21.148	80.075	96.887
Total Segment Operating Income	**275.718**	**245.509**	**238.244**	**291.152**	**258.988**	**338.142**	**213.906**	**70.866**	**72.483**	**64.888**	**62.722**	**270.959**	**80.405**	**57.239**	**80.159**	**82.397**	**300.200**	**336.005**
Segment Operating Margin:																		
Aircraft Controls	10.4%	9.2%	9.2%	10.1%	10.8%	10.7%	2.7%	9.7%	7.2%	7.5%	8.8%	8.3%	13.8%	4.0%	10.6%	10.7%	9.8%	10.4%
Space and Defense Controls	6.6%	8.7%	11.6%	8.8%	11.5%	13.0%	13.2%	12.2%	12.9%	10.4%	8.6%	11.0%	10.2%	10.8%	11.5%	12.3%	11.2%	11.3%
Industrial Systems	9.8%	8.6%	9.4%	9.3%	6.7%	11.9%	8.8%	9.5%	10.5%	10.0%	8.5%	9.6%	8.1%	8.8%	9.2%	9.3%	8.9%	10.3%
Total Segment Operating Income	**10.1%**	**9.7%**	**9.9%**	**10.5%**	**9.6%**	**11.6%**	**7.4%**	**10.4%**	**9.8%**	**9.2%**	**8.7%**	**9.5%**	**11.1%**	**7.4%**	**10.4%**	**10.7%**	**9.9%**	**10.6%**

Source: Company filings and Truist Securities research and estimates

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Moog Inc. Class A (NYSE:MOG.A)

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Michael Ciarmoli - (201) 401-2293

($MM, except per-share data)

Balance Sheet	F2014	F2015	F2016	F2017	F2018	F2019	F2020					F2021					F2022E	F2023E
(in millions, except per share values)								Dec	Mar	Jun	Sep		Dec	Mar	JunE	SepE		
Cash and Cash Equivalents	231.292	309.853	325.128	368.073	125.584	92.548	85.072	98.334	91.012	91.658	100.914	100.914	106.726	122.131	135.217	163.458	163.458	216.300
Receivables	780.874	698.419	688.388	727.740	793.911	957.287	855.535	872.843	922.092	896.998	945.929	945.929	891.588	931.297	829.574	807.907	807.907	867.580
Inventories	517.056	493.360	479.040	489.127	512.522	534.974	623.043	646.627	636.580	632.359	613.095	613.095	597.444	591.601	672.350	694.535	694.535	671.191
Deferred income taxes	92.390	91.210	92.903	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Prepaid expenses and other current assets	42.452	34.653	34.688	41.499	44.404	44.164	49.837	47.119	48.278	49.513	58.842	58.842	63.711	67.802	64.348	68.480	68.480	69.856
Total Current Assets	**1,664.064**	**1,627.495**	**1,620.147**	**1,626.439**	**1,476.421**	**1,628.973**	**1,613.487**	**1,664.923**	**1,697.962**	**1,670.528**	**1,718.780**	**1,718.780**	**1,659.469**	**1,712.831**	**1,701.488**	**1,734.379**	**1,734.379**	**1,824.928**
Property, plant and equipment	555.348	536.756	522.369	522.991	552.865	586.767	600.498	609.358	628.550	639.202	645.778	645.778	663.498	668.602	689.602	710.602	710.602	794.602
Operating lease right of use assets							68.393	68.772	65.410	62.507	60.355	60.355	62.657	61.659	61.659	61.659	61.659	61.659
Goodwill	757.852	737.212	740.162	774.268	797.217	784.240	821.856	866.366	860.239	860.268	851.605	851.605	842.042	842.203	840.203	838.203	838.203	828.603
Intangible assets	178.070	143.723	113.560	108.818	95.537	79.646	85.046	117.717	114.820	111.867	106.095	106.095	102.220	104.608	102.608	100.608	100.608	91.008
Deferred income taxes	-	-	-	26.558	17.328	19.992	18.924	20.524	18.808	18.467	17.769	17.769	18.239	16.022	16.022	16.022	16.022	16.022
Other Assets	53.118	41.285	45.621	31.518	24.680	14.619	17.627	18.888	20.051	20.471	32.787	32.787	36.480	35.568	35.924	36.283	36.283	37.756
Total Assets	**3,208.452**	**3,086.471**	**3,041.859**	**3,090.592**	**2,964.048**	**3,114.237**	**3,225.831**	**3,366.548**	**3,405.840**	**3,383.310**	**3,433.169**	**3,433.169**	**3,384.605**	**3,441.493**	**3,447.506**	**3,497.756**	**3,497.756**	**3,654.578**
Short-term borrowings	103.660	0.083	1.379	0.089	3.623	-	-	-	-	-	-	-	-	-	-	-	-	-
Current portion of long-term debt	5.262	0.034	0.167	0.295	0.365	0.249	0.350	69.148	71.652	56.062	80.365	80.365	0.367	0.372	0.372	0.372	0.372	0.372
Accounts payable	162.667	165.973	144.450	170.878	213.982	257.677	176.868	173.256	175.061	162.890	200.602	200.602	178.158	222.986	201.705	222.982	222.982	260.580
Accrued salaries, wages and commissions	141.096	125.270	126.319	148.406	147.765	143.765	109.510	102.138	99.223	111.159	112.703	112.703	90.965	79.709	79.709	79.709	79.709	79.709
Customer advances	145.500	167.423	167.514	159.274	151.687	137.242	203.338	234.480	256.080	259.425	263.686	263.686	367.873	321.594	321.594	321.594	321.594	321.594
Contract loss reserves	35.984	30.422	32.543	43.214	42.258	57.556	-	-	-	-	-	-	-	-	-	-	-	-
Other accrued liabilities	128.635	116.300	116.860	107.278	120.944	131.169	220.488	234.840	225.915	216.625	212.005	212.005	207.375	217.780	218.780	219.780	219.780	223.780
Total Current Liabilities	**722.804**	**605.505**	**589.232**	**629.434**	**680.624**	**727.658**	**710.554**	**813.862**	**827.931**	**806.161**	**869.361**	**869.361**	**844.738**	**842.441**	**822.160**	**844.437**	**844.437**	**886.035**
Long-term debt	765.114	1,075.067	1,010.304	956.653	858.836	832.984	929.982	898.078	896.955	863.682	823.355	823.355	775.262	832.391	826.391	820.391	820.391	796.391
Senior subordinated notes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Long-term pension and retirement obligations	288.216	348.239	401.747	271.272	117.471	160.034	183.366	189.081	180.112	181.400	162.728	162.728	161.285	157.962	157.962	157.962	157.962	157.962
Deferred income taxes	83.931	60.209	42.171	13.320	46.477	40.528	40.474	47.829	48.778	54.168	64.642	64.642	74.352	70.636	70.636	70.636	70.636	70.636
Other long-term liabilities	0.972	2.919	4.343	5.609	35.654	30.552	118.372	114.454	113.607	110.694	112.939	112.939	104.545	107.415	107.415	107.415	107.415	107.415
Total Liabilities	**1,861.037**	**2,091.939**	**2,047.797**	**1,876.288**	**1,739.062**	**1,791.756**	**1,982.748**	**2,063.304**	**2,067.383**	**2,016.105**	**2,033.025**	**2,033.025**	**1,960.182**	**2,010.845**	**1,984.564**	**2,000.841**	**2,000.841**	**2,018.439**
Non-controlling Interest	-	-	5.651	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Common Stock - Class A	43.628	43.667	43.667	43.704	43.785	43.795	43.799	43.802	43.802	43.802	43.803	43.803	43.803	43.804	43.804	43.804	43.804	43.804
Common Stock - Class B	7.652	7.613	7.613	7.576	7.495	7.485	7.481	7.478	7.478	7.478	7.477	7.477	7.477	7.476	7.476	7.476	7.476	7.476
Additional paid-in capital	463.965	456.512	465.762	492.246	502.257	510.546	472.645	505.038	519.006	519.636	509.622	509.622	518.857	543.292	545.292	547.292	547.292	555.292
Retained earnings	1,447.911	1,579.794	1,706.539	1,847.819	1,973.514	2,133.328	2,112.734	2,142.566	2,183.218	2,211.305	2,237.848	2,237.848	2,276.082	2,296.849	2,332.143	2,369.116	2,369.116	2,520.340
Treasury shares	(360.445)	(701.771)	(741.700)	(739.157)	(738.494)	(769.569)	(990.783)	(1,000.795)	(1,000.389)	(1,007.754)	(1,007.506)	(1,007.506)	(1,023.086)	(1,028.414)	(1,033.414)	(1,038.414)	(1,038.414)	(1,058.414)
Stock Employee Compensation Trust	(48.458)	(44.211)	(49.463)	(89.919)	(118.449)	(111.492)	(64.242)	(78.597)	(85.034)	(85.314)	(79.776)	(79.776)	(82.721)	(94.548)	(94.548)	(94.548)	(94.548)	(94.548)
Supplemental Retirement Plan Trust	-	(5.337)	(8.946)	(12.474)	(72.941)	(71.546)	(53.098)	(65.986)	(70.047)	(69.448)	(63.764)	(63.764)	(66.094)	(73.876)	(73.876)	(73.876)	(73.876)	(73.876)
Accumulated other comprehensive loss	(206.838)	(341.735)	(435.061)	(335.491)	(372.181)	(420.066)	(285.453)	(250.262)	(259.577)	(252.500)	(247.560)	(247.560)	(249.895)	(263.935)	(263.935)	(263.935)	(263.935)	(263.935)
Total Shareholders Equity	**1,347.415**	**994.532**	**988.411**	**1,214.304**	**1,224.986**	**1,322.481**	**1,243.083**	**1,303.244**	**1,338.457**	**1,367.205**	**1,400.144**	**1,400.144**	**1,424.423**	**1,430.648**	**1,462.942**	**1,496.915**	**1,496.915**	**1,636.139**
Total Liabilities & Shareholders Equity	**3,208.452**	**3,086.471**	**3,041.859**	**3,090.592**	**2,964.048**	**3,114.237**	**3,225.831**	**3,366.548**	**3,405.840**	**3,383.310**	**3,433.169**	**3,433.169**	**3,384.605**	**3,441.493**	**3,447.506**	**3,497.756**	**3,497.756**	**3,654.578**
Total cash	231.292	309.853	325.128	368.073	125.584	92.548	85.072	98.334	91.012	91.658	100.914	100.914	106.726	122.131	135.217	163.458	163.458	216.300
Total debt	(874.036)	(1,075.184)	(1,011.850)	(957.037)	(862.824)	(833.233)	(930.332)	(967.226)	(968.607)	(919.744)	(903.720)	(903.720)	(775.629)	(832.763)	(826.763)	(820.763)	(820.763)	(796.763)
Net cash (debt)	**(642.744)**	**(765.331)**	**(686.722)**	**(588.964)**	**(737.240)**	**(740.685)**	**(845.260)**	**(868.892)**	**(877.595)**	**(828.086)**	**(802.806)**	**(802.806)**	**(668.903)**	**(710.632)**	**(691.546)**	**(657.305)**	**(657.305)**	**(580.463)**
Blended average interest rate	1.4%	2.7%	3.4%	3.6%	4.2%	4.7%	4.2%	3.5%	3.6%	3.6%	3.8%	3.8%	4.1%	4.0%	4.4%	4.4%	4.2%	4.5%
Net cash (debt) per share	$ (14.30)	$ (19.46)	$ (18.80)	$ (16.26)	$ (20.45)	$ (21.05)	$ (25.28)	$ (26.95)	$ (27.15)	$ (25.59)	$ (24.84)	$ (24.85)	$ (20.78)	$ (22.12)	$ (21.51)	$ (20.43)	$ (20.44)	$ (18.09)
Net working capital per share	$ 20.94	$ 25.98	$ 28.22	$ 27.52	$ 22.07	$ 25.62	$ 27.00	$ 26.40	$ 26.91	$ 26.71	$ 26.28	$ 26.29	$ 25.31	$ 27.10	$ 27.35	$ 27.67	$ 27.68	$ 29.26
Tangible book per share	$ 9.15	$ 2.89	$ 3.69	$ 9.14	$ 9.22	$ 13.04	$ 10.05	$ 9.90	$ 11.24	$ 12.21	$ 13.69	$ 13.69	$ 14.92	$ 15.06	$ 16.18	$ 17.35	$ 17.36	$ 22.33
Book value per share	$ 29.97	$ 25.28	$ 27.06	$ 33.52	$ 33.98	$ 37.59	$ 37.18	$ 40.43	$ 41.41	$ 42.26	$ 43.31	$ 43.33	$ 44.25	$ 44.54	$ 45.51	$ 46.54	$ 46.55	$ 50.98
Debt to equity with pension								0.89	0.86	0.81	0.76		0.66	0.69	0.67	0.65		
Net Debt to Total Capitalization	28.9%	37.0%	34.3%	27.1%	35.3%	34.4%	38.9%	38.3%	38.0%	36.2%	34.8%	34.8%	30.4%	31.4%	30.2%	28.4%	28.4%	23.9%
LTD-to-Capital								0.40	0.39	0.38	0.36		0.35	0.37	0.36	0.35		
Debt to ttm EBITDA								10.48	10.45	5.99	3.19		2.70	3.07	2.95	2.83		
Net Debt to EBITDA	1.9	2.4	2.2	1.9	2.4	2.1	6.4					2.4					1.9	1.5
Current ratio								2.05	2.05	2.07	1.98		1.96	2.03	2.07	2.05		
A/R Turnover								3.17	3.28	3.11	3.14		3.15	3.38	3.70	3.80		
A/R DSOs								115.30	111.21	117.33	116.09		115.78	107.90	98.65	96.05		
A/P Turnover								11.29	12.32	12.23	11.64		11.22	11.09	10.50	9.50		
Inventory Turnover								3.11	3.34	3.26	3.40		3.51	3.74	3.15	3.05		
Return on sales								5.5%	6.6%	5.1%	4.8%		6.4%	3.8%	5.8%	6.0%		

Source: Company filings and Truist Securities research and estimates

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Moog Inc. Class A (NYSE:MOG.A)

TRUIST
Truist Securities

Michael Ciarmoli - (201) 401-2293

($MM, except per-share data)

Cash Flow Statement *(in millions, except per share values)*	F2013	F2014	F2015	F2016	F2017	F2018	F2019	F2020	Dec	Mar	Jun	Sep	F2021	Dec	Mar	JunE	SepE	F2022E	F2023E
Cash flows from operations:																			
Net Income	120.497	158.198	131.883	123.635	140.410	96.628	179.748	9.205	37.842	48.688	36.122	34.568	157.220	46.265	29.087	44.294	45.973	165.619	187.224
Depreciation	75.000	78.078	78.610	77.407	71.363	71.231	71.926	74.243	18.647	18.975	19.184	19.865	76.671	19.290	19.026	19.000	19.000	76.316	76.000
Amortization	33.073	31.181	24.999	21.325	18.804	17.341	13.334	12.729	2.841	3.595	3.564	3.488	13.488	3.402	3.333	4.000	4.000	14.735	19.200
Deferred income taxes	(8.216)	5.021	12.991	4.248	10.758	30.613	(4.598)	(40.845)	(0.139)	(1.048)	5.348	4.001	8.162	7.895	(3.061)	1.000	1.000	6.834	4.000
Equity-based compensation	6.620	7.189	5.074	3.271	4.582	5.804	6.464	5.661	2.502	2.127	1.791	1.041	7.461	2.658	1.920	1.000	1.000	6.578	4.000
Impairment of long-lived assets		-	-	-	-	34.455	-	60.547	-	-	-	-	-	-	18.441	-	-	18.441	-
Redemption of senior subordinated notes	-	8.002	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Provisions for non-cash losses on contracts	38.200	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Other	7.620	7.260	7.826	13.440	17.898	-	4.239	130.960	1.544	(4.659)	0.334	5.026	2.245	(13.947)	0.493			(13.454)	-
						-	-	-					-					-	-
Decrease/(increase) in accounts receivable	(58.368)	23.707	60.616	1.672	(44.558)	(67.621)	(82.818)	111.525	3.664	(51.361)	26.368	(52.130)	(73.459)	38.941	(43.164)	101.723	21.667	119.167	(59.673)
Decrease/(increase) in inventory	(6.871)	23.666	3.821	12.644	(5.999)	(32.451)	(96.652)	(99.015)	(4.058)	13.359	0.208	10.067	19.576	7.179	(0.228)	(80.749)	(22.185)	(95.983)	23.343
Increase/(decrease) in accounts payable and accrued expenses	10.543	(17.783)	8.107	(21.821)	25.740	39.440	52.499	(84.065)	(7.510)	2.422	(12.442)	38.050	20.520	(20.833)	45.221	(21.281)	21.277	24.384	37.598
Increase/(decrease) in customer advances	32.437	(0.304)	24.112	2.903	(7.054)	(10.998)	(14.432)	65.680	29.712	21.637	3.065	4.884	59.298	105.548	(45.156)	-	-	60.392	-
Increase/(decrease) in accrued expenses	1.053	7.685	(6.525)	(0.727)	16.901	11.466	3.014	(3.516)	6.989	(8.788)	5.302	(1.213)	2.290	(26.914)	(1.410)	-	-	(28.324)	-
Increase/(decrease) in accrued income tax	-	6.273	(9.986)	4.481	(4.686)	4.227	6.749	(17.964)	8.831	3.860	2.085	(10.123)	4.653	5.173	3.044	-	-	8.217	-
Increase/(decrease) in pension and post retirement liabilities	8.174	(43.612)	(15.048)	(29.708)	(29.029)	(123.500)	27.329	33.305	5.022	(1.176)	4.534	4.123	12.503	4.501	4.426	-	-	8.927	-
Increase/(decrease) other assets and liabilities	(8.485)	(7.459)	8.066	3.086	2.650	25.772	14.621	20.727	(11.792)	(4.359)	(2.250)	0.999	(17.402)	(21.973)	(8.960)	3.098	(4.491)	(32.326)	(2.850)
Total Adjustments	*130.780*	*128.904*	*202.663*	*92.221*	*77.370*	*5.779*	*1.675*	*269.972*	*56.253*	*(5.416)*	*57.091*	*28.078*	*136.006*	*110.920*	*(6.075)*	*27.792*	*41.268*	*173.905*	*101.619*
Net Cash Provided by Operating Activities	**251.277**	**287.102**	**334.546**	**215.856**	**217.780**	**102.407**	**181.423**	**279.177**	**94.095**	**43.272**	**93.213**	**62.646**	**293.226**	**157.185**	**23.012**	**72.086**	**87.241**	**339.524**	**288.842**
Cash flows from investing activities:																			
Acquisitions of businesses	(69.157)	-	-	(11.016)	(40.545)	(48.382)	-	(54.265)	(77.708)	0.108	-	-	(77.600)	-	(11.837)	-	-	(11.837)	-
Purchases of PPE	(93.174)	(78.771)	(80.693)	(67.208)	(75.798)	(94.517)	(118.422)	(88.284)	(20.309)	(37.710)	(30.554)	(40.161)	(128.734)	(37.059)	(37.028)	(40.000)	(40.000)	(154.087)	(160.000)
Other	(11.067)	(8.124)	13.095	(0.994)	6.820	1.257	2.702	(3.644)	1.604	0.291	1.720	11.562	15.177	37.336	0.440	-	-	37.776	-
Net Cash Used for Investing Activities	**(173.398)**	**(86.895)**	**(67.598)**	**(79.218)**	**(109.523)**	**(141.642)**	**(115.720)**	**(146.193)**	**(96.413)**	**(37.311)**	**(28.834)**	**(28.599)**	**(191.157)**	**0.277**	**(48.425)**	**(40.000)**	**(40.000)**	**(128.148)**	**(160.000)**
Cash flows from financing activities:																			
Net (repayments of) proceeds from notes payable	16.124	(0.977)	(3.570)	-	(1.280)	3.618	(3.653)	-	-	-	-	-	-	-	-	-	-	-	-
Proceeds from revolving lines of credit	897.162	361.135	428.130	324.670	255.622	568.550	971.658	1,151.550	271.700	231.500	150.300	146.450	799.950	215.200	248.750	80.000	80.000	623.950	320.000
Payments on revolving lines of credit	(782.617)	-	(518.130)	(409.670)	(305.512)	(678.660)	(998.726)	(1,187.159)	(235.700)	(232.000)	(184.286)	(186.950)	(838.936)	(263.476)	(192.000)	(85.000)	(85.000)	(625.476)	(340.000)
Payments on finance lease obligations									(0.488)	(0.554)	(0.546)	(0.568)	(2.156)	(0.505)	(0.580)				
Proceeds from issuance of long term debt	-	-	-	20.000	-	15.000	-	15.128	25.100	14.700	2.500	36.400	78.700	-	-	-	-	-	-
Payments on long term debt	(3.113)	(3.256)	(5.259)	(10.098)	(0.168)	(25.922)	(0.411)	(74.470)	(27.586)	(12.317)	(15.988)	(12.189)	(68.080)	(80.060)	(0.121)	(1.000)	(1.000)	(82.181)	(4.000)
Payment of dividends		-	-	-	-	(17.889)	(34.857)	(25.210)	(8.010)	(8.036)	(8.035)	(8.025)	(32.106)	(8.031)	(8.320)	(9.000)	(9.000)	(34.351)	(36.000)
Payments on senior subordinated notes	(187.000)	(191.575)	-	-	-	-	-	(300.000)	-	-	-	-	-	-	-	-	-	-	-
Payment of premium on redemption of sr. sub notes	-	(6.945)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Proceeds from senior sub notes	-	-	294.430	-	-	-	-	491.769	-	-	-	-	-	-	-	-	-	-	-
Proceeds from sale of treasury stock	10.725	-	11.436	4.574	3.797	4.560	(40.955)	7.014	-	4.230	0.373	6.263	10.866	2.144	6.557	1.000	1.000	10.701	4.000
Proceeds from sale of stock held by SECT	0.781	-	7.395	28.048	0.867	4.714	5.268	24.721	0.274	-	0.405	-	0.679	2.075	5.499	2.000	2.000	11.574	8.000
Purchase of outstanding shares for treasury	-	(272.876)	(363.848)	(44.933)	(8.643)	(8.218)	13.990	(232.290)	(11.674)	(7.170)	(7.858)	(4.971)	(31.673)	(16.657)	(9.824)	(5.000)	(5.000)	(36.481)	(20.000)
Purchase/Sale of stock held by SERP	-	-	(7.328)	(2.300)	-	(55.000)	4.293	-	-	-	-	-	-	-	-	-	-	-	-
Purchase of stock held by SECT	(9.676)	-	(15.151)	(28.799)	(18.685)	(30.358)	(15.288)	(6.774)	(0.655)	(1.904)	(0.976)	(0.704)	(4.239)	(2.275)	(8.121)	(2.000)	(2.000)	(14.396)	(8.000)
Excess tax benefits from equity-based pmt arrangements	1.089	2.910	5.996	0.598	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Other	(3.949)	(6.821)	(0.100)	(1.950)	(1.656)	(1.964)	-	(5.878)	-	-	-	-	-	-	-	-	-	-	-
Net Cash provided by Financing Activities	**(72.088)**	**(118.405)**	**(165.899)**	**(119.860)**	**(75.658)**	**(221.569)**	**(98.681)**	**(142.766)**	**12.961**	**(11.551)**	**(64.111)**	**(24.294)**	**(86.995)**	**(151.585)**	**41.840**	**(19.000)**	**(19.000)**	**(147.745)**	**(76.000)**
Net effect of exchange-rate changes on cash	2.458	(7.600)	(22.388)	(3.751)	10.433	1.541	(2.180)	2.306	2.619	(1.732)	0.378	(0.497)	0.768	(0.065)	(1.022)	-	-	(1.087)	-
Cash and Cash Equivalents at Beginning of Period	**148.841**	**157.090**	**231.292**	**330.912**	**343.937**	**386.969**	**127.706**	**92.548**	**85.072**	**98.334**	**91.012**	**91.658**	**85.072**	**100.914**	**106.726**	**122.131**	**135.217**	**100.914**	**163.458**
Net Increase (Decrease) in Cash and Cash Equivalents	*8.249*	*74.202*	*78.661*	*13.025*	*43.032*	*(259.263)*	*(35.158)*	*(7.476)*	*13.262*	*(7.322)*	*0.646*	*9.256*	*15.842*	*5.812*	*15.405*	*13.086*	*28.241*	*62.544*	*52.842*
Cash and Cash Equivalents at End of Period	**157.090**	**231.292**	**309.853**	**343.937**	**386.969**	**127.706**	**92.548**	**85.072**	**98.334**	**91.012**	**91.658**	**100.914**	**100.914**	**106.726**	**122.131**	**135.217**	**163.458**	**163.458**	**216.300**
Operating Cash Flow	**251.277**	**287.102**	**334.546**	**215.856**	**217.780**	**102.407**	**181.423**	**279.177**	**94.095**	**43.272**	**93.213**	**62.646**	**293.226**	**157.185**	**23.012**	**72.086**	**87.241**	**339.524**	**288.842**
Capital Expenditures	(93.174)	(78.371)	(80.693)	(67.208)	(75.798)	(94.517)	(118.422)	(88.284)	(20.309)	(37.710)	(30.554)	(40.161)	(128.734)	(37.059)	(37.028)	(40.000)	(40.000)	(154.087)	(160.000)
Free Cash Flow	**158.103**	**200.718**	**253.853**	**148.648**	**141.982**	**7.890**	**63.001**	**190.893**	**73.786**	**5.562**	**62.659**	**22.485**	**164.492**	**120.126**	**(14.016)**	**32.086**	**47.241**	**185.437**	**128.842**
Adjustment		-	-	-	-	118.938		(24.978)	-	1.176	(4.534)	(4.123)	(7.481)	(89.000)	(10.000)	-	-	(99.000)	-
Adj. Operating Cash Flow		287.102	334.546	215.856	217.780	221.345	181.423	254.199	94.095	44.448	88.679	58.523	285.745	68.185	13.012	72.086	87.241	240.524	288.842
Adj Free Cash Flow		**200.718**	**253.853**	**148.648**	**141.982**	**126.828**	**63.001**	**165.915**	**73.786**	**6.738**	**58.125**	**18.362**	**157.011**	**31.126**	**(24.016)**	**32.086**	**47.241**	**86.437**	**128.842**
FCF Conversion	131.2%	126.9%	192.5%	117.3%	100.5%	8.2%	35.0%	2073.8%					104.6%					112.0%	68.8%
Operating Cash Flow Per Share	$5.48	$6.39	$8.51	$5.91	$6.01	$2.84	$5.16	$8.35	$2.92	$1.34	$2.88	$1.94	$9.08	$4.88	$0.72	$2.24	$2.71	$10.56	$9.00
Free Cash Flow per Share	$3.45	$4.47	$6.45	$4.07	$3.92	$3.52	$1.79	$5.71	$2.29	$0.17	$1.94	$0.70	$5.09	$3.73	-$0.44	$1.00	$1.47	$5.77	$4.01

Source: Company filings and Truist Securities research and estimates

Company Description

Moog Inc. (MOG.A) is a designer, manufacturer, and systems integrator of high performance precision motion, fluid controls, and control systems for applications in aerospace and defense, and industrial markets. In the defense market, products include flight controls for military aircraft, stabilization and automatic ammunition loading controls for armored combat vehicles, tactical and strategic missile steering controls and gun aiming controls. In the commercial aircraft market - primary and secondary flight controls for commercial aircraft. In the commercial space market - satellite positioning controls and thrust vector controls for space launch vehicles. In the industrial market, injection molding, metal forming, material and automotive testing and pilot training simulators. In the energy market - wind energy, power generation and oil and gas exploration. Lastly, in the medical market - enteral clinical nutrition and infusion therapy pumps, CT scanners and ultrasonic sensors and surgical handpieces.

Investment Thesis

We effectively see limited room for future share appreciation and do not expect an expansion of the company's P/E multiple. While the company does have ~50% Space and Defense exposure we believe a lack of pricing power, elevated wide body aircraft exposure, and potential industrial headwinds are all downside risk factors. We rate the shares HOLD.

Valuation and Risks

To derive our $88 price target, we apply a P/E multiple of 15x to our FY 2023 EPS estimate of $5.84, compared to the five-year historical forward P/E average of 15.5x and the peer group average of ~20x.

Downside risks to our rating and price target include the cyclical nature of the commercial aerospace industry, continued elevated R&D spending tied to new platforms, changes in U.S. Defense spending patterns, general changes to the global macro environment that may influence the company's industrial products, and risk of program cuts or cancellations. Upside risks include new content wins, or a greater than anticipated build for production rates on key platforms.

Analyst Certification

I, Michael Ciarmoli , hereby certify that the views expressed in this research report accurately reflect my personal views about the subject company(ies) and its (their) securities. I also certify that I have not been, am not, and will not be receiving direct or indirect compensation in exchange for expressing the specific recommendation(s) in this report.

Required Disclosures

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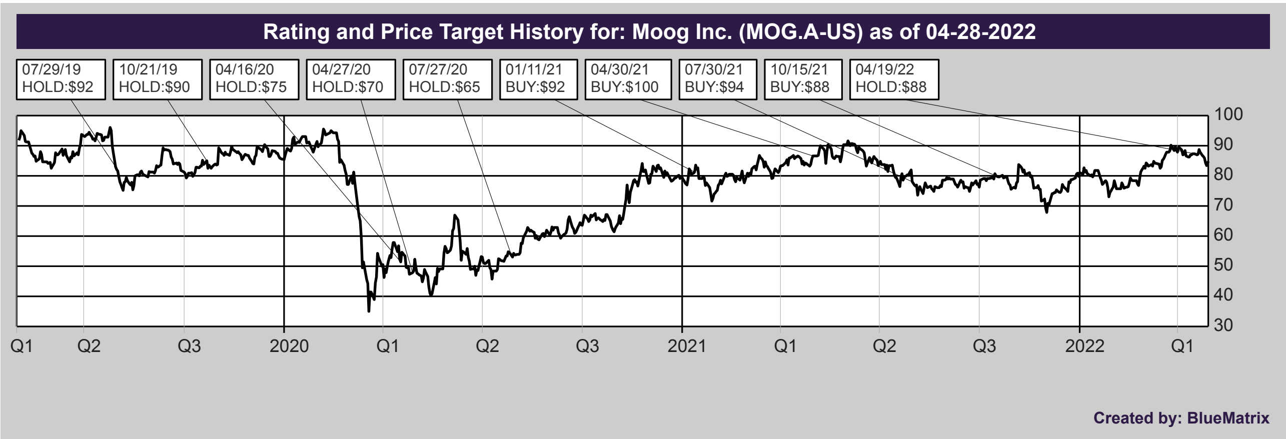

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Jefferies

EQUITY RESEARCH
MSC Industrial Direct Co., Inc. (MSM)

MSC Industrial
1FQ22: The Good, the Bad and the Outlook

December 22, 2021

Key Takeaway

What to do with MSM Shares: Hold on to what you own if you believe the industrial cycle will be longer and the company can achieve favorable pricing and execute on 400+bps of outgrowth vs the IP index and a return to high-teens ROIC by the end of FY23.

Numbers: MSM reported FQ1 EPS of $1.25 vs consensus and our estimate of $1.20. The beat to our figure came from better than expected sales and lower operating expenses as a % of sales. The company reaffirmed initial FY22 gross margin guidance of roughly flat with FY21 (42.0%), despite margins coming in at 41.6%, ~40bps below our estimate. The company invested $7mm in FQ1 as part of its FY22 strategy of $15mm in investments.

Good: (1) Operating expenses as a % of sales came in below our figure (30.2% vs our 30.8%) (2) FQ1 revenue came in at $848.5mm vs our figure of $833.7mm and consensus of $839.0mm (3) $10mm of the $25mm FY22 gross savings target achieved in FQ1 (4) MSM expects a bounce-back in gross margins in FQ2; and (5) MSM is preparing a significant price increase in early CY22.

Bad: (1) FQ1 gross margins came in 50bps below consensus (2) FQ1 FCF was down ~55% y/y (3) Supply constraints still negatively impacting MSM with no ease in sight (4) Tight labor market has led to severe labor shortages and made staffing and hiring for internal operations difficult; and (5) Government sales were down ~28% y/y on the back of tougher janitorial and safety comps.

Outlook: Expectations were low coming into the print, with MSM underperforming the market by ~240bps since the 4FQ21 print and ~24% YTD. Our sense is that recent underperformance stems from concerns around supply chain issues and inflationary pressures. With that said, the company's ADS growth of 9.9% outpaced the IP index by ~490bps in FQ1 primarily attributable to increased momentum in e-comm investments, in-plant initiatives, and MSM's vending program. Furthermore, the company achieved $10mm in costs savings in FQ1 and is on track to achieve $25mm in cost savings in FY22 and ultimately a total of $100mm by FY23. MSM appears to be executing well on their Mission Critical targets of 400bps+ of outgrowth vs the IP index, return to high teens ROIC, and cost savings of $100m by FY23. On the demand front, management noted that the industrial economy has been strong and as expected auto continues to lag. Moreover, IP index forecasts remain robust with growth expected to come in at 4.6% y/y in August 2022 (the end of MSM's FY22). While demand remains strong, tight labor market and supply chain conditions have created some persistent headwinds for MSM. However, management believes that current macro conditions position them nicely to take market share from local and regional players, who in our view are likely having a tougher time navigating the current climate compared to MSM. The strong sales trends in 4FQ21 have persisted into 1FQ22, achieving ADS growth of 9.9%. As a reminder, management guided ADS growth in the mid to high single-digit range in FY22. That said, management made a point to call out that if the current sales momentum continues the company could achieve double-digit ADS growth in FY22. **Continued on Page 3.**

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RATING	HOLD
PRICE	$83.61^
MARKET CAP	$4.7B
PRICE TARGET (PT)	$92.00 (FROM $95.00)
UPSIDE SCENARIO PT	$108.00
DOWNSIDE SCENARIO PT	$73.00

^Prior trading day's closing price unless otherwise noted.

FY Aug USD	2021A	2022E	2023E	2024E
EPS	4.81	↑5.72	6.05	↑6.63
Prev.		*5.64*		*6.55*
FY P/E	17.4x	14.6x	13.8x	12.6x

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MSC INDUSTRIAL (MSM)

Estimates				
USD	2021A	2022E	2023E	2024E
Rev. (MM)	3,243.2	3,585.7	3,721.9	3,917.6
Previous		3,558.3	3,693.1	3,887.3
EBITDA (MM)	440.3	517.5	546.3	587.7
Previous		515.9	546.5	583.8
FCF/Share	3.05	4.89	5.90	6.48
Previous		5.46		6.41
Total FCF (MM)	170.8	272.9	329.4	362.1
Previous		306.3	330.8	359.2
EPS				
Q1	1.10	1.25A	1.35	1.47
Previous		*1.20*	*1.32*	*1.44*
Q2	1.03	1.23	1.35	1.47
Previous			*1.36*	*1.46*
Q3	1.42	1.60	1.72	1.91
Previous		*1.58*	*1.73*	*1.88*
Q4	1.26	1.63	1.63	1.78
Previous			*1.64*	
FY Aug	4.81	5.72	6.05	6.63
Previous		*5.64*		*6.55*

Valuation				
	2021A	2022E	2023E	2024E
FCF Yield	3.64%	5.84%	7.05%	7.75%
FCF Yld	3.66%	5.84%	7.05%	7.75%
P/Rev	1.4x	1.3x	1.3x	1.2x
EV/EBITDA	12.2x	10.4x	9.9x	9.2x
FY P/E	17.4x	14.6x	13.8x	12.6x

Market Data	
52-Week Range:	$96.23 - $77.47
Total Entprs. Value	$5.4B
Avg. Daily Value MM (USD)	30.49
Float (%)	81.4%

Financial Summary	
Book Value (MM)	1,478.6
Book Value/Share	26.72
Return on Avg. Equity	19.5%
Net Debt/Capital	0.2%
Long-Term Debt (MM)	266.4
Dividend Yield	4.0%
Cash & ST Invest. (MM)	32.3

The Long View

Scenarios

Base Case

- ADS growth expected to hit 300+bps of outgrowth vs IP index in FY22 and exit FY23 at 400+bps of outgrowth.
- Gross margins expected to remain flat in FY22 at 42%.
- Cost saving targets of $25mm in gross savings in FY22 on track.
- Fewer M&A catalysts (higher bar cited). Major restructuring announced.
- 2023E EPS: $6.05; Target Multiple: 16x P/E; Price Target: $92/ share; discounted back.

Upside Scenario

- Restructuring plan on 1) improving field sales execution (new account openings outpacing resource planning), 2) need better profitability of supplier programs (relief on price cost) and 3) expense control (slower hiring) could provide upside to consensus earnings. If restructuring successful get to incremental 20%+ on mid-single-digit growth.
- Vending program growth accelerates. Ad hoc price increases.
- Have been growing in line with the market (~300-400bps of share gain happens faster).
- 2023E EPS: $6.66; Target Multiple: 17x P/E; Price Target: $108/ share; discounted back.

Downside Scenario

- FY22 gross margins come in lower than FY21 vs guide of flat y/y.
- Restructuring strategy has execution risk.
- 2023E EPS: $5.45; Target Multiple: 14x P/E; Price Target: $73/ share; discounted back.

Investment Thesis / Where We Differ

- A "show me" story on cost restructuring and price cost improving
- More cyclical than some peers (over-indexed to heavy manufacturing (~70%)).
- Historically M&A and sales force integration has been slow on large deals (Barnes in 2013). Growth underperformed in the industrial upcycle (slow to hire headcount in demand ramp). Conviction level on execution low for now.

Catalysts

- Earnings
- Monthly sales
- Upside / downside surprise in ISM, IP data
- Inflections in volume.

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Sales trends. FQ1 non-safety and non-janitorial sales were up 15% y/y, while safety and janitorial sales declined ~12% y/y. Government sales fell ~28% y/y (vs down 30% y/y in FQ4) as a result of tougher janitorial and safety comps. MSM expects government sales to be down double digits in FQ2, and should then start improving sequentially in 2H21 as the company gets past tough comps. National accounts and core customers have continued to achieve growth in the mid-teens range.

Pricing. Given the current inflationary environment, MSM is planning robust price increases in early calendar 2022. Historically, price increases have been in the 2% +/- range, and management noted that upcoming increases will be significantly greater than that and should start to see some strong price realization. During the quarter, price cost remained slightly positive, and the company began to see some improvements in price realization towards the end of FQ1 that has persisted into December. That said, the company relayed that it would have liked to see more positive price cost during the quarter. However, price initiatives have been set in place and the company is proactively renegotiating contract pricing mid cycle, shortening price quote duration and contract lengths. With the current macro backdrop, MSM should start to see some price realization as 2022 unfolds and with the pricing environment well understood by customers, management feels confident that they won't lose sales as a result of price hikes.

Gross margins. FQ1 gross margins came in at 41.6%, which was ~40bps worse than we expected and 30bps worse y/y due to typical mix headwinds which more than offset slightly positive price cost. However, the company disclosed that margins should improve in FQ2. Management reiterated their FY22 gross margin guidance of roughly flat despite inflationary pressures.

Operating margins. Operating expenses as a % of revenues was lower than we anticipated coming in at 30.2% vs our estimate of 30.8% and was down ~70bps y/y as a result of strong operating expense leverage despite ~$5m in COVID cost add-backs and a ~$2.5mm vaccine incentive cost. Furthermore, FQ1 operating margins came in at 11.3% vs our estimate of 11.2%. As a reminder, the company laid out two operating margin scenarios for FY22 which are tied to how ADS trends for the year. If ADS for FY22 lands in the mid single-digit range adj op margins should come in at 12% +/- 30bps and if ADS growth is in the high single digits the company expects adj op margins to be 12.3% +/- 30bps. MSM is currently trending towards the higher end of the range and given the current momentum in sales trends, management outlined a scenario if ADS growth reaches double digits adj op margins would likely exceed the higher end of the initial guidance range.

Capital allocation, cash flow and the balance sheet. MSM ended FQ1 with net leverage sitting at 1.6x Net Debt/TTM EBITDA. Going forward, management is focused on organic growth investments and the return of cash to shareholders. FCF came in at ~$43mm in FQ1, down 55% y/y due to increased A/R as a result of strong sales and pay down of A/P. Management guided FCF conversion to be ~100% in FY22. Inventory was roughly flat q/q as the company continues its inventory build due to accelerating sales.

Figure 1 - MSM Estimates

Income statement	2021	2022E	2023E	2024E
Sales	**3,243**	**3,586**	**3,722**	**3,918**
Growth	*2%*	*11%*	*4%*	*5%*
Cost of Goods Sold	(1,880)	(2,084)	(2,150)	(2,259)
Gross Profit	**1364**	**1502**	**1572**	**1659**
Margin	*42%*	*42%*	*42%*	*42%*
Operating (Expenses)/Income				
Operating expenses	(992)	(1,062)	(1,105)	(1,151)
% of sales	*31%*	*30%*	*30%*	*29%*
EBIT	**371**	**440**	**466**	**508**
Margin	*11%*	*12%*	*13%*	*13%*
EBITDA	**440**	**518**	**546**	**588**
Margin	*14%*	*14%*	*15%*	*15%*
Interest Expense	(15)	(15)	(16)	(14)
EBT	**357**	**424**	**451**	**494**
Margin	*11%*	*12%*	*12%*	*13%*
Tax Expense	(87)	(105)	(113)	(123)
Tax Rate	24.4%	24.7%	25.0%	25.0%
Net Income - Cont. Ops	**270**	**319**	**338**	**370**
Margin	*8%*	*9%*	*9%*	*9%*
Diluted EPS - Before Items	**$4.81**	**$5.72**	**$6.05**	**$6.63**
Diluted Shares O/S	56	56	56	56

Source: Company Data, Jefferies

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MSC Industrial

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Company Valuation/Risks

MSC Industrial

We value the shares based on a P/E multiple taking into account both the historical range over prior cycle and the peer group. Risks include: operational execution, cyclical pressures, gross margin headwinds, inventory level maintenance and competitive response on pricing.

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Recommendation Completion	December 22, 2021 , 21:05 ET.
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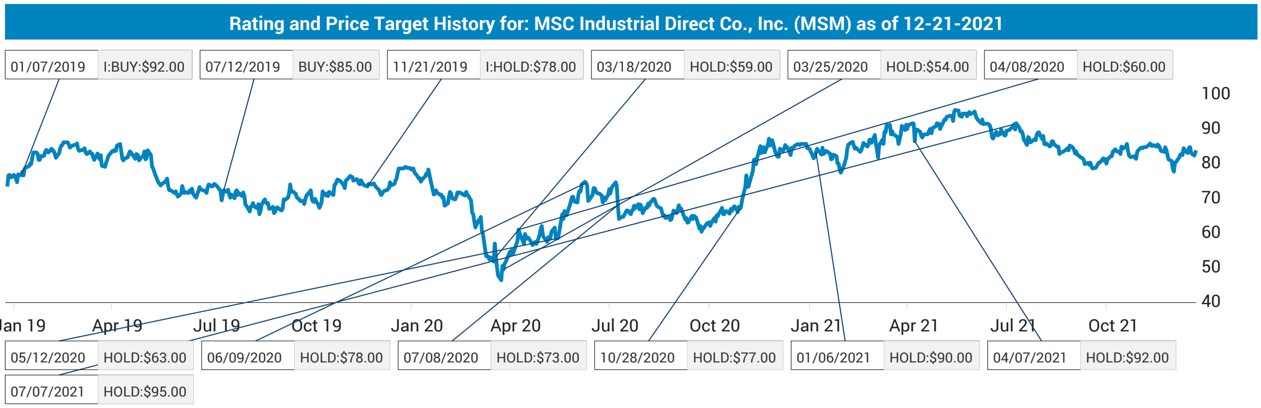

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D: Dropped Coverage

B: Buy

H: Hold

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Distribution of Ratings

Distribution of Ratings						
			IB Serv./Past12 Mos.		JIL Mkt Serv./Past12 Mos.	
	Count	Percent	Count	Percent	Count	Percent
BUY	1962	64.01%	153	7.80%	26	1.33%
HOLD	979	31.94%	31	3.17%	4	0.41%
UNDERPERFORM	124	4.05%	0	0.00%	0	0.00%

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J.P.Morgan

North America Equity Research
14 January 2022

MSC Industrial Direct

Model Update

We update our model for F1Q results. Our EPS estimates for FY22/FY23 are now \$5.70/\$5.95 (vs prior \$5.50/\$5.90), which assumes daily sales growth of 8%/4% (vs prior 6%/6%), with 20% incrementals in each year adjusted for the extra week in FY22. For F2Q we model 7% daily sales growth, 20% incremental margins, and \$1.26 in EPS.

Neutral

MSM, MSM US

Price (13 Jan 22): \$85.66

Price Target (Dec-22): \$92.00

Electrical Equipment & Multi-Industry

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J.P. Morgan Securities LLC

Key Changes (FYE Aug)

	Prev	Cur
Adj. EPS - 22E (\$)	5.50	5.70
Adj. EPS - 23E (\$)	5.90	5.95
Revenue - 22E (\$ mn)	3,518	3,593
Revenue - 23E (\$ mn)	3,640	3,669
Adj. EBITDA - 22E (\$ mn)	491	506
Adj. EBITDA - 23E (\$ mn)	519	523

Quarterly Forecasts (FYE Aug)

Adj. EPS (\$)

	2021A	2022E	2023E
Q1	1.10	1.25A	
Q2	1.03	1.26	
Q3	1.42	1.59	
Q4	1.26	1.59	
FY	4.81	5.70	5.95

Style Exposure

Quant Factors	Current %Rank	Hist %Rank (1=Top) 6M	1Y	3Y	5Y
Value	45	52	55	66	86
Growth	86	74	87	18	20
Momentum	44	79	65	18	15
Quality	34	32	15	17	10
Low Vol	15	9	10	19	11
ESGQ	78	25	14	88	91

Sources for: Style Exposure – J.P. Morgan Quantitative and Derivatives Strategy; all other tables are company data and J.P. Morgan estimates.

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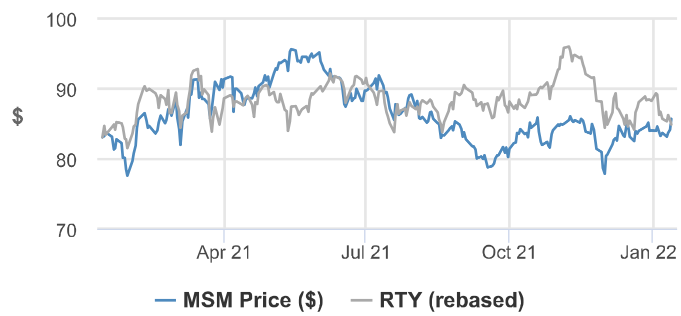
Price Performance



	YTD	1m	3m	12m
Abs	2.0%	2.8%	3.2%	3.2%
Rel	5.8%	3.7%	6.9%	0.9%

Company Data

Shares O/S (mn)	56
52-week range ($)	96.23-77.47
Market cap ($ mn)	4,792.16
Exchange rate	1.00
Free float(%)	97.2%
3M - Avg daily vol (mn)	0.35
3M - Avg daily val ($ mn)	29.4
Volatility (90 Day)	19
Index	RUSSELL 2000
BBG BUY|HOLD|SELL	5|5|0

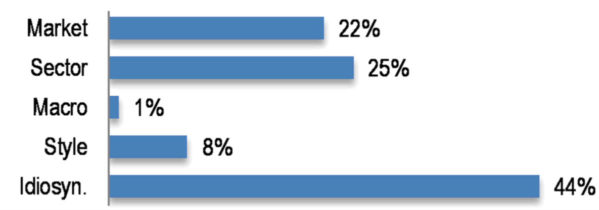
Key Metrics (FYE Aug)

$ in millions	FY21A	FY22E	FY23E
Financial Estimates			
Revenue	3,243	3,593	3,669
Adj. EBITDA	440	506	523
Adj. EBIT	371	437	455
Adj. net income	270	318	331
Adj. EPS	4.81	5.70	5.95
BBG EPS	4.83	5.81	6.07
Cashflow from operations	224	308	367
FCFF	171	241	297
Margins and Growth			
Revenue growth	1.6%	10.8%	2.1%
EBITDA margin	13.6%	14.1%	14.2%
EBITDA growth	0.8%	14.9%	3.4%
EBIT margin	11.5%	12.2%	12.4%
Net margin	8.3%	8.9%	9.0%
Adj. EPS growth	1.4%	18.4%	4.5%
Ratios			
Adj. tax rate	24.6%	24.6%	24.8%
Interest cover	30.5	33.8	34.9
Net debt/Equity	0.6	0.6	0.5
Net debt/EBITDA	1.7	1.4	1.3
ROCE	14.4%	16.7%	16.8%
ROE	21.7%	26.6%	25.9%
Valuation			
FCFF yield	3.6%	5.0%	6.2%
Dividend yield	7.6%	3.6%	3.9%
EV/Revenue	1.7	1.5	1.5
EV/EBITDA	12.6	10.9	10.5
Adj. P/E	17.8	15.0	14.4

Summary Investment Thesis and Valuation

MSM has historically been among the most levered in the group to improving domestic IP trends given its status as industry leader in metalworking distribution. However, growth has dragged in recent years by slowing share gains, a function of sales force effectiveness initiatives and premium pricing, in our view. This has been particularly true with the higher-margin, core metalworking customer group (>50% of sales), where its improvement initiatives are aimed though with limited benefits thus far, while pricing power has remained muted versus previous inflation cycles. We continue to view improvement here as a "show me" and have low conviction that benefits will be meaningful enough to recapture historical successes. This said, we give credit for solid performance this year, and will re-evaluate as the cycle normalizes and allows for a proper evaluation of performance vs. trend.

Performance Drivers



Factors	6M Corr	1Y Corr
Market: MSCI US	0.41	0.48
Sect: Industrials	0.46	0.56
Ind: Capital Goods	0.50	0.56
Macro:		
Crude Oil	0.35	0.26
US 10yr Breakeven	0.36	0.21
Non-Energy Commodity	0.28	0.18
Quant Styles:		
Quality	-0.46	-0.37
Growth	-0.51	-0.28
Value	0.40	0.26

Source: J.P. Morgan Quantitative and Derivatives Strategy for Performance Drivers; company data, Bloomberg Finance L.P. and J.P. Morgan estimates for all other tables. Note: Price history may not be complete or exact

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J.P.Morgan

Investment Thesis, Valuation and Risks

MSC Industrial Direct Co *(Neutral; Price Target: $92.00)*

Investment Thesis

MSM has historically been among the most levered in the group to improving domestic IP trends given its status as industry leader in metalworking distribution. However, growth has dragged in recent years by slowing share gains, a function of sales force effectiveness initiatives and premium pricing, in our view. This has been particularly true with the higher-margin, core metalworking customer group (>50% of sales), where its improvement initiatives are aimed though with limited benefits thus far, while pricing power has remained muted versus previous inflation cycles. We continue to view improvement here as a “show me” and have low conviction that benefits will be meaningful enough to recapture historical successes. This said, we give credit for solid performance this year, and will re-evaluate as the cycle normalizes and allows for a proper evaluation of performance vs. trend.

Valuation

Maintain Dec-22 PT at $92. On our 2023 EPS estimate, MSM shares trade at ~14x, a ~30% discount to the group (ex-GE/ROP). Our Dec 2022 price target of $92 equates to ~15.5x our 2022E EPS, a ~20% discount to the group target multiple vs. a three-year average discount in the ~15-20% range. Our group target multiple is 20x, set to be at a 0-5% premium to the NTM multiple for the S&P 500. Our PTs for the distributors remain centered around EV/EBITDA, with the target MSM multiple at ~11.3x, vs. its cycle average of ~11x. This is ~15% below the average distributor target multiple, vs. a 3-year average discount of ~10-15%.

Risks to Rating and Price Target

Upside risks include (1) a strong industrial recovery, combined with success in sales force effectiveness initiatives leads to better-than-expected growth, including from core accounts, (2) improved pricing beyond expectations as inflation persists, (3) margin improvement on supplier and cost savings initiatives, and/or (4) capital allocation (increased buybacks, M&A). Downside risks include (1) weaker-than-expected cyclical improvement, (2) incremental margins that are weaker than expected as a result of price/cost and mix pressure, and/or (3) poor capital allocation decisions.

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MSC Industrial Direct: Summary of Financials

Income Statement - Annual	FY20A	FY21A	FY22E	FY23E	FY24E
Revenue	**3,192**	**3,243**	**3,593**	**3,669**	**-**
COGS	(1,849)	(1,880)	(2,090)	(2,148)	-
Gross profit	**1,343**	**1,364**	**1,503**	**1,520**	**-**
SG&A	(976)	(992)	(1,066)	(1,066)	-
Adj. EBITDA	**437**	**440**	**506**	**523**	**-**
D&A	(69)	(69)	(68)	(68)	-
Adj. EBIT	**368**	**371**	**437**	**455**	**-**
Net Interest	(16)	(14)	(15)	(15)	-
Adj. PBT	**351**	**358**	**422**	**440**	**-**
Tax	(87)	(88)	(104)	(109)	-
Minority Interest	-	-	-	-	-
Adj. Net Income	**264**	**270**	**318**	**331**	**-**
Reported EPS	4.51	3.87	5.56	5.89	-
Adj. EPS	**4.75**	**4.81**	**5.70**	**5.95**	**-**
DPS	**7.98**	**6.47**	**3.11**	**3.31**	**-**
Payout ratio	176.9%	167.2%	55.9%	56.2%	-
Shares outstanding	56	56	56	56	-

Income Statement - Quarterly	1Q22A	2Q22E	3Q22E	4Q22E
Revenue	**849A**	**858**	**922**	**965**
COGS	(496)A	(498)	(534)	(562)
Gross profit	**353A**	**360**	**388**	**402**
SG&A	(257)A	(263)	(266)	(280)
Adj. EBITDA	**113A**	**114**	**139**	**139**
D&A	(17)A	(17)	(17)	(17)
Adj. EBIT	**96A**	**97**	**122**	**122**
Net Interest	(4)A	(4)	(4)	(4)
Adj. PBT	**92A**	**94**	**118**	**118**
Tax	(22)A	(23)	(29)	(29)
Minority Interest	-	-	-	-
Adj. Net Income	**70A**	**70**	**89**	**89**
Reported EPS	1.18A	1.24	1.57	1.57
Adj. EPS	**1.25A**	**1.26**	**1.59**	**1.59**
DPS	**0.00A**	**1.53**	**0.79**	**0.79**
Payout ratio	0.0%A	124.1%	50.1%	50.2%
Shares outstanding	56A	56	56	56

Balance Sheet & Cash Flow Statement	FY20A	FY21A	FY22E	FY23E	FY24E
Cash and cash equivalents	125	41	44	87	-
Accounts receivable	492	560	599	622	-
Inventories	543	624	653	672	-
Other current assets	78	89	88	98	-
Current assets	**1,238**	**1,314**	**1,384**	**1,479**	**-**
PP&E	302	298	300	302	-
LT investments	-	-	-	-	-
Other non current assets	843	849	849	849	-
Total assets	**2,382**	**2,462**	**2,533**	**2,630**	**-**
Short term borrowings	122	202	204	204	-
Payables	126	186	187	185	-
Other short term liabilities	161	173	179	173	-
Current liabilities	**409**	**562**	**570**	**563**	**-**
Long-term debt	497	584	558	558	-
Other long term liabilities	156	155	173	188	-
Total liabilities	**1,062**	**1,300**	**1,301**	**1,309**	**-**
Shareholders' equity	1,321	1,162	1,232	1,321	-
Minority interests	-	-	-	-	-
Total liabilities & equity	**2,382**	**2,462**	**2,533**	**2,630**	**-**
BVPS	**23.81**	**20.85**	**22.20**	**23.94**	**-**
y/y Growth	*(11.4%)*	*(12.4%)*	*6.5%*	*7.8%*	-
Net debt/(cash)	494	746	719	676	-
Cash flow from operating activities	**397**	**224**	**308**	**367**	**-**
o/w Depreciation & amortization	69	69	68	68	-
o/w Changes in working capital	17	(140)	(108)	(60)	-
Cash flow from investing activities	**(49)**	**(76)**	**(68)**	**(70)**	**-**
o/w Capital expenditure	(47)	(54)	(68)	(70)	-
as % of sales	*1.5%*	*1.7%*	*1.9%*	*1.9%*	-
Cash flow from financing activities	**(255)**	**(234)**	**(237)**	**(254)**	**-**
o/w Dividends paid	(444)	(363)	(174)	(184)	-
o/w Net debt issued/(repaid)	176	169	(24)	0	-
Net change in cash	**93**	**(85)**	**3**	**43**	**-**
Adj. Free cash flow to firm	**350**	**171**	**241**	**297**	**-**
y/y Growth	*26.4%*	*(51.2%)*	*41.0%*	*23.3%*	-

Ratio Analysis	FY20A	FY21A	FY22E	FY23E	FY24E
Gross margin	42.1%	42.0%	41.8%	41.4%	-
EBITDA margin	13.7%	13.6%	14.1%	14.2%	-
EBIT margin	11.5%	11.5%	12.2%	12.4%	-
Net profit margin	8.3%	8.3%	8.9%	9.0%	-
ROE	18.8%	21.7%	26.6%	25.9%	-
ROA	11.3%	11.1%	12.7%	12.8%	-
ROCE	14.3%	14.4%	16.7%	16.8%	-
SG&A/Sales	30.6%	30.6%	29.7%	29.0%	-
Net debt/equity	0.4	0.6	0.6	0.5	-
P/E (x)	18.1	17.8	15.0	14.4	-
P/BV (x)	3.6	4.1	3.9	3.6	-
EV/EBITDA (x)	12.1	12.6	10.9	10.5	-
Dividend Yield	9.3%	7.6%	3.6%	3.9%	-
Sales/Assets (x)	1.4	1.3	1.4	1.4	-
Interest cover (x)	26.7	30.5	33.8	34.9	-
Operating leverage	187.9%	63.1%	164.5%	187.9%	-
Revenue y/y Growth	(5.1%)	1.6%	10.8%	2.1%	-
EBITDA y/y Growth	(7.5%)	0.8%	14.9%	3.4%	-
Tax rate	24.8%	24.6%	24.6%	24.8%	-
Adj. Net Income y/y Growth	(10.2%)	2.2%	17.9%	3.9%	-
EPS y/y Growth	(10.4%)	1.4%	18.4%	4.5%	-
DPS y/y Growth	204.1%	(19.0%)	(51.9%)	6.4%	-

Source: Company reports and J.P. Morgan estimates.
Note: $ in millions (except per-share data).Fiscal year ends Aug. o/w - out of which

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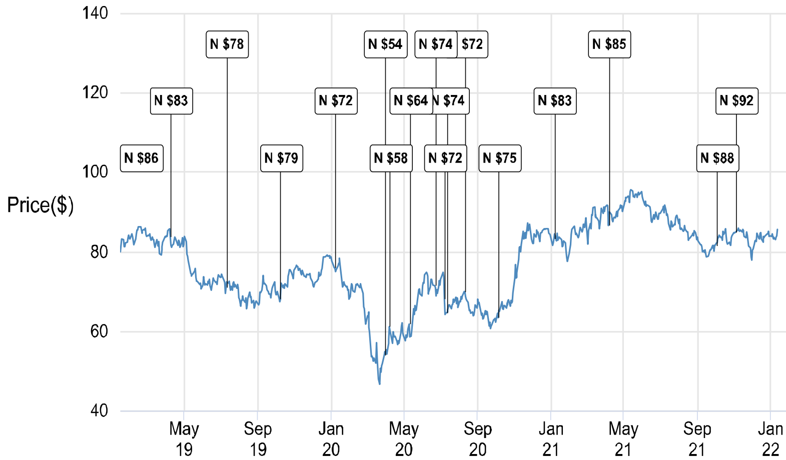
MSC Industrial Direct (MSM, MSM US) Price Chart



Source: Bloomberg Finance L.P. and J.P. Morgan; price data adjusted for stock splits and dividends.
Initiated coverage Jun 02, 2017. All share prices are as of market close on the previous business day.

Date	Rating	Price ($)	Price Target ($)
15-Jan-19	N	84.10	86
10-Apr-19	N	83.71	83
12-Jul-19	N	71.08	78
10-Oct-19	N	68.07	79
09-Jan-20	N	76.00	72
31-Mar-20	N	54.02	54
09-Apr-20	N	61.21	58
12-May-20	N	61.82	64
23-Jun-20	N	71.45	74
09-Jul-20	N	68.20	72
13-Jul-20	N	64.64	74
12-Aug-20	N	69.94	72
07-Oct-20	N	63.46	75
07-Jan-21	N	83.32	83
08-Apr-21	N	86.65	85
04-Oct-21	N	81.43	88
05-Nov-21	N	84.88	92

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TRADING COMPANIES & DISTRIBUTORS

December 22, 2021
Company Update

RATING: **HOLD**
Price Target: **$93.00**

Click here for the full model

MSC Industrial Direct Co., Inc. (MSM - $83.97)

Solid 1Q Earnings, but Soft Gross Margin Performance Fuels Lingering Concerns

Chris Dankert, Senior Vice President
Chris.Dankert@loopcapital.com
Tel: 310-439-5591

Loop Equity Trading: 312-913-4908

STOCK DATA

Price	$83.97
Price Target	$93.00
Market Cap ($M)	$4,690M
52-Week Range	$77.47-$96.23
Shares (M)	55.9
ADTV (000)	333
Enterprise Value ($M)	$5,390M
Dividend Per Share	$0.75
Debt to Capitalization	41%

FINANCIAL DATA

	2021A	2022E	2023E
P/E Ratio	17.4x	14.4x	13.8x
EBIT Margin	11.5%	12.4%	12.5%
EV/EBITDA	12.2x	10.4x	10.1x

**Financial data in $ millions except per share.*

OPERATING EPS ($)

FY August	2021A	2022E	2023E
Q1	**1.10**	**1.25A**	**1.38E**
Consensus			*1.35E*
Q2	**1.03**	**1.27E**	**1.31E**
Consensus		*1.23E*	*1.33E*
Q3	**1.42**	**1.60E**	**1.70E**
Consensus		*1.55E*	*1.70E*
Q4	**1.26**	**1.70E**	**1.71E**
Consensus		*1.61E*	*1.57E*
FY Prior	4.81	5.70E	6.00E
FY	**4.81**	**5.83E**	**6.10E**
Consensus		*5.66E*	*5.96E*

REVENUE ($) Million

FY August	2021A	2022E	2023E
Q1	**771.9**	**848.5A**	**902.7E**
Consensus			*890.9E*
Q2	**774.0**	**870.5E**	**890.2E**
Consensus		*856.2E*	*898.2E*
Q3	**866.3**	**931.4E**	**975.4E**
Consensus		*912.0E*	*959.2E*
Q4	**831.0**	**964.2E**	**965.1E**
Consensus		*951.6E*	*942.1E*
FY Prior	3,243.2	3,605.2E	3,723.5E
FY	**3,243.2**	**3,614.6E**	**3,733.5E**
Consensus		*3,548.7E*	*3,690.3E*

Source: FactSet, Loop Capital Markets estimates

UCC-178

Summary

Summary: MSM reported a solid quarter as earnings edged ahead of our forecast and consensus aided by favorable tax treatment ($0.02 benefit). Meanwhile, sales growth matched our estimates, increased with our latest round of channel checks, and beat consensus providing a *positive read-through for peers FAST and GWW*. Robust SG&A control more than offset disappointing gross margin as MSM has struggled to keep pace with price increases. We see this as more idiosyncratic to MSM's pricing regime and expect improvement into CY22.

Event Alert: We will be hosting virtual meetings with John Chironna, VP of Investor Relations and Treasurer on January 11th (open to CA and PA investors). Please contact your Loop sales representative for details.

Key Points

- When asked about the drivers behind soft gross margin performance in the quarter, CEO Erik Gershwind was quick to cite the impact of "hyper-inflation" which resulted in weaker (albeit still positive) price/cost, that could not fully offset mix headwinds. To combat accelerating costs, MSM has implemented fresh gross margin mitigation actions including more frequent contract renegotiation, shorter duration price quotes, and sourcing alternative product. In addition, MSM expects to realize January price gains that are "considerably larger" than the recent ~2% price realization level, we forecast +5% for January (vendor prices +7.6% y/y in our Nov. checks).

- **FY1Q Results:** Adj. EPS of $1.25 edged ahead of our forecast for $1.22 and $1.20 consensus led by favorable tax treatment ($0.02 benefit vs. our model), solid opex control and slightly lower interest expense. Sales growth of +9.9% y/y matched our forecast (increased modestly with our November distributor survey) and beat +8.7% consensus aided by solid manufacturing demand (+15.7% y/y vs. +21.8% during FY4Q).

- FY1Q gross margin of 41.6% missed consensus (42.1%) and declined -30bp y/y given ongoing mix headwinds and positive but weaker-than-expected price/cost. Net price & mix contributed +2.3% y/y to sales growth but weakened 50bp sequentially. Despite the gross margin drag, EBIT margin increased +30bp y/y to 11.3% (vs. 11.4% Loop, 11.1% Street) aided by SG&A control and roughly $3M of net savings associated with 'Mission Critical' initiatives.

- **Drivers:** Government sales declined -28% y/y during FY1Q and are expected to decline double-digits during FY2Q before rebounding on easier comps into FY2H. Offsetting these declines, MSM witnessed roughly +17% y/y growth in heavy manufacturing markets. MSM again declined to break-out the discrete impact of growth drivers like VMI and vending (Ecommerce growth essentially paced overall sales) but noted that in-plant business increased to 8% of sales for FY1Q vs. 7% last quarter.

- **Estimate Changes:** We now forecast FY22 adj. EPS of $5.83 (+$0.13 and vs. $5.66 consensus) on sales growth of +11.5% (+8.5% ADS basis) and gross margin of 41.9% (-10bp vs. FY21). We also forecast FY23 adj. EPS of $6.10 (+$0.10 and vs. $5.96 consensus) on sales growth of +3.3% (+6.2% ADS basis).

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MSC Industrial Direct

Quarterly Income Statement Comparison

($M, except per-share data)

	Actual 1Q21 Nov-20	Loop 1Q22E Nov-21	Actual 1Q22 Nov-21	Consensus 1Q22E Nov-21	Δ vs. Loop	Δ vs. Prior Year
Net Sales	**771.9**	**848.2**	**848.5**	**839.0**	**0.4**	**76.6**
Cost of Goods Sold	448.6	490.5	496.0		5.4	47.4
Gross Profit	**323.3**	**357.6**	**352.6**	**353.1**	**(5.0)**	**29.3**
Operating Expenses	238.7	261.2	256.6		(4.7)	17.9
Income from Operations	**84.6**	**96.4**	**96.0**	**93.2**	**(0.4)**	**11.4**
Total Other Income (Expense)	(2.7)	(5.0)	(4.1)		0.9	(1.4)
Interest Income, net	(3.3)	(5.0)	(3.7)		1.3	(0.4)
Other Income, net	0.7	0.0	(0.4)		(0.4)	(1.1)
Earnings Before Income Taxes	**81.9**	**91.4**	**91.9**		**0.5**	**10.0**
Income Taxes	19.9	22.8	21.7		(1.2)	1.8
Net Income	**62.0**	**68.5**	**70.2**	**66.6**	**1.7**	**8.2**
Diluted Shares Outstanding	55.9	55.9	55.9		0.0	0.0
Adjusted EPS	**$1.10**	**$1.22**	**$1.25**	**$1.20**	**$0.03**	**$0.15**
Margins						
Gross Margin	41.9%	42.2%	41.6%	42.1%	-61bp	-33bp
Operating Expenses	30.9%	30.8%	30.2%		-56bp	-69bp
EBIT Margin	11.0%	11.4%	11.3%	11.1%	-5bp	35bp
NOPAT Margin	8.3%	8.5%	8.6%		12bp	35bp
EBITDA Margin	13.2%	13.4%	13.4%		-3bp	19bp
Incremental EBIT Margin YoY	-16.0%	15.5%	14.9%		-58bp	NM
Effective Tax Rate	24.3%	25.0%	23.6%		-140bp	-70bp
Net Margin	8.0%	8.1%	8.3%		19bp	24bp
Y/Y growth						
Sales	-6.3%	9.9%	9.9%	8.7%	5bp	1621bp
Gross Profit	-6.9%	10.6%	9.1%		-156bp	1593bp
Operating Expenses	-6.1%	9.4%	7.5%		-195bp	1363bp
EBITDA	-8.1%	11.6%	11.5%		-13bp	1961bp
EBIT	-8.9%	13.9%	13.5%		-45bp	2237bp
Pretax Income	-8.8%	11.6%	12.2%		61bp	2096bp
Net Income	-8.0%	10.5%	13.2%		268bp	2115bp
Diluted EPS	-9.1%	10.4%	13.5%		308bp	2252bp

Source: Company Reports, Loop Estimates

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MSC Industrial Direct

Earnings Forecast Revisions

(Dollars in millions, except per-share data)	*Current Quarter* Prior 2Q22E Feb-22	New 2Q22E Feb-22	Δ vs. Prior	*Current FY* Prior FY22E	New FY22E	Δ vs. Prior	*FY+1* Prior FY23E	New FY23E	Δ vs. Prior
Net Sales	**861.5**	**870.5**	**9.0**	**3,605.2**	**3,614.6**	**9.4**	**3,723.5**	**3,733.5**	**10.0**
Cost of Goods Sold	497.3	505.1	7.8	2,088.6	2,101.2	12.6	2,166.4	2,176.8	10.3
Gross Profit	**364.2**	**365.4**	**1.2**	**1,516.6**	**1,513.4**	**(3.2)**	**1,557.0**	**1,556.7**	**(0.3)**
Operating Expenses	265.3	266.4	1.0	1,070.5	1,065.9	(4.6)	1,088.5	1,088.9	0.4
Income from Operations	**98.9**	**99.0**	**0.1**	**446.1**	**447.4**	**1.4**	**468.5**	**467.8**	**(0.7)**
Total Other Income (Expense)	(5.0)	(3.8)	1.2	(20.0)	(15.6)	4.4	(20.0)	(15.3)	4.7
Interest Income, net	(5.0)	(3.8)	1.2	(20.0)	(15.2)	4.8	(20.0)	(15.3)	4.7
Other Income, net	0.0	0.0	0.0	0.0	(0.4)	(0.4)	0.0	0.0	0.0
Earnings Before Income Taxes	**93.9**	**95.2**	**1.3**	**426.0**	**431.8**	**5.8**	**448.5**	**452.5**	**4.0**
Income Taxes	23.5	23.8	0.3	106.2	105.4	(0.8)	111.5	110.9	(0.6)
Net Income	**70.4**	**71.4**	**1.0**	**319.8**	**326.4**	**6.6**	**337.0**	**341.6**	**4.7**
Diluted Shares Outstanding	55.9	55.9	(0.0)	55.9	55.9	(0.0)	55.9	55.9	(0.0)
Adjusted EPS	**$1.25**	**$1.27**	**$0.02**	**$5.70**	**$5.83**	**$0.13**	**$6.00**	**$6.10**	**$0.09**
Margins									
Gross Margin	42.3%	42.0%	-0.3%	42.1%	41.9%	-0.2%	41.8%	41.7%	-0.1%
Operating Expenses	30.8%	30.6%	-0.2%	29.7%	29.5%	-0.2%	29.2%	29.2%	-0.1%
EBIT Margin	11.5%	11.4%	-0.1%	12.4%	12.4%	0.0%	12.6%	12.5%	-0.1%
NOPAT Margin	8.6%	8.5%	-0.1%	9.3%	9.4%	0.1%	9.5%	9.5%	0.0%
EBITDA Margin	13.5%	13.4%	-0.1%	14.3%	14.3%	0.0%	14.4%	14.4%	-0.1%
Incremental EBIT Margin YoY	21.1%	19.2%	-1.8%	20.6%	20.4%	-0.2%	19.0%	17.1%	-1.8%
Effective Tax Rate	25.0%	25.0%	0.0%	24.9%	24.4%	-0.5%	24.9%	24.5%	-0.4%
Net Margin	8.2%	8.2%	0.0%	8.9%	9.0%	0.2%	9.1%	9.2%	0.1%
Y/Y growth									
Sales	11.3%	12.5%	1.2%	11.2%	11.5%	0.3%	3.3%	3.3%	0.0%
COGS	10.7%	12.5%	1.7%	11.1%	11.8%	0.7%	3.7%	3.6%	-0.1%
Gross Profit	12.1%	12.5%	0.4%	11.2%	11.0%	-0.2%	2.7%	2.9%	0.2%
Operating Expenses	8.6%	9.0%	0.4%	7.9%	7.4%	-0.5%	1.7%	2.2%	0.5%
EBITDA	19.1%	19.3%	0.2%	17.3%	17.8%	0.4%	4.2%	3.7%	-0.4%
EBIT	22.9%	23.1%	0.2%	20.1%	20.4%	0.4%	5.0%	4.6%	-0.5%
Pretax Income	22.2%	23.9%	1.7%	19.0%	20.6%	1.6%	5.3%	4.8%	-0.5%
Net Income	21.7%	23.4%	1.7%	18.1%	20.5%	2.4%	5.4%	4.7%	-0.7%
Diluted EPS	22.3%	24.1%	1.8%	18.4%	21.1%	2.6%	5.3%	4.6%	-0.7%

Source: Company Reports, Loop Estimates
Analyst: Chris Dankert

MSC Industrial Direct

Monthly Sales Metrics

(Dollars in millions, except per-share data)

Analyst: Chris Dankert

FY21	Month	Sep-20	Oct-20	Nov-20	Dec-20	Jan-21	Feb-21	Mar-21	Apr-21	May-21	Jun-21	Jul-21	Aug-21
	Net Sales ($M)	293.7	254.7	223.5	259.4	256.6	258	327.6	273.1	265.6	315.8	246.5	268.7
	Sales/Day ($M)	12.2	12.7	12.4	12.4	12.8	12.9	13.1	13.7	13.3	13.2	13.0	13.4
	Selling Days	24	20	18	21	20	20	25	20	20	24	19	20
	ADS Growth YoY	-8.5%	-3.9%	-5.9%	3.1%	-4.0%	-3.4%	-0.7%	16.0%	-6.4%	15.2%	11.2%	11.8%
	Core Volume	-9.8%	-5.2%	-7.2%	1.9%	-5.2%	-4.6%	-0.8%	15.9%	-6.5%	11.9%	7.9%	8.5%
	Pricing & Other	1.3%	1.3%	1.3%	1.2%	1.2%	1.2%	0.1%	0.1%	0.1%	2.8%	2.8%	2.8%
	M&A	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.4%	0.5%	0.5%
	ADS Growth MoM	1.9%	4.1%	-2.5%	-0.5%	3.9%	0.5%	1.6%	4.2%	-2.7%	-0.9%	-1.4%	3.6%

FY22	Month	Sep-21	Oct-21	Nov-21	Dec-21	Jan-22	Feb-22	Mar-22	Apr-22	May-22	Jun-22	Jul-22	Aug-22
	Net Sales ($M)	326.2	272.2	250.1	296.8	286.1	287.6	356.7	286.6	288.1	341.1	263.8	359.4
	Sales/Day ($M)	13.6	13.6	13.9	12.9	14.3	14.4	14.3	14.3	14.4	14.2	13.9	14.4
	Selling Days	24	20	18	23	20	20	25	20	20	24	19	25
	ADS Growth YoY	11.1%	6.9%	11.9%	4.5%	11.5%	11.5%	8.9%	5.0%	8.5%	8.0%	7.0%	7.0%
	Core Volume	8.3%	4.0%	9.0%	1.0%	6.0%	6.5%	4.5%	1.0%	5.0%	6.0%	5.0%	5.0%
	Pricing & Other	2.3%	2.3%	2.3%	3.0%	5.0%	4.5%	4.0%	3.5%	3.0%	2.0%	2.0%	2.0%
	M&A	0.5%	0.5%	0.6%	0.5%	0.5%	0.5%	0.4%	0.5%	0.5%	0.0%	0.0%	0.0%
	ADS Growth MoM	1.2%	0.1%	2.1%	-7.1%	10.8%	0.5%	-0.8%	0.4%	0.5%	-1.3%	-2.3%	3.6%

FY23	Month	Sep-22	Oct-22	Nov-22	Dec-22	Jan-23	Feb-23	Mar-23	Apr-23	May-23	Jun-23	Jul-23	Aug-23
	Net Sales ($M)	349.0	288.5	265.1	276.4	306.1	307.7	381.6	301.0	292.8	363.2	295.7	306.2
	Sales/Day ($M)	14.5	14.4	14.7	13.2	15.3	15.4	15.3	15.0	15.4	15.1	14.8	15.3
	Selling Days	24	20	18	21	20	20	25	20	19	24	20	20
	ADS Growth YoY	7.0%	6.0%	6.0%	2.0%	7.0%	7.0%	7.0%	5.0%	7.0%	6.5%	6.5%	6.5%
	Core Volume	4.5%	4.5%	4.5%	1.0%	6.0%	6.0%	6.0%	4.0%	6.0%	6.0%	6.0%	6.0%
	Pricing & Other	2.5%	1.5%	1.5%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	0.5%	0.5%	0.5%
	M&A	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	ADS Growth MoM	1.2%	-0.8%	2.1%	-10.6%	16.3%	0.5%	-0.8%	-1.4%	2.4%	-1.8%	-2.3%	3.6%

Source: Company Reports, Loop Estimates

MSM Quarterly Earnings Model

Income Statement (FY)

(Dollars in millions, except per-share data)

Analyst: Chris Dankert

	2021				2022				2023			
	1Q21	2Q21	3Q21	4Q21	1Q22	2Q22E	3Q22E	4Q22E	1Q23E	2Q23E	3Q23E	4Q23E
	Nov-20	Feb-21	May-21	Aug-21	Nov-21	Feb-22	May-22	Aug-22	Nov-22	Feb-23	May-23	Aug-23
Net Sales	**771.9**	**774.0**	**866.3**	**831.0**	**848.5**	**870.5**	**931.4**	**964.2**	**902.7**	**890.2**	**975.4**	**965.1**
Cost of Goods Sold	448.6	449.2	499.8	482.1	496.0	505.1	538.2	562.0	528.4	519.0	566.9	562.6
Gross Profit	**323.3**	**324.8**	**366.5**	**349.0**	**352.6**	**365.4**	**393.2**	**402.2**	**374.2**	**371.3**	**408.6**	**402.6**
Operating Expenses	238.7	244.4	256.9	252.1	256.6	266.4	269.2	273.8	269.0	269.7	277.0	273.1
Income from Operations	**84.6**	**80.5**	**109.5**	**96.9**	**96.0**	**99.0**	**124.0**	**128.4**	**105.2**	**101.6**	**131.6**	**129.4**
Total Other Income (Expense)	-2.7	-3.6	-2.6	-4.5	-4.1	-3.8	-3.8	-3.8	-3.8	-3.8	-3.8	-3.8
Interest Income, net	-3.3	-3.6	-3.7	-3.9	-3.7	-3.8	-3.8	-3.8	-3.8	-3.8	-3.8	-3.8
Other Income, net	0.7	-0.1	1.1	-0.7	-0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Earnings Before Income Taxes	**81.9**	**76.8**	**107.0**	**92.3**	**91.9**	**95.2**	**120.2**	**124.6**	**101.4**	**97.7**	**127.7**	**125.6**
Income Taxes	19.9	19.0	26.3	22.0	21.7	23.8	30.0	29.9	24.3	24.4	31.9	30.1
Net Income	**62.0**	**57.8**	**80.7**	**70.4**	**70.2**	**71.4**	**90.1**	**94.7**	**77.1**	**73.3**	**95.8**	**95.5**
GAAP EPS- Basic	$0.69	$0.32	$1.69	$1.19	$1.19	$1.28	$1.61	$1.71	$1.38	$1.31	$1.71	$1.72
GAAP EPS- Diluted	**$0.69**	**$0.32**	**$1.68**	**$1.18**	**$1.18**	**$1.27**	**$1.60**	**$1.70**	**$1.38**	**$1.31**	**$1.70**	**$1.71**
Charges and One-Time Items	23.2	39.5	-14.3	4.5	3.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Charges and One-Time Items (EPS Impact)	$0.42	$0.70	-$0.25	$0.08	$0.07	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Adjusted EPS	**$1.10**	**$1.03**	**$1.42**	**$1.26**	**$1.25**	**$1.27**	**$1.60**	**$1.70**	**$1.38**	**$1.31**	**$1.70**	**$1.71**
Basic Shares Outstanding	55.7	55.8	55.9	55.5	55.5	55.5	55.5	55.5	55.5	55.5	55.5	55.5
Diluted Shares Outstanding	55.9	56.1	56.4	55.9	55.9	55.9	55.9	55.9	55.9	55.9	55.9	55.9
Cash Dividends per Share	$0.75	$0.75	$0.75	$0.75	$0.75	$0.75	$0.75	$0.79	$0.79	$0.79	$0.79	$0.83
Dividend Payout Ratio (%)												
Margins												
Cost of Goods Sold	58.1%	58.0%	57.7%	58.0%	58.4%	58.0%	57.8%	58.3%	58.5%	58.3%	58.1%	58.3%
Gross Margin	41.9%	42.0%	42.3%	42.0%	41.6%	42.0%	42.2%	41.7%	41.5%	41.7%	41.9%	41.7%
Operating Expenses	30.9%	31.6%	29.7%	30.3%	30.2%	30.6%	28.9%	28.4%	29.8%	30.3%	28.4%	28.3%
EBIT Margin	11.0%	10.4%	12.6%	11.7%	11.3%	11.4%	13.3%	13.3%	11.7%	11.4%	13.5%	13.4%
NOPAT Margin	8.3%	7.8%	9.5%	8.9%	8.6%	8.5%	10.0%	10.1%	8.9%	8.6%	10.1%	10.2%
EBITDA Margin	13.2%	12.7%	14.6%	13.7%	13.4%	13.4%	15.2%	15.1%	13.5%	13.3%	15.2%	15.2%
Incremental EBIT Margin YoY	-16.0%	23.0%	-1.0%	15.3%	14.9%	19.2%	22.2%	23.7%	17.1%	12.9%	17.2%	112.9%
Effective Tax Rate	24.3%	24.7%	24.6%	23.8%	23.6%	25.0%	25.0%	24.0%	24.0%	25.0%	25.0%	24.0%
Net Margin	8.0%	7.5%	9.3%	8.5%	8.3%	8.2%	9.7%	9.8%	8.5%	8.2%	9.8%	9.9%
Y/Y growth												
Sales	-6.3%	-1.5%	3.8%	11.1%	9.9%	12.5%	7.5%	16.0%	6.4%	2.3%	4.7%	0.1%
COGS	-5.8%	-1.3%	3.9%	10.4%	10.6%	12.5%	7.7%	16.6%	6.5%	2.7%	5.3%	0.1%
Gross Profit	-6.9%	-1.9%	3.5%	12.2%	9.1%	12.5%	7.3%	15.3%	6.1%	1.6%	3.9%	0.1%
Operating Expenses	-6.1%	-3.5%	5.3%	11.0%	7.5%	9.0%	4.8%	8.6%	4.8%	1.3%	2.9%	-0.3%
EBITDA	-8.1%	2.1%	-1.6%	11.8%	11.5%	19.3%	12.6%	27.7%	7.8%	2.0%	5.2%	0.5%
EBIT	-8.9%	3.6%	-0.3%	15.2%	13.5%	23.1%	13.2%	32.6%	9.6%	2.6%	6.1%	0.8%
Pretax Income	-8.8%	3.6%	2.9%	15.5%	12.2%	23.9%	12.3%	34.9%	10.4%	2.7%	6.3%	0.8%
Net Income	-8.0%	4.1%	3.3%	15.0%	13.2%	23.4%	11.7%	34.6%	9.8%	2.7%	6.3%	0.8%
Diluted EPS	-9.1%	2.7%	1.8%	15.1%	13.5%	24.1%	12.7%	34.7%	9.8%	2.6%	6.2%	0.8%
Q/Q growth												
Sales	3.2%	0.3%	11.9%	-4.1%	2.1%	2.6%	7.0%	3.5%	-6.4%	-1.4%	9.6%	-1.1%
COGS	2.7%	0.1%	11.3%	-3.6%	2.9%	1.8%	6.6%	4.4%	-6.0%	-1.8%	9.2%	-0.8%
Gross Profit	3.9%	0.5%	12.8%	-4.8%	1.0%	3.6%	7.6%	2.3%	-7.0%	-0.8%	10.0%	-1.5%
Operating Expenses	5.1%	2.4%	5.1%	-1.9%	1.8%	3.8%	1.1%	1.7%	-1.8%	0.3%	2.7%	-1.4%
EBITDA	-0.2%	-4.2%	28.7%	-9.1%	-0.5%	2.5%	21.5%	3.1%	-16.1%	-3.0%	25.3%	-1.4%
EBIT	0.6%	-4.9%	36.1%	-11.6%	-0.9%	3.1%	25.2%	3.6%	-18.0%	-3.5%	29.5%	-1.6%
Pretax Income	2.5%	-6.2%	39.2%	-13.7%	-0.5%	3.6%	26.3%	3.7%	-18.6%	-3.6%	30.7%	-1.7%
Net earnings	1.4%	-6.8%	39.5%	-12.8%	-0.2%	1.7%	26.3%	5.1%	-18.6%	-4.9%	30.7%	-0.3%
Diluted EPS	0.9%	-7.2%	38.7%	-11.5%	-0.5%	1.5%	26.0%	5.8%	-18.9%	-5.1%	30.4%	0.4%

Source: Company Reports, Loop Estimates

MSM Annual Earnings Model

Income Statement (FY)

(Dollars in millions, except per-share data)

Analyst: Chris Dankert

	F2008	F2009	F2010	F2011	F2012	F2013	F2014	F2015	F2016	F2017	F2018	F2019	F2020	F2021	F2022E	F2023E
Net Sales	**1,779.8**	**1,489.5**	**1,692.1**	**2,021.8**	**2,355.9**	**2,457.6**	**2,787.1**	**2,910.4**	**2,863.5**	**2,887.7**	**3,203.9**	**3,363.8**	**3,192.4**	**3,243.2**	**3,614.6**	**3,733.5**
Cost of Goods Sold	957.3	801.7	920.9	1,080.9	1,277.7	1,339.1	1,500.9	1,593.8	1,574.6	1,601.5	1,810.9	1,931.8	1,849.1	1,879.6	2,101.2	2,176.8
Gross Profit	**822.5**	**687.8**	**771.2**	**940.9**	**1,078.2**	**1,118.5**	**1,286.3**	**1,316.6**	**1,288.9**	**1,286.2**	**1,393.0**	**1,432.0**	**1,343.3**	**1,363.6**	**1,513.4**	**1,556.7**
Operating Expenses	503.0	483.1	531.3	591.2	664.8	717.1	885.7	932.5	912.9	907.2	972.4	1,025.3	978.9	992.1	1,065.9	1,088.9
Income from Operations	**319.5**	**204.7**	**239.9**	**349.8**	**413.4**	**401.4**	**400.5**	**384.0**	**376.0**	**379.0**	**420.6**	**406.7**	**364.5**	**371.5**	**447.4**	**467.8**
Total Other Income (Expense)	-6.1	2.3	-0.9	-0.4	0.0	-2.1	-3.7	-6.4	-4.2	-11.0	-14.4	-16.9	-16.5	-13.4	-15.6	-15.3
Earnings Before Income Taxes	**313.4**	**207.1**	**239.0**	**349.3**	**413.4**	**399.3**	**396.9**	**377.6**	**371.7**	**368.0**	**406.2**	**389.9**	**348.0**	**358.1**	**431.8**	**452.5**
Income Taxes	117.1	76.8	90.3	130.5	153.6	151.1	150.1	143.6	140.5	136.7	77.0	95.9	85.8	87.2	105.4	110.9
Net Income	**196.3**	**125.2**	**148.7**	**218.8**	**259.8**	**248.2**	**246.8**	**234.1**	**231.2**	**231.2**	**329.2**	**294.0**	**262.2**	**270.9**	**326.4**	**341.6**
GAAP EPS- Basic	$3.08	$2.03	$2.38	$3.47	$4.12	$3.80	$3.81	$3.76	$3.79	$4.06	$5.84	$5.23	$4.53	$3.89	$5.79	$6.13
GAAP EPS- Diluted	**$3.04**	**$2.00**	**$2.36**	**$3.43**	**$4.10**	**$3.78**	**$3.79**	**$3.74**	**$3.76**	**$4.04**	**$5.79**	**$5.20**	**$4.52**	**$3.87**	**$5.75**	**$6.10**
Charges and One-Time Items	-0.9	0.0	0.0	0.0	0.8	10.3	10.7	2.5	0.0	0.0	-41.2	5.2	10.5	52.9	3.9	0.0
Charges and One-Time Items (EPS Impact)	-$0.02	$0.00	$0.00	$0.00	$0.01	$0.16	$0.17	$0.04	$0.00	$0.00	-$0.72	$0.09	$0.19	$0.95	$0.07	$0.00
Adjusted EPS	**$3.02**	**$2.00**	**$2.35**	**$3.43**	**$4.12**	**$3.92**	**$3.95**	**$3.79**	**$3.76**	**$4.04**	**$5.08**	**$5.30**	**$4.71**	**$4.81**	**$5.83**	**$6.10**
Basic Shares Outstanding	63.8	61.8	62.5	62.9	62.4	62.7	62.0	61.3	60.9	56.8	56.4	55.2	55.5	55.7	55.5	55.5
Diluted Shares Outstanding	64.7	62.6	63.1	63.3	62.8	63.0	62.3	61.5	61.1	56.9	56.7	55.5	55.6	56.1	55.9	55.9
Cash Dividends per Share	$0.74	$0.80	$0.88	$1.88	$1.00	$1.20	$1.32	$4.60	$1.72	$1.80	$2.22	$2.64	$3.00	$3.00	$3.04	$3.19
Margins																
Cost of Goods Sold	53.8%	53.8%	54.4%	53.5%	54.2%	54.5%	53.9%	54.8%	55.0%	55.5%	56.5%	57.4%	57.9%	58.0%	58.1%	58.3%
Gross Margin	46.2%	46.2%	45.6%	46.5%	45.8%	45.5%	46.1%	45.2%	45.0%	44.5%	43.5%	42.6%	42.1%	42.0%	41.9%	41.7%
Operating Expenses	28.3%	32.4%	31.4%	29.2%	28.2%	29.2%	31.8%	32.0%	31.9%	31.4%	30.4%	30.5%	30.7%	30.6%	29.5%	29.2%
EBIT Margin	18.0%	13.7%	14.2%	17.3%	17.5%	16.3%	14.4%	13.2%	13.1%	13.1%	13.1%	12.1%	11.4%	11.5%	12.4%	12.5%
NOPAT Margin	11.2%	8.6%	8.8%	10.8%	11.0%	10.2%	8.9%	8.2%	8.2%	8.2%	10.6%	9.1%	8.6%	8.7%	9.4%	9.5%
EBITDA Margin	19.5%	15.6%	15.7%	18.7%	19.0%	18.3%	16.7%	15.6%	15.6%	15.3%	15.1%	14.0%	13.6%	13.6%	14.3%	14.4%
Incremental EBIT Margin YoY	31.3%	-39.5%	17.4%	33.3%	19.1%	-11.8%	-0.3%	-13.4%	-17.2%	12.5%	13.1%	-8.6%	-24.6%	13.8%	20.4%	17.1%
Effective Tax Rate	37.4%	37.1%	37.8%	37.4%	37.1%	37.8%	37.8%	38.0%	37.8%	37.2%	18.9%	24.6%	24.6%	24.4%	24.4%	24.5%
Net Margin	11.0%	8.4%	8.8%	10.8%	11.0%	10.1%	8.9%	8.0%	8.1%	8.0%	10.3%	8.7%	8.2%	8.4%	9.0%	9.2%
Y/Y growth																
Sales	5.4%	-16.3%	13.6%	19.5%	16.5%	4.3%	13.4%	4.4%	-1.6%	0.8%	10.9%	5.0%	-5.1%	1.6%	11.5%	3.3%
COGS	5.5%	-16.3%	14.9%	17.4%	18.2%	4.8%	12.1%	6.2%	-1.2%	1.7%	13.1%	6.7%	-4.3%	1.7%	11.8%	3.6%
Gross Profit	5.4%	-16.4%	12.1%	22.0%	14.6%	3.7%	15.0%	2.4%	-2.1%	-0.2%	8.3%	2.8%	-6.2%	1.5%	11.0%	2.9%
Operating Expenses	2.7%	-3.9%	10.0%	11.3%	12.4%	7.9%	23.5%	5.3%	-2.1%	-0.6%	7.2%	5.4%	-4.5%	1.4%	7.4%	2.2%
EBITDA	13.6%	-31.0%	13.8%	41.9%	19.3%	0.3%	4.3%	-1.2%	-0.6%	5.8%	9.9%	-0.3%	-8.4%	0.7%	17.8%	3.7%
EBIT	9.8%	-35.9%	17.2%	45.8%	18.2%	-2.9%	-0.2%	-4.1%	-2.1%	0.8%	11.0%	-3.3%	-10.4%	1.9%	20.4%	4.6%
Pretax Income	12.1%	-33.9%	15.4%	46.2%	18.3%	-3.4%	-0.6%	-4.8%	-1.6%	-1.0%	10.4%	-4.0%	-10.7%	2.9%	20.6%	4.8%
Net Income	12.8%	-36.2%	18.8%	47.1%	18.8%	-4.5%	-0.6%	-5.1%	-1.2%	0.0%	42.4%	-10.7%	-10.8%	3.3%	20.5%	4.7%
Diluted EPS	16.5%	-33.8%	17.2%	46.1%	20.2%	-4.7%	0.6%	-4.1%	-0.8%	7.4%	25.8%	4.4%	-11.2%	2.3%	21.1%	4.6%

Source: Company Reports, Loop Estimates

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Valuation

Our price target of $93 reflects roughly 16.0x our FY22 (Aug) EPS forecast of $5.83, and 15.3x our FY23 EPS forecast of $6.10 vs. MSM's 10-year median multiple of 17x. MSM is currently trading at 14.3x our FY22 EPS forecast of $5.83, and 13.7x our FY23 EPS forecast of $6.10. MSM is also trading at 10.3x our FY22 EBITDA forecast of $517M and 10.0x our FY23 EBITDA forecast of $536M, which compares to MSM's 10-year median EV/EBITDA multiple of 10.1x.

Risks to Our Analysis

Downside risks to our HOLD rating and price target include, but are not limited to: a downturn in North American industrial production, reduced U.S. export activity, any missteps or share loss due to the strategy pivot, any weakening in pricing power or inability to effectively pass along rising vendor and/or labor costs, the potential for increased U.S. corporate tax rate, and potential conflicts of interest between MSM's Class B and Class A shareholders. Upside risks include greater than anticipated savings associated with the 'Mission Critical' program, accelerated sales growth above and beyond the targeted market share gains, accretive cash deployment, or greater-than-expected demand recovery in key markets (aerospace, heavy equipment, etc.).

Public Companies Mentioned in this Report

MSC Industrial Direct Co., Inc. (MSM:$83.97-HOLD)

Fastenal Company (FAST:$61.59-HOLD)

W.W. Grainger, Inc. (GWW:$496.79-BUY)

IMPORTANT DISCLOSURES

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(2) no part of the compensation was, is, or will be directly, or indirectly, related to the specific recommendations or views expressed in this report.

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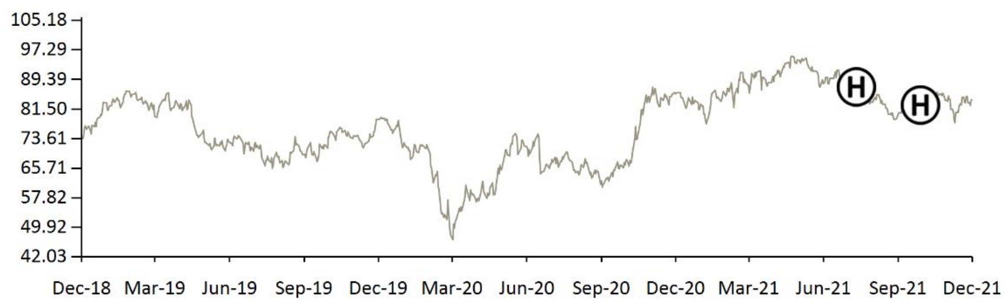
MSC Industrial Direct Co., Inc. Rating History as of 12/21/2021



Date	Closing Price ($)	Target Price ($)	Analyst	Rating
02-Aug-21	87.17	92.00	Chris Dankert	I,HOLD
21-Oct-21	82.40	93.00	Chris Dankert	HOLD

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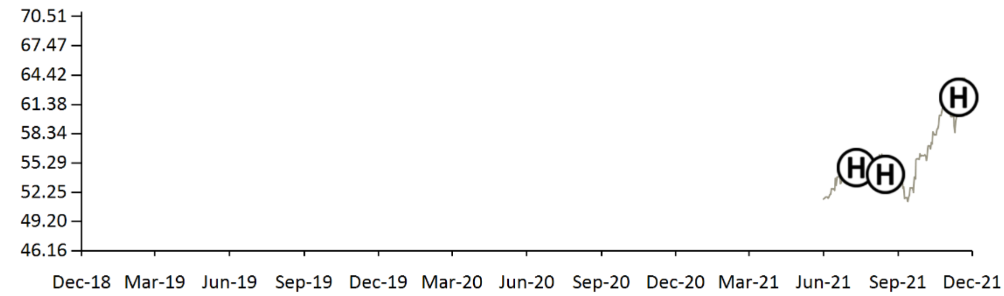
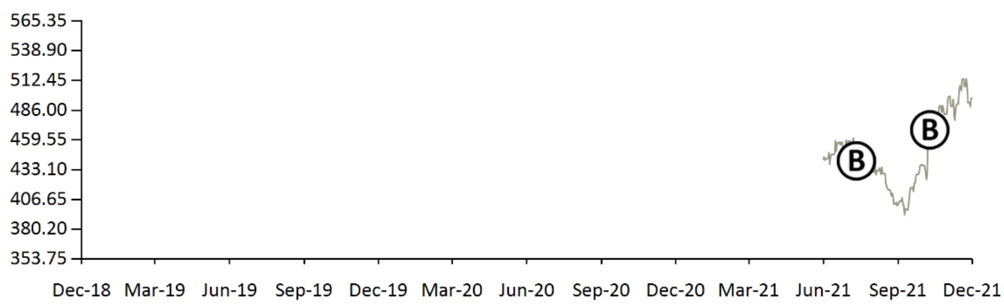
Fastenal Company Rating History as of 12/21/2021



Date	Closing Price ($)	Target Price ($)	Analyst	Rating
02-Aug-21	54.71	52.00	Chris Dankert	I,HOLD
07-Sep-21	54.01	53.00	Chris Dankert	HOLD
06-Dec-21	62.00	57.00	Chris Dankert	HOLD

W.W. Grainger, Inc. Rating History as of 12/21/2021



Date	Closing Price ($)	Target Price ($)	Analyst	Rating
02-Aug-21	440.16	525.00	Chris Dankert	I,BUY
01-Nov-21	467.92	565.00	Chris Dankert	BUY

Stock Ratings

Buy - The stock is expected to trade higher on an absolute basis or outperform relative to the market or its peer stocks over the next 12 months.

Hold - The stock is expected to perform in line with the market or its peer stocks over the next 12 months.

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Sell - The stock is expected to trade lower on an absolute basis or underperform relative to the market or its peer stocks over the next 12 months.

Ratings Distribution for Loop Capital Markets as of December 21, 2021

			IB Serv./Past 12 Mos.	
	Count	% of total	Count	% of total
Buy	156	60.47%	38	24.36%
Hold	98	37.98%	13	13.27%
Sell	4	1.55%	1	25.00%

Source: Loop Capital Markets

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MSC INDUSTRIAL DIRECT CO., INC. (MSM-NYSE)

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JANUARY 6, 2021 | 8:38 AM EST
COMPANY BRIEF

F1Q Essentially In-Line With Views, With Dec ADS Encouraging

Summary: F1Q21 EPS mildly beat our estimate and consensus views, with slightly higher 1Q ADS and sequentially improved gross margin. Preliminary December ADS were comfortably above our FY2Q ADS assumption and consensus. The company reiterated the 2021 full-year operating margin framework, which remains in line with our estimates and consensus.

(+) F1Q21 (September-November) EPS of $1.10 beat our estimate of $1.04 and consensus $1.08. See Figure 1 for a summary of F1Q results. Adjusted results exclude a $27M impairment charge related to a pre-payment for shipments of nitrile gloves not yet received.

(=) 1Q EBIT of $85M beat our $82M estimate but mildly missed consensus of $86M. Gross margin improved sequentially by 30bps and beat our model by 33bps.

(+/=) 1Q total average daily sales (ADS) were -6.3% y/y, slightly higher versus our model of -6.6%. Management noted continued sequential improvement in non-safety products. Safety products sales grew at ~20% y/y, remained stable sequentially.

(+) Preliminary December ADS of +2.4% y/y were well above our F2Q (December-February) ADS assumption of -4.6% y/y and consensus -4.8% y/y.

(=) MSC reiterated its 2021 full-year operating margin framework, which comports with views. We currently model FY21 revenue -1.4% y/y with an operating margin of 11.3%, which is generally in line with company guidance of 11.0%-11.4% if sales were to fall in the low single digits. Consensus views FY21 revenue flat y/y with an operating margin of 11.4%, which is in line with MSC's guided range of 11.2%-11.6% if sales were to be flat. MSC also continues to suggest that operating margins would range between 11.5% to 11.9% if FY21 revenue were to grow in the low single digits.

MSC is hosting its F1Q21 conference call at 8:30 a.m. ET. Dial-in: 1-877-443-5575.

Market Perform 3

Suitability	Medium Risk/Growth

MARKET DATA

Current Price (Jan-5-21)	$82.32
Market Cap (mln)	$4,588
Current Net Debt (mln)	$494
Enterprise Value (mln)	$5,082
Shares Outstanding (mln)	55.7
30-Day Avg. Daily Value (mln)	$28.2
Dividend	$3.00
Dividend Yield	3.6%
52-Week Range	$44.93 - $87.84
BVPS	$23.76
ROE	17.0%
Long-Term Debt (mln)	$619
Long-Term Debt as % of Cap	32%

KEY FINANCIAL METRICS

	1Q	2Q	3Q	4Q
Non-GAAP EPS ($, Aug FY)				
2019A	1.33	1.24	1.44	1.30
2020A	1.21	1.00	1.42	1.09
2021E	1.04	0.95	1.37	1.12
2022E	1.11	1.02	1.44	1.19

	2019A	2020A	2021E	2022E
Non-GAAP EPS ($, Aug FY)	5.29	4.74	4.50	4.75
P/E (Non-GAAP)	15.6x	17.4x	18.3x	17.3x
GAAP EPS ($, Aug FY)	5.20	4.51	4.29	4.62
Revenue (mln) ($, Aug FY)	3,364	3,192	3,147	3,264
Adj. EBITDA (mln) ($, Aug FY)	472	435	427	447

Source: Thomson One, Raymond James & Associates. Quarterly figures may not add to full year due to rounding.
Non-GAAP EPS excludes one-time items.

UCC-179

WESCO_UCC00003201

Figure 1:

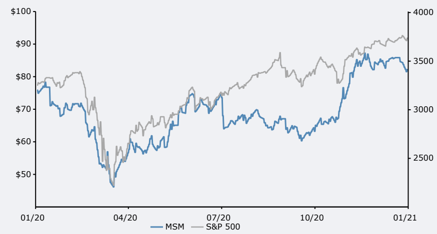
MSC Industrial Direct 1Q 2021 Results							
Data Item	**Last Year**	**This Year**	**RJ Est**	**Y/Y Ch**	**Variance Vs. RJ**	**EPS Delta**	**Comments**
Total Avg Daily Sales (ADS)	**-1.0%**	**-6.3%**	**-6.6%**				organic volumes -7.5%, pricing +1.3%
Shipping Days	62	62	62				
ADS - Mfrg End Mkts	-1.3%	-13.5%	-10.8%				65% of total sales vs 70% LY
ADS - non-Mfrg End Mkts	-0.3%	10.8%	7.4%				35% of total sales (government 11% of total sales vs 7% last year)
ADS September	**-0.6%**	**-8.5%**					
ADS October	**-1.2%**	**-3.9%**					
ADS November	**-1.2%**	**-5.9%**					
ADS December	**-1.4%**	**2.4%**					
ADS Midwest	-4.6%	-4.1%					
ADS Northeast	1.7%	-7.0%					
ADS Southeast	-3.1%	-10.4%					
ADS West	0.5%	-10.5%					
ADS International/Other	36.7%	27.8%					
Net Sales	$824	$772	$769	-6.3%	$3	$0.00	Street $770m (MILD BEAT), ecomm sales -6.3% y/y (61% of total)
Cost of Sales	$476	$449	$450	-6%	-$1		
Gross Profit	$347	$323	$320	-7%	$4		
Gross Margin	42.2%	41.9%	41.6%	-27 bps	33 bps	$0.03	Street 41.8% (MILD BEAT)
Operating Exp, ex items	$254	$239	$237	-6.1%	$1.3		field associates -1.5% y/y, full time associates -5% y/y, part time associates +22% y/y
Oper Exp % of Sales	30.9%	30.9%	30.9%	4 bps	7 bps	($0.01)	
EBIT $	$93	$85	$82	-9%	$2	**$0.03**	Street $86m (MILD MISS)
Oper Margin, Reported	11.3%	11.0%	10.7%	-31 bps	26 bps		Street 11.1% (MILD MISS)
YOY Op Profit Pull-Thru		35%	38%				
YOY Contrib Margin		16%	19%				
Int Exp	($3)	($3)	($5)	6%	-$1	$0.02	
Int Income	$0	$0	$0	110%	$0	($0.00)	
Other (exp) inc, incl items	($2)	($30)	($4)	1127%	-$26	($0.35)	includes $27m impairment loss
Pre-tax Inc	$87	$51	$74	-41%	-$23	($0.31)	
Income Tax	25.0%	24.3%	25.0%	-69 bps	-70 bps	$0.01	adjusted tax rate also 24.3%
Net Income	$65	$38	$56				
Non-Recurring Items	$2	$23	$3		$20	$0.36	
Adj Net Inc (Loss)	$67.3	$61.7	$58.4	-8%	$3	$0.06	
Reptd EPS	$1.18	$ 0.69	$ 0.99	-42%			
EPS effect, 1-time items	$ 0.03	$ 0.42	$ 0.05				
Dltd EPS (ex-items)	**$1.21**	**$ 1.10**	**$ 1.04**	-9%		**$0.06**	Street $1.08 (BEAT)
Avg Diluted Sh O/S	55.4	55.9	55.9	1%		$0.00	
Cash Flow Items:							
A/R in DSOs (net of doubtfuls)	59	58	59	-1 days	-1 days		
Inventory days COGS	103	106	102	3 days	4 days		
A/P days COGS	27	29	27	2 days	2 days		
Cash Conversion Cycle	135	135	134	0 days	1 days		
Cash Flow Impacts							
Net A/R DSOs				*$9*	*$8*		
Inventory Day COGS				*-$13*	*-$18*		
A/P Day COGS				*$9*	*$9*		
Cash Conversion Cycle				*$5*	*-$1*		
Qtrly Oper Cash Flow	**$85**	**$103**	**$107**	**21%**	**-$4**		
Oper Cash Flow Margin	**10%**	**13%**	**14%**				

Source: Company Reports, Raymond James

WESCO_UCC00003202

COMPANY DESCRIPTION

MSC Industrial Direct, based in Melville, New York, is one of the largest direct marketers of a full line of industrial products in the U.S., primarily for maintenance, repair, and operations (MRO) needs. Domestic manufacturing end-markets represent the bulk of MSC's demand, with particular focus on metalworking applications.



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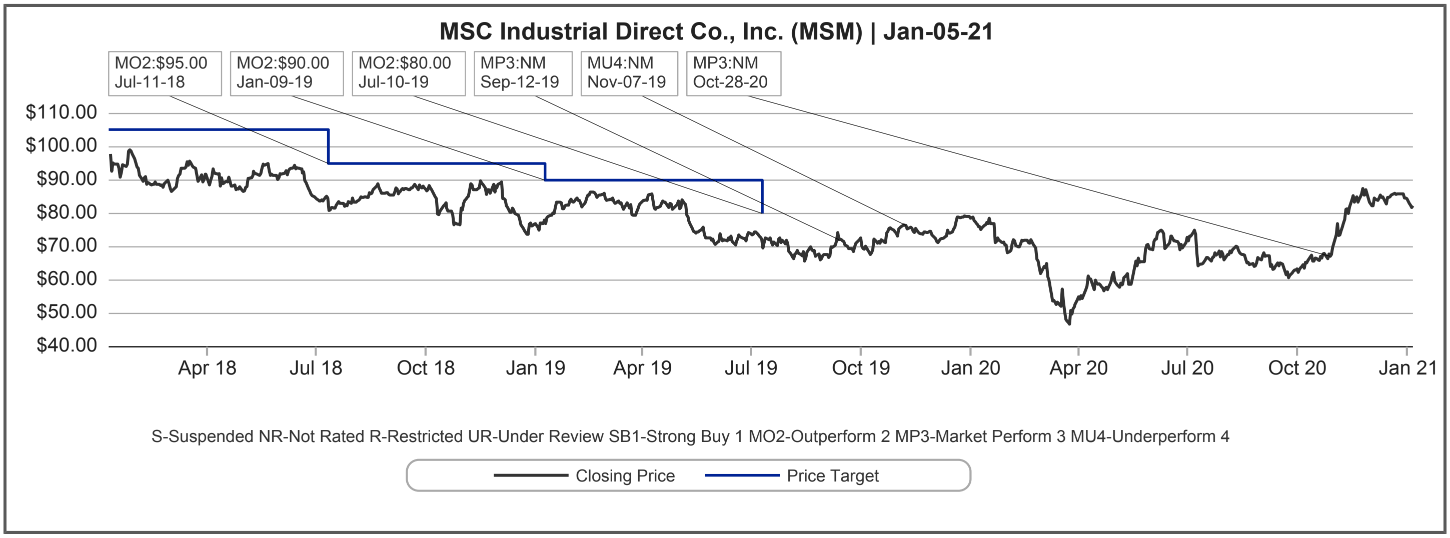

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MSC Industrial Direct Co., Inc.
Valuation Methodology: We value MSC Industrial based on P/E multiples relative to peers and the market, and also consider EV/EBITDA multiples and our DCF-derived estimate of intrinsic value.

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Company Specific Risk Factors

MSC Industrial Direct Co., Inc.

Exposure to General Economic Activity
As much as 75% of MSC's revenue is derived from manufacturing end-markets, with the remaining 25+% coming from other economically-sensitive end-markets. If economic growth is below average, it is likely MSC's financial results would be negatively impacted.

Acquisition Integration Risk
From time to time, MSC has made acquisitions in an effort to expand its product line or geographic offering. We expect this to continue in the future. If MSC were to pay too expensive a price, or not achieve estimated synergies, an acquisition could negatively impact financial results.

Changes in Mix Could Negatively Impact Margin
The tendency over time has been toward larger customers (and larger order sizes), which generally carry lower margin to MSC. As this mix shift continues, it could negatively pressure margin.

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MSC INDUSTRIAL DIRECT CO., INC. (MSM-NYSE)

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DECEMBER 22, 2021 | 8:25 AM EST
COMPANY BRIEF

1Q EBITDA Beats Views, Primarily Via Opex Control

Summary: MSC's 1Q results beat external expectations, primarily via op-ex control as gross margins were softer than expected. Management noted its operating margin framework for FY22 was trending towards the higher end of the prior range.

(+) MSC reported F1Q22 (September-November) adjusted EPS of $1.25, beating both our $1.16 estimate and $1.20 consensus. Below the line, a slightly lower than expected tax rate benefited EPS by $0.02 per share. Figure 1 compares reported 1Q line item results to expectations.

(+) F1Q total average daily sales (ADS) were +9.9% y/y, similar to our model of +9.8% and above consensus of +8.7%. PPE/safety/janitorial supplies were -12% y/y, while the rest of the business was +15% y/y. ADS to manufacturing customers (~70% of total sales) were +16% y/y (RJ +20%); non-manufacturing customers were -1% y/y (RJ -9%). eCommerce/vending sales (~60% of total sales) were +9.4% y/y. Acquisitions added +0.5% to total ADS, while organic volumes were +7% and price was +2%.

(+) Adjusted EBIT beat our model by $0.09 per share, entirely via better than expected operating expense control (alone, a $0.14 benefit vs RJ). Operating expenses were only 30.2% of sales below both our 31.5% model and 30.9% prior year. Adjusted EBIT margin was 11.3%, beating both our estimate of 10.5% and consensus of 11.1%.

(-) Gross margin missed both internal and external expectations due to early quarter mix pressures (despite management having provided gross margin guidance in late October). Specifically, gross margin was 41.6%, missing our 42.0% model (also guidance) and consensus of 42.1%. The y/y decline of ~30 bp was driven by adverse mix, which was partially offset by favorable price/cost. Management "implemented countermeasures," which led to gross margin improvement late in F1Q and into December. **MSC continues to expect gross margin will be roughly flat y/y in FY22.**

(=) MSC achieved $10M in cost savings in the quarter and elected to reinvest $7M. MSC continues to target $25M in savings in FY22 and $15M in savings in FY23.

(=/+) MSC reiterated the entirety of its prior FY22 ADS/operating margin guidance framework, but noted it was trending toward the higher end. Recall the current range is mid- to high single digit ADS growth (RJ/Street +7%) and adjusted operating margin of 11.7-12.6% (RJ/Street 12.0%/12.2%).

MSC is hosting its conference call at 8:30 a.m. ET.

Market Perform 3

Suitability	MA/ACC

MARKET DATA

Current Price (Dec-21-21)	$83.97
Market Cap (mln)	$4,694
Current Net Debt (mln)	$746
Enterprise Value (mln)	$5,440
Shares Outstanding (mln)	55.9
30-Day Avg. Daily Value (mln)	$29.1
Dividend	$3.00
Dividend Yield	3.6%
52-Week Range	$77.47 - $96.23
BVPS	$20.93
ROE	22.1%
Long-Term Debt (mln)	$786
Long-Term Debt as % of Cap	40%

KEY FINANCIAL METRICS

Non-GAAP EPS ($, Aug FY)	1Q	2Q	3Q	4Q
2020A	1.21	1.00	1.42	1.09
2021A	1.10	1.03	1.42	1.26
2022E	1.16	1.22	1.56	1.62
2023E	1.27	1.34	1.68	1.36

	2020A	2021A	2022E	2023E
Non-GAAP EPS ($, Aug FY)	4.74	4.81	5.56	5.66
P/E (Non-GAAP)	17.7x	17.5x	15.1x	14.8x
GAAP EPS ($, Aug FY)	4.51	3.87	5.45	5.59
Revenue (mln) ($, Aug FY)	3,192	3,243	3,555	3,668
Adj. EBITDA (mln) ($, Aug FY)	435	440	494	502

Source: Thomson One, Raymond James & Associates. Quarterly figures may not add to full year due to rounding.
Non-GAAP EPS excludes one-time items.

UCC-180

Figure 1:

MSC Industrial Direct 1Q 2022 Results

Data Item	Last Year	This Year	RJ Est	Y/Y Ch	Variance Vs. RJ	EPS Delta	Comments
Total Avg Daily Sales (ADS)	**-6.3%**	**9.9%**	**9.8%**				organic volumes +7.0%, pricing +2.3% (+2.8% last quarter), non PPE/janitorial +15%, PPE -12%, acq's +0.5%
Shipping Days	62	62	62				
ADS - Mfrg End Mkts	-13.5%	15.7%	19.5%				68% of total sales vs 65% LY
ADS - non-Mfrg End Mkts	10.8%	-0.6%	-9.1%				32% of total sales (government 7% of total sales vs 7% last quarter)
ADS Sept	**-8.5%**	**11.1%**					
ADS Oct	**-3.9%**	**6.9%**					
ADS Nov	**-5.9%**	**11.9%**					
ADS Dec	**3.1%**						
ADS Midwest	-4.1%	9.3%					
ADS Northeast	-7.0%	6.0%					
ADS Southeast	-10.4%	11.9%					
ADS West	-10.5%	11.9%					
ADS International/Other	27.8%	9.9%					
Net Sales	$772	$849	$847	9.9%	$1	$0.00	Street $839m (BEAT), ecomm sales +9.4% y/y (60% of total)
Cost of Sales	$449	$496	$491	11%	$4		
Gross Profit	$323	$353	$356	9%	-$3		
Gross Margin	41.9%	41.6%	42.0%	-33 bps	-44 bps	($0.05)	Street 42.1% (MISS), prior guidance 42.0% (ie flat sequentially), "positive price-cost partially offset mix headwinds"
Operating Exp, ex items	$239	$257	$266	7.5%	-$9.9		field associates +6% y/y, full time associates +5% y/y, part time associates +3% y/y
Oper Exp % of Sales	30.9%	30.2%	31.5%	-69 bps	-121 bps	$0.14	
EBIT $	$85	$96	$89	13%	$7	**$0.09**	Street $93m (BEAT)
Oper Margin, Reported	11.0%	11.3%	10.5%	35 bps	77 bps		Street 11.1% (BEAT)
YOY Contrib Margin		15%	6%				
EBITDA $	**$102**	**$113**	**$107**	12%	$7	**$0.09**	**Street $109m (BEAT)**
Int Exp	($3)	($4)	($4)	11%	$0	$0.00	
Int Income	$0	$0	$0	-10%	$0	$0.00	
Other (exp) inc, incl items	($30)	($6)	($2)	-81%	-$4	($0.05)	incl $5m restr
Pre-tax Inc	$51	$87	$83	69%	$3	$0.04	
Income Tax	24.3%	23.5%	24.8%	-80 bps	-125 bps	$0.02	adjusted tax rate 23.6%, benefit of $0.02 EPS vs RJ
Net Income	$39	$66	$63				
Non-Recurring Items	$23	$4	$1		$3	$0.05	
Adj Net Inc (Loss)	$62	$70	$64	13%	$6	$0.10	
Reptd EPS	$0.69	$1.18	$1.13	70%			
EPS effect, 1-time items	$ 0.41	$ 0.07	$ 0.03				
Dltd EPS (ex-items)	**$1.10**	**$1.25**	**$1.16**	13%		**$0.10**	**Street $1.20 (BEAT)**
Avg Diluted Sh O/S	56	56	56	0%		($0.01)	repurchased $4.6m worth of stock during quarter
Cash Flow Items:							
A/R in DSOs (net of doubtfuls)	58	62	60	4 days	2 days		
Inventory days COGS	106	115	116	9 days	-1 days		
A/P days COGS	29	33	29	4 days	4 days		
Cash Conversion Cycle	135	144	147	9 days	-3 days		
Cash Flow Impacts							
Net A/R DSOs				*-$36*	*-$18*		
Inventory Day COGS				*-$46*	*$8*		
A/P Day COGS				*$19*	*$19*		
Cash Conversion Cycle				*-$63*	*$9*		
Qtrly Oper Cash Flow	**$103**	**$58**	**$22**	**-44%**	**$36**		
Oper Cash Flow Margin	**13%**	**7%**	**3%**				

Source: Company Reports, Raymond James

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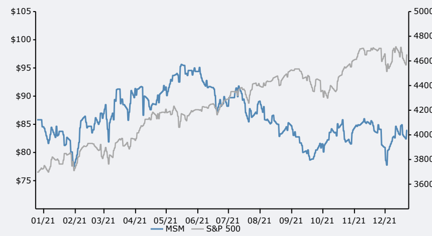
MSC Industrial Direct, based in Melville, New York, is one of the largest direct marketers of a full line of industrial products in the U.S., primarily for maintenance, repair, and operations (MRO) needs. Domestic manufacturing end-markets represent the bulk of MSC's demand, with particular focus on metalworking applications.



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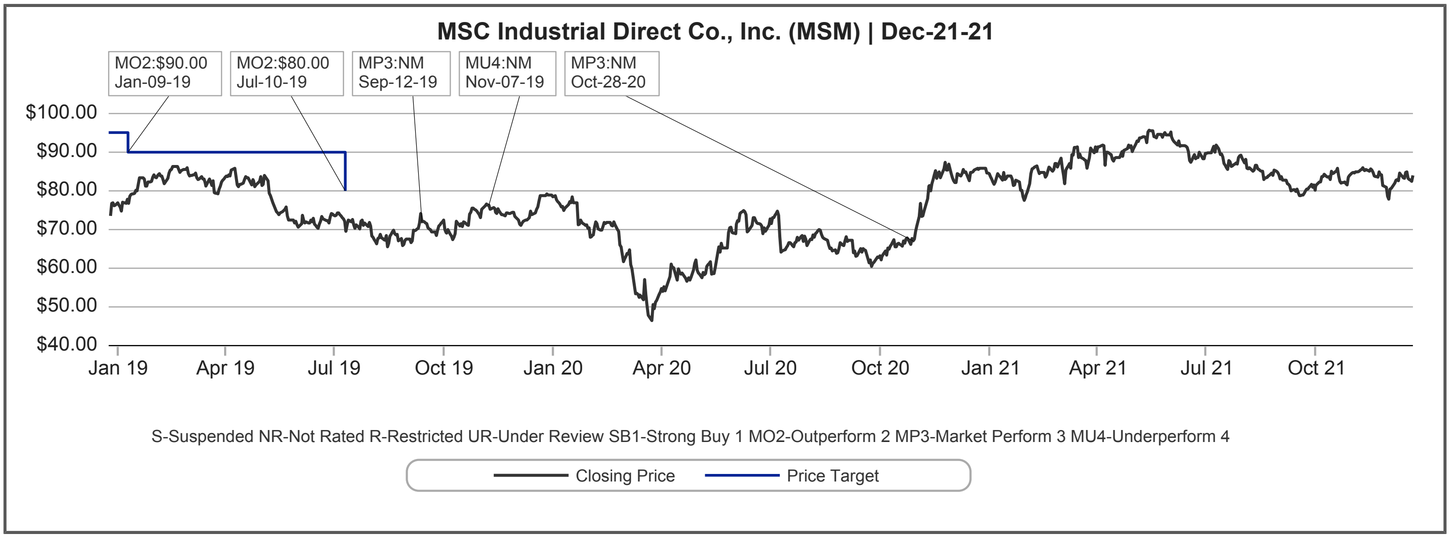

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MSC Industrial Direct Co., Inc.
Valuation Methodology: We value MSC Industrial based on P/E multiples relative to peers and the market, and also consider EV/EBITDA multiples and our DCF-derived estimate of intrinsic value.

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MSC Industrial Direct Co., Inc.

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Total Number of Companies	949	100%	251	100%	250	100%	83	100%

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MSC INDUSTRIAL DIRECT CO., INC. (MSM-NYSE)

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COMPANY COMMENT

Solid 1Q Opex Control, But Mfg ADS Spread vs. IP+PPI Narrowing

RECOMMENDATION

Summary: Reiterate **Market Perform**. MSC is gaining share in manufacturing and its opex discipline has been solid. However, we are concerned about the prospect of a push for firming pricing amid moderating market share trends. Valuation is in line with the five-year median.

- **F1Q22 (Sept-Nov) adjusted EPS was $1.25 vs. RJ/Street $1.16/$1.20.** F1Q total average daily sales (ADS) were +9.9% y/y, virtually matching our model but above consensus +8.7%. **Adjusted EBIT beat our model by $0.09/share, entirely via better than expected operating expense control (alone, a $0.14 benefit vs. RJ).** Below the line, tax rate aided results by another $0.02. Fig. 1 compares reported 1Q line item results to expectations; refer to our brief for additional discussion of 1Q results.
- Beyond the solid opex control performance, 1Q was constructively notable for several reasons. First, much like 4Q there has been clear traction related to "Mission Critical" sales growth initiatives related to vending and in-plants. Specifically, vending signings rose by over 50% y/y, and in-plant (onsite) sales represented 8% of 1Q sales vs. 7% sequentially in 4Q. Further, the early returns on MSC's new price realization efforts (including discount management and contract pricing re-negotiations) appear encouraging, especially given the mid/high single digit price hikes expected in late January.
- That said, there were clearly some negative items of note, which likely capped investor enthusiasm despite the "beat". **First, reported gross margin missed views for the first time since 2017** (especially unusual given that management provided 1Q gross margin guidance in late October). This was due to greater price-cost pressures than previously expected, thus prompting the price realization efforts described above. Further – and perhaps relatedly – although MSC's ADS to manufacturing end markets (+16% y/y) exceeded IP+PPI during the quarter (+14%), the spread between MSC's manufacturing ADS and the market growth approximation narrowed in F1Q22 (Fig. 5). Hence, it would seem that **MSC's more rigid pricing could put further market share gains at risk.**
- **All-in, we characterize MSC's 1Q performance vs. its "Mission Critical" benchmarks as "mixed" and similar to last quarter** (Fig. 3). On the positive side, again we see manufacturing sales outgrowth vs IP+PPI as evidence of share gains in metalworking, vending signings were strong, and cost savings/opex control was excellent. That said, progress in CCSG/fastening was unclear at best, e-commerce sales growth was only in line with overall ADS, and government/non-cyclical mix was unchanged and back at pre-pandemic levels.
- **Estimates:** Our new FY22 and FY23 adjusted EPS estimates are $5.87 from $5.56 prior and $6.09 from $5.66 prior, respectively. Figure 2 summarizes the changes to our model, which are mostly driven by assumptions for improving opex leverage.

Valuation: MSM trades at ~10x our new NTM adjusted EBITDA estimate, approximating the five-year median (Fig. 9). Constructively, the forward FCF yield (excluding changes in working capital) now approximates ~7%, which we deem as increasingly attractive.

Market Perform 3
Target Price NM

Suitability	MA/ACC

MARKET DATA

Current Price (Dec-22-21)	$83.61
Market Cap (mln)	$4,670
Current Net Debt (mln)	$746
Enterprise Value (mln)	$5,416
Shares Outstanding (mln)	55.9
30-Day Avg. Daily Value (mln)	$30.6
Dividend	$3.00
Dividend Yield	3.6%
52-Week Range	$77.47 - $96.23
BVPS	$21.48
ROE	20.6%
Long-Term Debt (mln)	$763
Long-Term Debt as % of Cap	39%

KEY FINANCIAL METRICS

	1Q	2Q	3Q	4Q
Non-GAAP EPS ($, Aug FY)				
2021A	1.10	1.03	1.42	1.26
2022E	1.16	1.22	1.56	1.62
new	**1.25 A**	**1.25**	**1.63**	**1.74**
2023E	1.27	1.34	1.68	1.36
new	**1.34**	**1.37**	**1.76**	**1.62**

	2021A	2022E	2023E
Non-GAAP EPS ($, Aug FY)			
old	4.81	5.56	5.66
new	**4.81**	**5.87**	**6.09**
P/E (Non-GAAP)			
	17.4x	14.2x	13.7x
GAAP EPS ($, Aug FY)			
old	3.87	5.45	5.59
new	**3.87**	**5.73**	**6.02**
Revenue (mln) ($, Aug FY)			
old	3,243	3,555	3,668
new	**3,243**	**3,625**	**3,732**
Adj. EBITDA (mln) ($, Aug FY)			
old	440	494	502
new	**440**	**519**	**535**

Source: Thomson One, Raymond James & Associates. Quarterly figures may not add to full year due to rounding.
Non-GAAP EPS excludes one-time items.

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Please read domestic and foreign disclosure/risk information beginning on page 10 and Analyst Certification on page 11.

Figure 1:

MSC Industrial Direct 1Q 2022 Results

Data Item	Last Year	This Year	RJ Est	Y/Y Ch	Variance Vs. RJ	EPS Delta	Comments
Total Avg Daily Sales (ADS)	**-6.3%**	**9.9%**	**9.8%**				organic volumes +7.0%, pricing +2.3% (+2.8% last quarter), non PPE/janitorial +15%, PPE -12%, acq's +0.5%
Shipping Days	62	62	62				
ADS - Mfrg End Mkts	-13.5%	15.7%	19.5%				68% of total sales vs 65% LY
ADS - non-Mfrg End Mkts	10.8%	-0.6%	-9.1%				32% of total sales (government 7% of total sales vs 7% last quarter)
ADS Sept	**-8.5%**	**11.1%**					
ADS Oct	**-3.9%**	**6.9%**					
ADS Nov	**-5.9%**	**11.9%**					
ADS Dec	**3.1%**						
ADS Midwest	-4.1%	9.3%					
ADS Northeast	-7.0%	6.0%					
ADS Southeast	-10.4%	11.9%					
ADS West	-10.5%	11.9%					
ADS International/Other	27.8%	9.9%					
Net Sales	$772	$849	$847	9.9%	$1	$0.00	Street $839m (BEAT), ecomm sales +9.4% y/y (60% of total)
Cost of Sales	$449	$496	$491	11%	$4		
Gross Profit	$323	$353	$356	9%	-$3		
Gross Margin	41.9%	41.6%	42.0%	-33 bps	-44 bps	($0.05)	Street 42.1% (MISS), prior guidance 42.0% (ie flat sequentially), "positive price-cost partially offset mix headwinds"
Operating Exp, ex items	$239	$257	$266	7.5%	-$9.9		field associates +6% y/y, full time associates +5% y/y, part time associates +3% y/y
Oper Exp % of Sales	30.9%	30.2%	31.5%	-69 bps	-121 bps	$0.14	
EBIT $	$85	$96	$89	13%	$7	**$0.09**	Street $93m (BEAT)
Oper Margin, Reported	11.0%	11.3%	10.5%	35 bps	77 bps		Street 11.1% (BEAT)
YOY Contrib Margin		15%	6%				
EBITDA $	**$102**	**$113**	**$107**	12%	$7	**$0.09**	**Street $109m (BEAT)**
Int Exp	($3)	($4)	($4)	11%	$0	$0.00	
Int Income	$0	$0	$0	-10%	$0	$0.00	
Other (exp) inc, incl items	($30)	($6)	($2)	-81%	-$4	($0.05)	incl $5m restr
Pre-tax Inc	$51	$87	$83	69%	$3	$0.04	
Income Tax	24.3%	23.5%	24.8%	-80 bps	-125 bps	$0.02	adjusted tax rate 23.6%, benefit of $0.02 EPS vs RJ
Net Income	$39	$66	$63				
Non-Recurring Items	$23	$4	$1		$3	$0.05	
Adj Net Inc (Loss)	$62	$70	$64	13%	$6	$0.10	
Reptd EPS	$0.69	$1.18	$1.13	70%			
EPS effect, 1-time items	$ 0.41	$ 0.07	$ 0.03				
Dltd EPS (ex-items)	**$1.10**	**$1.25**	**$1.16**	13%		**$0.10**	**Street $1.20 (BEAT)**
Avg Diluted Sh O/S	56	56	56	0%		($0.01)	repurchased $4.6m worth of stock during quarter
Cash Flow Items:							
A/R in DSOs (net of doubtfuls)	58	62	60	4 days	2 days		
Inventory days COGS	106	115	116	9 days	-1 days		
A/P days COGS	29	33	29	4 days	4 days		
Cash Conversion Cycle	135	144	147	9 days	-3 days		
Cash Flow Impacts							
Net A/R DSOs				*-$36*	*-$18*		
Inventory Day COGS				*-$46*	*$8*		
A/P Day COGS				*$19*	*$19*		
Cash Conversion Cycle				*-$63*	*$9*		
Qtrly Oper Cash Flow	**$103**	**$58**	**$22**	**-44%**	**$36**		
Oper Cash Flow Margin	**13%**	**7%**	**3%**				

Source: Company Reports, Raymond James

Figure 2:

MSC Industrial Estimate Changes

	2Q22				FY22				FY23			
	Prior	Current	Change	EPS Effect	Prior	Current	Change	EPS Effect	Prior	Current	Change	EPS Effect
Net Sales	$871	$862	($9)	-$0.01	$3,555	$3,625	$70	$0.11	$3,668	$3,732	$64	$0.10
Prior Consensus	*$856*				*$3,549*				*$3,690*			
TOTAL y/y Growth (RJ)	12.5%	11.4%			9.6%	11.8%			3.2%	3.0%		
ADS y/y Growth	9.0%	7.9%			6.6%	8.7%			5.2%	5.0%		
ADS y/y Growth, ex Acq's	9.0%	7.9%			6.6%	8.6%			5.2%	5.0%		
Gross Margin	41.9%	41.9%	0.0%	$0.00	42.0%	41.9%	-0.1%	-$0.05	41.6%	41.5%	-0.1%	-$0.05
y/y bps	-10	-10			-6	-16			-40	-40		
Prior Consensus	*42.1%*				*42.1%*				*41.7%*			
EBITDA	**$111**	**$114**	**$3**		**$494**	**$519**	**$25**		**$502**	**$535**	**$34**	
Prior Consensus	*$113*				*$502*				*$527*			
Operating Margin	10.8%	11.2%	0.4%	$0.05	12.0%	12.4%	0.4%	$0.21	11.8%	12.5%	0.7%	$0.34
y/y bps	40	81			52	95			-15	9		
Prior Consensus	*11.3%*				*12.2%*				*12.4%*			
Net Interest Expense	$4	$4	($0)	$0.00	$15	$14	($1)	$0.02	$13	$11	($2)	$0.03
Tax Rate	25%	25%	0%	$0.00	25%	24%	0%	$0.02	25%	25%	0%	$0.00
y/y bps	-5	-5			32	7			0	26		
Net Income, ex-items	$68	$70	$2	$0.04	$309	$328	$20	$0.35	$316	$343	$26	$0.47
y/y Growth	18%	21%			14%	22%			2%	4%		
EPS	**$1.22**	**$1.25**	**$0.03**	**$0.03**	**$5.56**	**$5.87**	**$0.32**	**$0.32**	**$5.66**	**$6.09**	**$0.43**	**$0.43**
Prior Consensus	*$1.23*				*$5.66*				*$5.96*			
y/y Growth	19%	22%			15%	22%			2%	4%		
Shares	56	56	0	-$0.01	56	56	0	-$0.03	56	56	0	-$0.04

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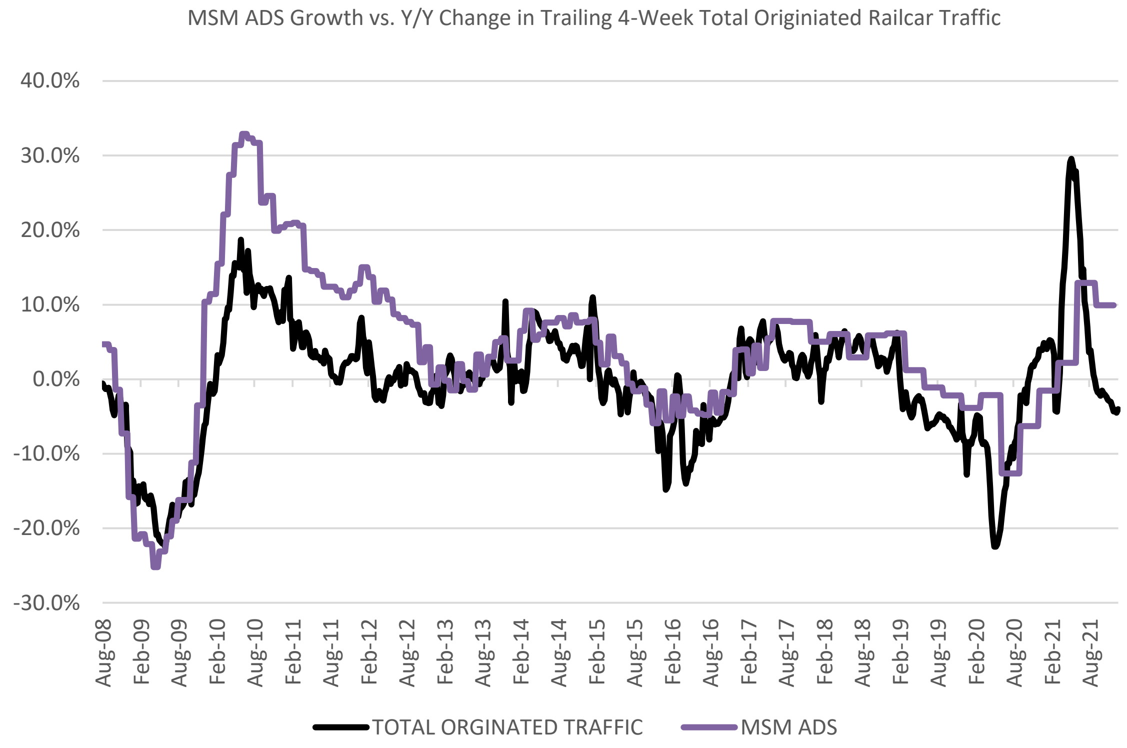
Figure 3:

"Mission Critical" Benchmark Performance, F1Q22

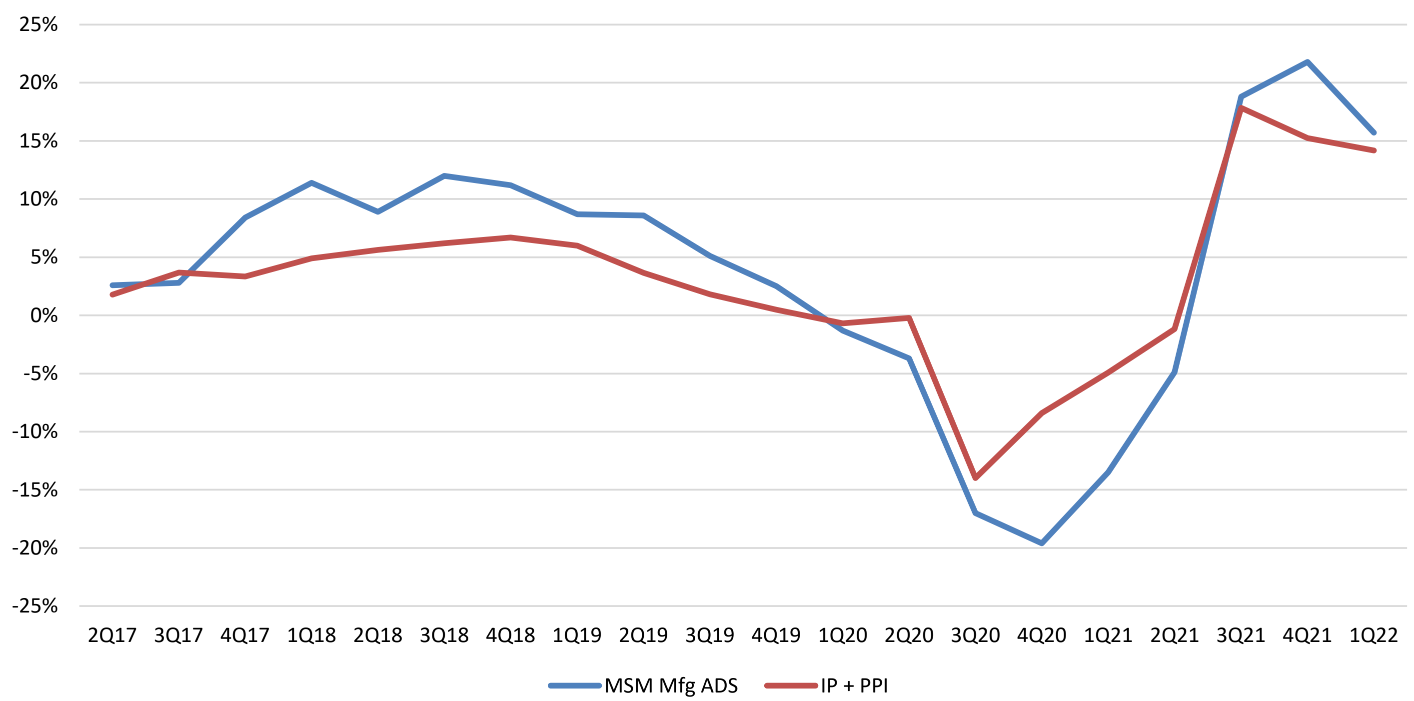
Mission Critical Objectives	Specifics	F1Q Performance	RJ Grade
Solidify Metalworking	Gain share in metalworking	**- Sales to manufacturing (ie metalworking) end markets +16%, flattish sequentially on 2-yr stack. This compares favorably to IP plus PPI in F1Q at +14% y/y, which worsened sequentially by 100bp on a 2-year stack** -non-safety/jan/san +15% in 1Q, which weakened vs 4Q +20%	✓
Leverage Portfolio Strength	Gain share in CCSG / fastening consumables	**- CCSG sales growth was undisclosed and not listed as a growth driver; note FAST fastener ADS ~+20%**	X
Expand Solutions	Grow vending, VMI, onsite (in-plant) sales	**- "Vending signings +50% in 1Q, in-plant 8% of sales in 1Q vs 7% of sales in 4Q"**	✓
Grow E-commerce	Grow digital-based sales	**- Total e-com sales +9% y/y in 1Q vs overall ADS +10%, although MSCDIRECT.COM growing faster than fleet avg**	X
Diversify Customers & End Markets	Grow market share in non-cyclical areas i.e. government	**- Government mix still 7% of total, similar to pre-pandemic levels**	X
Cost Savings - Op-Ex Takeout	Extract $100M in gross savings by end of FY23 vs FY19	- Additional gross savings of $10M in F4Q (investment $7M, net 1Q savings $3M) - Maintained guidance of savings for FY22 of $25M - Maintaining guidance for "investment" in FY22 of $15M **- Expected FY23 net savings maintained "at least $100M"**	✓

Figure 4:



Source: Association of American Railroads, Raymond James Research.

Figure 5: MSC's Y/Y Manufacturing ADS vs. Y/Y Industrial Production + Y/Y Producer Price Index (Final Demand)



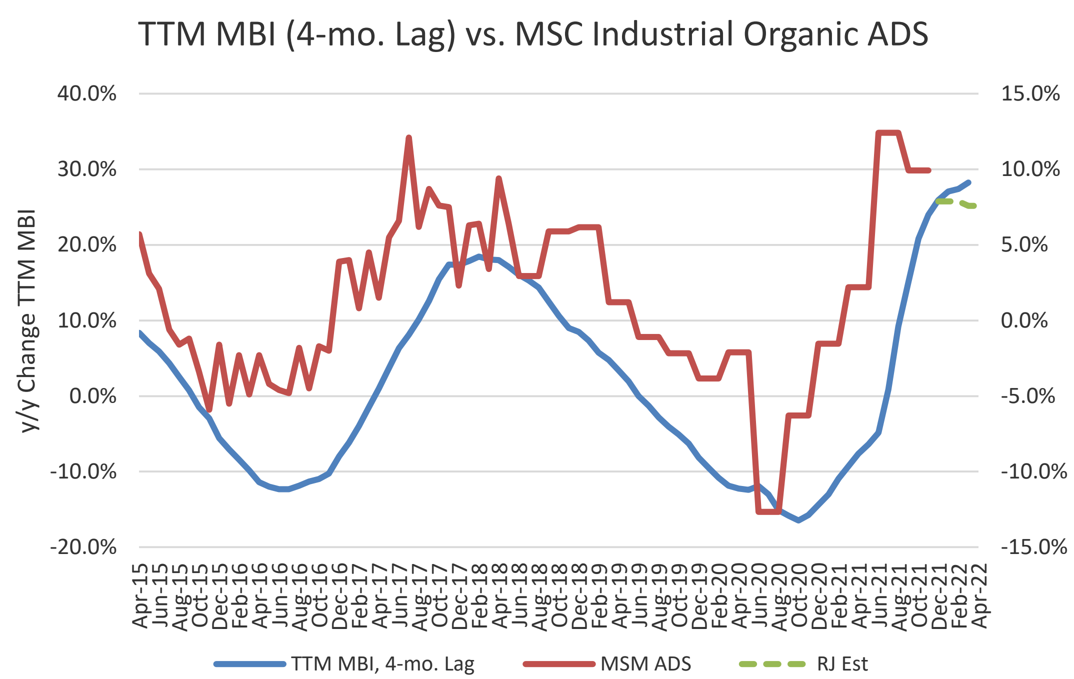
Source: Company information, Federal Reserve, Bureau of Labor Statistics, Raymond James research.

Figure 6:

Metalworking Business Index (MBI)		
Month	**Index**	**Variance from 50**
Oct-19	48.3	-3.4%
Nov-19	47.0	-6.0%
Dec-19	48.2	-3.6%
Jan-20	50.2	0.4%
Feb-20	50.2	0.4%
Mar-20	41.0	-18.0%
Apr-20	34.4	-31.2%
May-20	40.8	-18.4%
Jun-20	42.9	-14.2%
Jul-20	46.1	-7.8%
Aug-20	48.6	-2.8%
Sep-20	50.0	0.0%
Oct-20	52.9	5.8%
Nov-20	50.2	0.4%
Dec-20	53.6	7.2%
Jan-21	53.5	7.0%
Feb-21	56.0	12.0%
Mar-21	62.8	25.6%
Apr-21	62.2	24.4%
May-21	62.2	24.4%
Jun-21	63.7	27.4%
Jul-21	61.2	22.4%
Aug-21	59.6	19.2%
Sep-21	58.0	16.0%
Oct-21	60.7	21.4%
Nov-21	59.0	18.0%

Source: Gardner Intelligence, Modern Machine Shop, Raymond James Research

Figure 7:



Source: Gardner Intelligence, FactSet, Modern Machine Shop, Company Filings, Raymond James Research

Figure 8:

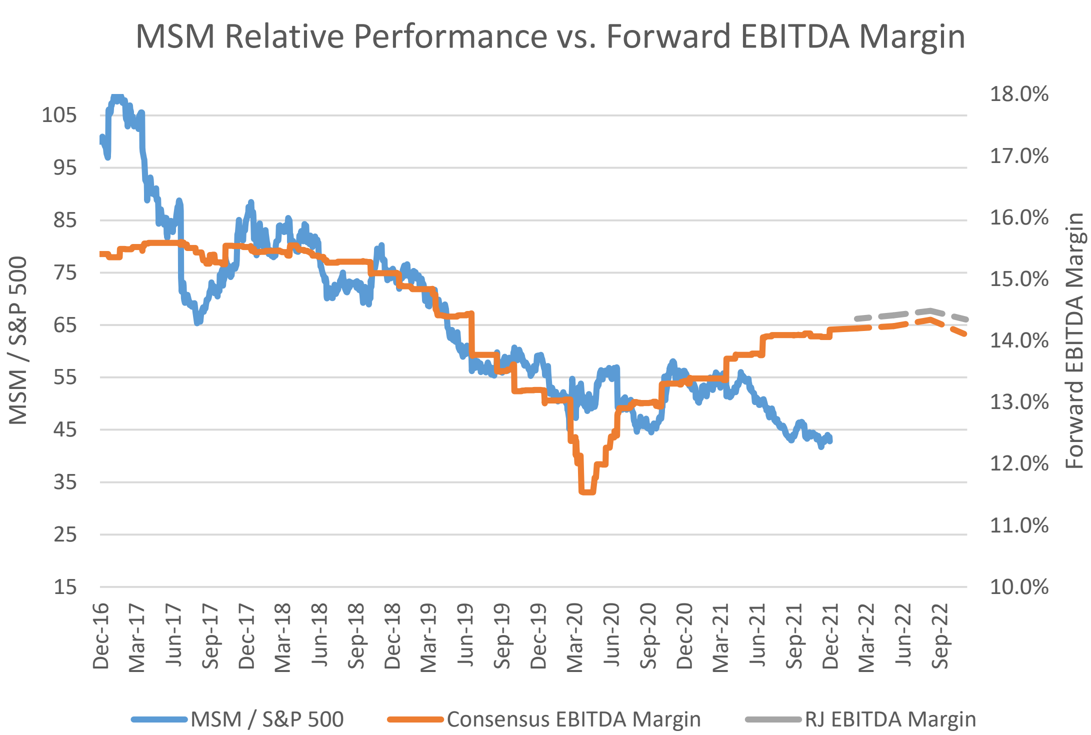
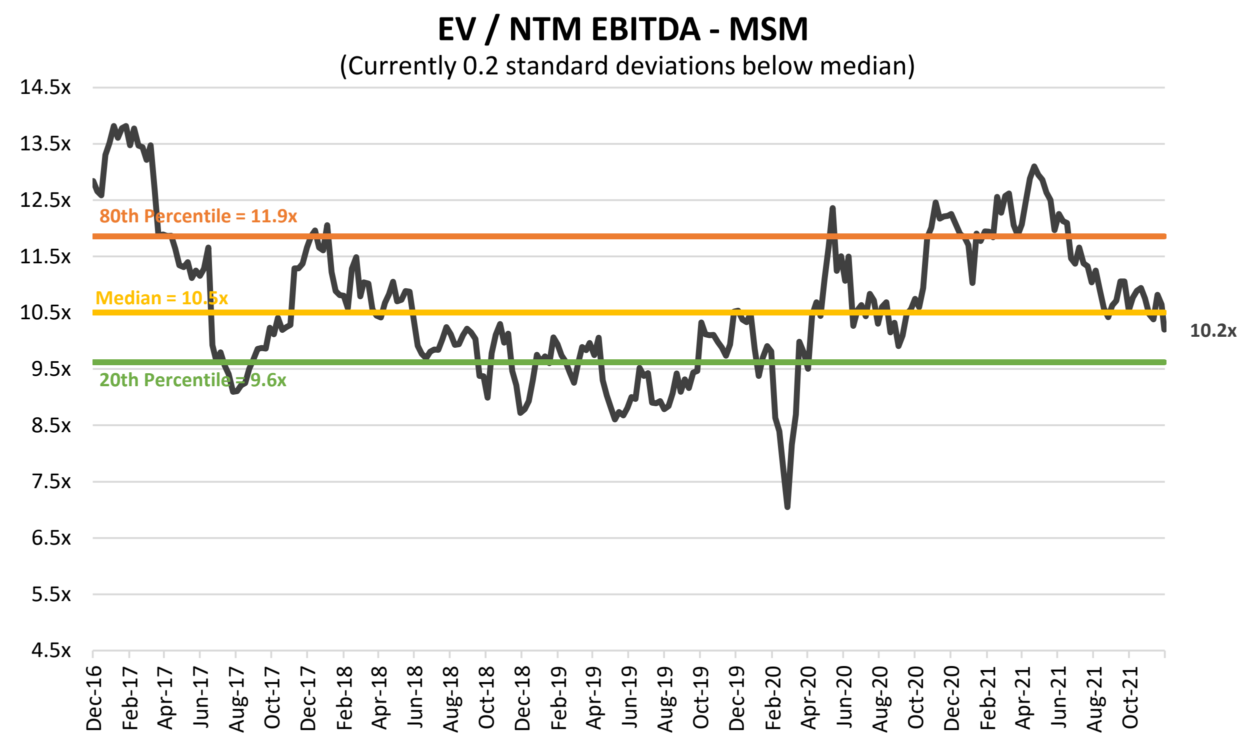
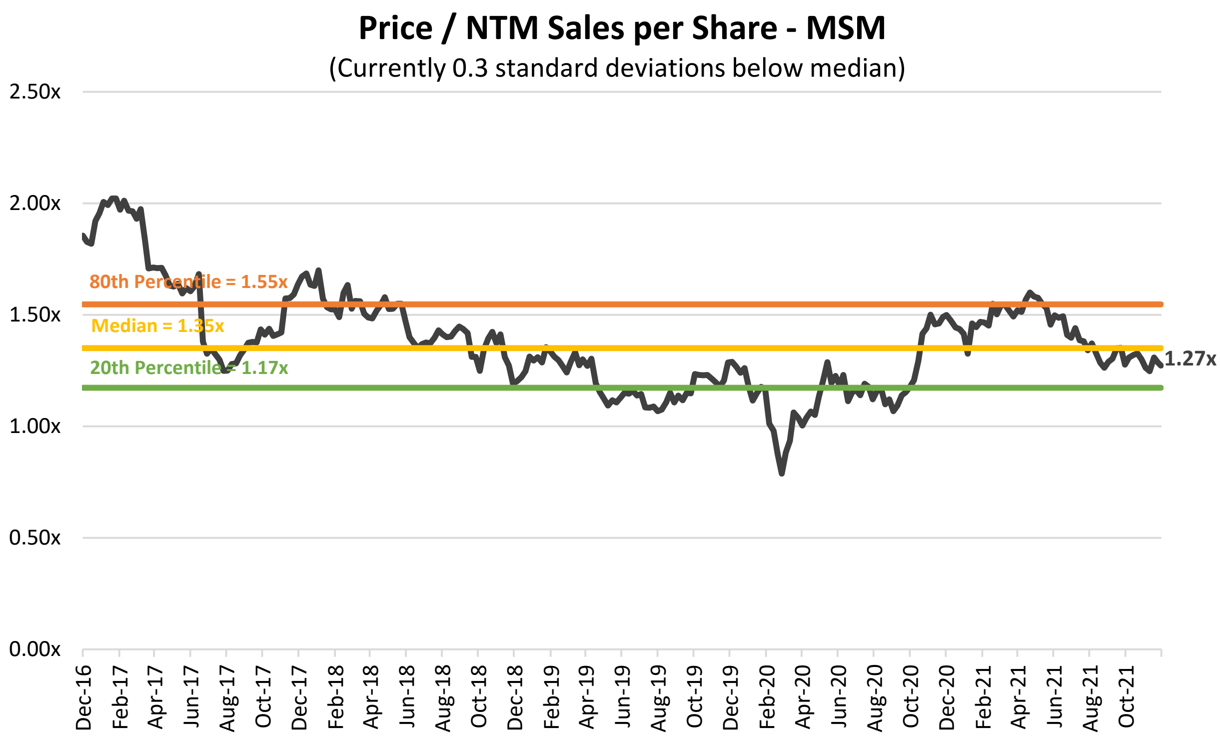


Figure 9:



Source: FactSet, Raymond James research.

Figure 10:



Source: FactSet, Raymond James research.

MSC Industrial Direct Co							EST	EST	EST	EST	EST	EST	EST	EST	EST	EST
Income Statement	1Q21	2Q21	3Q21	4Q21	FY21	1Q22	2Q22	3Q22	4Q22	FY22	1Q23	2Q23	3Q23	4Q23	FY23	FY24
$Million, except per share	Nov-20	Feb-21	May-21	Aug-21	(end Aug)	Nov-21	Feb-22	May-22	Aug-22	(end Aug)	Nov-22	Feb-23	May-23	Aug-23	(end Aug)	(end Aug)
Period Ending	11/28/20	02/27/21	05/29/21	08/28/21	08/28/21	11/27/21	02/26/22	05/28/22	08/27/22	08/27/22	11/26/22	02/25/23	05/27/23	09/02/23	09/02/23	08/31/24
Net sales	**$772**	**$774**	**$866**	**$831**	**$3,243**	**$849**	**$862**	**$932**	**$982**	**$3,625**	**$888**	**$907**	**$980**	**$957**	**$3,732**	**$3,900**
Cost of goods sold	$449	$449	$500	$482	$1,880	$496	$501	$539	$571	$2,106	$523	$531	$570	$560	$2,184	$2,294
Gross profit	$323	$325	$366	$349	$1,364	$353	$361	$393	$411	$1,518	$366	$376	$410	$397	$1,548	$1,606
Operating Expenses	$239	$244	$257	$252	$992	$257	$264	$269	$279	$1,069	$262	$271	$275	$273	$1,082	$1,102
Income from operations	**$85**	**$80**	**$110**	**$97**	**$371**	**$96**	**$97**	**$125**	**$133**	**$450**	**$103**	**$105**	**$134**	**$124**	**$466**	**$504**
Interest expense	($3)	($4)	($4)	($4)	($15)	($4)	($4)	($3)	($3)	($14)	($3)	($3)	($3)	($2)	($11)	($8)
Interest income	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Other (expense) income, net	($30)	($52)	$20	($6)	($69)	($6)	($2)	($2)	($2)	($11)	($1)	($1)	($1)	($1)	($5)	($5)
Income before tax	**$51**	**$24**	**$126**	**$87**	**$288**	**$87**	**$91**	**$119**	**$127**	**$424**	**$99**	**$101**	**$130**	**$120**	**$450**	**$491**
Income Tax Expense	$12	$6	$31	$21	$70	$20	$23	$30	$32	$104	$24	$25	$32	$30	$111	$121
Reported GAAP Net Income, cont ops	**$39**	**$18**	**$95**	**$66**	**$218**	**$66**	**$69**	**$90**	**$96**	**$320**	**$74**	**$76**	**$98**	**$90**	**$339**	**$369**
Extraordinary gain (loss) net of tax	$23	$39	($15)	$5	$52	$4	$1	$1	$1	$8	$1	$1	$1	$1	$4	$0
Adjusted Net Income	**$62**	**$58**	**$80**	**$70**	**$270**	**$70**	**$70**	**$91**	**$97**	**$328**	**$75**	**$77**	**$99**	**$91**	**$343**	**$369**
Reported GAAP EPS	**$0.69**	**$0.32**	**$1.68**	**$1.18**	**$3.87**	**$1.18**	**$1.23**	**$1.60**	**$1.71**	**$5.73**	**$1.32**	**$1.35**	**$1.74**	**$1.60**	**$6.02**	**$6.52**
a/t effect Extraordinary Items per share	0.41	0.70	(0.26)	0.08	0.93	0.07	0.03	0.03	0.03	0.14	0.02	0.02	0.02	0.02	0.07	0.00
Dil Oper EPS	**$1.10**	**$1.03**	**$1.42**	**$1.26**	**$4.81**	**$1.25**	**$1.25**	**$1.63**	**$1.74**	**$5.87**	**$1.34**	**$1.37**	**$1.76**	**$1.62**	**$6.09**	**$6.52**
Wtd Avg Sh Basic	56	56	56	56	56	56	56	56	56	56	56	56	56	56	56	56
Avg Diluted Shares	56	56	56	56	56	56	56	56	56	56	56	56	56	56	56	57
Dividends Per Share	$0.75	$4.25	$0.75	$0.75	$6.50	$0.75	$0.75	$0.75	$0.75	$3.00	$0.82	$0.82	$0.82	$0.82	$3.27	$3.57
EBITDA, ex-items	**$102**	**$98**	**$127**	**$114**	**$440**	**$113**	**$114**	**$142**	**$150**	**$519**	**$120**	**$122**	**$152**	**$141**	**$535**	**$573**
shipping days	62	61	65	63	251	62	63	65	68	258	62	63	65	63	253	253
	1Q21	2Q21	3Q21	4Q21	FY21	1Q22	2Q22	3Q22	4Q22	FY22	1Q23	2Q23	3Q23	4Q23	FY23	FY24
As a % of Sales	Nov-20	Feb-21	May-21	Aug-21	(end Aug)	Nov-21	Feb-22	May-22	Aug-22	(end Aug)	Nov-22	Feb-23	May-23	Aug-23	(end Aug)	(end Aug)
Net sales	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**
Average Daily Sales (ADS)	$12.45	$12.69	$13.33	$13.19	$12.92	$13.69	$13.69	$14.34	$14.44	$14.05	$14.33	$14.40	$15.08	$15.18	$14.75	$15.41
Cost of goods sold	58.1%	58.0%	57.7%	58.0%	58.0%	58.4%	58.1%	57.8%	58.1%	58.1%	58.8%	58.5%	58.2%	58.5%	58.5%	58.8%
Gross profit	**41.9%**	**42.0%**	**42.3%**	**42.0%**	**42.0%**	**41.6%**	**41.9%**	**42.2%**	**41.9%**	**41.9%**	**41.2%**	**41.5%**	**41.8%**	**41.5%**	**41.5%**	**41.2%**
Operating Expenses	30.9%	31.6%	29.7%	30.3%	30.6%	30.2%	30.7%	28.8%	28.4%	29.5%	29.5%	29.9%	28.1%	28.6%	29.0%	28.3%
Income from operations	**11.0%**	**10.4%**	**12.6%**	**11.7%**	**11.5%**	**11.3%**	**11.2%**	**13.4%**	**13.5%**	**12.4%**	**11.6%**	**11.6%**	**13.7%**	**12.9%**	**12.5%**	**12.9%**
EBITDA	**13.2%**	**12.7%**	**14.6%**	**13.7%**	**13.6%**	**13.4%**	**13.2%**	**15.2%**	**15.3%**	**14.3%**	**13.5%**	**13.5%**	**15.5%**	**14.7%**	**14.3%**	**14.7%**
YoY Contribution Margin	**16%**	**-23%**	**-5%**	**15%**	**11%**	**15%**	**18%**	**23%**	**24%**	**21%**	**18%**	**19%**	**21%**	**35%**	**16%**	**22%**
YoY Op Profit Pull-Through	35%	-45%	-13%	34%	28%	39%	45%	56%	57%	51%	55%	58%	60%	62%	56%	65%
Seq Contribution Margin	2%	-199%	32%	36%		-5%	4%	40%	16%		31%	12%	40%	46%		
Seq Op Profit Pull-Through	26%	-273%	70%	72%		27%	7%	87%	44%		28%	21%	87%	85%		
Interest expense	-0.4%	-0.5%	-0.4%	-0.5%	-0.4%	-0.4%	-0.4%	-0.4%	-0.3%	-0.4%	-0.4%	-0.3%	-0.3%	-0.3%	-0.3%	-0.2%
Interest income	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Other (expense) income, net	-3.9%	-6.8%	2.3%	-0.8%	-2.1%	-0.7%	-0.2%	-0.2%	-0.2%	-0.3%	-0.1%	-0.1%	-0.1%	-0.1%	-0.1%	-0.1%
Income before tax	6.6%	3.2%	14.6%	10.4%	8.9%	10.2%	10.6%	12.8%	13.0%	11.7%	11.1%	11.1%	13.3%	12.5%	12.1%	12.6%
Income Tax Expense	24.3%	24.8%	24.7%	24.0%	24.4%	23.5%	24.8%	24.8%	24.8%	24.5%	24.8%	24.8%	24.8%	24.8%	24.8%	24.8%
Adjusted Net Income	**8.0%**	**7.4%**	**9.3%**	**8.5%**	**8.3%**	**8.3%**	**8.1%**	**9.8%**	**9.9%**	**9.1%**	**8.5%**	**8.5%**	**10.1%**	**9.5%**	**9.2%**	**9.5%**
							EST	EST	EST	EST	EST	EST	EST	EST	EST	EST
	1Q21	2Q21	3Q21	4Q21	FY21	1Q22	2Q22	3Q22	4Q22	FY22	1Q23	2Q23	3Q23	4Q23	FY23	FY24
Y/Y % increase	Nov-20	Feb-21	May-21	Aug-21	(end Aug)	Nov-21	Feb-22	May-22	Aug-22	(end Aug)	Nov-22	Feb-23	May-23	Aug-23	(end Aug)	(end Aug)
Sales growth	-6.3%	-1.5%	3.8%	11.1%	1.6%	9.9%	11.4%	7.6%	18.1%	11.8%	4.7%	5.2%	5.2%	-2.6%	3.0%	4.5%
Average Daily Sales (ADS) growth	**-6.3%**	**-1.5%**	**2.2%**	**12.9%**	**1.2%**	**9.9%**	**7.9%**	**7.6%**	**9.5%**	**8.7%**	**4.7%**	**5.2%**	**5.2%**	**5.2%**	**5.0%**	**4.5%**
Estimated ADS Growth EX ACQ'S	**-6.3%**	**-1.5%**	**2.2%**	**12.4%**	**1.1%**	**9.4%**	**7.9%**	**7.6%**	**9.5%**	**8.6%**	**4.7%**	**5.2%**	**5.2%**	**5.2%**	**5.0%**	**4.5%**
Net Pricing YY	**1.3%**	**1.2%**	**0.1%**	**2.8%**	**1.3%**	**2.3%**										
Cost of goods sold	-5.8%	-1.3%	3.9%	10.4%	1.7%	10.6%	11.6%	7.8%	18.3%	12.1%	5.4%	5.9%	5.9%	-1.9%	3.7%	5.0%
Gross Profit	-6.9%	-1.9%	3.5%	12.2%	1.5%	9.1%	11.1%	7.3%	17.9%	11.3%	3.7%	4.2%	4.2%	-3.5%	2.0%	3.7%
Operating Expenses	-6.1%	-3.5%	5.8%	11.0%	1.5%	7.5%	8.2%	4.6%	10.6%	7.7%	2.3%	2.4%	2.4%	-2.0%	1.2%	1.9%
Income from operations	-8.9%	3.6%	-1.5%	15.2%	1.6%	13.5%	20.1%	13.7%	36.8%	21.1%	7.4%	9.0%	8.0%	-6.8%	3.7%	8.1%
Pre-tax income	-41.3%	-67.1%	21.2%	26.0%	-13.7%	69.1%	273.2%	-5.4%	47.0%	47.2%	14.0%	11.0%	9.4%	-5.9%	6.1%	9.0%
Net income	-8.4%	3.6%	1.4%	15.4%	2.2%	13.5%	21.5%	13.8%	38.1%	21.7%	7.4%	10.1%	8.7%	-6.3%	4.3%	7.8%
GAAP EPS	-41.2%	-68.0%	19.9%	24.8%	-14.2%	70.0%	283.1%	-4.8%	45.2%	48.0%	12.2%	10.4%	8.7%	-6.6%	5.1%	8.2%
Diluted Operating EPS	**-9.1%**	**2.6%**	**0.0%**	**15.1%**	**1.4%**	**13.5%**	**22.0%**	**14.6%**	**37.9%**	**22.1%**	**7.0%**	**9.5%**	**8.0%**	**-7.0%**	**3.7%**	**7.0%**

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MSC Industrial Direct Co

Balance Sheet Model						EST	EST	EST	EST	EST	EST	EST	EST
$Million, except per share	1Q21	2Q21	3Q21	4Q21	1Q22	2Q22	3Q22	4Q22	1Q23	2Q23	3Q23	4Q23	4Q24
Assets:	Nov-20	Feb-21	May-21	Aug-21	Nov-21	Feb-22	May-22	Aug-22	Nov-22	Feb-23	May-23	Aug-23	Aug-24
Cash and cash equivalents	$53	$20	$27	$41	$63	$43	$47	$49	$44	$45	$49	$48	$51
Accounts Rec, Net	$494	$527	$565	$560	$579	$580	$593	$633	$587	$610	$623	$616	$654
Inventories	$521	$533	$598	$624	$623	$636	$645	$676	$651	$667	$677	$657	$695
Prepaid expenses and other current assets	$80	$105	$117	$89	$84	$84	$84	$84	$84	$83	$83	$83	$83
Deferred income taxes	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Total current assets	$1,148	$1,185	$1,308	$1,314	$1,348	$1,342	$1,368	$1,442	$1,365	$1,405	$1,432	$1,404	$1,483
PP&E, net of depreciation	$298	$293	$296	$298	$299	$298	$298	$297	$296	$296	$295	$295	$295
Goodwill	$678	$678	$680	$693	$692	$692	$692	$692	$692	$692	$692	$692	$692
Identifiable intangibles, net	$103	$100	$98	$102	$98	$95	$92	$88	$85	$81	$78	$74	$61
Other assets	$60	$45	$43	$55	$59	$59	$59	$59	$59	$59	$59	$59	$59
Total Assets	$2,287	$2,302	$2,424	$2,462	$2,496	$2,486	$2,508	$2,577	$2,497	$2,533	$2,556	$2,524	$2,588
Liabilities & Stockholders' Equity:													
Revolving credit notes	$0	$223	$413	$202	$204	$0	$0	$0	$0	$0	$0	$0	$0
Current maturities of long-term notes payable	$23	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Accounts payable	$144	$170	$196	$186	$178	$201	$223	$233	$187	$213	$236	$229	$244
Accrued/other liabilities	$347	$160	$146	$173	$204	$204	$204	$204	$204	$204	$204	$204	$204
Total current liabilities	$514	$553	$754	$562	$586	$405	$427	$437	$391	$417	$440	$433	$448
Long-term notes payable	$467	$462	$346	$584	$558	$702	$655	$660	$596	$576	$524	$455	$336
Def. inc tax/other liabilities	$175	$169	$157	$155	$159	$159	$159	$159	$159	$159	$159	$159	$159
Total Liabilities	$1,156	$1,184	$1,258	$1,300	$1,303	$1,266	$1,240	$1,255	$1,146	$1,152	$1,122	$1,046	$943
Stockholder's Equity:													
Preferred stock	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Class A common stock	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Class B common stock	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Additional paid-in capital	$702	$713	$736	$741	$756	$756	$756	$756	$756	$756	$756	$756	$756
Retained Earnings	$548	$524	$529	$532	$557	$583	$631	$686	$714	$745	$797	$841	$1,009
Accumulated other comp income/NCI	($20)	($19)	($15)	($7)	($12)	($12)	($12)	($12)	($12)	($12)	($12)	($12)	($12)
Treasury stock, at cost	($106)	($106)	($105)	($104)	($108)	($108)	($108)	($108)	($108)	($108)	($108)	($108)	($108)
Total Stockholder's Equity	$1,124	$1,112	$1,145	$1,162	$1,193	$1,220	$1,268	$1,322	$1,351	$1,381	$1,433	$1,478	$1,646
Total Liabilities & Stockholders' Equity	$2,280	$2,296	$2,403	$2,462	$2,496	$2,486	$2,508	$2,577	$2,497	$2,533	$2,556	$2,524	$2,588
Working Capital Statistics													
Cash and equivalents as a % of sales	6.9%	2.6%	3.2%	4.9%	7.4%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%
Gross A/R in DSOs	61.0	62.1	58.7	59.5	62.0	63.1	59.7	60.5	62.0	63.1	59.7	60.5	60.5
y/y increase in A/R	-8.0%	-1.8%	3.8%	14.0%	17.2%	9.9%	4.9%	12.9%	1.4%	5.2%	5.2%	-2.6%	6.1%
Allowance for Bad Debts	2.7%	2.7%	2.7%	2.7%	2.7%	2.7%	2.7%	2.7%	2.7%	2.7%	2.7%	2.7%	2.7%
Inventory in days COGS	106.0	108.2	109.2	118.2	114.6	115.7	109.2	108.2	113.6	114.7	108.2	107.2	106.2
Inventory turns	3.4 x	3.4 x	3.3 x	3.1 x	3.2 x	3.2 x	3.3 x	3.4 x	3.2 x	3.2 x	3.4 x	3.4 x	3.4 x
A/P in days COGS	29.2	34.6	35.8	35.3	32.7	36.6	37.8	37.3	32.7	36.6	37.8	37.3	37.3
Cash conversion cycle in days	137.8	135.6	132.2	142.3	143.8	142.1	131.2	131.3	142.8	141.1	130.2	130.3	129.3
y/y increase in Inventory	-3.4%	-4.3%	4.0%	14.9%	19.4%	19.3%	7.8%	8.3%	4.5%	5.0%	4.9%	-2.8%	5.7%
y/y increase in A/P	0.6%	9.8%	54.3%	48.1%	23.9%	18.0%	13.8%	25.1%	5.4%	5.9%	5.9%	-1.9%	6.7%
Current Ratio	2.2	2.1	1.7	2.3	2.3	3.3	3.2	3.3	3.5	3.4	3.3	3.2	3.3
Working Capital as % of TTM Sales	27.7%	28.4%	30.6%	30.8%	30.8%	29.7%	29.2%	29.7%	28.6%	28.7%	28.3%	28.0%	28.3%
Leverage Statistics:													
Interest bearing Debt as a % of capital	30.4%	38.1%	39.9%	40.4%	39.0%	36.5%	34.0%	33.3%	30.6%	29.4%	26.8%	23.5%	17.0%
Net Interest bearing Debt as a % of capital	27.1%	37.0%	38.4%	38.3%	35.8%	34.3%	31.6%	30.8%	28.3%	27.1%	24.3%	21.1%	14.4%
Interest bearing Debt as a % of equity	43.6%	61.5%	66.3%	67.7%	63.9%	57.6%	51.6%	49.9%	44.1%	41.7%	36.5%	30.8%	20.4%
Funded Debt-to-ttm EBITDA	1.1x	1.6x	1.8x	1.8x	1.7x	1.5x	1.4x	1.3x	1.1x	1.1x	1.0x	0.8x	0.6x
Net Funded-Debt-to-ttm EBITDA	1.0x	1.5x	1.7x	1.7x	1.5x	1.4x	1.3x	1.2x	1.0x	1.0x	0.9x	0.8x	0.5x
ttm EBITDA / ttm i-exp coverage	25.3x	25.4x	28.2x	30.3x	30.4x	31.2x	32.9x	36.8x	38.9x	41.8x	44.8x	47.3x	67.7x
Book value per share	$20.20	$19.92	$20.46	$20.93	$21.48	$21.95	$22.79	$23.74	$24.21	$24.71	$25.61	$26.35	$29.14
Tangible book value per share	$6.18	$5.98	$6.56	$6.62	$7.25	$7.79	$8.71	$9.74	$10.29	$10.88	$11.86	$12.69	$15.82
DuPont Analysis:													
TTM Net Profit Margin	7.2%	6.0%	6.5%	7.9%	7.4%	8.7%	8.4%	9.8%	9.0%	9.1%	9.2%	9.4%	10.1%
TTM Asset Turnover	1.4 x	1.4 x	1.3 x	1.3 x	1.3 x	1.4 x	1.4 x	1.4 x	1.5 x	1.5 x	1.5 x	1.5 x	1.5 x
ROA, end	9.8%	8.2%	8.4%	10.4%	9.8%	11.9%	11.6%	13.7%	13.2%	13.3%	13.5%	13.9%	15.3%
Assets/Equity, end	2.0 x	2.1 x	2.1 x	2.1 x	2.1 x	2.0 x	2.0 x	1.9 x	1.8 x	1.8 x	1.8 x	1.7 x	1.6 x
ROE, end	20.0%	16.9%	17.9%	22.1%	20.6%	24.2%	22.9%	26.8%	24.3%	24.3%	24.0%	23.8%	24.0%

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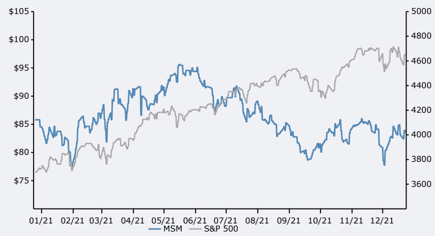
MSC Industrial Direct Co
Cashflow Statement and Model
$Million, except per share

NOT CUMULATIVE, except for Year totals	FY17 (end Aug)	FY18 (end Aug)	FY19 (end Aug)	FY20 (end Aug)	1Q21 Nov-20	2Q21 Feb-21	3Q21 May-21	4Q21 Aug-21	FY21 (end Aug)	1Q22 Nov-21	EST 2Q22 Feb-22	EST 3Q22 May-22	EST 4Q22 Aug-22	EST FY22 (end Aug)	EST FY23 (end Aug)	EST FY24 (end Aug)
CASH FLOWS FROM OPERATING ACTIVITIES:																
Net Income	$231	$329	$289	$252	$39	$18	$95	$66	$218	$66	$69	$90	$96	$320	$339	$369
Depreciation and Amortization	$63	$63	$65	$69	$17	$17	$17	$17	$69	$17	$17	$17	$17	$69	$69	$69
Loss on disposal of PP&E	$1	$0	$0	$1	$0	$0	$0	$0	$1	$0				$0	$0	$0
Gain on sale of securities	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0				$0	$0	$0
Stock-based compensation	$14	$15	$16	$17	$4	$5	$4	$4	$18	$6	$6	$6	$6	$23	$23	$23
Provision for doubtful accounts	$7	$7	$11	$11	$3	$2	$1	$3	$8	$2	$1	$0	$1	$4	($0)	$1
Deferred income taxes	$13	($20)	$14	$8	$0	$0	$0	($14)	($14)	$0	$0	$0	$0	$0	$0	$0
Stock option income tax benefit	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0				$0	$0	$0
Amortization of bond premium	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0				$0	$0	$0
Reclassification of excess tax benefits from stock comp	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0				$0	$0	$0
Other (catch-all)	$0	$0	$0	$23	$4	$51	$2	$7	$65	$4				$4	$0	$0
Changes in operating assets and liabilities:																
Accounts Recievable	($72)	($50)	($27)	$37	($4)	($36)	($38)	$4	($73)	($22)	($20)	($14)	($41)	($96)	$17	($39)
Inventories	($16)	($33)	($33)	$16	$23	($42)	($64)	($24)	($107)	($1)	($13)	($9)	($31)	($54)	$19	($37)
Prepaid expenses and other current assets	($7)	($5)	($8)	($12)	($2)	($25)	($11)	$29	($10)	$4	$0	$0	$0	$5	$1	$0
Other assets	$1	$1	($2)	$3	($4)	($5)	($16)	$24	($1)	($4)	$0	$0	$0	($4)	$0	$0
Accounts payable and accrued liabilities	$12	$31	$2	($28)	$23	$29	$31	($32)	$51	($15)	$23	$22	$10	$40	($4)	$15
Net cash provided by operating activities:	**$247**	**$340**	**$328**	**$397**	**$103**	**$16**	**$20**	**$85**	**$224**	**$58**	**$83**	**$112**	**$58**	**$311**	**$462**	**$401**
CASH FLOWS FROM INVESTING ACTIVITIES:																
Proceeds from sales of invests in avail for sale securities	$0	$0	$27	$0	$0	$0	$0	$0	$0	$0				$0	$0	$0
Purchases of investments in available for sale securities	$0	$0	$0	$0					$0					$0	$0	$0
Cash used in business acquisition	($42)	($87)	($12)	($2)	$0	$0	$0	($22)	($22)	$0				$0	$0	$0
Expenditures for PP&E	($47)	($45)	($52)	($47)	($8)	($12)	($18)	($16)	($54)	($15)	($17)	($17)	($17)	($65)	($66)	($69)
Other (catch-all)	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$3	$3	$3	$10	$14	$14
Net cash (used in) provided by investing activities:	**($89)**	**($132)**	**($36)**	**($49)**	**($8)**	**($12)**	**($18)**	**($38)**	**($76)**	**($15)**	**($13)**	**($13)**	**($13)**	**($55)**	**($53)**	**($55)**
CASH FLOWS FROM FINANCING ACTIVITIES:																
Increase in LT Debt for estimate periods	$0	$0	$0	$0					$0		$144	($48)	$5	$101	($205)	($119)
Purchases of treasury stock	($49)	($82)	($85)	($3)	($3)	($0)	($47)	($21)	($71)	($5)	$0	$0	$0	($5)	$0	$0
Payment of cash dividends	($102)	($125)	($146)	($444)	($42)	($237)	($42)	($42)	($363)	$0	($42)	($42)	($42)	($125)	($183)	($201)
Reclass excess tax benefits fr stock-based comp	($1)	$0	$0	$0	$0	$0	$0	$0	$0	$0				$0	$0	$0
Proceeds from sale Class A common re stock purch plan	$4	$4	$5	$4	$1	$1	$1	$1	$4	$1				$1	$0	$0
Proceeds from exercise of Class A common stock options	$27	$24	$16	$14	$6	$5	$18	$1	$30	$7				$7	$0	$0
Net proceeds/revolving credit facility loans	$547	$352	$358	$1,192	($1)	$417	$89	($321)	$184	($0)	($204)	$0	$0	($205)	$0	$0
Repayments of NP under credit facility	($620)	($350)	($427)	($1,016)	($130)	($220)	($15)	$350	($15)	($24)				($24)	$0	$0
Stock-option expense offset for estimate periods	$0	$0	$0	$0					$0		($6)	($6)	($6)	($17)	($23)	($23)
Other (catch-all)	$0	$0	($27)	($1)	$1	($3)	$1	($2)	($3)	$1	$0	$0	$0	$1	($0)	($0)
Net cash (used in) provided by financing activities:	**($195)**	**($178)**	**($306)**	**($255)**	**($168)**	**($37)**	**$5**	**($33)**	**($234)**	**($20)**	**($108)**	**($95)**	**($42)**	**($265)**	**($411)**	**($343)**
Effect of FX changes on cash and cash equivalents	($0)	($0)	($0)	$0	$0	$1	($0)	($0)	$0	($0)	$0	$0	$0	($0)	$0	$0
Net increase (decrease) in cash and cash equivalents	($37)	$30	($14)	$93	($72)	($33)	$7	$13	($85)	$22	($38)	$3	$2	($10)	($1)	$3
Cash and equivalents beginning of period	$53	$16	$46	$32	$125	$53	$20	$27	$125	$41	$63	$43	$47	$41	$49	$48
Cash and equivalents end of period	$16	$46	$32	$125	$53	$20	$27	$41	$41	$63	$25	$47	$49	$31	$48	$51
Supplemental:																
Cash paid during the year for interest	$12	$13	$17	$15	$2	$5	$2	$6	$15	$2				$2	$0	$0
Cash paid during the year for income taxes	$122	$101	$79	$69	$2	$40	$20	$8	$69	$2				$2	$0	$0
Estimated Free-Cash-Flow	(end Aug)	(end Aug)	(end Aug)	(end Aug)	Nov-20	Feb-21	May-21	Aug-21	(end Aug)	Nov-21	Feb-22	May-22	Aug-22	(end Aug)	(end Aug)	(end Aug)
Cash from Operating Activities	$247	$340	$328	$397	$103	$16	$20	$85	$224	$58	$83	$112	$58	$311	$462	$401
CFO as % of Net Income	107%	103%	114%	158%					103%					97%	136%	109%
Capital Expenditures	($47)	($45)	($52)	($47)	($8)	($12)	($18)	($16)	($54)	($15)	($17)	($17)	($17)	($65)	($66)	($69)
Free-Cash-Flow	**$200**	**$295**	**$277**	**$350**	**$95**	**$4**	**$3**	**$69**	**$171**	**$43**	**$66**	**$95**	**$41**	**$245**	**$396**	**$332**
Cash from Ops as a % of net income	107%	118%	112%	150%	266%	86%	22%	129%	103%	83%	119%	123%	60%	95%	135%	109%
sh count	57.0	56.7	55.5	55.6	55.9	56.1	56.4	55.9	56.1	55.9	55.9	56.0	56.0	55.9	56.3	56.7
FCF per share	$3.52	$5.20	$4.98	$6.29	$1.71	$0.06	$0.05	$1.23	$3.04	$0.76	$1.19	$1.70	$0.74	$4.39	$7.03	$5.86

COMPANY DESCRIPTION

MSC Industrial Direct, based in Melville, New York, is one of the largest direct marketers of a full line of industrial products in the U.S., primarily for maintenance, repair, and operations (MRO) needs. Domestic manufacturing end-markets represent the bulk of MSC's demand, with particular focus on metalworking applications.



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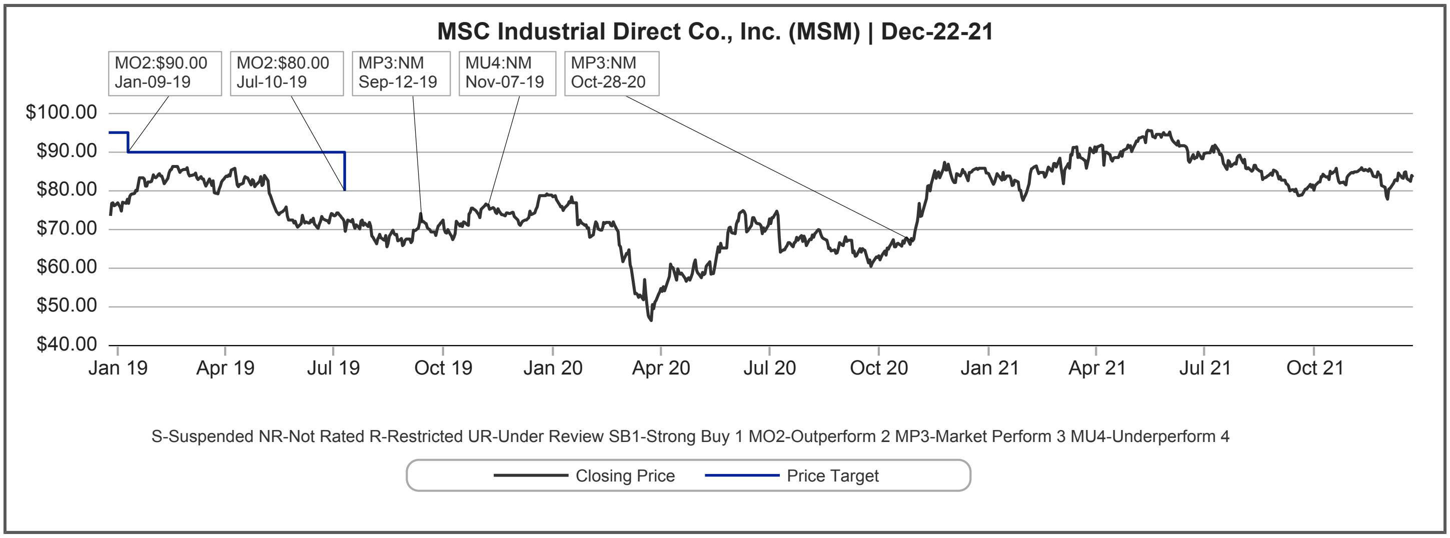

Valuation Methodology

MSC Industrial Direct Co., Inc.
Valuation Methodology: We value MSC Industrial based on P/E multiples relative to peers and the market, and also consider EV/EBITDA multiples and our DCF-derived estimate of intrinsic value.

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Company Specific Risk Factors

MSC Industrial Direct Co., Inc.

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As much as 75% of MSC's revenue is derived from manufacturing end-markets, with the remaining 25+% coming from other economically-sensitive end-markets. If economic growth is below average, it is likely MSC's financial results would be negatively impacted.

Acquisition Integration Risk
From time to time, MSC has made acquisitions in an effort to expand its product line or geographic offering. We expect this to continue in the future. If MSC were to pay too expensive a price, or not achieve estimated synergies, an acquisition could negatively impact financial results.

Changes in Mix Could Negatively Impact Margin
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	RJA		RJL		RJA		RJL	
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Market Perform (Hold)	326	34%	51	20%	50	15%	9	18%
Underperform (Sell)	24	3%	2	1%	5	21%	0	0%
Total Number of Companies	949	100%	251	100%	250	100%	83	100%

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Completed: 09-Feb-22, 12:07 GMT
Released: 09-Feb-22, 12:07 GMT

Triumph Group Inc

Further Organic Revenue Decline; Generates Slight Positive FCF

Stock Rating/Industry View: Underweight/Neutral
Price Target: USD 20.00
Price (08-Feb-2022): USD 19.98
Potential Upside/Downside: 0%
Tickers: TGI

Q3 adjusted EPS at $0.21/$0.11 GAAP

Q3 compares to our model at $0.22 and consensus at $0.20. 25% revenue decline (-5% organic) below our -13% (flat organic) while adjusted segment EBIT margin at 13.1% was below our 13.3% with lower tax rate offsetting. Adjusted results exclude $0.07 restructuring costs and $0.03 debt extinguishment loss. Systems & Support revenue declined 11% YOY (-5% sequentially), with 20.2% adjusted EBITDAP margin vs 18.2% in Q2. Q3 FCF at $7M, above our -$3M usage. TGI's backlog was at $1.95B, up $10M sequentially. TGI had $206M cash on hand at the end of Q3, with $1.58B in gross debt, ~$30M lower from Q2.

FY22 Guidance: Adj EPS guidance raised $0.07 to $0.80-0.90 compares to Barclays at $0.75 and consensus $0.76. Revenue lowered by $50M to ~$1.5B vs Barclays at $1.6B and consensus at $1.5B. CFO use increased to bottom end of range at ~$125M from $110-125M and FCF use increased ~$150M from $135-150M vs Barclays -$149M and consensus -$144M.

We will look for more color on the 8:30am conference call. Dial domestic +1 (888) 255-5185, international +1 (281) 973-6499.

Q3 Key Metrics

	Actual	Barclays Estimate	Difference
Sales ($M)	319	370	-51
Adj Operating Margin	10.3%	9.7%	0.6%
Recurring EPS	$0.21	$0.22	-$0.01
FCF ($M)	7	-3	10

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Mentioned Stocks (Ticker, Date, Price)

Triumph Group Inc (TGI, 08-Feb-2022, USD 19.98), Underweight/Neutral, CD/CE/J/K/M

Valuation Methodology: Our $20 price target reflects a 10x EBITDA multiple on our 2024 estimates discounted back one year (~$270M).
Risks which May Impede the Achievement of the Barclays Research Valuation and Price Target: The Aerospace stocks have historically been highly cyclical, and are subject to the risk of a downturn in aircraft production rates or airline traffic, which could materially impact results. Aerospace programs often involve large up-front investments in R&D, working capital and initial losses, which might not be recovered depending on ultimate demand for the aircraft.
TGI may sell non-core AS for substantially more than our estimate ($550M) and margins may improve faster than our forecast.

Ratings and Price Target History:
Triumph Group Inc
Currency=USD

Source: IDC, Barclays Research

Publication Date	Closing Price*	Rating	Adjusted Price Target
14-Nov-2021	21.73		20.00
16-Mar-2021	18.34		17.00
04-Dec-2020	15.95		12.00
20-Mar-2020	4.81		2.00
15-Nov-2019	28.49		23.00
23-Aug-2019	21.24	Underweight	20.00

On 09-Feb-2019, prior to any intra-day change that may have been published, the rating for this security was Equal Weight, and the adjusted price target was 23.00.

Source: Bloomberg, Barclays Research

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Jefferies

EQUITY RESEARCH
Triumph Group, Inc. (TGI)

Triumph Group, Inc.

Upgrade to Buy: A Turnaround 6 Years in the Making

February 13, 2022

Key Takeaway

We upgrade TGI to Buy from Hold w/ visibility to positive FCF following the last divestiture this month. Revenues, profit, FCF are all set to inflect. This has been a process 6 years in the making as the mgmt team had to unwind / divest 'bad' contracts over that term. As such the Structures business contracted from $2.6BB of revenue in 2016 to $132MM or 95% slated for FY23. The end of a multi-year portfolio reshaping under a mgmt team unlocks the SOTP of $26.

5 Reasons for Upgrade: 1) Restructuring complete as mgmt has divested $1.1BB in sales over the past 3 yrs (Ex 4); 2) Rev growth accelerates from 3% in FY22 to 8% in FY23 on improving N/B rates; 3) EBITDA margins inflect from 11.6% in FY22 to 14.6% in FY23 on vol and restructuring actions; 4) FCF improves from a use of $150MM in FY22 to $58MM generated in FY23 given absence of 1X items; and 5) Valuation: If we consider our FY24 EBITDA TGI at a slight disct to peers' 14X, shares could be valued at $26 on a SOTP (Ex 12); this is based on ests ~20% below mgmt's targets. If we assume mgmt targets are achieved and a peer multiple, shares could be valued at $36 (Ex 1).

Raising FY22 EPS Est. to $0.81 from $0.68 Based on Better Profitability. Revs contracted 5% organically in FQ3 turning to 9% implied growth for FQ4 due to military shipments deferred due to supply chain. We expect FY22 (Mar YE) adj EBITDA margins of 11.6% (10.8% YTD), up from 8.5% in FY21 reflecting absence of loss-making programs in H2.

At the End of Structures Restructuring. Structures revs fall to $132MM in FY23E from $423MM in FY22E. This compares to revs of $1.6BB just in FY20 as TGI has divested 7 businesses or 50% of legacy sales. The decline includes the divestiture of Stuart ($250MM) to Daher Aerospace expected to close by June 2022. The Interiors business is likely $120MM in FY22 (or $250MM pre-COVID) set to grow 9% organically in FY23 w/ primary shipset content to include MAX ($200K per shipset) and 787 ($200K).

'Clean' Structures Margins of 3.9% and 18.3% for Systems in FY22. Structures (30% of sales) profitability could rise to LSD in FY23E to 5.3% in FY24E with normalized vols for Interiors supported by the high op leverage on the MAX w/ rates at ~26/mo today to 31/mo in FY23E. In TSS we est 90 bps of expansion for FY23 to 19.9% from 19.0% in FY22 supported by price negotiations. TGI targets doubling EBITDA from FY22 to FY25. This implies ~$300MM of FY25 EBITDA, with our est 19% below at $242MM of FY25 EBITDA on a 15.8% margin vs 14.6% in FY23. Each 100bps of EBITDA is worth $15MM to FCF and $2/share (Ex 9).

FCF Turns with $58MM Generated in FY23E. FCF usage of $150MM in FY22E improves to $58MM generated in FY23E (Ex 8) and $73MM in FY24. Cash losses on the B747, restructuring, and customer advances repayments total $166MM of outflow in FY22. These items come to an end after a decade in FY23, assuming the unwind of $103MM of BA advances from $150MM (est. 0.6X sales) of Stuart proceeds. The remainder of the FCF bridge comes improved WC ($20MM) and NI ($22MM). We now est positive FCF in FY23 from FY24 prior.

Rating | Target | Estimate Change

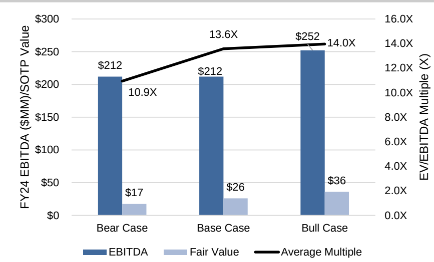
USA | Aerospace & Defense Electronics

RATING	BUY (FROM HOLD)
PRICE	$21.05^
MARKET CAP	$1.1B
PRICE TARGET (PT)	$26.00 (FROM $20.00)
UPSIDE SCENARIO PT	$36.00
DOWNSIDE SCENARIO PT	$12.00

^Prior trading day's closing price unless otherwise noted.

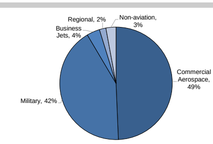
FY Mar USD	2021A	2022E	2023E	2024E
EPS	(0.03)	0.81	0.80	1.00
Prev.		*0.68*	*0.95*	*1.30*
FY P/E	NM	26.0x	26.3x	21.1x

Exhibit 1 - SOTP Bull Case Assumes EBITDA on Track for FY25 Target and Peer Average Multiples



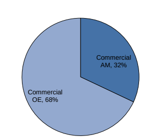
Source: Company data, Jefferies estimates

Exhibit 2 - FY23 Sales 50% Commercial Aero After Stuart



Source: Company data, Jefferies estimates

Exhibit 3 - Commercial Aerospace Business 68% OE in FQ3:21



Source: Company data, Jefferies estimates

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Please see analyst certifications, important disclosure information, and information regarding the status of non-US analysts on pages 23 to 28 of this report.

* Jefferies LLC / Jefferies Research Services, LLC

TRIUMPH GROUP, INC. (TGI)

Estimates				
USD	2021A	2022E	2023E	2024E
Rev. (MM)	1,870.0	1,497.9	1,283.7	1,395.7
Previous		1,530.0	1,417.0	1,533.0
EBITDA (MM)	159.0	174.0	187.0	212.0
Previous		177.0	183.0	216.0
Total FCF (MM)	(198.0)	(150.0)	58.0	73.0
Previous		(143.0)	(11.0)	53.0
Consensus EPS	(0.13)	0.77	1.17	1.66
Previous			1.19	
EPS				
Q1	(0.19)	0.09A	0.16	-
Previous				
Q2	(0.08)	0.10A	0.15	-
Previous				
Q3	0.09	0.21A	0.15	-
Previous				
Q4	0.10	0.40	0.35	-
Previous		*0.29*		
FY Mar	(0.03)	0.81	0.80	1.00
Previous		*0.68*	*0.95*	*1.30*

Valuation				
	2021A	2022E	2023E	2024E
FY P/E GAAP	6.4x			
EV/Rev	1.3x	1.6x	1.9x	1.8x
P/Rev	0.6x	0.7x	0.8x	0.8x
EV/EBITDA	15.5x	14.1x	13.2x	11.6x
FCF Yld	NM	NM	5.46%	6.87%
FY P/E	NM	26.0x	26.3x	21.1x

Market Data	
52-Week Range:	$24.53 - $13.80
Total Entprs. Value	$2.5B
Avg. Daily Value MM (USD)	15.36
Insider Ownership	1.8%
Institutional Ownership	92.6%
Float (%)	126.2%

Financial Summary	
Long-Term Debt (MM)	$1,605.2
Cash & ST Invest. (MM)	$206.1

The Long View

Scenarios

Base Case

- Revenue declines 14% in FY23 (+9% organic) with 9% organic growth in FY24.
- Aerospace Structures revenue is up 9% organic in FY23 (-69% total due to divestitures) vs 4% organic growth in FY22.
- Adj. EBITDA margins expand to 15.2% in FY24 driven by cost-reduction benefits from restructuring and volumes ramping.
- Price Target: $26 based on a 13.4X blended peer average SOTP EV/EBITDA multiple on FY24E of $212MM.
- PT implies a 40% premium to the historical 30% discount to the S&P on a EV/EBITDA basis, which reflects lower EBITDA due to COVID, as well as the change in business mix and exit of loss-making programs.

Upside Scenario

- Revenue expands by 15% organically in FY24 given growth in commercial and military content.
- Higher margin commercial AM comprises larger portion of mix growing ahead of expectations.
- Company drives improvement across core programs and receives payback from cost-restructuring program.
- EBITDA on track for FY25 target.
- Price Target: $36 based on a ~14X EV/EBITDA (peer average) on FY24 EBITDA of $252MM.
- PT implies a 40% premium to the historical 30% discount to the S&P on a P/E basis, which reflects lower EV/EBITDA due to COVID, as well as the change in business mix and exit of loss-making programs.

Downside Scenario

- Revenues expand modestly at 5% organically in FY24 as volumes in aerospace and military do not fully recover to prior peak.
- Commercial AM growth lags expectations and new product wins decelerate.
- EBITDA margins of 13.3% as TGI fails to deliver on margin expansion opportunities.
- FY24 EBITDA of $179MM with EV/EBITDA of ~11X (15% discount to market); Price Target: $12.
- PT implies a 25% premium to the historical 30% discount to the S&P on a EV/EBITDA basis, which reflects lower EBITDA due to COVID, as well as the change in business mix and exit of loss-making programs.

Investment Thesis / Where We Differ

- FY22 rounds out the divestiture strategy (~7 of legacy sales already divested) with the recently announced sale of the Stuart facility, with the proceeds covering the remaining $103MM of BA advance repayments. FCF generation should inflect in FY23 to $58MM given the absence of BA advance repayments, the 747 wind-down, and restructuring costs. Visibility to positive FCF and the end of divestitures removes an overhang to our SOTP fair value of $26.

Catalysts

- Recently announced Stuart sale proceeds offset remaining $103MM of BA advance repayments, with FCF inflecting in FY23 to $58MM of generation.
- MAX production rates improve and 787 begins to ship.
- EBITDA margin expansion from mix (higher AM contribution) and productivity improvements. Upside from target of ~$300MM of EBITDA by 2025.
- Content wins on commercial platforms and military programs.
- Upside from incremental debt paydown given next maturity in 2024.

Investment Considerations

In this report we highlight the following:

- **1. Backlog Up as TGI Works to Re-grow Business**
- **2. Organic Sales Continues in FY23 with 8% Growth vs. 2% in FY22**
  - **a) Aerospace Structures (28% of FY22E Rev): Set to Re-size in FY23E Following Final Divestiture**
  - **b) Systems and Support (72% of FY22E Rev): 7% Organic Growth in FY23E**
- **3. Settlement of BA Repayments in FY22 Causes FCF Inflection in FY23**
- **4. Price Target and Valuation**

1. Backlog Up as TGI Works to Re-grow Business

Backlog of $1.95BB included $1.13BB to be shipped in the next 12 months. Backlog contracted 14% y-o-y, and was up 1% sequentially including divested backlog. The decline was driven by divestitures, sunsetting programs, and production rate reductions, with a partial benefit coming from military programs in Systems and Support as military was up slightly. The B767 backlog is ~$429MM, which is within the Stuart facility related to the KC-46 with the divestiture closing by the end of FQ1:23. TGI has recorded $2BB of new orders YTD with a B2B of 1.2X.

TGI has announced several wins in the past year including:

- ***December 2021:*** TGI Actuation Products & Services was awarded production contract extensions with BA Commercial Airplanes to continue to manufacture and deliver hydraulic and actuation equipment for the 737 MAX, 777, 777X, and 767 aircraft.
- ***November 2021:*** TGI Mechanical Solutions was awarded a two-year contract to design, develop, and manufacture the throttle quadrant assembly for the B-250 aircraft for Calidus Aerospace.
- ***November 2021:*** TGI Geared Solutions was awarded a 10-year contract extension to manufacture, assemble, and test complex gear boxes and loose gears to support RR's engines on fixed wing and rotary platforms.
- ***October 2021:*** TGI Interiors business was awarded a LT agreement to provide air distribution system composite ducting and composite cockpit assemblies on the 777X as well as thermal-acoustic primary insulation systems for the 737 MAX, 767 Freighter, and 777, KC-46 tanker and P-8 Poseidon platforms.
- ***October 2021:*** TGI and Air France KLM Engineering & Maintenance announced a JV under the name xCelle Americas to overhaul nacelles for new generation aircraft including B787, B737 MAX, A320neo, and A350 aircraft for operators in North and South America.
- ***October 2021:*** TGI Actuation Products & Services announced a contract with Sine Draco Aviation Technology to design, develop, and manufacture the main deck cargo door lift actuator and hydraulic power pack assembly for A320-200 SDF passenger to freighter conversions.
- ***June 2021:*** TGI Actuation Products & Services announced an agreement to provide hydraulic utility actuation valves to LMT for F-35 readiness at the USMC Air Station Cherry Point. This is an extension of a contract signed in 2014 to provide OE and AM HUAV parts for the F-35 program with an additional 5 years.

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- ***June 2021:*** TGI was awarded a repair and overhaul services agreement with BA for engine driven pumps on the AH-65 Apache as part of a long term agreement for the BA Vertical Lift Sustainment Depot Program. The contract extends through 2024.
- ***May 2021:*** TGI Product Support was awarded multiple contract extensions with BA Commercial Airplanes for critical system components including hydraulic components across multiple programs. The three contract extensions include landing gear hydraulic locking actuators, transducers, and control valve components for the B787.
- ***May 2021:*** TGI Product Support was awarded a seven-year agreement with Collins Aerospace for repair services on various environmental control system components for multiple BA programs. TGI will offer systems such as actuation, hydraulic and fueling systems, geared solutions, and MRO.
- ***May 2021:*** TGI Aviation Services Asia signed a MoU with Thai Aviation Industries (TAI) to cooperate on a wide range of training, business development, and maintenance services including composite training for Diamond DA40 and DA62 aircraft maintenance. TAI conducts repairs and overhauls on a wide range of aircraft structures and components including engine nacelles, flight control surfaces, and various aircraft accessories.
- ***March 2021:*** TGI Systems and Support awarded a two-year contract to maintain ground support equipment (GSE) for the KC-46 program. TGI will provide services for critical ground support equipment used for aircraft maintenance and operations through October 2023.
- ***January 2021:*** TGI Systems was awarded the first and second LRIP contract from LMT/Sikorsky to provide the blade fold actuation and dampening systems for the CH-53K King Stallion helicopter to replace the US Marine Corp's aging fleet of CH-53E Super Stallion. Deliveries are expected to extend through the end of 2021.

2. Organic Sales Continues in FY23 with 8% Growth vs. 2% in FY22

We expect FY22 sales of $1.5BB, up 3% organically. Systems and Support rises 2% organically on our estimates, while Structures expands 4% organically. On a reported basis, sales are down 20% including a 48% decline for Structures given the divestiture of composites and G650 businesses. The largest programs after the divestitures completed in October are the A321, V-22, B737 and AH-64. TGI is diversifying platform and customer exposure to support growth going forward, in part by actively pursuing work on military platforms in both the OE and MRO space in order to offset commercial reductions.

Update on Strategic Review. On February 2nd, TGI announced an agreement to sell its Stuart, FL operations to Daher Aerospace. The transaction is expected to close in the first half of CY22. We est Stuart revs were in the $250MM range with normalized EBITDA margins of 10%. This could imply proceeds in the $150MM range at 6X EBITDA or 0.6X Sales. Stuart specializes in the manufacturer of large, complex metallic structures such as the wing and fuselage assemblies. In aggregate, the facility is 485,000 sq ft and employs ~400 people. Key programs include 767 large structures, along with the 737 and 777 inboard flaps. The 767 structures are largely for KC-46 military aircraft. The business is modestly cash positive with normalized EBITDA margins in the 10% range. We estimate proceeds could be in the range of $150MM, which could be used to pay down the $103MM of outstanding BA advance repayments remaining in FY23.

Previous transactions include:

- ***October 2021:*** On Oct 1st, TGI announced the sale of its Staverton, UK facility to Ontic Engineering & Manufacturing UK, including the business, assets and select product lines. Staverton generated ~$35MM in annual sales with proceeds of $35MM, or 1X sales. $24MM of the proceeds were used to pay down the First Lien.
- ***February 2021*****:** On Feb 10th, TGI announced an agreement to sell its Red Oak, Texas Operations to Arlington Capital Partners. The ops include both the facilities and thermoplastic engineering capabilities. Arlington previously announced a deal to acquire TGI's composite facilities operations. Red Oak, TX is a 1.1MM sq. foot facility on 123 acres focused on empennages, wing design and manufacturing, cabin & fuselage assemblies, nacelles and thrust reversers with capability in automated riveting, string composites, composite tape laying and large autoclave production. The facility serves both commercial and military programs, with the BA T-X Trainer one large recent award. TGI previously manufactured the Global 7500 wing at Red Oak prior to transferring operations to Bombardier. We estimate Red Oak revenues were in the $225MM range with normalized EBITDA margins of 10%. The transaction closed in May 2021 in conjunction with the Composites business for combined proceeds of $155MM net of related facility purchases and other transaction costs.
- ***August 2020*****:** Announced the sale of its Composites business to Arlington Capital Partners. The operations consist of two facilities: one in Milledgeville, GA and one in Rayong, Thailand. The operations consist of structural and engine composite fabrications and assemblies across commercial, biz jet, and defense. We estimate annual revenue in the range of ~$100MM in FY21E, with proceeds in the range of ~$50MM. The transaction closed in May 2021 in conjunction with the Red Oak business for combined proceeds of $155MM net of related facility purchases and other transaction costs.
- ***August 2020:*** After previously announcing the divestment of the G650/G700 wing business to Gulfstream in May, TGI announced it divested its remaining work including supply chain management, engineering services, inventory, facilities, and personnel to Gulfstream. In total, we estimate TGI's G650/G700 business generated ~$235MM of annual revenue in FY20. Cash proceeds were in the $1MM range from the sale, but there is a $50MM liquidation of inventory within operating cash flows. The net proceeds were $52MM in total with ~$10MM of the inventory liquidation recognized in FQ3.
- ***Jan. 2020:*** Completed the sale of its Nashville-based assembly operations to TECT Aerospace. The operations consist of machining, processing, and large-scale assembly for commercial aerospace platforms with annual revenue of $125MM in FY19 (~8% of Aerospace Structures revenue). Proceeds were in the $50MM range.
- ***Mar. 2019:*** NWI purchased TGI's metallics machining business (~$121MM in FY18 revenue). The transaction closed on Mar. 8th, 2019.
- ***Mar. 2019:*** TGI's forming and fabrication facilities (~$150MM in FY18 revenue) were divested to Arlington Capital for an undisclosed amount. The transaction closed on Mar. 31st, 2019.
- ***Feb. 2019:*** TGI's Global 7500 Wing Program was divested for a nominal cash consideration to BBD who will lease out TGI's Red Oak facility to complete the program. The transaction closed on Feb. 6th, 2019.

Exhibit 4 - TGI Has Divested 52% of Legacy Sales for $540MM in Proceeds

Divested Asset	Buyer	Date	Proceeds	Sales	EV/Sales	% of TGI
Global 7500 Wing	BBD	6-Feb-19	$0	$200	--	6%
Forming and Fabrication	Arlington Capital	31-Mar-19	$124	$150	0.8x	5%
Metallics Machining	NWI	8-Mar-19	$124	$121	1.0x	4%
Nashville Assembly	TECT Aerospace	2-Jan-20	$50	$125	0.4x	4%
G650/G700 Wings	Gulfstream	4-Aug-20	$52	$235	0.2x	13%
Composites/Red Oak	Arlington Capital	7-May-21	$155	$266	0.6x	18%
Staverton, UK	Ontic	1-Oct-21	$35	$35	1.0x	2%
Total Completed			**$540**	**$1,132**	**0.5x**	**52%**
Stuart, FL (estimated proceeds)	**Daher Aerospace**	**H1-CY22**	**$150***	**$250**	**0.6x**	**17%**

Source: Company data, Jefferies estimates

a) Aerospace Structures (28% of FY22E Rev): Set to Re-size in FY23E Following Final Divestiture

Revenue Outlook: FQ3:22 sales grew 3% organically driven primarily by narrowbody rate ramps, partially offset by the B787 production pause, which we estimate at a 5.5-pt headwind to segment sales. We estimate the MAX was a 9-pt tailwind as an offset. Within Structures, the 767 is the largest program in the commercial backlog followed by the B777, G650, and A350. The G650 continues to be a high exposure program in the segment backlog despite the transition out of wing assembly with higher-margin kitting business, but this is in part due to the lower production rates for large commercial platforms. The B777 and A350 will be higher exposure commercial platforms in backlog once rates normalize. We forecast a 4% organic increase in FY22 with FY23 up 9% organically.

Post-divestitures, we estimate the interiors business is likely ~$120MM in annual sales in FY22 with some return in volumes next year, growing 9% to $132MM in FY23 and 13% growth in FY24. Management has stated that there is line of sight to >$175MM in the out years as volumes on major programs fully recover. The bridge from $423MM to $132MM includes the divestiture of Stuart ($250MM in annual sales) in addition to sunsetting programs and the last remaining shipsets from Red Oak/composites (closed May 2021).

Exhibit 5 - Aerospace Structures Reset at ~$120MM Base w/ Organic Growth in FY23E

Revenue (USD in MM)	FY19	FY20	FY21	FY22E	FY23E	FY24E	FY25E
Commercial aerospace	$1,021	$879	$482	$377	$131	$148	$176
Military	238	116	137	15	0	0	0
Business Jets	700	464	158	25	0	0	0
Regional	36	90	12	5	0	0	0
Non-aviation	28	0	0	0	0	0	0
Elims	33	7	24	0	0	0	0
Structures	**$2,062**	**$1,556**	**$813**	**$423**	**$132**	**$149**	**$177**
Adjusted op. margin	1.4%	2.6%	2.7%	4.7%	-6.0%	-2.7%	1.0%
Adjusted EBITDAP margin	0.6%	6.6%	1.7%	5.7%	3.1%	5.3%	7.7%
YoY % Change							
Commercial aerospace	-37%	-14%	-45%	-22%	-65%	13%	19%
Military	-66%	-51%	19%	-89%	-100%		
Business Jets	69%	-34%	-66%	-84%	-100%		
Regional	95%	149%	-87%	-57%	-100%		
Non-aviation	9%	-100%		0%	0%	0%	0%
% Change	**-26%**	**-25%**	**-48%**	**-48%**	**-69%**	**13%**	**19%**
% Organic	**10%**	**3%**	**-32%**	**4%**	**9%**	**13%**	**19%**

Source: Company data, Jefferies estimates

Profitability: We forecast adjusted operating margins remain under pressure through FY23E but segment Adjusted EBITDAP margins increase as the amortization of acquired contract liabilities headwind rolls off. The segment is expected to benefit from the strategic divestitures going forward and the exit of loss-making programs. The business is changing

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from build to print to more interiors work, which is under a significant amount of pressure given COVID's downward effect on the industry. Stuart generated an adj. EBITDA margin in the 10% range, while interiors is currently close to breakeven due to volume headwinds.

However, the operating leverage is linked to the MAX with profitability in the MSD range. MAX rates are at 26/mo with a path toward 31/mo by the end of 2022, which will help to accelerate profitability within the Interiors business at Structures.

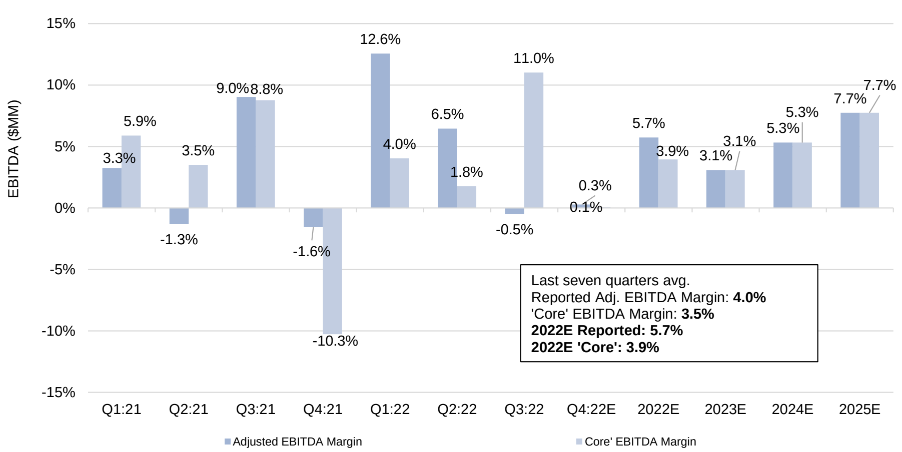
Structures generated adj. EBITDA margin of -0.5% in FQ3, or 5.1% excluding the $4.6MM restructuring expense recorded in the segment, which compares to a 9.0% margin in FQ3:21. Restructuring in the quarter was related to the final B747 shipset delivered in the quarter as well as the Spokane exit. Net unfavorable cum catch ups were $4.9MM in the quarter. Adj EBITDA margins excluding cum catch ups and restructuring were 11.0%, with our FY22 estimate implying adj EBITDA ex items at 3.9%. We assume 3.1% core margin in FY23E and 0.3% margins in FQ4:22E.

TGI has completed its G280 and B747 work, closing out the last dilutive programs in the business. The exit of the final loss-making programs and recent divestitures set Structures up to improve to 5.7% adj. EBITDA margins in FY22E from 1.7% in FY21.

Long term, TGI targets low-teens adj. EBITDA margins for the business. Actions taken to right-size the business and shift away from loss-making programs have resulted in a lower cost base, which should support a more profitable business than pre-COVID once volumes return.

If we look at the core EBITDA margin in Structures excluding restructuring and net favorable or unfavorable cum catch ups, we can consider a 'core' EBITDA margin underlying the business. In FQ3, 'core' EBITDA was 11.0% well above the reported -0.5%. In total for FY22, we estimate 'core' EBITDA at 3.9% given higher net favorable cum catch ups in FH1, which compares to 5.7% reported. Our estimate of a 3.1% FY23E Structures margin is down 80 bps from FY22 'core' given the divestiture of Stuart, which typically generates ~10% margins, with Interiors profitability expected to improve with operating leverage on key platforms such as the MAX.

Exhibit 6 - FQ3 Structures Margins of 11% W/ Restructuring and Catch-Up Addbacks



Source: Company data, Jefferies estimates

b) Systems and Support (72% of FY22E Rev): 7% Organic Growth in FY23E

Revenue Outlook: Systems and Support revenue fell 7.6% organically (-11% total) in FQ3, with the decline roughly split down the middle between the 787 and deferred military deliveries. Commercial Aero which accounts for 41% of segment sales was up 8% y-o-y, with narrowbody production rates on the A320 and MAX as well as MRO services growth (+12%) offsetting 787 headwinds related to the production pause. Military (49% of FY22E sales) declined 22% in the quarter y-o-y, but should begin to see some benefit in FQ4 and into FY23 as deferrals return.

FY22 revenue is expected to improve 2% organically. The improvement is driven by Commercial Aerospace with our estimates factoring in a 9% organic recovery in FY22. The sub-segment does include the 767, which is partially used for military applications through the KC-46 tanker program. Military sales accounted for just 48% of segment sales in FQ3, down slightly from 55% for FQ3:21, and should decline 3% on the year in our estimates.

The 22% decline in military sales included some B767 and V-22 shipments delayed due to supply of small components. The V-22 in particular has had quality issues with a small subcontractor, somewhat related to high turnover and labor challenges. The B767 has been challenged due to casting supply. However, we assume some of the deferred shipments are completed in FQ4 given the shipsets are largely complete in inventory, supporting a 3% organic increase in military for FQ4.

Profitability: FQ3:22 Adjusted EBITDA margins of 20.2% expanded from 18.0% a year ago driven by cost actions and supportive military profitability. FY21 EBITDA margins included a $24MM inventory impairment, which fully reverses this year. There has also been margin improvement from pre-COVID levels supported by facility consolidation. We forecast FY22 EBITDA margins improve to 19.0% from 14.9% in FY21 and migrate to 20.2% through FY2025.

FQ4 includes another ~$10MM benefit from AMJP with $3MM recorded in FQ3, although it will not repeat in 2023. This implies a 130 bps one-time benefit to FY22 with core profitability expansion driven by pricing, operating leverage and operational improvements.

TGI has a long-term target of ~20% margins in Systems and Support and has set a target to double total company EBITDA in three years (~$150MM today ex-divestitures to $300MM). The three main levers in TSS to achieve this level of profitability include: 1) higher contribution of MRO and spares vs. OEM; 2) renegotiating contract work to include price plus-ups; and 3) targeting 25% of sales from new products and customers. Our estimate takes a discount to the FY25 target by 19%, which may be a source of upside longer term.

TGI has stated its MRO margins could be >50% compared with OEM at 20%, which is the main driver of margin expansion in the segment with our estimates assuming it reaches 20% margins by 2025. Management said the mix of AM rose to 32% of total company aerospace sales vs. 24% previously, supporting margins in FQ3.

Exhibit 7 - Systems and Support Revenue Above Peak Revenues in FY25

Revenue (USD in MM)	FY19	FY20	FY21	FY22E	FY23E	FY24E	FY25E
Commercial aerospace	$731	$738	$397	$433	$502	$584	$683
Military	409	436	552	536	541	552	563
Business Jets	64	61	37	46	48	50	52
Regional	45	44	25	24	24	25	25
Non-aviation	27	37	31	31	31	31	31
Elims	50	34	15	6	6	6	6
Product Support	**$1,325**	**$1,358**	**$1,060**	**$1,075**	**$1,152**	**$1,247**	**$1,360**
Adjusted op. margin	15.6%	10.7%	14.0%	16.4%	17.1%	17.5%	17.8%
Adjusted EBITDAP margin	15.7%	15.5%	14.9%	19.0%	19.9%	20.1%	20.2%
YoY % Change							
Commercial aerospace	-4%	1%	-46%	9%	16%	16%	17%
Military	11%	7%	27%	-3%	1%	2%	2%
Business Jets	17%	-4%	-40%	26%	4%	4%	4%
Regional	-5%	-4%	-43%	-5%	2%	2%	2%
Non-aviation	4%	39%	-16%	0%	0%	0%	0%
% Change	**5%**	**2%**	**-22%**	**0%**	**6%**	**8%**	**9%**
% Organic	**6%**	**5%**	**-22%**	**2%**	**7%**	**8%**	**9%**

Source: Company data, Jefferies estimates

3. Settlement of BA Repayments in FY22 Causes FCF Inflection in FY23

We forecast FCF use of $150MM in FY22, compared to FCF usage of $198MM in FY21. For FQ3:22, TGI reported FCF of a $7MM inflow compared to the $186MM YTD outflow. Full-year guidance was lowered to a $150MM outflow (implying $36MM of generation in Q4) versus the prior range of an outflow of $135-150MM. Cash drags included the following:

- $63MM of BA advance repayments YTD ($21MM in FQ3).
- $32MM of B747 closeout costs YTD ($8MM in FQ3).
- $25MM of customer settlements, which were completed in FH1.
- $20MM of restructuring costs YTD.
- $16MM of capex YTD with $25MM expected for full year.

The bridge between FY21 to FY22 includes:

- FY22 BA advanced repayments guided at $84MM, or $21MM per quarter, up from a total of $40MM in FY21. TGI has $103MM left of payments, which management hopes to settle by year-end at a discounted amount using Stuart proceeds.
- TGI lowered its expected full year cash usage tied to the B747-8 to $37MM from $55MM (implying $5MM use in Q4).
- Other headwinds to FY22 FCF include $25MM of customer settlements occurring in FH1, which mostly offsets the $33MM of cash restructuring in FY21.
- Pension contributions are a minor use of cash at just $5MM in FY22 and should be minimal going forward.

In FY23, we estimate FCF inflects to generation of $58MM as BA advance repayments are settled, pensions contributions are minimal, and 747 cash usage is completed. The bridge between FY22 to FY23 includes:

- The absence of B747 losses (+$37MM y-o-y), cash restructuring (+$20MM), and customer advance repayments (+$84MM).
- BA advance repayments are a tailwind to FCF vs. $84MM in FY22. We assume the $103MM of outstanding advance repayments are covered by the proceeds from the Stuart divestiture and settled by year-end FY22.

- Interest expense falls to $138MM on our estimate from $140MM (plus $10MM debt extinguishment costs), reflecting the $24MM repayment of debt following the sale of the Staverton, UK facility.
- Core working capital is expected to improve $20MM y-o-y driven by inventory. The B767 and V-22 program have faced supply chain headwinds, largely related to quality at small subcontractors, which have led to higher inventory in FQ3:22. Inventory is expected to begin to unwind in FQ4:22 and into FY23E.

Exhibit 8 - FCF Outlook ($MM) - Inflection in FY23 on Settling BA Repayments by End of FY22 Using Stuart Proceeds

Free Cash Flow	FY19	FY20	FY21	FY22E	FY23E	FY24E	FY25E
GAAP Net Income	($323)	($28)	($451)	($4)	$52	$66	$90
Income tax	(5)	6	3	5	1	11	18
Interest	115	122	171	150	138	138	138
Loss on divestitures & other	235	68	128	14	0	0	0
Amortization of acquired contract liabilities	(67)	(75)	(39)	(5)	(1)	(1)	(1)
D&A	150	204	385	50	46	46	46
Adjusted EBITDA	**$191**	**$297**	**$159**	**$174**	**$187**	**$212**	**$242**
Net Change in WC (ex-Global 7500)	117	72	(22)	21	41	31	22
Global 7500 (in working capital)	(188)	0	0	0	0	0	0
Global 7500 (development expense)	(42)	0	0	0	0	0	0
Pension/OPEB Income	(57)	(39)	(51)	0	0	0	0
Pension Contribution	87	(10)	(2)	(5)	(2)	(2)	(2)
SPR Payment for Tulsa Assets	(8)	(60)	(52)	0	0	0	0
ETN Payment for Settlement	0	0	0	0	0	0	0
Tulsa Cash Outflow	0	0	0	0	0	0	0
747 Charge: Cash Forward Loss	(27)	20	(10)	(37)	0	0	0
NADEC Charge and other charges	0	0	0	0	0	0	0
Spokane Strike Costs	0	0	0	0	0	0	0
Cash Restructuring Costs	0	(7)	(33)	(20)	0	0	0
Cash Advance Repayments	(80)	(60)	(40)	(84)	0	0	0
Cash Advances (Benefit to Cash)	0	0	0	(25)	0	0	0
Others	(62)	27	0	0	0	0	0
Capex	(47)	(40)	(25)	(25)	(30)	(30)	(30)
Interest	(100)	(122)	(117)	(150)	(138)	(138)	(138)
Pre-tax FCF	**($241)**	**$54**	**($193)**	**($150)**	**$58**	**$73**	**$94**
Cash tax rate	7%	-8%	-3%	0%	0%	0%	0%
Tax	18	3	(5)	0	0	0	0
FCF	**($223)**	**$57**	**($198)**	**($150)**	**$58**	**$73**	**$94**

Source: Company data, Jefferies estimates

TGI has set a target of doubling total company EBITDA from FY22 to FY25 for the continuing business. This implies an expansion from ~$150MM in FY22E after subtracting ~$25MM of EBITDA related to Stuart, toward $300MM in FY25. Our estimate assumes a slightly more moderate ramp to $242MM of EBITDA by FY25E on a 15.8% EBITDA margin, expanding 420 bps over the period. Margin expansion is supported by improved workforce engagement and virtual collaboration tools, as well as operating leverage on higher volumes and price negotiations on contract renewals and the exit of lower margin programs.

We consider the impact of EBITDA expansion on FY25 FCF dependent on both top line and margin expansion. If we consider total company sales and EBITDA margin in FY25, FCF could be as high as ~$160MM if EBITDA were to reach the $300MM target, or 71% upside to our estimate of $94MM.

Exhibit 9 - Each 100 bps of TGI EBITDA Margin Expansion Worth $15MM to FY25 FCF

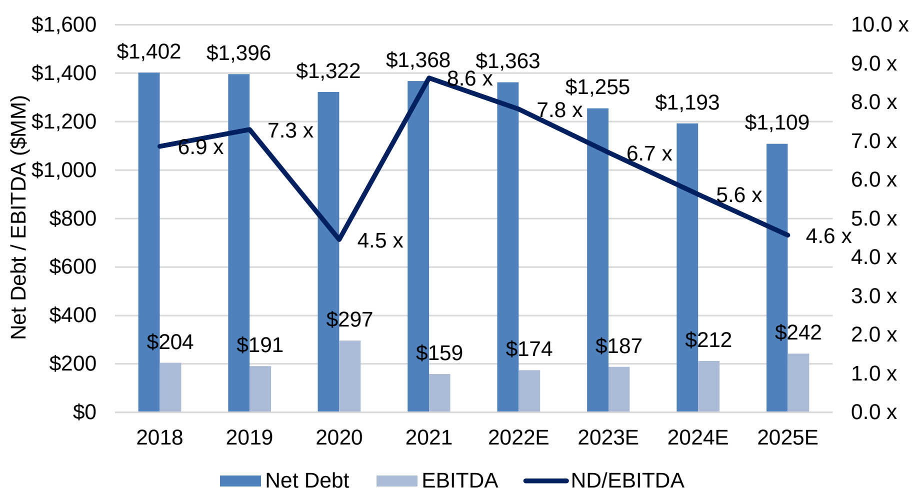
FY25 Adj EBITDA Margin (%)	FY25 Sales ($MM) $1,437	$1,537	$1,637	$1,737	$1,837
12.7%	$34	$47	$60	$72	$85
13.7%	$49	$62	$76	$90	$103
14.7%	$63	$78	$92	$107	$122
15.7%	$77	$93	$109	$124	$140
16.7%	$92	$108	$125	$142	$159
17.7%	$106	$124	$141	$159	$177
18.7%	$120	$139	$158	$177	$195

Source: Company data, Jefferies estimates

Leverage Update. TGI ended FQ3:22 with $1.4BB in net debt following YTD debt repayment of $379MM. Cash available is $206MM. We expect TGI to end FY22 with net debt of $1.36BB, or 7.8X EBITDA, before EBITDA and FCF ramp in FY23.

With the proceeds from its Staverton asset sale, management paid down $24MM of first lien notes. Management also extended the maturity of its receivables securitization facility to Nov 2024 and increased capacity from $75MM to $100MM. The company does not have a revolver so this provides additional liquidity.

Exhibit 10 - Net Leverage to Fall to 6.7X in 2023E with EBITDA Recovery and Positive FCF



Source: Company data, Jefferies estimates

Current Debt as of the end of FQ3:22 includes:

- $563MM of 8.875% 1st Lien Notes Due 2024
- $525MM 6.250% Senior Notes Due Sept 2024
- $500MM 7.750% Senior Notes Due Aug 2025
- $17MM of Finance Leases

In terms of expected debt pay down, TGI does not have any maturities until FY24, but the $206MM of cash on the balance sheet in addition to proceeds from Stuart could support incremental paydown. YTD, the company has repaid $236.5MM of FY22 maturities and $152MM of 1st Lien Notes.

Exhibit 11 - Next Maturity Not Until FY24 with >7X Leverage in FY22

		Debt Outstanding ($MM)						
Debt	**Maturity**	**Interest Rate**	**2019**	**2020**	**2021**	**2022E**	**2023E**	**2024E**
Revolving Credit Facility			215	400	0	0	0	0
Senior secured notes	Sept. 2021	4.88%	375	0	0	0	0	0
Senior notes	May. 2022	5.25%	300	300	236	0	0	0
Senior secured first lien notes	June 2024	8.88%	0	0	700	563	563	563
Senior secured notes	Sept. 2024	6.25%	0	525	525	525	525	525
Senior notes	Aug. 2025	7.75%	500	500	500	500	500	500
Finance leases	NA		31	24	20	0	0	0
Receivables Securitization	Other		81	75	0	0	0	0
Principal Debt			**$1,502**	**$1,824**	**$1,982**	**$1,588**	**$1,588**	**$1,588**
Unamortized Discount/Deferred Costs			(13)	(16)	(24)	(4)	(4)	(4)
Carrying Amount of LT Debt			1,489	1,808	1,958	1,585	1,585	1,585
Current Portion of Debt			(8)	(7)	(5)	(5)	(5)	(5)
Carrying LT Debt			**$1,481**	**$1,800**	**$1,952**	**$1,579**	**$1,579**	**$1,579**
Metrics								
Cash			$93	$485	$590	$246	$353	$416
Net Debt (excl. minorities)			$1,396	$1,322	$1,368	$1,363	$1,255	$1,193
Debt to EBITDA			7.8X	6.2X	12.5X	9.1X	8.5X	7.5X
Net Debt to EBITDA			7.3X	4.5X	8.6X	7.8X	6.7X	5.6X
Net Interest			$115	$122	$171	$150	$138	$138

Repaid $236MM of 2022 maturities during FQ1:22.

TGI used a portion of the $155MM of divestiture proceeds in May 2021 to redeem $137MM of its First Lien Notes YTD.

Source: Company data, Jefferies estimates

4. Price Target and Valuation

a) Price Target Derivation - SOTP

We arrive at our price target for TGI using a SOTP analysis. Given the last of the divestitures to close by June and the likely sale of remaining BA advances providing line of sight to clean FCF generation, visibility has improved to support a SOTP value. We estimated segment values based on peer EV/EBITDA multiples (Ex. 12) adjusted for divisional performance factors.

We assume a 13.7x multiple for Systems & Support at discount to peer average FY24E EV/EBITDA multiple of 14.1X. We apply a 9.5X multiple to Aerospace Structures in line with SPR's 9.5x multiple. Lastly, we layer an estimated $50MM of FY23E corporate expense at the average of 13.6x. We arrive at $26.03 per share of value on a blended average multiple of 13.6X.

Exhibit 12 - Sum of the Parts Valuation - $26 Fair Value in FY24E

FCF Summary by Segment	FY20	FY21	FY22E	FY23E	FY24E
Systems & Support	$149	$46	$77	$237	$249
Aerospace Structures	36	(108)	(25)	5	8
Corporate	(9)	(15)	(53)	(46)	(46)
Interest	(122)	(117)	(150)	(138)	(138)
Taxes	3	(5)	0	0	0
Combined FCF	**$57**	**($198)**	**($150)**	**$58**	**$73**

Adjusted EBITDA by Segment	FY20	FY21	FY22E	FY23E	FY24E
Systems & Support	$205	$156	$203	$229	$250
Aerospace Structures	$100	$18	$4	$4	$8
Corporate	($9)	($15)	($33)	($46)	($46)
Total Adjusted EBITDA	**$297**	**$159**	**$174**	**$187**	**$212**

Potential SOTP EBITDA Multiples	FY20	FY21	FY22E	FY23E	FY24E
Systems & Support	13.7X	13.7X	13.7X	13.7X	13.7X
Aerospace Structures	9.5X	9.5X	9.5X	9.5X	9.5X
Corporate	12.3X	13.3X	13.6X	13.6X	13.6X
Blended Average	**12.3X**	**13.3X**	**13.6X**	**13.6X**	**13.6X**

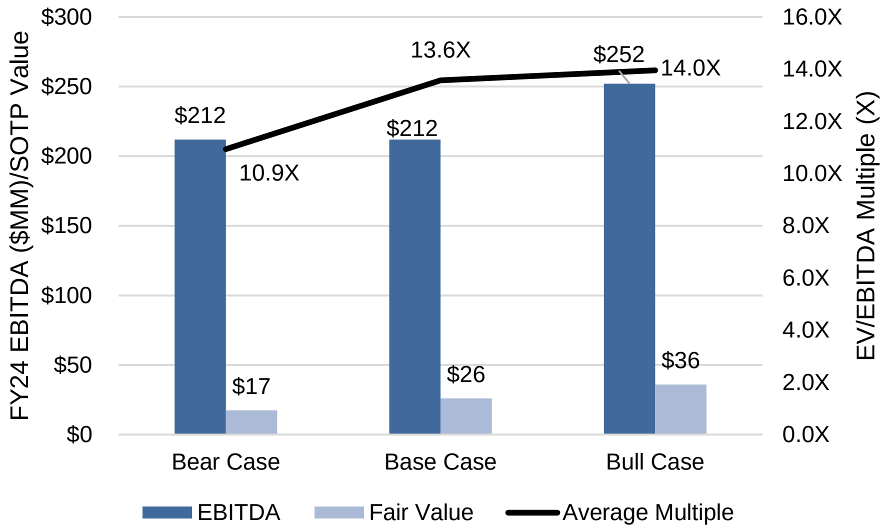
Equity Value Per Segment	FY20	FY21	FY22E	FY23E	FY24E
Systems & Support	$2,813	$2,133	$2,780	$3,139	$3,424
Aerospace Structures	954	166	40	39	75
Corporate	(114)	(195)	(449)	(626)	(624)
Total Equity Value	**$3,654**	**$2,104**	**$2,371**	**$2,551**	**$2,876**
Net Debt ($MM)					$1,193
Equity Value ($MM)					$1,683
Shares (MM)					64.7
Price/Share					**$26.03**

Source: Company data, Jefferies estimates

In a downside scenario, if Systems and Support were to trade at a 15% discount to peers' average or an 11X multiple, shares would be worth $17.

In a bull case, we consider EBITDA on track for management's target of ~$310MM by FY25. Given our FY25 EBITDA of $242MM is 19% below the target, if we take a 19% premium to our FY24 estimate to reach $252MM of EBITDA, a peer average 14X multiple would imply a fair value of $36.

Exhibit 13 - SOTP Bull Case Assumes EBITDA on Track for FY25 Target and Peer Average Multiples



Source: Company data, Jefferies estimates

B) Price Target Derivation - Premium to History

We arrive at our price target for TGI using three valuation methodologies. We use a 40% premium to its 3-year average relative discount to the market given the deflated EBITDA due to lower production rates due to COVID and the change in business mix and improved operations. We arrive at a blended price target of $26 based on: 1) FY23E EV/EBITDA of 14.1X (10% discount to S&P vs. 3-yr avg. 30% discount) arrives at a fair value of $27; 2) 23.0X our FY23E EPS (25% premium to the S&P vs. 3-yr avg. 16% discount to S&P) arrives at a fair value of $23; and 3) 4.1% FCF yield on our FY24 estimate of $73MM.

Exhibit 14 - Price Target Derivation

Valuation Method	Price	Assumptions
EV/EBITDA	$27	14.1x EV / FY24 Adj. EBITDA of $212MM
P/E	$23	23.0x FY24 P/E of GAAP EPS $1.00
FCF Yield	$27	4.1% on $73MM FY24 FCF
Average	**$26**	**Blended average**

Source: Company data, Jefferies estimates

c) Valuation Relative to Peers

In terms of TGI's valuation relative to peers, the company has historically traded at a significant discount to its Aerospace peers on most metrics. On 2023E P/E basis, TGI trades at an 1% premium vs. peers and a 1% discount on a 2023 EV/EBITDA basis.

Exhibit 15 - Relative Valuation Table (2/11/2022)

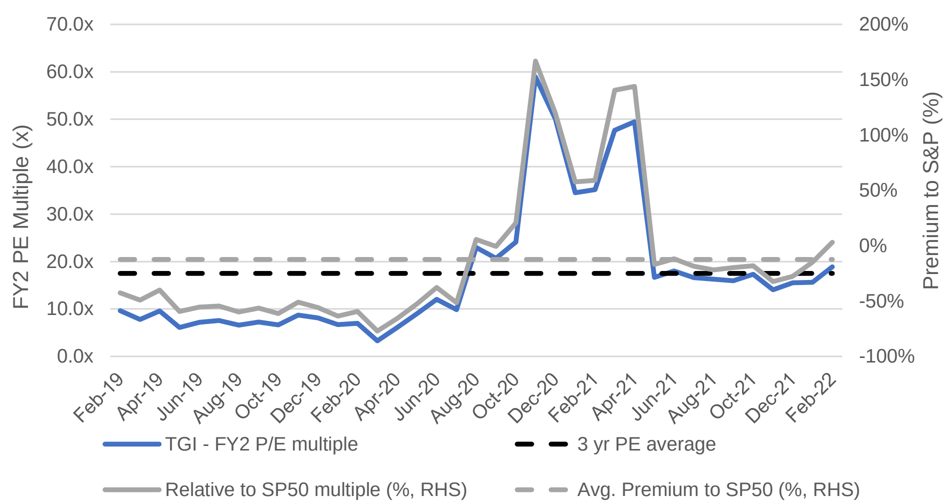
Aerospace Peers	Ticker	JEF Rating	Stock Px 2/11/2022	Consensus BUY Rating	Market Cap	Enterprise Value	P/E 2022E	P/E 2023E	P/E 2024E	EV / SALES 2022E	EV / SALES 2023E	EV / SALES 2024E	EV / EBITDA 2022E	EV / EBITDA 2023E	EV / EBITDA 2024E	Yield Dividend	Yield FCF
Spirit Aerosystems	SPR	Buy	$52.33	79%	5,497	7,711	--	20.5x	10.0x	1.1x	0.8x	0.7x	18.2x	9.5x	6.3x	0.1%	-1.3%
Honeywell	HON	Hold	$192.02	54%	132,191	144,607	22.1x	19.9x	18.2x	3.6x	3.4x	3.6x	16.0x	14.8x	13.9x	2.0%	3.9%
Raytheon Technologies	RTX	Buy	$95.65	74%	143,167	171,013	20.0x	16.5x	14.3x	2.1x	1.9x	1.8x	14.2x	12.6x	11.2x	2.1%	4.2%
Transdigm	TDG	Buy	$651.58	75%	36,138	53,802	41.2x	30.8x	26.3x	6.7x	6.1x	5.7x	21.1x	18.4x	16.6x	0.0%	2.8%
Woodward	WWD	Buy	$116.93	42%	7,375	7,937	31.4x	24.2x	21.3x	3.0x	2.7x	2.5x	17.4x	15.0x	14.0x	0.6%	4.0%
AAR Corp.	AIR	N/C	$42.16	100%	1,495	1,618	18.0x	13.3x	--	0.8x	0.8x	--	9.6x	9.6x	--	0.0%	5.9%
Peer Average				**69%**			**26.5x**	**20.9x**	**18.0x**	**2.9x**	**2.6x**	**2.8x**	**16.1x**	**13.3x**	**12.4x**	**0.8%**	**3.3%**
Triumph	**TGI**	**Buy**	**$21.12**	**22%**	**1,365**	**2,779**	**26.5x**	**21.0x**	**15.6x**	**2.2x**	**2.0x**	**1.8x**	**14.8x**	**13.1x**	**11.5x**	**0.0%**	**2.1%**
Discount / Premium							**0%**	**1%**	**-13%**	**-25%**	**-24%**	**-36%**	**-8%**	**-1%**	**-8%**		

Source: Company data, Jefferies estimates, FactSet

d) Valuation Relative to History: Trading Above Historical Discount to Market

TGI is currently trading at FY2 PE multiple of 18.9x, 9% above its 3-year average of 17.2x. On market relative basis, the stock is trading at a 3% premium to S&P vs. historical average discount of 14%.

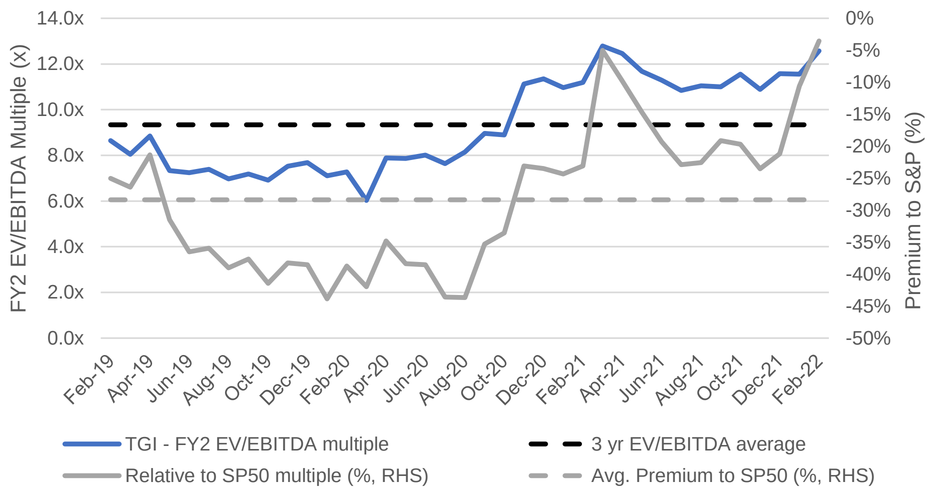
Exhibit 16 - Trading at 18.9x P/E, 3% Premium to Mkt vs. 14% Historical Disct



Source: FactSet, Jefferies estimates

On an EV/EBITDA multiple, TGI is trading at 12.6x, 36% above its 3-year avg of 9.2x and at a 3% discount to the S&P, which compares to a 3-year historical discount of 29%.

Exhibit 17 - Trading at 12.6x EV/EBITDA, 4% Disct to Mkt vs. 29% Historical Disct



Source: FactSet, Jefferies estimates

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Exhibit 18 - Annual Statement of Income ($MM)

(millions, except per share data)	2021		2022E		2023E		2024E		2025E	
	dollars	% of sales	dollars	% of sales	dollars	% of sales		% of sales		% of sales
Total Revenues	**$1,870**	100%	**$1,498**	100%	**$1,284**	100%	**$1,396**	100%	**$1,536**	100%
Costs and expenses										
Costs of Sales	($1,476)	79%	($1,118)	75%	($967)	75%	($1,043)	75%	($1,139)	74%
Selling, General & Administrative	($216)	12%	($187)	13%	($128)	10%	($140)	10%	($154)	10%
Depreciation and amortization	($93)	5%	($50)	3%	($46)	4%	($46)	3%	($46)	3%
Acquisition and integration expenses	($53)	3%	$0	0%	$0	0%	$0	0%	$0	0%
Curtailments and early retirement incentive	$0	0%	($13)	1%	$0	0%	$0	0%	$0	0%
Special Charge	($357)	19%	($14)	1%	$0	0%	$0	0%	$0	0%
Total Operating Costs	**($2,196)**	117%	**($1,382)**	92%	**($1,141)**	89%	**($1,228)**	88%	**($1,338)**	87%
Operating Profit	**($326)**	-17%	**$116**		**$143**	11%	**$168**	12%	**$198**	13%
Non recurring (pre tax):										
747-8	$0		$0		$0		$0		$0	
Losson Divestitures/BBD Global Expense	$105		$0		$0		$0		$0	
Restructuring charges	$53		$13		$0		$0		$0	
Curtailment & Settlement/Goodwill trade	$53		$0		$0		$0		$0	
Other Impairments / Charges	$252		$11		$0		$0		$0	
EBIT excluding non-recurring items	**$108**		**$142**		**$143**		**$168**		**$198**	
Total Interest	($171)		($150)		($138)		($138)		($138)	
Pension income	$50		$35		$48		$48		$48	
Income before taxes (GAAP)	($448)		$1		$53		$77		$108	
Income before taxes (adjusted)	**($14)**		**$27**		**$53**		**$77**		**$108**	
Taxes (GAAP rate %)	$3	-1%	$5	480%	$1	1%	$11	14%	$18	17%
Taxes (Adjusted rate %)	$3	-21%	$5	18%	$1	1%	$11	14%	$18	17%
GAAP Net Income	($451)		($4)		$52		$66		$90	
Adjusted Net Income	**($14)**		**($105)**		**$52**		**$66**		**$90**	
Diluted shares (millions)	52.7		64.7		65.3		65.9		66.5	
Adjusted EPS	**($0.03)**		**$0.81**		**$0.80**		**$1.00**		**$1.35**	

Source: Company data, Jefferies estimates

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Exhibit 19 - Select Operating Metrics ($MM)

	2021	2022E	2023E	2024E	2025E
YoY Change					
Total Revenue Change %	**-35.5%**	**-19.9%**	**-14.3%**	**8.7%**	**10.1%**
Organic Change %	-27.3%	2.6%	7.6%	8.7%	10.1%
M&A %	-8.3%	-22.5%	-21.9%	0.0%	0.0%
Net Income Growth % (continuing)	1505%	-99%	-1429%	27%	36%
EPS Growth % (continuing)	-101%	-2815%	-1%	26%	35%
Margin Analysis					
Gross margin %	21.0%	25.3%	24.7%	25.3%	25.9%
SG&A as % of sales	11.6%	12.5%	10.0%	10.0%	10.0%
Operating Margin %	-17.4%	7.7%	11.1%	12.0%	12.9%
Segment Op. Margin % (excl. one time items)	9.0%	13.0%	14.7%	15.3%	0.0%
Operating Margin % (excl. one time items)	5.8%	9.5%	11.1%	12.0%	12.9%
Adj. EBITDA	$159	$174	$187	$212	$242
Adj. EBITDA Margin %	8.5%	11.6%	14.6%	15.2%	15.8%
EBT %	-24.0%	0.1%	4.1%	5.5%	7.0%
Tax Rate %	-0.6%	480.2%	1.0%	14.4%	$0.17
Net margin % (continuing)	-24.1%	-0.3%	4.1%	4.7%	5.9%
Balance Sheet Analysis					
Net Debt / Equity	-167.0%	-198.5%	-178.6%	-158.1%	-143.0%
Net Debt / EBITDA	8.6x	7.8x	6.7x	5.6x	4.6x
Cash Flow Analysis					
Free Cash Flow	($198)	($150)	$58	$73	$94
Free Cash Flow Conversion %	44%	3799%	111%	110%	104%
Free Cash Flow Yield %	-46.9%	-29.0%	11.0%	13.8%	17.6%
Dividend Yield %	0.0%	0.0%	1.9%	1.9%	1.9%
Valuation and Profitability					
Diluted P/E	-0.9x	-132.3x	10.0x	8.0x	5.9x
EV/EBITDA	11.3x	10.8x	9.5x	8.1x	6.8x
EV/Sales	1.0x	1.3x	1.4x	1.2x	1.1x
ROIC	12%	-64%	19%	23%	32%
EV/IC	1.2x	1.8x	1.6x	1.7x	1.6x

Source: Company data, Jefferies estimates

Exhibit 20 - Sources and Uses of Funds ($MM)

(millions, except per share data)	2021	2022E	2023E	2024E	2025E
Operating Activities					
Net income	($450.9)	($3.9)	$52.1	$66.2	$90.0
Depreciation & Amortization	93.3	49.6	45.6	45.6	45.6
Other Items	244.4	(178.7)	(50.8)	(40.2)	(33.4)
Op cash flow pre-working capital	**($113.2)**	**($133.0)**	**$46.9**	**$71.6**	**$102.1**
Change in inventory	52.6	28.3	25.0	40.0	30.0
Change in receivables	165.4	7.6	26.0	(14.0)	(17.6)
Change in payables	(278.2)	(28.2)	(10.1)	5.3	9.4
Changes in working capital	(60.2)	7.7	40.9	31.3	21.8
Cash Flow from Operations	**($173.4)**	**($125.4)**	**$87.8**	**$102.9**	**$124.0**
Investment activities					
Capital expenditures	(25.2)	(25.0)	(30.0)	(30.0)	(30.0)
Proceeds from sale of assets	15.9	155.0	50.0	0.0	0.0
Cash used for businesses acquired	0.0	0.0	0.0	0.0	0.0
Cash Flow from Investments	**($9.3)**	**$130.0**	**$20.0**	**($30.0)**	**($30.0)**
Financing Activities					
Change in debt	225.0	(349.0)	0.0	0.0	0.0
Cash dividends paid	0.0	0.0	0.0	(10.2)	(10.3)
Dividend payment / Buyback	0.0	0.0	(10.2)	(10.2)	(10.3)
Cash Flow from Financing	**$225.0**	**($349.0)**	**($10.2)**	**($20.5)**	**($20.7)**
Net change in cash items	**$42.3**	**($344.4)**	**$97.7**	**$52.4**	**$73.3**
Cash at the beginning of the period	485.5	589.9	245.5	353.3	416.0
Cash at the end of the period	**$589.9**	**$245.5**	**$353.3**	**$416.0**	**$499.6**

Source: Company data, Jefferies estimates

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Exhibit 21 - Annual Balance Sheet ($MM)

(millions, except per share data)	2021	2022E	2023E	2024E	2025E
Assets					
Cash and cash equivalents	$590	$246	$353	$416	$500
Accounts receivable - net	194	186	160	174	192
Inventories and contracts in progress	400	372	347	307	277
Contract Assets	135	135	135	135	135
Deferred income tax assets	0	0	0	0	0
Rotable assets	19	19	19	19	19
Prepaid expenses	0	0	0	0	0
Assets held for sale	216	216	216	216	216
Other current assets	0	0	0	0	0
Total Current Assets	**1,554**	**1,174**	**1,231**	**1,268**	**1,339**
PPE	211	368	298	228	158
Goodwill	522	514	514	514	514
Intangible assets	102	102	102	102	102
Deferred income tax assets	0	0	0	0	0
Other assets	61	61	61	61	61
Total non-current assets	897	1,045	975	905	835
Total Assets	**$2,451**	**$2,219**	**$2,206**	**$2,172**	**$2,174**
Liabilities					
Current portion of long- term debt	5	5	5	5	5
Accounts payable	179	151	141	147	156
Income taxes payable	0	0	0	0	0
Accrued liabilities	476	489	502	515	528
Liabilities related to assets held for sale	58	58	58	58	58
Total Current Liabilities	**$718**	**$703**	**$706**	**$724**	**$747**
Long-term debt	1,952	1,603	1,603	1,603	1,603
Deferred income tax liabilities	384	384	384	384	384
Other long-term liabilities	215	215	215	215	215
Total Non-current Liabilities	2,551	2,202	2,202	2,202	2,202
Total Liabilities	**$3,270**	**$2,906**	**$2,909**	**$2,927**	**$2,949**
Total Stockholders equity	**($819)**	**($687)**	**($703)**	**($755)**	**($776)**
Total liabilities and S/E	**$2,451**	**$2,219**	**$2,206**	**$2,172**	**$2,174**

Source: Company data, Jefferies estimates

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Exhibit 22 - Quarterly Income Statement

(millions, except per share data)	2021					2022E				
	Q1	Q2	Q3	Q4	Year	Q1	Q2	Q3	Q4E	Year
Revenues	$495.1	$481.8	$426.0	$466.8	$1,870	$396.6	$357.4	$319.2	$424.6	$1,498
Costs and Expenses										
Costs of Sales	(394)	(382)	(341)	(360)	(1,476)	(294)	(262)	(232)	(330)	(1,118)
Selling, General & Administrative	(57)	(56)	(49)	(54)	(216)	(56)	(54)	(42)	(34)	(187)
Depreciation and amortization	(29)	(22)	(22)	(21)	(93)	(15)	(13)	(12)	(10)	(50)
Acquisition and integration expenses	(252)	0	0	199	(53)	0	0	0	0	0
Curtailments and early retirement incenti	(15)	(13)	(4)	33	0	(4)	(4)	(5)	0	(13)
Special Charge	0	(1)	(45)	(311)	(357)	(6)	(8)	0	(0)	(14)
Total Operating Costs	(747)	(474)	(461)	(513)	(2,196)	(376)	(341)	(291)	(374)	(1,382)
Total Operating Profit (EBIT)	**($252)**	**$7**	**($35)**	**($46)**	**($326)**	**$21**	**$16**	**$28**	**$50**	**$116**
Non recurring (pre tax):										
747-8	0	0	0	0	0	0	0	0	0	0
Losson Divestitures/BBD Global Expens	0	0	45	59	104	0	0	0	0	0
Curtailment & Settlement/Goodwill trade	0	0	0	0	0	0	0	0	0	0
Other Impairments / Charges	252	0	24	0	276	0	0	0	0	0
Restructuring charges	16	13	4	20	54	4	4	5	0	13
EBIT excluding non-recurring items	**$16**	**$21**	**$38**	**$33**	**$108**	**$25**	**$20**	**$33**	**$50**	**$129**
Total Interest	(35)	(53)	(45)	(39)	(171)	(48)	(34)	(34)	(33)	(150)
Pension income	11	12	12	12	50	(2)	10	14	12	35
Income before taxes	**($276)**	**($33)**	**($67)**	**($73)**	**($448)**	**($29)**	**($7)**	**$8**	**$29**	**$1**
Tax	(0.9)	(0.8)	(0.7)	(0.5)	(2.9)	(1.2)	(1.8)	(1.1)	(0.9)	(5.0)
Adjusted Tax	1.0	(0.8)	(0.7)	(0.5)	(2.9)	(1.2)	(1.8)	(1.1)	(0.9)	(5.0)
Net earnings	**($277)**	**($33)**	**($68)**	**($74)**	**($451)**	**($30)**	**($9)**	**$7**	**$28**	**($4)**
Diluted shares (millions)	51.9	52.0	52.5	57.9	52.7	64.3	64.5	65.1	64.7	64.7
Adjusted EPS	**($0.15)**	**($0.08)**	**$0.09**	**$0.10**	**($0.03)**	**$0.09**	**$0.10**	**$0.21**	**$0.40**	**$0.81**

	2021					2022E				
	Q1	Q2	Q3	Q4	Year	Q1	Q2	Q3	Q4E	Year
Revenue change YoY	-32.2%	-37.6%	-39.5%	-32.6%	-35.5%	-19.9%	-25.8%	-25.1%	-9.0%	-19.9%
Organic Revenue Change YoY	-29.0%	-29.6%	-29.2%	-29.0%	-27.3%	11.0%	-1.9%	-5.0%	9.8%	2.6%
Gross margin %	20.4%	20.7%	20.0%	23.0%	21.0%	26.0%	26.6%	27.2%	22.3%	25.3%
SG&A as % of sales	11.6%	11.7%	11.4%	11.5%	11.6%	9.9%	109.9%	209.9%	8.1%	12.5%
EBIT Margin (including charges) %	-51.0%	1.5%	-8.2%	-9.9%	-17.4%	5.3%	4.6%	8.8%	11.8%	7.7%
EBIT Margin (excluding one time items) %	3.1%	4.4%	8.9%	7.0%	5.8%	7.9%	7.8%	10.3%	11.8%	9.5%
EBT %	-55.8%	-6.8%	-15.8%	-15.6%	-24.0%	-7.3%	-2.0%	2.6%	6.9%	0.1%
Tax rate	-0.3%	-2.5%	-1.0%	-0.7%	-0.7%	-4.2%	-24.5%	13.2%	3.1%	462.8%
Net margin	-56.0%	-7.0%	-16.0%	-15.7%	-24.1%	-7.7%	-2.5%	2.3%	6.7%	-0.3%

Source: Company data, Jefferies estimates

Company Description

Triumph Group, Inc.

Triumph Group, Inc. is an international supplier of aerospace components and systems. Based in Berwyn, Pennsylvania, Triumph is primarily a Tier 1 aero structures manufactures with a broad offering of Tier 2 and Tier 3 components for commercial, military, and business jet aircraft. The company actively utilizes its balance sheet deploying capital to complete 40 transactions over the past 15 years. The largest acquisition was in June 2010, with the acquisition of Vought Aircraft Industries increasing the company's presence as a Tier 1 aerostructures manufacturer.

Company Valuation/Risks

Triumph Group, Inc.

Our blended price target is based on a SOTP on our FY24E EBITDA with a slight discount to peer average Structures multiple and a peer average Systems multiple.

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(Article 3(1)e and Article 7 of MAR)

Recommendation Completion	February 13, 2022 , 14:15 ET.
Recommendation Distributed	February 13, 2022 , 14:15 ET.

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- Hexcel Corporation (HXL: $53.94, HOLD)
- Honeywell International Inc. (HON: $186.99, HOLD)
- Raytheon Technologies (RTX: $95.27, BUY)
- Spirit AeroSystems Holdings, Inc. (SPR: $49.54, BUY)
- TransDigm Group Incorporated (TDG: $649.24, BUY)
- Woodward (WWD: $114.50, BUY)

Rating and Price Target History for: Triumph Group, Inc. (TGI) as of 02-10-2022

Distribution of Ratings

Distribution of Ratings						
			IB Serv./Past12 Mos.		JIL Mkt Serv./Past12 Mos.	
	Count	Percent	Count	Percent	Count	Percent
BUY	1988	63.84%	142	7.14%	26	1.31%
HOLD	1002	32.18%	24	2.40%	3	0.30%
UNDERPERFORM	124	3.98%	0	0.00%	0	0.00%

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Equity Research
February 5, 2023

Getting INTERESTing; Lowering FCF on Rate Assumption

TGI lowered FCF use modestly to a use of ($55MM)-($65MM). TGI is on a path to positive FCF on normalized working capital and the absence of one-time items ($24MM FYTD). The question remains the 2024 maturities ($1.1BB), set to be refinanced. We raise our base case FY25 interest expense to $155MM from $130MM, driving FCF of $34MM in FY24 (down from our prior est of $62MM). Each 1% rate in rates is worth $3 to TGI shares, assuming a 5% FCF yield.

FY23 Adjusted EPS Largely Unchanged at $0.56, with Higher Share Count Offset by Higher Volumes. We forecast $1.31BB of rev in FY23 (from $1.28BB prior), or up 2%, to reflect a quicker production ramp at AS. The offset is a sh count of 72-73MM in FY23 (65MM prior), reflecting the warrant issuance. Shares were 65MM on Jan 30 w/our est at 72MM in FY24E. We est GAAP EPS of $1.71 (from $1.85 prior) reflecting shares.

Profit Coming In Better - TGI Delivered 10.9% Adj EBIT Margins in FQ3 vs 10.8% in FY23 & 11.1% in FY24. Structures posted 13.1% adj EBITDA margins in FQ3 w/ Interiors in the single digits and modest overhang from closeouts. We assume op margins of 17.3% for FY23 and 11.1% for FY24. We assume overall company margins of 14.4% with mgmt's guidance ~14%. In TSS, we est 110 bps of contraction for FY23 to 17.4%. TGI targets doubling EBITDA from $155MM core in FY22 to ~$310MM of FY25 EBITDA w/ our ests more conservative at $217MM (15.2% margin) (Ex 3).

FCF to Turn Positive in 2024E. We est $64MM FCF used in FY23E (Ex 11) to $23MM generated in FY24. One-timers in FY23 now total $24MM, completed FYTD, with FCF guidance improved to $55-65MM or by $5MM less usage on lower capex. Looking to FY24, we est $23MM of FCF generation. We assume working cap is net neutral vs $59MM of usage in FY23. We assume a 10% rate for $1.1BB of maturities vs 7.6% on current debt, implying interest of $156MM vs $130MM currently.

Warrant Progress and Refinancing Risk. TGI issued warrants in Dec, which could result in a $20MM reduction in interest expense if successful (up to $270MM of paydown at a 7.6% avg rate). The warrants expire either at the 1yr mark (Dec 2024) or if shares trade above the $12.35 strike price for 20 days out of 30. Warrants can be exercised with cash or TGI bonds, offering an opportunity for deleveraging. We consider the impact of the refinancing of 2024 maturities at interest rates from the current blended rate of 7.6% up to 12.0% with every 100 bps of incremental interest a $10MM headwind to FCF and worth $3 to shares at a 5.0% yield (Ex 1).

Valuation on FCF at $9 with Upside on SOTP Value at $15. We use peer comps AAR, HON, RTX, SPR, TDG, and WWD for TGI. Peers trade at 14X, but we value TGI at a 20% discount to 11X EV/EBITDA of $217MM on FY25, arriving at $15. In our bear case, we assume a downside EBITDA of $193MM on slower top-line growth with a 30% discount multiple implying a $5 price target. If the company were to meet FY25 EBITDA targets of $310MMM, a 20% discount to peers multiple implies an upside value of $30.

(FY Mar)	2022A	2023E	2024E	2025E
Rev. (MM)	1,459.9	1,312.0	1,323.8	1,426.7
EV/Rev	1.6x	1.8x	1.8x	1.6x
P/Rev	0.6x	0.6x	0.6x	0.6x
EBITDA (MM)	169.0	183.0	190.0	217.0

TARGET | ESTIMATE CHANGE

RATING	BUY
PRICE	$12.22^
PRICE TARGET | % TO PT	↓$15.00 ($19.00) | +23%
52W HIGH-LOW	$27.85 - $7.84
FLOAT (%) | ADV MM (USD)	93.1% | 10.45
MARKET CAP	$837.1M
TICKER	TGI

^Prior trading day's closing price unless otherwise noted.

	CHANGE TO JEFe		JEF vs CONS	
	2023	2024	2023	2024
REV	+2%	+2%	NA	NA
EPS	+2%	NA	NA	NA

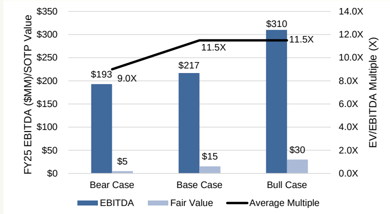
2023 ($)	Q1A	Q2A	Q3A	Q4	FY
EPS	0.12	0.07	↑0.12	↓0.25	↑0.56
PREV			0.10	0.27	0.55

Exhibit 1 - Every 100 bps of Refinanced Interest Rate Worth $3 to Shares

FCF Yield (%)	Refinancing Rate 7.6%	9.0%	10.0%	11.0%	12.0%
5.0%	$16	$12	$9	$6	$3
6.0%	$14	$10	$8	$5	$3
7.0%	$12	$9	$7	$5	$2
8.0%	$10	$8	$6	$4	$2
9.0%	$9	$7	$5	$4	$2
10.0%	$8	$6	$5	$3	$2
11.0%	$7	$6	$4	$3	$2

Source: Company data, Jefferies estimates

Exhibit 2 - SOTP Bull Case Assumes EBITDA at Target of Doubling by FY25



Source: Company data, Jefferies estimates

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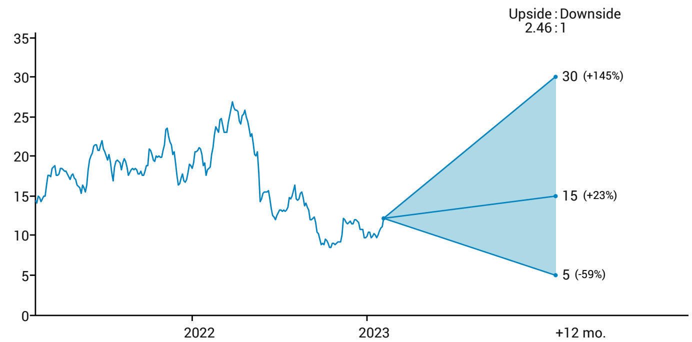
The Long View: Triumph Group, Inc.

Investment Thesis / Where We Differ

- FY22 saw the completion of the divestiture strategy, although facility exits and wind-down costs are stranded into FY23, driving negative FCF. TSS and Structures should return to organic growth in FY23 as volumes begin to ramp, although the focus remains on EBITDA execution and FCF generation. Our SOTP implies a price target of $15.

Risk/Reward - 12 Month View



Base Case, $15, +23%

- Organic revenue increases 6% in FY24 and 8% in FY25, driven by ramping volumes.
- Aerostructures grows organically in FY25 at +26%, while TSS grows at 5% due to NB rates and MRO work.
- Adj. EBITDA margins expand to 15.2% in FY24 driven by cost-reduction benefits and volumes ramping.
- PT $15: SOTP at 11.5X (20% disct to peers avg) on adj. EBITDA of $217MM in FY25.

Upside Scenario, $30, +145%

- Revenue expands by 13% organically in FY25 given growth in commercial and military content.
- Adj. EBITDA margins expand to 19.5% in FY25 from higher mix of commercial AM.
- Adj. EBITDA meets target of $310MM by FY25.
- FCF conversion meets target of 10% of sales by FY25.
- PT $30: Assumes FY25 EBITDA doubles FY22 run rate, trading at peers avg 12X.

Downside Scenario, $5, -59%

- Revenues expand modestly at 4% organically in FY25 as volumes in aerospace and military do not fully recover to prior peak and production rates fall under the forecast.
- Commercial AM growth lags expectations and new product wins decelerate.
- TGI fails to drive margin execution from cost takeout and operating leverage; reinvestment weighs on TSS EBITDAP margins at 15%.
- PT $5: Assumes 35% discount to peers, or 9X.

Sustainability Matters

Top Material Issue(s): 1) Supply Chain Mgmt: In Nov '21, TGI hosted a conference called Ready for Rate Ramp with 250 key global suppliers to jointly develop actions ahead of OEM rate increases, such as advanced forecasting, AI-based risk mgmt, innovative staffing, dual sourcing, and disciplined price mgmt.

Company Target(s): 1) Reduce Scope 1 and 2 emissions by 30% by 2030 with a long-term ambition to be carbon-neutral by 2050; **2)** reduce hazardous waste by 30% by '30; **3)** continuously increase the percentage of women and people of color in leadership roles through 2030; **4)** implement a serious injury and fatality prevention program, site-specific water reduction programs in high-stress water regions, and recycling and reuse programs by 2025; **5)** reach 100% ISO 14001 certified facilities by 2030 from 5 today

Qs to Mgmt: 1) What are the early focus areas for executing on goals across energy usage & emissions, social, governance, water & wastewater, and waste? **2)** Can TGI explain the introduction of sustainability criteria into its product development process?

The Five ESG Issues Investors Should Look At When Investing in A&D

Catalysts

- Commercial aerospace production rates improve with the recovery, particularly on the MAX (16% of backlog) and A321 (9% of backlog).
- Continued strength in bookings.
- Content wins on commercial and military platforms.
- Volume growth drives EBITDA towards doubling by 2025, while one-timers end in FY23, driving a return to positive FCF.

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Investment Considerations

In this report, we highlight the following:

- **1. Doubling EBITDAP by FY25 With 20%+ Margins in FY26 and 10% FCF Conversion to Sales**
- **2. Backlog Up with Support from Commercial Aero**
- **3. Organic Sales Return in FY23 with 7% Growth**
  - **a) Aerospace Structures (16% of FY23E Rev): Re-Sized Following End of Portfolio Reshaping**
  - **b) Systems and Support (84% of FY23E Rev): Positioned to the Narrowbody Ramp**
- **4. Inventory Headwinds Weigh on FY23 FCF with a Risk from Refi Longer Term**
- **5. Price Target and Valuation**

1. Doubling EBITDAP by FY25 with 20%+ Margins in FY26 and 10% FCF Conversion to Sales

Mgmt previously provided a long-term framework for the continuing business as the close of the Stuart divestiture marks the end of a portfolio transformation that started in 2016.

TGI has set a target of doubling total company EBITDA from FY22 to FY25, implying an expansion from $155MM in core EBITDA as of FY22 to $310MM in FY25. The growth is supported primarily by operating leverage on higher volumes and better pricing on contract renewals, as well as the exit of loss-making programs including through divestitures and the closeout of G280 and B747 operations.

By FY26, TGI is targeting 20%+ EBITDAP margins, 10% free cash flow conversion to sales, and 3-4X leverage to adj. EBITDA. The margin target assumes low-to-mid 20% margins in Systems & Support and low-teens margins in Structures.

We currently estimate $217MM in EBITDAP in FY25, 30% below TGI's target, reflecting more modest commercial OE production rates than in plan (JEF est MAX at 38/mo in 2024 vs. ~50/mo at TGI; JEF est 787 at 5/mo in 2024 vs. ~10/mo at TGI; JEF est A320 family at 63/mo in 2024 vs. ~70/mo at TGI).

In FY26, we estimate $249MM in EBITDAP for a margin of 16.1% on sales of $1.6BB, 390 bps below the 20%+ margin target. FY26 FCF is $66MM on our estimates for conversion of 4.3% to sales, 570 bps below the 10% target. Net debt to EBITDAP is 5.2X in FY26 on our estimates, 1.7X above the midpoint target of 3-4X.

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Exhibit 3 - TGI Targets vs. JEF Ests - More Conservative Across the Board, Primarily on Lower Est Production Rates

JEF Ests	FY22	FY23	FY24	FY25	FY26	Target FY25*/FY26	JEF vs. TGI FY25*/FY26
Revenue	$1,460	$1,312	$1,324	$1,427	$1,550		
% Organic Growth	*0.2%*	*6.8%*	*5.7%*	*7.8%*	*8.6%*		
EBITDAP	$169	$183	$190	$217	$249	$310*	*-30%*
% Margin	*11.6%*	*13.9%*	*14.4%*	*15.2%*	*16.1%*	20%+	*-392 bps*
Free Cash Flow	($157)	($64)	$23	$34	$40		
% Conversion to Sales	*-10.8%*	*-4.9%*	*1.7%*	*2.4%*	*2.6%*	10%	*-740 bps*
Leverage	8.0x	7.7x	7.4x	6.4x	5.4x	3-4x	*1.9x*
737 MAX Production	159	289	348	456	534		
Per Month	*13.3*	*24.1*	*29.0*	*38.0*	*44.5*	50.0*	*-24%*
787 Production	45	20	36	60	72		
Per Month	*3.8*	*1.7*	*3.0*	*5.0*	*6.0*	10.0*	*-44%*
A320 Production	489	526	613	723	800		
Per Month	*42.5*	*45.7*	*53.3*	*62.9*	*69.6*	70.0*	*-10%*

Source: Company data, Jefferies estimates. Note: * Indicates FY25 target. TGI production targets based on indexed values in Ex. 5.

TGI provided market growth estimates that it uses to inform its guidance and four-year plan, which embeds a ~9% CAGR through 2026 for the aviation production market. Coming from the low base in FY23, widebody platforms are expected to lead w/ an ~18% CAGR led by growth in the 777 and 787, while narrowbodies grow at a ~12% CAGR driven by ramping rates on the MAX and A320neo. Defense is flattish although management called out opportunities such as content wins on the F-35 and growth in the CH-53K. MRO activity is driven by the return in flight hours, growing at a 3.5% to 5% CAGR through FY26. The combination of exposures is expected to drive an HSD to LDD growth rate for TGI.

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Exhibit 4 - Market Growth - WBs Lead Growth from Low Base, but NB Ramp Drives Revs

Market	FY23-FY26 CAGR
Commercial Transport	**13.2%**
Commercial Transport - Narrowbody	11.7%
737	16.1%
A320	9.0%
A220	3.8%
Commercial Transport - Widebody	17.7%
767	-1.6%
777	82.0%
787	19.3%
A330	8.0%
A350	9.6%
Military - Fixed Wing and Rotorcraft	**0.5%**
AH-64 E	-3.4%
UH-60	-3.2%
CH-53K	31.1%
F-35	0.5%
V-22	-23.3%
F/A-18	-13.4%
F-15	17.4%
F-16 v	27.6%
MRO	**3.5% to 5%**
Total Aviation Production CAGR	**~9%**

Source: Company data

In FQ4:22, TGI provided its internal rate projections, shown in Exhibit 5. Mgmt noted its rates are informed by conversations with its customers, as well as supported by the order outlook and backlog of the OEMs. However, its production rates are well ahead of our estimated production rates through 2024 (TGI's FY25).

On the **787**, TGI is currently producing shipsets at ~2-2.5/mo on our ests, still well below the pre-pandemic rate of 14/mo, although mgmt expects the rate to move towards 4/mo exiting the year, supported by the 787 order book and accounting for inventory burn. Longer-term, TGI and BA have provided for rates approaching ~10/mo by FY25 (CY24), still below the pre-pandemic rate of 14/mo. This compares to our production forecasts for a rate of 3/mo in 2023 and 5/mo in 2024.

For the **MAX**, TGI mgmt noted a 30-31/mo rate today with internal forecasts assuming a 45/mo production rate in FY24 (CY23), which implies the index in FY25 is in the ~50/mo range as the rate transitions towards 57/mo beyond 2026. This compares to our estimates for production rates of 28/mo in 2023 and 29/mo in 2024 as inventory and supply chain disruptions are worked through.

For the **A320 Family**, TGI's indexed value in FY25 (CY24) is in the range of 1.3X, which implies the production rate at ~70/mo, compared to our estimates of 65/mo in 2024. Currently, the company is producing at a ~45/mo rate on our estimates.

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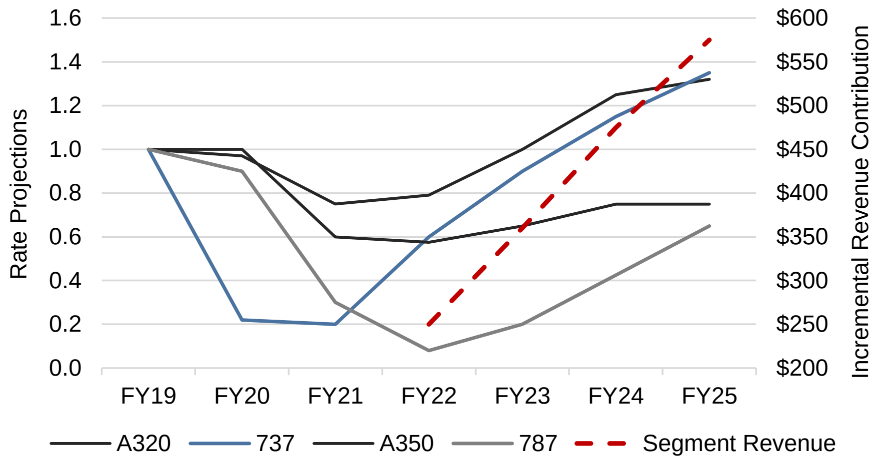
Exhibit 5 - TGI Commercial Production Rates Indexed to FY19



Source: Company data. Note: Production estimates based on indexed 1.0 at FY19 rates.

2. Backlog Up with Support from Commercial Aero

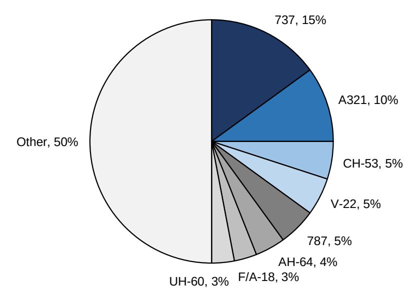
Total backlog fell 18% y-o-y to $1.59BB (+12% vs FYE22 organic), representing the next 24 months of purchase orders with firm deliveries or contract requirements. Bookings of ~$400MM in the quarter increased 21%, translating to a total company B2B of 1.21X. $1.03BB of the backlog is expected to be shipped within 12 months, implying 79% coverage of our estimate.

TGI is diversifying platform and customer exposure to support growth, in part by actively pursuing work on military platforms in both the OE and MRO space. 45% of awards were associated with new products or customers with $130MM of competitive wins in the quarter.

TGI has announced several wins in the past year including:

- ***January 2023:*** Actuation Products & Services business awarded a contract from Airbus to provide A220 On Wing Emergency Exit Door (OWEED) control cables.
- ***January 2023:*** Actuation Products & Services business awarded two multi-year contracts from Airbus, including the manufacture of ball-bearing control cables for the A330, A320, and A350 fleets.
- ***December 2022:*** Product support awarded a four-year service agreement from SR Technics to perform MRO services on engine components supporting the PW4000, CFM56-5B, and CFM56-7B engines.
- ***November 2022:*** Product Support business awarded shipset maintenance for Passenger service units, pilot and flight attendant seats for the 737NG aircraft from a major US mainline operator over the next 12 months.
- ***November 2022:*** Systems, Electronics, and Controls business received a production contract from a major engine OEM for its first Auto Feather Unit (AFU) to be used on the ATR72 family.
- ***October 2022:*** Actuation Products & Services business awarded an agreement from LMT to manufacture brake valve assembly for the F-16.
- ***September 2022:*** TGI and Sanad entered into an exclusive framework agreement for engine accessory MRO services on V2500s.
- ***September 2022:*** TGI and NAVSUP entered into an agreement to provide Pylon Conversion Actuators (PCA) spare units for the V-22.
- ***September 2022:*** Completed an extension with Airbus to continue the provision of repair station services for Airbus Proprietary Parts in Chonburi, Thailand.

Exhibit 6 - Backlog Up 12% to $1.6BB w/ Top 8 Programs Representing 50% Led by MAX at 15% and A321 at 10%



Source: Company data, Jefferies estimates

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- ***August 2022:*** Actuation Products and Services business awarded a 10-year contract from Diehl Aviation to manufacture fluid flow controls on aircraft such as the A320 and A330. Continuing work performed since 2008.
- ***July 2022:*** TGI and NAVSUP entered into a five-year MRO agreement extension for the F/A-18C/D Airframe Mounted Accessory Drive gearboxes.
- ***July 2022:*** TGI and Moog entered into a four-year agreement to provide MRO solutions for 787 landing gear and cargo door actuation control systems for an APAC operator.
- ***July 2022:*** TGI Systems, Electronics and Controls received a DAL contract to support the Army on Enhanced Digital Electronic Control Units (EDECUs) for the UH-60 Black Hawk and AH-64 Apache fleets.
- ***July 2022:*** TGI Actuation Products and Services awarded a wire control cables contract from Boeing on the MAX, 767, 777, and 777X.
- ***July 2022:*** TGI Geared Solutions awarded a five-year licensing agreement extension with RUAG for sustainment on the F/A-18 Aircraft Mounted Accessory Drive (AMAD).
- ***June 2022:*** TGI Interiors awarded a contract from Mammoth Freighters for composite air distribution ducts on the Boeing 777 P2F conversions.
- ***June 2022:*** TGI's Product Support business awarded a two-year wheel and brake maintenance and repair contract from STARLUX Airlines for the A350 XWB fleet.
- ***May 2022:*** TGI signed an MOU to collaborate on the provision of next-generation engine MRO capabilities with the UAE's Sanad, as well as offer joint MRO solutions for the V2500, CFM, and GE90.
- ***April 2022:*** TGI awarded a contract from RTX RIS for air inlet and exhaust electro-mechanical door actuators and control system for the Next Generation Jammer (NGJ).
- ***March 2022:*** TGI Actuation Products & Services received a contract extension with a European aerostructures provider to supply BA 787 cargo door actuation systems.
- ***March 2022:*** TGI Actuation Products & Services secured a multi-year contract to provide the main rotor blade folding system, lag damper system, and brake system for LMT Sikorsky's CH-53K
- ***March 2022:*** TGI Systems, Electronics and Controls received a five-year contract with the Naval Supply Systems Command to provide repair services on the SH-60 Seahawk digital electronic control units.
- ***March 2022:*** TGI Actuation Products & Services was selected to supply hydraulic power pack units on Mammoth Freighters' 777 conversion program.
- ***February 2022:*** TGI Interiors was awarded a contract to design the primary thermal acoustic insulation system on the A220.

3. Organic Sales Return in FY23 with 7% Growth

We forecast FY23 sales of $1.3BB, up 7% organically. Systems and Support rises 7% organically on our estimates, while Structures expands 8% organically. On a reported basis, sales are down 10% including a 51% decline for Structures given the divestiture of Stuart. The largest programs in the backlog include 737 MAX (15% of backlog), A321 (10%), CH-53 (5%), V-22 (5%), and 787 (5%). For the 737 MAX, the backlog grew 28% y-o-y and the A320 backlog is up 12%. A watch item is the legacy military programs in backlog such as V-22.

Mgmt highlighted 87% of supplier deliveries were on-time in-full in the quarter, up from 77% in FQ2 and compared to the targeted >90% level by year-end. The company completed a thorough review of supply chain requirements for planned deliveries and has sufficient parts on hand or in transit to support planned deliveries. Certain parts have been dual-sourced from domestic and low-cost sources.

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a) Aerospace Structures (16% of FY23E Rev): Re-Sized Following End of Portfolio Reshaping

Revenue Outlook: FQ3:23 sales fell 47% total, but increased 21% organically driven by increased B737 and B787 content in Interiors.

Within Structures, the 737 is the largest program in the commercial backlog followed by the A321, B787, B767, B777, and A350. The B777 and A350 will be higher exposure commercial platforms in backlog once rates normalize.

The run-rate of the remaining Interiors business was ~$120MM exiting FY22, but growing faster than the rest of the business given exposure to ramping MAX volumes and the recent win on the A220, which is planned to ramp from 5-6/mo today to 14/mo by mid-decade. Structures increased 2% organically in FY22, with our forecasts for a 7% organic increase in FY23 to $209MM (~$130MM excluding one quarter of Stuart and the $15MM IP sale, or 8% growth in Interiors from the $120MM run rate in FY22) and 7% in FY24 to $160MM.

The bridge from $430MM in FY22 to $202MM in FY25 on our estimates includes the divestiture of Stuart ($250MM in annual sales) in addition to sunsetting programs and the last remaining shipsets from Red Oak/composites (closed May 2021).

Exhibit 7 - Aerospace Structures Growing 7% Organically Off of ~$120MM Interiors Base

Revenue (USD in MM)	FY20	FY21	FY22	FY23E	FY24E	FY25E	FY26E
Commercial aerospace	$879	$482	$377	$225	$159	$200	$229
Military	116	137	16	0	0	0	0
Business Jets	464	158	28	0	0	0	0
Regional	90	12	6	0	0	0	0
Non-aviation	0	0	1	1	1	1	1
Elims	7	24	0	(17)	0	0	0
Structures	**$1,556**	**$813**	**$430**	**$209**	**$160**	**$202**	**$230**
Adjusted op. margin	2.6%	2.7%	7.1%	12.7%	5.4%	10.8%	14.5%
Adjusted EBITDAP margin	6.6%	1.7%	7.0%	13.5%	7.9%	12.8%	16.3%
YoY % Change							
Commercial aerospace	-45%	-45%	-22%	-40%	-29%	26%	14%
Military	-81%	19%	-88%	-100%			
Business Jets	23%	-66%	-82%	-100%			
Regional	497%	-87%	-44%	-100%			
Non-aviation							
% Change	**-40%**	**-48%**	**-47%**	**-51%**	**-23%**	**26%**	**14%**
% Organic	**3%**	**-32%**	**2%**	**7%**	**7%**	**26%**	**14%**

Source: Company data, Jefferies estimates

Profitability: Structures generated an 11.5% operating margin in FQ3. Adj. EBITDAP margins of 13.1% improved 13.6-pts y-o-y from -0.5% in FQ3:22. The company disclosed Interiors profitability in the single-digits with operating leverage to return to ~20% longer term.

The Stuart divestiture (est 10% normalized margins) closed on July 1st with the Spokane closure completed within the quarter. The core Interiors business is running in the single digits with potential upside from here given operating leverage is linked to OEM rates, particularly on the MAX. Adj operating margins appear likely to remain pressured through the year, although adj EBITDAP margins should increase as the amortization of acquired contract liabilities headwinds roll off. There is also an opportunity for additional favorable one-time closeouts of other legacy contracts.

Segment margins are expected to benefit from the exit of loss-making programs (divestitures, G280, and B747), as well as cost takeout efforts over the pandemic including the consolidation of the Spokane operations to the Mexicali facility. Long term, TGI targets low-teens adj. EBITDA margins for Structures, supported by the return of volumes. We estimate Structures generates 13.5% adj. EBITDAP margins in FY23 (including one quarter of Stuart), 7.9% in FY24, before expanding to 16.3% in FY26 on higher volumes.

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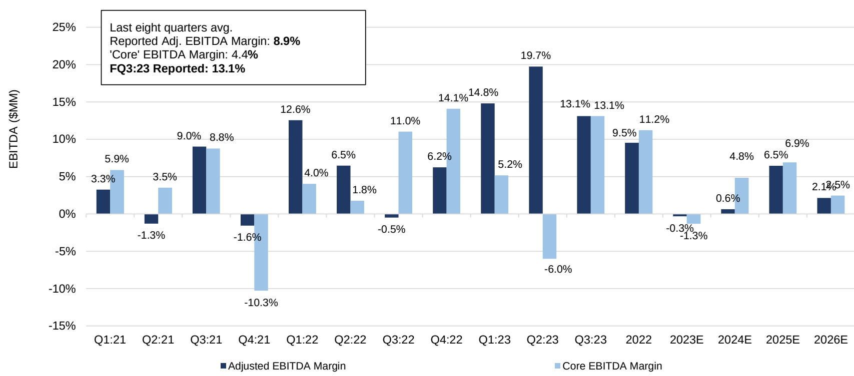
If we look at the core EBITDA margin in Structures excluding restructuring and net favorable or unfavorable cum catch-ups, we can consider a 'core' EBITDA margin underlying the business. Our estimate of a 5.1% core margin for Structures in FY23 includes a 1-quarter contribution from Stuart, which typically generates ~10% margins. We assume FQ4 profitability of 4.6% on an adj EBITDAP basis.

Exhibit 8 - Core Structures Margins of -1.3% in 2023 W/ Restructuring and Catch-Ups



Source: Company data, Jefferies estimates

b) Systems and Support (84% of FY23E Rev): Positioned to the Narrowbody Ramp

Revenue Outlook: Systems and Support revenue increased 21% organically in FQ3 as narrowbody volumes with Military begin to improve.

Commercial OE sales advanced 19% in FQ3. MRO revenues increased 59% y-o-y and xx% sequentially in FQ3, driven by a recovery in global flight hours. Military volumes fell 1% y-o-y, but were up 5% sequentially.

Mgmt previously laid out a framework for 18-22% growth in FY23 for commercial aero, which compares to our 25% est. For the total segment, we estimate 5% organic growth in FY23, accelerating to 11% in FY24 and 13% in FY25 driven by commercial aero growth.

Profitability: FQ3:23 adj. EBITDA margins of 17.5% improved 20 bps from 17.3% a year ago. Lumpiness in military spares sales can produce some mix impact on profitability across the quarters, but the company expects to continue to drive improvement with narrowbody volumes. FQ2 included a modest benefit from the $15MM IP sale, driving a sequential decline. However, given just 17.2% YTD adj EBITDAP margin, we forecast FY23 EBITDA margins to fall 110 bps y-o-y to 17.4% and migrate to 18.8% through FY26.

TGI has a long-term target of low-to-mid 20% margins in Systems and Support by 2025, supporting the target to double total company EBITDA in three years ($155MM in FY22 ex-divestitures to $310MM). The three main levers in TSS to achieve this level of profitability include: 1) higher contribution of MRO and spares vs OEM; 2) renegotiating contract work to include price plus-ups; and 3) targeting 25% of sales from new products and customers.

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Exhibit 9 - Systems and Support Revenue Approaching Peak Revenues in FY25

Revenue (USD in MM)	FY20	FY21	FY22	FY23E	FY24E	FY25E	FY26E
Commercial aerospace	$738	$397	$406	$528	$577	$622	$699
Military	436	552	511	460	470	484	498
Business Jets	61	37	49	51	53	55	57
Regional	44	25	23	23	24	24	25
Non-aviation	37	31	35	35	35	35	35
Elims	34	15	6	6	6	6	6
Product Support	**$1,358**	**$1,060**	**$1,030**	**$1,103**	**$1,163**	**$1,225**	**$1,320**
Adjusted op. margin	10.7%	14.0%	16.0%	14.8%	15.9%	16.2%	16.6%
Adjusted EBITDAP margin	15.5%	14.9%	18.5%	17.4%	18.4%	18.5%	18.8%
YoY % Change							
Commercial aerospace	1%	-46%	2%	30%	9%	8%	12%
Military	7%	27%	-7%	-10%	2%	3%	3%
Business Jets	-4%	-40%	34%	3%	4%	4%	4%
Regional	-4%	-43%	-8%	1%	2%	2%	2%
Non-aviation	39%	-16%	12%	0%	0%	0%	0%
% Change	**2%**	**-22%**	**-4%**	**6%**	**5%**	**5%**	**8%**
% Organic	**5%**	**-22%**	**-2%**	**7%**	**5%**	**5%**	**8%**

Source: Company data, Jefferies estimates

4. Inventory Headwinds Weigh on FY23 FCF with a Risk from Refi Longer Term

Mgmt updated the FY23 cash flow outlook to a use of ($55MM) to ($65MM), which includes:

- CFO of ($30MM) to ($40MM)
- Capex of $25MM from $30MM previously
- Implied FCF of ($55MM) to ($65MM)
- Non-core cash items of ($24MM) completed FYTD
- Core CFO of ($6MM) to ($16MM) given inventory built to offset supply chain challenges.
- Core FCF of ($31MM) to ($41MM)

The non-core cash items mgmt is adjusting out of its core cash flow were completed in FQ1 at $21MM related to one quarter of Stuart and close out costs for the Spokane facility. The company has been able to negotiate and manage the remainder of the one-time cash items initially expected to total $70-75MM. However, this is offset by higher working capital with full year cash guidance unchanged.

In FQ3:23, TGI CFO was breakeven, translating to a $5MM use of reported FCF after $5MM of capex. Working capital was an $11MM use with a $0.5MM use of inventories adn $5MM use from accounts payable.

We expect $61MM generated from FCF in FQ4 to support a $66MM use for the full year, in line with typical seasonality.

Exhibit 10 - Quarterly FCF - Stuart Closed at $17MM vs. $20MM Expected, Another ~$50MM of Non-Core Items To Go After Net $21MM In FQ1

($MMs)	Q1:23	Q2:23	Q3:23	Q4:23E	FY23E	Guidance
Adjusted EBITDA	**$24**	**$40**	**$47**	**$72**	**$183**	**Non-Core Items**
Working Capital	(70)	(17)	(11)	38	($59)	
747 Charge	(2)	0	(3)	0	($5)	$5
Stuart	(17)	0	0	0	($17)	$17
Stuart IT Wind	0	0	0	0	$0	$0
Spokane	(2)	0	0	0	($2)	$2
Capex	(3)	(4)	(5)	(13)	($25)	**$24**
Interest	(26)	(37)	(27)	(40)	($130)	
Pension/Other	0	(4)	(4)	6	($2)	
Pre-Tax FCF	(95)	(22)	(3)	63	($57)	
Cash Tax	(1)	(2)	(2)	(2)	($7)	
Adjusted FCF	**($96)**	**($24)**	**($5)**	**$61**	**($64)**	**($55)-($65)**
Core FCF Guidance	**($75)**	**($20)-($30)**	**($5)**	**$60-$70**		**($31) - ($41)**

Source: Company data, Jefferies estimates

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The bridge from a $157MM use in FY22 to a $64MM use in FY23 includes:

- Stuart closed on July 1, with the proceeds satisfying the $104MM of remaining advance repayments to BA.
- $24MM of non-core Structures costs were recorded FYTD, down from $164MM recorded in FY22.
- Pension and OPEB contributions are expected at <$3MM annually through FY27. However, lower asset returns could result in an increase in the pension contributions required beginning in FY24.
- Offset by a $60MM use of operating working capital largely related to inventory. This compares to a $29MM benefit from core WC in FY22.

Mgmt set a long-term target of converting 10% of sales to FCF by FY26, led by reducing overhead and the absence of non-core cash uses, which compares to our est of 4% in FY26.

The watch areas in the out years include the refinancing of $1.1BB of maturities in calendar 2024, as well as pension contributions. At March 2022, the company did not expect any material pension contributions through FY27, but given asset returns and interest rates there are likely pension contributions needed in the FY25-27 period. The company outlined that every 25 bps increase in the discount rate is a ~$0.37MM headwind to pension income. The company has reverted to the initial estimate for FY23 pension income of $25MM given it is calculated annually, but this is likely a $5MM headwind to pension income next year given a ~200 bps increase in the 10-year rate since March 31.

In terms of the pension contribution from cash, the company has funding credits in place covering the next four years of pension contributions from prior contributions of stock and prior legislative relief. However, with every 25 bps of discount rate increase, the gross obligation is lowered by $44MM. Similarly, the $1.65BB asset base has seen a decline in value, which could result in incremental funding requirements if there is not a recovery before the company remeasures assets in March. By our estimate, every 100 bps of lower asset return results in a $1.6MM increase in the net funding requirement based on 1/10th of the net unfunded change.

Exhibit 11 - FCF Outlook ($MM) - Lingering Structures Charges and Inventory Keep FCF in the Negative in FY23

Free Cash Flow	FY19	FY20	FY21	FY22	FY23E	FY24E	FY25E	FY26E
GAAP Net Income	($323)	($28)	($451)	($43)	$122	$44	$43	$70
Income tax	(5)	6	3	5	7	5	6	12
Interest	115	122	171	136	130	130	156	156
Adoption of ASU 2017-07	87	0	0	0	0	0	0	0
Pension Income	0	(55)	(50)	(5)	(34)	(31)	(31)	(31)
Loss on divestitures & other	235	68	128	21	(84)	0	0	0
Share-based compensation	10	11	13	10	10	10	10	10
Amortization of acquired contract liabilities	(67)	(75)	(39)	(6)	(2)	(1)	(1)	(1)
D&A	150	204	346	52	34	34	34	34
Adjusted EBITDA	**$202**	**$253**	**$122**	**$169**	**$183**	**$190**	**$217**	**$249**
Net Change in WC (ex-Global 7500)	117	72	(22)	29	(59)	(1)	10	(16)
Global 7500 (in working capital)	(188)	0	0	0	0	0	0	0
Global 7500 (development expense)	(42)	0	0	0	0	0	0	0
Pension/OPEB Income	(57)	(39)	(62)	0	0	0	0	0
Pension Contribution	87	(10)	(2)	0	(2)	(7)	(7)	(7)
SPR Payment for Tulsa Assets	(8)	(60)	(52)	0	0	0	0	0
ETN Payment for Settlement	0	0	0	0	0	0	0	0
Tulsa Cash Outflow	0	0	0	0	0	0	0	0
747 Charge: Cash Forward Loss	(27)	20	(10)	(36)	(5)	0	0	0
Stuart Remain Co cos	0	0	0	0	(17)	0	0	0
Stuart IT Wind-down	0	0	0	0	0	0	0	0
E2 Losses	(25)	(24)	0	0	0	0	0	0
NADEC Charge and other charges	0	0	0	0	0	0	0	0
Spokane Costs	0	0	0	0	(2)	0	0	0
Cash Restructuring Costs	0	(7)	(33)	(20)	0	0	0	0
Cash Advance Repayments	(80)	(60)	(40)	(83)	0	0	0	0
Cash Advances (Benefit to Cash)	0	0	0	(25)	0	0	0	0
Others	(62)	27	0	(10)	0	0	0	0
Pre-tax FCF	**($231)**	**$10**	**($240)**	**($152)**	**($57)**	**$28**	**$39**	**$45**
Capex	(47)	(40)	(25)	(20)	(25)	(25)	(25)	(25)
Interest	(100)	(122)	(117)	(157)	(130)	(130)	(156)	(156)
FCF	**($213)**	**$13**	**($245)**	**($157)**	**($64)**	**$23**	**$34**	**$40**

Source: Company data, Jefferies estimates

Net debt ended FQ3 at $1.5BB after cash of $116MM. We expect TGI to end FY23 at 7.7X ND/EBITDA as adj. EBITDA improves.

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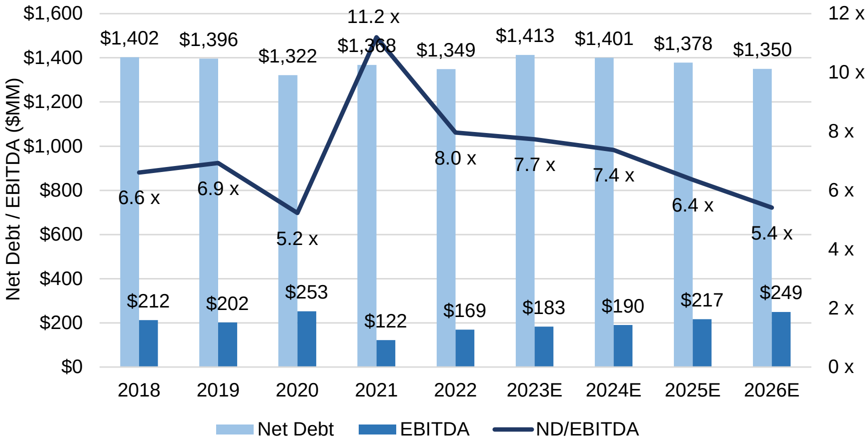
Exhibit 12 - Net Leverage to Fall to 7.9X in 2023E with EBITDA Recovery



Source: Company data, Jefferies estimates

Current debt includes:

- $563MM of 8.875% 1st Lien Notes Due June 2024
- $525MM 6.250% Senior Secured Notes Due Sept 2024
- $500MM 7.750% Senior Notes Due Aug 2025
- $15MM of Finance Leases

TGI does not have maturities until 2024, however, we expect just $201MM of cash on the balance sheet at the end of FY24 (Mar YE) implying the company will need to refinance the maturity given cash on the BS will not cover the maturities of $1.1BB. The company aims to refinance the secured notes before each go current in June 2023 and September 2023.

On Dec 1, TGI declared a distribution of warrants to TGI shareholders with an exercise price of $12.35 per share. The pro-rata warrant distribution offers shareholders the option to either exercise with cash or TGI bonds, or sell warrants to other investors. The warrants will be distributed on Dec 19 to shareholders of record (>3 shares) on Dec 12. Three warrants were issued for every 10 shares owned and fractional rounded down.

The warrants expire one year from distribution, or five business days after the "price condition date," which is the date on which the daily volume weighted average price of TGI equals or exceeds the exercise price for 20 trading days in any 30-trading day period. Holders who exercise the warrant prior to the expiration date will have an "over-exercise option" to increase the number of shares under the warrant by 15% by paying an additional 15% of the exercise price for each warrant exercised. If fully exercised, the warrants reduce interest expense by $20MM.

Currently, TGI has a CCC+ credit rating and its 2024 maturities trade at a 7.0% (first lien notes) and 7.1% yield (senior secured), respectively. 2025 Senior Notes are trading at a 12.8% yield. However, they are unsecured and as such are at a higher rate.

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Exhibit 13 - Next Maturity Not Until FY24 with >7X Leverage in FY23

		Debt Outstanding ($MM)								
Debt	**Maturity**	**Interest Rate**	**2019**	**2020**	**2021**	**2022**	**2023E**	**2024E**	**2025E**	**2026E**
Revolving Credit Facility			215	400	0	0	0	0	0	0
Senior secured notes	Sept. 2021	4.88%	375	0	0	0	0	0	0	0
Senior notes	May. 2022	5.25%	300	300	236	0	0	0	0	0
Senior secured first lien notes	June 2024	8.88%	0	0	700	563	563	563	563	563
Senior secured notes	Sept. 2024	6.25%	0	525	525	525	525	525	525	525
Senior notes	Aug. 2025	7.75%	500	500	500	500	500	500	500	500
Finance leases	NA		31	24	20	0	0	0	0	0
Receivables Securitization	Other		81	75	0	0	0	0	0	0
Principal Debt			**$1,502**	**$1,824**	**$1,982**	**$1,588**	**$1,588**	**$1,588**	**$1,588**	**$1,588**
Unamortized Discount/Deferred Costs			(13)	(16)	(24)	(4)	(4)	(4)	(4)	(4)
Carrying Amount of LT Debt			1,489	1,808	1,958	1,585	1,585	1,585	1,585	1,585
Current Portion of Debt			(8)	(7)	(5)	(241)	(241)	(241)	(241)	(241)
Carrying LT Debt			**$1,481**	**$1,800**	**$1,952**	**$1,344**	**$1,344**	**$1,344**	**$1,344**	**$1,344**
Metrics										
Cash			$93	$485	$590	$241	$177	$189	$211	$240
Net Debt (excl. minorities)			$1,396	$1,322	$1,368	$1,349	$1,413	$1,401	$1,378	$1,350
Debt to EBITDA			7.5X	7.2X	16.2X	9.4X	8.7X	8.4X	7.3X	6.4X
Net Debt to EBITDA			6.9X	5.2X	11.2X	8.0X	7.7X	7.4X	6.4X	5.4X
Net Interest			$115	$122	$171	$136	$130	$130	$156	$156

$1.1BB in 2024 maturities (June & Sept) will likely be refinanced in the near term.

Source: Company data, Jefferies estimates

If we consider the two maturities in 2024, the notes are priced at 8.875% ($563MM due June 2024) and 6.25% ($525MM due Sept 2024) today. The rate in a refi could likely be in the 10% range, but remains uncertain and depends on the progress of the debt environment.

We consider 100 bps increments up to 12.9% for the refinancing rate of the June maturity. On the Senior Notes due Sept 2024, we consider the impact of interest rates up to 18%. Every 200 bps of interest rate priced is a $20MM headwind from incremental interest expense.

Exhibit 14 - Every 200 bps of 2024 Refinanced Interest Rate Worth $20MM to FCF in FY25E

		June 2024 Maturity Refinancing Rate				
		8.9%	**10.0%**	**11.0%**	**12.0%**	**13.0%**
Sept 2024 Maturity Refinancing Rate	**6.3%**	$60	$54	$48	$42	$37
	8.0%	$51	$44	$39	$33	$28
	10.0%	$40	$34	$28	$23	$17
	12.0%	$30	$23	$18	$12	$7
	14.0%	$19	$13	$7	$2	-$4
	16.4%	$7	$0	-$5	-$11	-$17
	18.0%	-$2	-$8	-$14	-$19	-$25

Source: Company data, Jefferies estimates

Taking the blended refi rate from 7.6% under current terms up to 12.0%, at a 6.0% FCF yield every 100 bps of incremental interest is a $2 impact to share fair value.

Exhibit 15 - Every 100 bps of Interest Rate a $2 Impact to Shares

		Refinancing Rate				
		7.6%	**9.0%**	**10.0%**	**11.0%**	**12.0%**
FCF Yield (%)	**5.0%**	$16	$12	$9	$6	$3
	6.0%	$14	$10	$8	$5	$3
	7.0%	$12	$9	$7	$5	$2
	8.0%	$10	$8	$6	$4	$2
	9.0%	$9	$7	$5	$4	$2
	10.0%	$8	$6	$5	$3	$2
	11.0%	$7	$6	$4	$3	$2

Source: Company data, Jefferies estimates

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5. Price Target and Valuation

a) Price Target Derivation - SOTP

We arrive at our price target for TGI using a SOTP analysis. Given the last of the divestitures is now closed, there is a line of sight to clean EBITDAP and FCF generation for the continuing business. Our SOTP uses peer average EV/EBITDA multiples with assumed premiums/discounts based on divisional performance factors to arrive at a $15price target.

We assume a 12X multiple for Systems & Support, at a 20% discount to commercial aero peers given refi risk, despite near-20% EBITDAP margins and a clear growth profile. We also layer $53MM of corporate expense at the 11.5X rate. This derives a $15.31 per share value for TGI.

Exhibit 16 - Sum of the Parts Valuation - $15 Fair Value in FY25E

FCF Summary by Segment	FY20	FY21	FY22	FY23E	FY24E	FY25E	FY26E
Systems & Support	$149	$42	$113	$140	$198	$217	$225
Aerospace Structures	36	(113)	(58)	(28)	(5)	14	12
Corporate	(53)	(51)	(51)	(39)	(36)	(36)	(36)
Interest	(122)	(117)	(157)	(130)	(130)	(156)	(156)
Taxes	3	(5)	(5)	(7)	(5)	(5)	(5)
Combined FCF	**$13**	**($245)**	**($157)**	**($64)**	**$23**	**$34**	**$40**

Adjusted EBITDA by Segment	FY20	FY21	FY22	FY23E	FY24E	FY25E	FY26E
Systems & Support	$205	$156	$190	$191	$213	$227	$248
Aerospace Structures	$100	$18	$30	$31	$13	$26	$37
Corporate	($53)	($51)	($51)	($39)	($36)	($36)	($36)
Total Adjusted EBITDA	**$253**	**$122**	**$169**	**$183**	**$190**	**$217**	**$249**

Potential SOTP EBITDA Multiples	FY20	FY21	FY22	FY23E	FY24E	FY25E	FY26E
Systems & Support	11.5X	11.5X	11.5X	11.5X	11.5X	11.5X	11.5X
Aerospace Structures	11.5X	11.5X	11.5X	11.5X	11.5X	11.5X	11.5X
Corporate	11.5X	11.5X	11.5X	11.5X	11.5X	11.5X	11.5X
Blended Average	**11.5X**	**11.5X**	**11.5X**	**11.5X**	**11.5X**	**11.5X**	**11.5X**

Equity Value Per Segment	FY20	FY21	FY22	FY23E	FY24E	FY25E	FY26E
Systems & Support	$2,362	$1,790	$2,186	$2,201	$2,454	$2,610	$2,850
Aerospace Structures	1,155	201	347	352	145	298	430
Corporate	(610)	(587)	(585)	(454)	(414)	(414)	(414)
Total Equity Value	**$2,906**	**$1,405**	**$1,948**	**$2,100**	**$2,186**	**$2,494**	**$2,866**
Net Debt ($MM)						$1,378	
Equity Value ($MM)						$1,115	
Shares (MM)						72.8	
Price/Share						**$15.31**	

Source: Company data, Jefferies estimates

In a downside scenario, we assume TSS EBITDAP margins remain in the 15% range due to reinvestment, which leads total company FY25 EBITDA 25% lower than our estimate. At a 35% discount to peers, or a 9X multiple, shares are implied at $5.

In a bull case, we consider EBITDA on track for management's target of ~$310MM by FY25. At a 20% discount to peer average 12X multiple, this implies a price target of $30.

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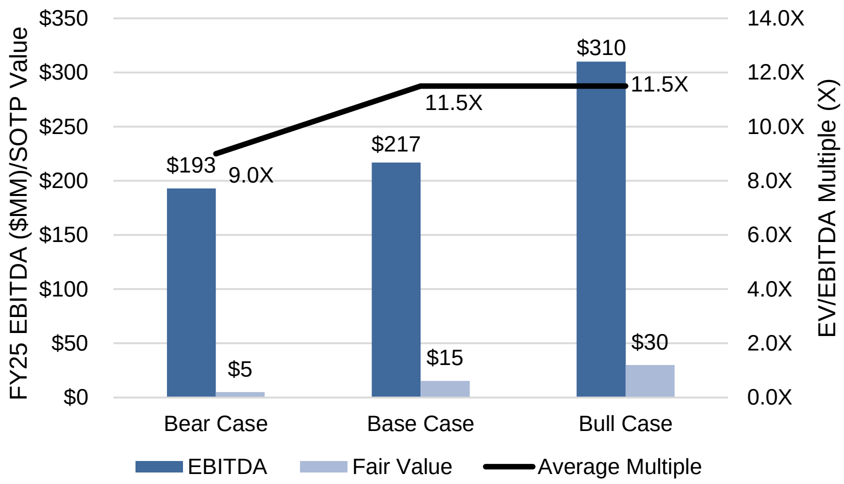
Exhibit 17 - SOTP Bull Case Assumes EBITDA on Track for FY25 Target and Peer Average Multiples



Source: Company data, Jefferies estimates

b) Price Target Derivation

To complement our SOTP, we also use a blended valuation that arrives at a $15 PT based on our FY25 estimates given the portfolio transition and lower production rates: 1) FY25 EV/EBITDA of 11.1X (10% discount to S&P vs. 3-yr avg 23% discount); 2) 20.5X P/E on FY25 EPS (10% prem to S&P vs. 3-yr avg 1% premium); and 3) 2.7% FY25 FCF yield (80% prem to S&P).

Exhibit 18 - Price Target Derivation

Valuation Method	Price	Assumptions
EV/EBITDA	$14	11.1x EV / FY25 Adj. EBITDA of $217MM
P/E	$12	20.6x FY25 P/E of GAAP EPS $0.60
FCF Yield	$17	2.7% on $34MM FY25 FCF
Average	**$15**	**Blended average**

Source: Company data, Jefferies estimates

c) Valuation Relative to Peers

TGI trades at a 46% discount to peers on 2024E (FY25) P/E and a 21% discount on 2024E (FY25) EV/EBITDA.

Exhibit 19 - Relative Valuation Table (2/2/2023)

			Stock Px	Consensus	Market	Enterprise		P/E			EV / SALES			EV / EBITDA		Yield	
Aerospace Peers	Ticker	JEF Rating	2/2/2023	BUY Rating	Cap	Value	2022E	2023E	2024E	2022E	2023E	2024E	2022E	2023E	2024E	Dividend	FCF
Spirit Aerosystems	SPR	Buy	$36.06	63%	3,795	6,973	--	99.4x	19.2x	0.7x	0.6x	0.5x	28.1x	11.6x	8.0x	0.1%	-13.3%
Honeywell	HON	Hold	$207.38	46%	139,426	151,547	23.7x	22.8x	20.6x	3.9x	3.8x	3.9x	17.4x	16.0x	14.8x	1.9%	3.6%
Raytheon Technologies	RTX	Buy	$96.96	63%	142,537	174,619	20.3x	19.4x	16.6x	2.1x	2.0x	1.8x	16.3x	14.5x	12.9x	2.2%	3.4%
Transdigm	TDG	Buy	$711.84	74%	38,706	58,319	41.5x	32.6x	26.9x	7.1x	6.4x	5.9x	22.0x	19.2x	17.4x	0.0%	3.4%
Woodward	WWD	Hold	$106.59	18%	6,370	7,438	38.8x	32.4x	25.4x	2.7x	2.4x	2.2x	20.6x	18.5x	15.6x	0.7%	3.3%
AAR Corp.	AIR	N/C	$52.10	100%	1,795	2,006	21.9x	18.0x	11.9x	1.0x	1.0x	0.8x	12.8x	12.8x	8.5x	0.0%	-1.2%
Peer Average				60%			**29.2x**	**37.4x**	**20.1x**	**2.9x**	**2.7x**	**2.5x**	**19.5x**	**15.4x**	**12.9x**	**0.8%**	**-0.1%**
Triumph	**TGI**	**Buy**	**$12.22**	**22%**	**794**	**2,328**	**21.7x**	**20.2x**	**20.5x**	**1.8x**	**1.8x**	**1.6x**	**12.8x**	**12.3x**	**10.7x**	**0.0%**	**-2.8%**
Discount / Premium							**-26%**	**-46%**	**2%**	**-39%**	**-35%**	**-35%**	**-35%**	**-21%**	**-17%**		

Source: Company data, Jefferies estimates, FactSet

d) Valuation Relative to History

TGI is currently trading at FY2 PE multiple of 17.5x, 12% below its 3-year average of 20.0x. On a market-relative basis, the stock is trading at a 5% discount to the S&P vs a historical average premium of 10%.

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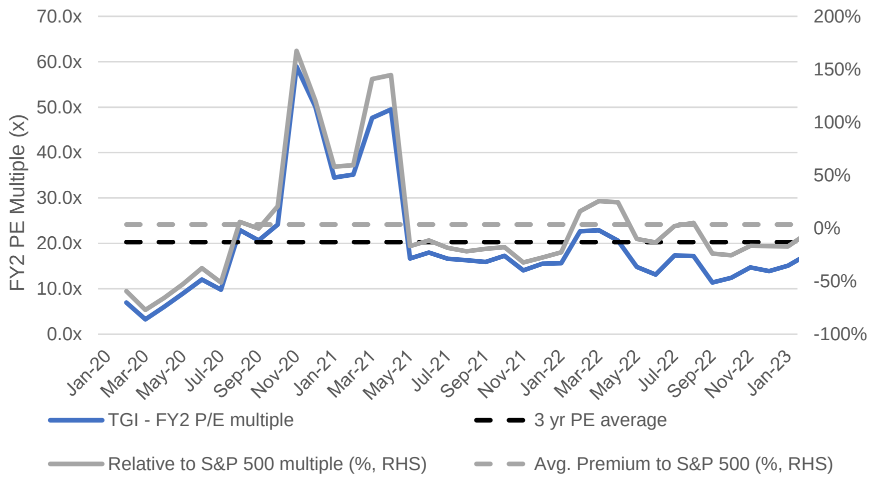
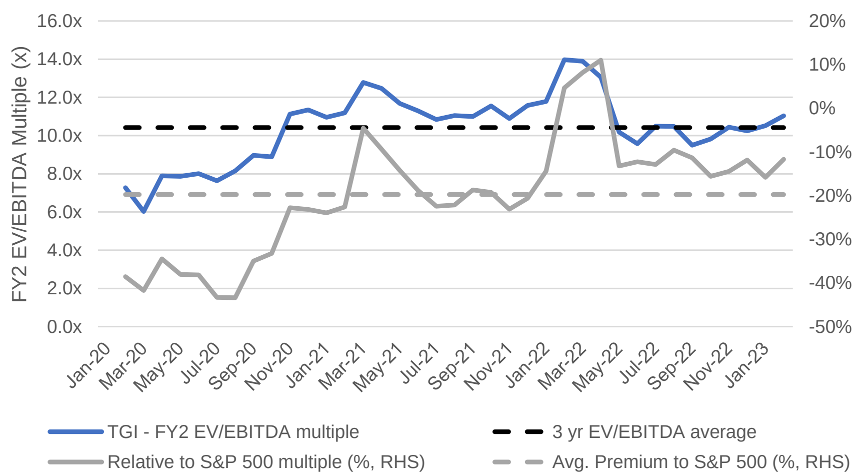
Exhibit 20 - Trading at 17.5x P/E, 5% Disct to Mkt vs. 10% Historical Prem



Source: FactSet, Jefferies estimates

On an EV/EBITDA multiple, TGI is trading at 11.0x, 3% above its 3-year avg and at a 9% discount to the S&P vs. historical average discount of 21%.

Exhibit 21 - Trading at 10.4X FY2 EV/EBITDA, 9% Disct to Mkt vs. Historical Avg Disct of 21%



Source: FactSet, Jefferies estimates

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Exhibit 22 - Annual Statement of Income ($MM)

(millions, except per share data)	2021		2022		2023E		2024E		2025E		2026E	
	dollars	% of sales	dollars	% of sales	dollars	% of sales		% of sales		% of sales		% of sales
Total Revenues	**$1,870**	100%	**$1,460**	100%	**$1,312**	100%	**$1,324**	100%	**$1,427**	100%	**$1,550**	100%
Costs and expenses												
Costs of Sales	($1,476)	79%	($1,073)	74%	($955)	73%	($1,010)	76%	($1,076)	75%	($1,154)	74%
Selling, General & Administrative	($216)	12%	($202)	14%	($197)	15%	($132)	10%	($143)	10%	($155)	10%
Depreciation and amortization	($93)	5%	($54)	4%	($34)	3%	($34)	3%	($34)	2%	($34)	2%
Acquisition and integration expenses	($53)	3%	$0	0%	$0	0%	$0	0%	$0	0%	$0	0%
Curtailments and early retirement incentive	$0	0%	($22)	1%	($3)	0%	$0	0%	$0	0%	$0	0%
Special Charge	($357)	19%	($14)	1%	$103	-8%	$0	0%	$0	0%	$0	0%
Total Operating Costs	**($2,196)**	117%	**($1,365)**	93%	**($1,086)**	83%	**($1,176)**	89%	**($1,253)**	88%	**($1,343)**	87%
Operating Profit	**($326)**	-17%	**$95**		**$226**	17%	**$147**	11%	**$174**	12%	**$206**	13%
Non recurring (pre tax):												
747-8	$0		$0		$0		$0		$0		$0	
Losson Divestitures/BBD Global Expense	$105		$0		($86)		$0		$0		$0	
Restructuring charges	$53		$22		$3		$0		$0		$0	
Curtailment & Settlement/Goodwill trade	$53		$0		$0		$0		$0		$0	
Other Impairments / Charges	$252		$9		($1)		$0		$0		$0	
EBIT excluding non-recurring items	**$108**		**$135**		**$142**		**$147**		**$174**		**$206**	
Total Interest	($171)		($136)		($130)		($130)		($156)		($156)	
Pension income	$50		$5		$34		$31		$31		$31	
Income before taxes (GAAP)	($448)		($35)		$131		$49		$49		$82	
Income before taxes (adjusted)	**($14)**		**$5**		**$46**		**$49**		**$49**		**$82**	
Taxes (GAAP rate %)	$3	-1%	$5	-14%	$7	5%	$5	11%	$6	12%	$12	15%
Taxes (Adjusted rate %)	$3	-21%	$5	105%	$7	15%	$5	11%	$6	12%	$12	15%
GAAP Net Income	($451)		($40)		$124		$44		$43		$70	
Adjusted Net Income	**($14)**		**$5**		**$44**		**$44**		**$43**		**$70**	
Diluted shares (millions)	52.7		64.6		71.6		72.2		72.8		73.4	
Adjusted EPS	**($0.03)**		**$0.79**		**$0.56**		**$0.60**		**$0.60**		**$0.95**	

Source: Company data, Jefferies estimates

Exhibit 23 - Select Operating Metrics ($MM)

	2021	2022	2023E	2024E	2025E	2026E
YoY Change						
Total Revenue Change %	**-35.5%**	**-21.9%**	**-10.1%**	**0.9%**	**7.8%**	**8.6%**
Organic Change %	-27.3%	0.2%	6.8%	5.7%	7.8%	8.6%
M&A %	-8.3%	-22.2%	-16.9%	-4.8%	0.0%	0.0%
Net Income Growth % (continuing)	1505%	-91%	-386%	-64%	-1%	60%
EPS Growth % (continuing)	-101%	-2758%	-29%	7%	-1%	59%
Margin Analysis						
Gross margin %	21.0%	26.5%	27.2%	23.7%	24.6%	25.5%
SG&A as % of sales	11.6%	13.8%	15.0%	10.0%	10.0%	10.0%
Operating Margin %	-17.4%	6.5%	17.3%	11.1%	12.2%	13.3%
Segment Op. Margin % (excl. one time items)	9.0%	13.3%	14.5%	14.6%	0.0%	0.0%
Operating Margin % (excl. one time items)	5.8%	9.3%	10.8%	11.1%	12.2%	13.3%
Adj. EBITDA	$122	$169	$183	$190	$217	$249
Adj. EBITDA Margin %	6.5%	11.7%	13.9%	14.4%	15.2%	16.1%
EBT %	-24.0%	-2.4%	10.0%	3.7%	3.5%	5.3%
Tax Rate %	-0.6%	-14.0%	5.4%	10.5%	$0.12	$0.15
Net margin % (continuing)	-24.1%	-2.7%	9.4%	3.3%	3.0%	4.5%
Balance Sheet Analysis						
Net Debt / Equity	-167.0%	-171.3%	-292.1%	-250.5%	-217.2%	-199.2%
Net Debt / EBITDA	11.2x	8.0x	7.7x	7.4x	6.4x	5.4x
Cash Flow Analysis						
Free Cash Flow	($245)	($157)	($64)	$23	$34	$40
Free Cash Flow Conversion %	54%	394%	-52%	52%	78%	58%
Free Cash Flow Yield %	-58.0%	-30.4%	-11.2%	4.0%	5.8%	6.8%
Dividend Yield %	0.0%	0.0%	1.9%	1.9%	1.9%	1.9%
Valuation and Profitability						
Diluted P/E	-0.9x	-12.1x	4.7x	13.3x	13.5x	8.5x
EV/EBITDA	14.7x	11.0x	10.9x	10.4x	9.1x	7.8x
EV/Sales	1.0x	1.3x	1.5x	1.5x	1.4x	1.3x
ROIC	12%	17%	17%	18%	24%	32%
EV/IC	1.2x	1.7x	2.1x	2.2x	2.3x	2.5x

Source: Company data, Jefferies estimates

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Exhibit 24 - Sources and Uses of Funds ($MM)

(millions, except per share data)	2021	2022	2023E	2024E	2025E	2026E
Operating Activities						
Net income	($450.9)	($42.8)	$122.3	$43.7	$43.4	$69.6
Depreciation & Amortization	93.3	49.6	34.0	34.0	34.0	34.0
Other Items	197.5	(180.5)	(136.3)	(29.2)	(28.2)	(22.0)
Op cash flow pre-working capital	**($160.1)**	**($173.6)**	**$20.0**	**$48.5**	**$49.2**	**$81.6**
Change in inventory	52.6	38.8	(63.3)	19.4	26.5	(12.0)
Change in receivables	165.4	15.4	14.7	(1.5)	(12.9)	(15.4)
Change in payables	(278.2)	(17.9)	(10.7)	(18.5)	(4.0)	11.1
Changes in working capital	(60.2)	36.3	(59.3)	(0.6)	9.7	(16.3)
Cash Flow from Operations	**($220.3)**	**($137.4)**	**($39.3)**	**$47.9**	**$58.9**	**$65.3**
Investment activities						
Capital expenditures	(25.2)	(19.7)	(25.0)	(25.0)	(25.0)	(25.0)
Proceeds from sale of assets	15.9	224.5	0.0	0.0	0.0	0.0
Cash used for businesses acquired	0.0	(23.7)	0.0	0.0	0.0	0.0
Cash Flow from Investments	**($9.3)**	**$181.2**	**($25.0)**	**($25.0)**	**($25.0)**	**($25.0)**
Financing Activities						
Change in debt	225.0	(368.1)	0.0	0.0	0.0	0.0
Cash dividends paid	0.0	0.0	0.0	(11.2)	(11.3)	(11.4)
Dividend payment / Buyback	0.0	0.0	(11.1)	(11.2)	(11.3)	(11.4)
Cash Flow from Financing	**$225.0**	**($368.1)**	**($11.1)**	**($22.5)**	**($22.7)**	**($22.9)**
Net change in cash items	**($4.6)**	**($324.2)**	**($75.4)**	**$0.4**	**$11.2**	**$17.4**
Cash at the beginning of the period	485.5	589.9	240.9	176.9	188.5	239.9
Cash at the end of the period	**$589.9**	**$240.9**	**$176.9**	**$188.5**	**$211.1**	**$239.9**

Source: Company data, Jefferies estimates

Exhibit 25 - Annual Balance Sheet ($MM)

(millions, except per share data)	2021	2022	2023E	2024E	2025E	2026E
Assets						
Cash and cash equivalents	$590	$241	$177	$189	$211	$240
Accounts receivable - net	194	179	164	165	178	194
Inventories and contracts in progress	400	362	425	406	379	391
Contract Assets	135	102	102	102	102	102
Deferred income tax assets	0	0	0	0	0	0
Rotable assets	19	19	19	19	19	19
Prepaid expenses	0	0	0	0	0	0
Assets held for sale	216	60	60	60	60	60
Other current assets	0	0	0	0	0	0
Total Current Assets	**1,554**	**963**	**947**	**941**	**950**	**1,006**
PPE	211	169	288	213	138	63
Goodwill	522	514	514	514	514	514
Intangible assets	102	85	85	85	85	85
Deferred income tax assets	0	0	0	0	0	0
Other assets	61	30	30	30	30	30
Total non-current assets	897	798	917	842	767	692
Total Assets	**$2,451**	**$1,761**	**$1,864**	**$1,783**	**$1,716**	**$1,698**
Liabilities						
Current portion of long- term debt	5	3	3	3	3	3
Accounts payable	179	162	151	132	128	139
Income taxes payable	0	0	0	0	0	0
Accrued liabilities	476	379	189	202	215	228
Liabilities related to assets held for sale	58	58	58	58	58	58
Total Current Liabilities	**$718**	**$602**	**$401**	**$395**	**$404**	**$428**
Long-term debt	1,952	1,586	1,586	1,586	1,586	1,586
Deferred income tax liabilities	384	301	301	301	301	301
Other long-term liabilities	215	59	59	59	59	59
Total Non-current Liabilities	2,551	1,947	1,947	1,947	1,947	1,947
Total Liabilities	**$3,270**	**$2,548**	**$2,347**	**$2,342**	**$2,351**	**$2,375**
Total Stockholders equity	**($819)**	**($787)**	**($484)**	**($559)**	**($635)**	**($677)**
Total liabilities and S/E	**$2,451**	**$1,761**	**$1,864**	**$1,783**	**$1,716**	**$1,698**

Source: Company data, Jefferies estimates

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Exhibit 26 - Quarterly Income Statement

(millions, except per share data)	2022					2023E				
	Q1	Q2	Q3	Q4	Year	Q1	Q2	Q3	Q4E	Year
Revenues	$396.6	$357.4	$319.2	$386.7	$1,460	$349.4	$307.6	$328.9	$326.2	$1,312.0
Costs and Expenses										
Costs of Sales	(294)	(262)	(232)	(285)	(1,073)	(272)	(208)	(240)	(235)	(955)
Selling, General & Administrative	(56)	(54)	(42)	(49)	(202)	(52)	(60)	(44)	(40)	(197)
Depreciation and amortization	(15)	(13)	(12)	(10)	(50)	(10)	(9)	(9)	(7)	(34)
Acquisition and integration expenses	0	0	0	(2)	(2)	0	0	0	0	0
Curtailments and early retirement incent	(4)	(4)	(5)	(6)	(19)	(1)	(2)	0	0	(3)
Special Charge	(6)	(8)	0	4	(9)	0	104	(1)	0	103
Total Operating Costs	(376)	(341)	(291)	(348)	(1,356)	(335)	(175)	(294)	(282)	(1,086)
Total Operating Profit (EBIT)	**$21**	**$16**	**$28**	**$39**	**$104**	**$15**	**$132**	**$35**	**$44**	**$226**
Non recurring (pre tax):										
747-8	0	0	0	0	0	0	0	0	0	0
Losson Divestitures/BBD Global Expens	0	0	0	0	0	0	0	0	0	0
Curtailment & Settlement/Goodwill trade	0	0	0	0	0	0	0	0	0	0
Other Impairments / Charges	0	0	0	0	0	0	0	0	0	0
Restructuring charges	4	4	5	9	22	1	2	0	0	3
EBIT excluding non-recurring items	**$25**	**$20**	**$33**	**$47**	**$126**	**$15**	**$134**	**$35**	**$44**	**$229**
Total Interest	(48)	(34)	(34)	(31)	(136)	(32)	(32)	(38)	(29)	(130)
Pension income	(2)	10	14	(18)	5	9	9	9	8	34
Income before taxes	**($29)**	**($7)**	**$8**	**($10)**	**($26)**	**($9)**	**$108**	**$6**	**$24**	**$131**
Tax	(1.2)	(1.8)	(1.1)	(0.8)	(4.9)	(1.8)	(1.8)	(0.6)	(2.9)	(7.0)
Adjusted Tax	(1.2)	(1.8)	(1.1)	(0.8)	(4.9)	(1.8)	(1.8)	(0.6)	(2.9)	(7.0)
Net earnings	**($30)**	**($9)**	**$7**	**($11)**	**($31)**	**($10)**	**$107**	**$5**	**$21**	**$124**
Diluted shares (millions)	64.3	64.5	65.1	64.6	64.6	64.8	65.3	68.5	88.0	71.6
Adjusted EPS	**$0.09**	**$0.10**	**$0.21**	**$0.39**	**$0.79**	**$0.12**	**$0.07**	**$0.12**	**$0.25**	**$0.56**

	2022					2023E				
	Q1	Q2	Q3	Q4	Year	Q1	Q2	Q3	Q4E	Year
Revenue change YoY	-19.9%	-25.8%	-25.1%	-17.2%	-21.9%	-11.9%	-13.9%	3.0%	-15.6%	-10.1%
Organic Revenue Change YoY	11.0%	-1.9%	-5.0%	-0.9%	0.2%	0.8%	12.7%	23.0%	0.5%	7.8%
Gross margin %	26.0%	26.6%	27.2%	26.4%	27.1%	22.0%	32.4%	27.0%	28.0%	27.2%
SG&A as % of sales	14.2%	15.1%	13.3%	12.7%	13.8%	14.8%	19.6%	13.5%	12.4%	15.0%
EBIT Margin (including charges) %	5.3%	4.6%	8.8%	10.0%	7.1%	4.2%	43.0%	10.7%	13.6%	17.3%
EBIT Margin (excluding one time items) %	7.9%	7.8%	10.3%	11.1%	9.3%	9.3%	9.9%	10.9%	13.2%	10.8%
EBT %	-7.3%	-2.0%	2.6%	-2.5%	-2.6%	-2.5%	35.2%	1.8%	7.3%	9.9%
Tax rate	-4.2%	-24.5%	13.2%	-8.4%	-13.0%	-20.4%	1.6%	10.2%	12.2%	5.4%
Net margin	-7.7%	-2.5%	2.3%	-2.7%	-2.9%	-3.0%	34.6%	1.6%	6.4%	9.3%
Sales By Segment										
Revenue										
Systems and Support	$258	$249	$236	$287	$1,030	$255	$274	$285	$289	$1,103
Aerospace Structures	138	109	83	100	430	95	33	44	37	209
elims	(0)	(0)	0	(0)	(0)	(0)	(0)	(0)	0	0
Total Revenue	**$397**	**$357**	**$319**	**$387**	**$1,460**	**$349**	**$308**	**$329**	**$326**	**$1,312**
Revenue YoY % change										
Systems and Support	8%	-2%	-11%	-5%	-3%	-1%	10%	21%	1%	5%
Aerospace Structures	-46%	-53%	-49%	-40%	-47%	-31%	-69%	-47%	-63%	26%
Total Revenue	-20%	-26%	-25%	-17%	-22%	-12%	-14%	3%	-16%	8%
% organic	**11%**	**-2%**	**-5%**	**-1%**	**0%**	**1%**	**13%**	**23%**	**1%**	**8%**
Operating Income										
Systems and Support	$36	$38	$41	$49	$163	$33	$43	$43	$44	$163
Aerospace Structures	11	4	(4)	3	14	(2)	6	5	1	10
Segment Operating Income	47	42	37	52	177	31	49	48	45	173
Corporate	(26)	(25)	(9)	(13)	(73)	(16)	83	(13)	(0)	53
Total Operating Income	**$21**	**$16**	**$28**	**$39**	**$104**	**$15**	**$132**	**$35**	**$44**	**$226**
Adjusted Operating Income										
Systems and Support	$36	$38	$41	$49	$163	$33	$43	$43	$44	$163
Aerospace Structures	14	8	1	8	31	15	6	5	1	27
Total segment operating income	50	46	42	57	194	48	49	48	45	190
Corporate	(19)	(18)	(9)	(13)	(59)	(15)	(19)	(12)	(1)	(48)
Total	**$30**	**$28**	**$33**	**$44**	**$135**	**$33**	**$30**	**$36**	**$43**	**$142**
Adjusted Operating Margin										
Systems and Support	13.8%	15.3%	17.2%	17.2%	15.9%	13.0%	15.8%	15.1%	15.2%	14.8%
Aerospace Structures	10.3%	7.0%	1.4%	7.7%	7.1%	15.7%	17.7%	11.5%	2.1%	12.7%
Total segment operating margin	12.5%	12.8%	13.1%	14.7%	13.3%	13.7%	16.0%	14.6%	13.7%	14.5%
Total operating margin	**7.6%**	**7.8%**	**10.3%**	**11.5%**	**9.3%**	**9.3%**	**9.9%**	**10.9%**	**13.2%**	**10.8%**

Source: Company data, Jefferies estimates

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Company Description

Triumph Group, Inc.

TRIUMPH is a Tier 1 aerospace and military supplier which has undertaken a six-year portfolio transformation to reposition the company for high-margin growth. TGI has two segments: Systems & Support and Aerospace Structures. TSS provides hydraulic, mechanical and electromechnical actuation; power and control; gearboxes; heat exchangers; fuel pumps; flight controls; and surface treatment option. Following the divestitures of its fuselage, tail and structural designs businesses, the Aerospace Structures unit focuses on interiors including insulation, ducting, reinforced thermoplastic and other aircraft interior and composite components.

Company Valuation/Risks

Triumph Group, Inc.

Our PT is based on a SOTP analysis, in which we apply a peer avg multiple to Systems & Support, in-line with the commercial aerospace peer group and a 20% disct to SPR multiple to Structures. Risks: Higher interest rate on refinanced maturities limits ability to reach positive FCF; global demand for commercial aircraft and air travel; rising rate environment leads to higher pension contribution requirements.

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(Article 3(1)e and Article 7 of MAR)

Recommendation Published	February 3, 2023 , 13:10 ET.
Recommendation Distributed	February 5, 2023 , 10:00 ET.

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- Raytheon Technologies (RTX: $96.48, BUY)
- Spirit AeroSystems Holdings, Inc. (SPR: $34.43, BUY)
- TransDigm Group Incorporated (TDG: $713.50, BUY)
- Triumph Group, Inc. (TGI: $12.22, BUY)
- Woodward (WWD: $103.84, HOLD)

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Rating and Price Target History for: Triumph Group, Inc. (TGI) as of 02-02-2023

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			IB Serv./Past12 Mos.		JIL Mkt Serv./Past12 Mos.	
	Count	Percent	Count	Percent	Count	Percent
BUY	1916	58.45%	62	3.24%	16	0.84%
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Triumph Group, Inc.

Equity Research
March 2, 2023

A Better Refi Rate and Warrant Exercise on Deck

On Feb 28th, TGI priced its $1.2BB secured note offering due in 2028, which will retire the co's $1.1BB of debt due 2024 (8.875% Snr Sec First Lien Ntes due 2024 and 6.25% Snr Sec Ntes due 2024). The new debt priced at 9.0% implying an incremental $25MM of interest w/ the warrants a partial offset given shares above the strike price for 15 of the past 16 days. At a 5% yield on our FY25 FCF of $53MM this implies fair value of $12 incl $235MM of warrant proceeds.

TGI Refinanced $1.2BB at 9.0%, Rate Better than Expected. TGI priced its $1.2BB debt offering of 9.0% Sr Secured First Lien Notes due 2028. The offering is expected to close March 14 and is intended to repay the $563MM of outstanding 8.875% Sr Secured First Lien Notes due 2024 and the $525MM of 6.25% Sr Secured Notes due 2024. The draw down beyond the $1.09BB of maturities will be used to pay off a $35MM A/R securitization draw and cover $24MM of associated fees. The offering implies an incremental $25MM of interest - 9.0% rate vs blended rate of 7.6% on the prior debt. Given a March 31 YE, the impact to FY23 is more moderate w/ just $1MM of incremental interest relative to prior rates.

Warrant Progress - Above Strike Price for 15 of Past 16 Days. TGI issued warrants in Dec, which could result in a $21MM reduction in interest if successful (up to $270MM of paydown at a 7.8% avg rate). Warrants can be exercised with cash or TGI bonds, offering an oppty for deleveraging. The only bonds eligible for the warrant transaction are the Sr Secure Nts due 2025, which carry a 7.75% rate. Through March 1, shares have been above the strike price for 15 of the past 16 days. The company announced this March 8 as the price condition date, assuming shares remain above $12.35, resulting in the warrant expiration. The Oversubscription period would begin March 9 and run until March 15. We assume $235MM of proceeds from the transaction.

Potential Upside from Warrant Deal. We assume $235MM of warrant proceeds effective March 15 in our FY25 FCF of $53MM including an $18MM benefit from lower interest. However, it would be modestly dilutive with 19MM shares issued in the transaction leading to upside FCF/sh of $0.58 in our base case vs $0.48 in the absence of warrants. If we take a 5.0% FCF yield, then our base case implies a fair value of $12.

FY25 EPS Modestly Better Despite Dilution. We lower our FY23 and FY24 EPS to account for the higher interest expense with $0.55 of FY23 adj EPS (vs guidance of $0.48-0.68) from $0.56 previously. Our FY25 adj EPS had previously included a 10% refi rate with the better rate implying adj EPS of $0.65 from $0.60 previously.

SOTP and FCF Yield Blended PT. Our blended PT of $15 is based on: 1) a 5% dsct to peer avg EV/EBITDA, which implies a fair value of $19; and 2) a 5.0% FCF yield on our FY25 of $53MM implies a fair value of $12. Each $5MM FCF is worth $1 to shares.

(FY Mar)	2022A	2023E	2024E	2025E
Rev. (MM)	1,459.9	1,312.0	1,324.3	1,429.8
EV/Rev	1.6x	1.8x	1.8x	1.6x
P/Rev	0.6x	0.7x	0.6x	0.6x
EBITDA (MM)	169.0	183.0	190.0	218.0

ESTIMATE CHANGE

RATING	BUY
PRICE	$12.45^
PRICE TARGET | % TO PT	$15.00 | +20%
52W HIGH-LOW	$27.85 - $7.84
FLOAT (%) | ADV MM (USD)	0.0% | 11.90
MARKET CAP	$852.8M
TICKER	TGI

^Prior trading day's closing price unless otherwise noted.

	CHANGE TO JEFe		JEF vs CONS	
	2023	2024	2023	2024
REV	NA	NM	NA	NA
EPS	-2%	-33%	NA	NA

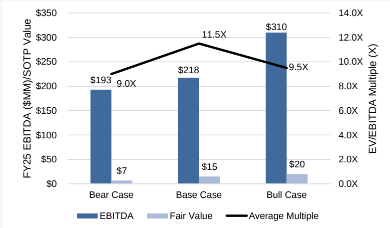
2023 ($)	Q1A	Q2A	Q3A	Q4	FY
EPS	0.12	0.07	0.12	↓0.24	↓0.55
PREV				0.25	0.56

Exhibit 1 - Every $50MM of Warrant Proceeds Worth $1 to Shares

Deleveraging from Warrants	FCF Yield (%) 3.0%	4.0%	5.0%	6.0%	7.0%
$0	$16	$12	$10	$8	$7
$50	$17	$13	$10	$8	$7
$100	$18	$13	$11	$9	$8
$150	$18	$14	$11	$9	$8
$200	$19	$14	$11	$9	$8
$235	$19	$14	$12	$10	$8
$270	$20	$15	$12	$10	$8

Source: Company data, Jefferies estimates

Exhibit 2 - SOTP Bull Case Assumes EBITDA at Target of Doubling by FY25



Source: Company data, Jefferies estimates

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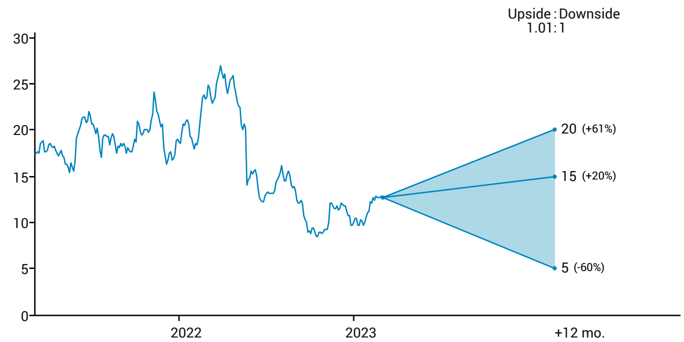
The Long View: Triumph Group, Inc.

Investment Thesis / Where We Differ

- FY22 saw the completion of the divestiture strategy, although facility exits and wind-down costs are stranded into FY23, driving negative FCF. TSS and Structures should return to organic growth in FY23 as volumes begin to ramp, although the focus remains on EBITDA execution and FCF generation. Our SOTP blended with a 5.0% FCF yield implies a price target of $15.

Risk/Reward - 12 Month View



Base Case,
$15, +20%

- Organic revenue increases 6% in FY24 and 8% in FY25, driven by ramping volumes.
- Aerostructures grows organically in FY25 at +26%, while TSS grows at 5% due to NB rates and MRO work.
- Adj. EBITDA margins expand to 15.2% in FY24 driven by cost-reduction benefits and volumes ramping.
- Assumes $235MM of warrant proceeds used to paydown debt with corresponding 19MM share dilution.
- PT $15: SOTP at 13.1X (5% disct to peers avg) on adj. EBITDA of $218MM in FY25; 5.0% FCF yield on our FY25 FCF of $53MM.

Upside Scenario,
$20, +61%

- Revenue expands by 13% organically in FY25 given growth in commercial and military content.
- Adj. EBITDA margins expand to 19.5% in FY25 from higher mix of commercial AM.
- Adj. EBITDA meets target of $310MM by FY25.
- FCF conversion meets target of 10% of sales by FY25.
- PT $20: Assumes FY25 EBITDA doubles FY22 run rate, trading at a 30% disct to peers avg 9.5X.

Downside Scenario,
$5, -60%

- Revenues expand modestly at 4% organically in FY25 as volumes in aerospace and military do not fully recover to prior peak and production rates fall under the forecast.
- Commercial AM growth lags expectations and new product wins decelerate.
- TGI fails to drive margin execution from cost takeout and operating leverage; reinvestment weighs on TSS EBITDAP margins at 15%.
- PT $5: Assumes 35% discount to peers, or 9X.

Sustainability Matters

Top Material Issue(s): 1) Supply Chain Mgmt: In Nov '21, TGI hosted a conference called Ready for Rate Ramp with 250 key global suppliers to jointly develop actions ahead of OEM rate increases, such as advanced forecasting, AI-based risk mgmt, innovative staffing, dual sourcing, and disciplined price mgmt.

Company Target(s): 1) Reduce Scope 1 and 2 emissions by 30% by 2030 with a long-term ambition to be carbon-neutral by 2050; **2)** reduce hazardous waste by 30% by '30; **3)** continuously increase the percentage of women and people of color in leadership roles through 2030; **4)** implement a serious injury and fatality prevention program, site-specific water reduction programs in high-stress water regions, and recycling and reuse programs by 2025; **5)** reach 100% ISO 14001 certified facilities by 2030 from 5 today

Qs to Mgmt: 1) What are the early focus areas for executing on goals across energy usage & emissions, social, governance, water & wastewater, and waste? **2)** Can TGI explain the introduction of sustainability criteria into its product development process?

The Five ESG Issues Investors Should Look At When Investing in A&D

Catalysts

- Commercial aerospace production rates improve with the recovery, particularly on the MAX (16% of backlog) and A321 (9% of backlog).
- Continued strength in bookings.
- Content wins on commercial and military platforms.
- Volume growth drives EBITDA towards doubling by 2025, while one-timers end in FY23, driving a return to positive FCF.

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After the refinancing closes on March 14, TGI will have two tranches of debt outstanding. This includes the $500MM of 2025 Senior Notes (7.75%) and the newly issued $1.2BB of 2028 Senior Secured Notes (9.0%). We assume that the warrant transaction is successful with $235MM of proceeds used to pay down debt by March 15. There is upside if the over-exercise option results in proceeds up to $270MM. Our base assumption implies that the warrants result in a $18MM reduction in interest expense, partially offsetting the $25MM of incremental interest related to the refinancing transaction.

Going forward, the company will aim to bring down debt further with cash generation and any opportunities to monetize product lines winding down, similar to the IP sale conducted in FQ2.

We assume net leverage falls from 6.5X in FY23E to 4.4X at the end of FY26.

Exhibit 3 - Net Leverage to Fall to 4.4X by FY26E

		Debt Outstanding ($MM)								
Debt	**Maturity**	**Interest Rate**	**2019**	**2020**	**2021**	**2022**	**2023E**	**2024E**	**2025E**	**2026E**
Revolving Credit Facility			215	400	0	0	0	0	0	0
Senior secured notes	Sept. 2021	4.88%	375	0	0	0	0	0	0	0
Senior notes	May. 2022	5.25%	300	300	236	0	0	0	0	0
Senior secured first lien notes	June 2024	8.88%	0	0	700	563	0	0	0	0
Senior secured notes	Sept. 2024	6.25%	0	525	525	525	0	0	0	0
Senior notes	Aug. 2025	7.75%	500	500	500	500	265	265	265	265
Senior secured notes	Jul-05	9.00%	0	0	0	0	1,200	1,200	1,200	1,200
Finance leases	NA		31	24	20	0	0	0	0	0
Receivables Securitization	Other		81	75	0	0	0	0	0	0
Principal Debt			**$1,502**	**$1,824**	**$1,982**	**$1,588**	**$1,465**	**$1,465**	**$1,465**	**$1,465**
Unamortized Discount/Deferred Costs			(13)	(16)	(24)	(4)	(4)	(4)	(4)	(4)
Carrying Amount of LT Debt			1,489	1,808	1,958	1,585	1,462	1,462	1,462	1,462
Current Portion of Debt			(8)	(7)	(5)	(241)	(241)	(241)	(241)	(241)
Carrying LT Debt			**$1,481**	**$1,800**	**$1,952**	**$1,344**	**$1,221**	**$1,221**	**$1,221**	**$1,221**
Metrics										
Cash			$93	$485	$590	$241	$288	$289	$328	$373
Net Debt (excl. minorities)			$1,396	$1,322	$1,368	$1,349	$1,178	$1,177	$1,139	$1,094
Debt to EBITDA			7.5X	7.2X	16.2X	9.4X	8.0X	7.7X	6.7X	5.8X
Net Debt to EBITDA			6.9X	5.2X	11.2X	8.0X	6.5X	6.2X	5.2X	4.4X
Net Interest			$115	$122	$171	$136	$130	$137	$137	$137

$1.1BB in 2024 maturities (June & Sept) refinanced in March 2023. Assumes $235MM of warrant proceeds.

Source: Company data, Jefferies estimates

After accounting for the impact to interest from the two transactions planned for this month, we assume $15MM of FCF generation in FY24E on $137MM of interest expense. This rises to $53MM in FY25E and $60MM in FY26E.

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Exhibit 4 - FCF Generation Rises to $60MM by FY26E with $15MM in FY24E

Free Cash Flow	FY19	FY20	FY21	FY22	FY23E	FY24E	FY25E	FY26E
GAAP Net Income	($323)	($28)	($451)	($43)	$122	$37	$60	$87
Income tax	(5)	6	3	5	7	5	9	15
Interest	115	122	171	136	130	137	137	137
Adoption of ASU 2017-07	87	0	0	0	0	0	0	0
Pension Income	0	(55)	(50)	(5)	(34)	(31)	(31)	(31)
Loss on divestitures & other	235	68	128	21	(84)	0	0	0
Share-based compensation	10	11	13	10	10	10	10	10
Amortization of acquired contract liabilities	(67)	(75)	(39)	(6)	(2)	(1)	(1)	(1)
D&A	150	204	346	52	34	34	34	34
Adjusted EBITDA	**$202**	**$253**	**$122**	**$169**	**$183**	**$190**	**$218**	**$251**
Net Change in WC (ex-Global 7500)	117	72	(22)	29	(59)	(1)	9	(17)
Global 7500 (in working capital)	(188)	0	0	0	0	0	0	0
Global 7500 (development expense)	(42)	0	0	0	0	0	0	0
Pension/OPEB Income	(57)	(39)	(62)	0	0	0	0	0
Pension Contribution	87	(10)	(2)	0	(2)	(7)	(7)	(7)
SPR Payment for Tulsa Assets	(8)	(60)	(52)	0	0	0	0	0
ETN Payment for Settlement	0	0	0	0	0	0	0	0
Tulsa Cash Outflow	0	0	0	0	0	0	0	0
747 Charge: Cash Forward Loss	(27)	20	(10)	(36)	(5)	0	0	0
Stuart Remain Co cos	0	0	0	0	(17)	0	0	0
Stuart IT Wind-down	0	0	0	0	0	0	0	0
E2 Losses	(25)	(24)	0	0	0	0	0	0
NADEC Charge and other charges	0	0	0	0	0	0	0	0
Spokane Costs	0	0	0	0	(2)	0	0	0
Cash Restructuring Costs	0	(7)	(33)	(20)	0	0	0	0
Cash Advance Repayments	(80)	(60)	(40)	(83)	0	0	0	0
Cash Advances (Benefit to Cash)	0	0	0	(25)	0	0	0	0
Others	(62)	27	0	(10)	0	0	0	0
Pre-tax FCF	**($231)**	**$10**	**($240)**	**($152)**	**($58)**	**$20**	**$58**	**$65**
Capex	(47)	(40)	(25)	(20)	(25)	(25)	(25)	(25)
Interest	(100)	(122)	(117)	(157)	(130)	(137)	(137)	(137)
FCF	**($213)**	**$13**	**($245)**	**($157)**	**($65)**	**$15**	**$53**	**$60**
Cash and equivalents	**93**	**485**	**590**	**241**	**288**	**289**	**328**	**373**

Source: Company data, Jefferies estimates

Price Target and Valuation

We arrive at our price target for TGI using a SOTP analysis blended with a 5.0% FCF Yield. Given the last of the divestitures is now closed, there is a line of sight to clean EBITDAP and FCF generation for the continuing business. Our SOTP uses a 5% discount to peer average EV/EBITDA multiples on our $218MM of EBITDA in FY25, implying a fair value of $19. A 5.0% FCF yield on our FY25 estimate of $53MM implies a fair value of $12.

Exhibit 5 - Price Target Derivation

Valuation Method	Price	Assumptions
EV/EBITDA	$19	13.1x EV / FY25 Adj. EBITDA of $218MM
FCF Yield	$12	5.0% on $53MM FY25 FCF
Average	**$15**	**Blended average**

Source: Company data, Jefferies estimates

a) Price Target Derivation - SOTP

We arrive at our price target for TGI using a SOTP analysis blended with a 5.0% FCF Yield. Given the last of the divestitures is now closed, there is a line of sight to clean EBITDAP and FCF generation for the continuing business. Our SOTP uses peer average EV/EBITDA multiples with assumed premiums/discounts based on divisional performance factors to arrive at a $15 price target.

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We assume a 13X multiple for Systems & Support, at a 5% discount to commercial aero peers given the high interest rate load, despite near-20% EBITDAP margins and a clear growth profile. We also layer $36MM of corporate expense at the 13X rate. This derives a $18.78. per share value for TGI.

Exhibit 6 - Sum of the Parts Valuation - $15 Fair Value in FY25E

FCF Summary by Segment	FY20	FY21	FY22	FY23E	FY24E	FY25E	FY26E
Systems & Support	$149	$42	$113	$140	$198	$217	$226
Aerospace Structures	36	(113)	(58)	(28)	(5)	14	11
Corporate	(53)	(51)	(51)	(39)	(36)	(36)	(36)
Interest	(122)	(117)	(157)	(130)	(137)	(137)	(137)
Taxes	3	(5)	(5)	(7)	(5)	(5)	(5)
Combined FCF	**$13**	**($245)**	**($157)**	**($65)**	**$15**	**$53**	**$60**

Adjusted EBITDA by Segment	FY20	FY21	FY22	FY23E	FY24E	FY25E	FY26E
Systems & Support	$205	$156	$190	$191	$214	$228	$249
Aerospace Structures	$100	$18	$30	$31	$12	$26	$38
Corporate	($53)	($51)	($51)	($39)	($36)	($36)	($36)
Total Adjusted EBITDA	**$253**	**$122**	**$169**	**$183**	**$190**	**$218**	**$251**

Potential SOTP EBITDA Multiples	FY25E
Systems & Support	13.1X
Aerospace Structures	13.1X
Corporate	13.1X
Blended Average	**13.1X**

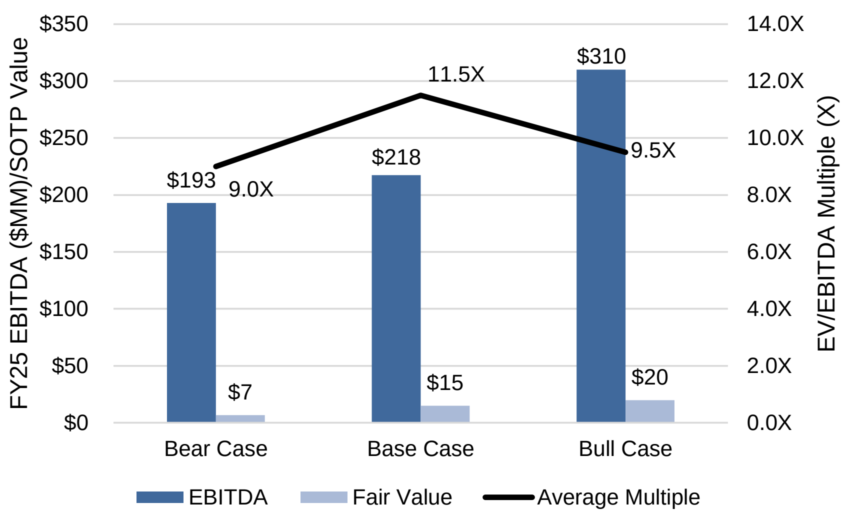
Equity Value Per Segment	FY25E
Systems & Support	$2,985
Aerospace Structures	339
Corporate	(472)
Total Equity Value	**$2,853**
Net Debt ($MM)	$1,139
Equity Value ($MM)	$1,714
Shares (MM)	91.3
Price/Share	**$18.78**

Source: Company data, Jefferies estimates

In a downside scenario, we assume TSS EBITDAP margins remain in the 15% range due to reinvestment, which leads total company FY25 EBITDA 25% lower than our estimate. At a 35% discount to peers, or a 9X multiple, shares are implied at $5.

In a bull case, we consider EBITDA on track for management's target of ~$310MM by FY25. At a 30% discount to peer average 9.5X multiple, this implies a price target of $20.

Exhibit 7 - SOTP Bull Case Assumes EBITDA on Track for FY25 Target and Peer Average Multiples



Source: Company data, Jefferies estimates

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We consider the impact of the warrant deal in the below. If warrants are fully exercised including the "over exercise option," then there could be up to $3MM of upside to our FCF. However, given up to 2MM of additional dilution from incremental shares, the upside to share value is more limited.

Exhibit 8 - Warrants Could Support Up to $21MM Lower Interest and Up to $4 of Upside to Shares

		FCF Yield (%)				
		3.0%	4.0%	5.0%	6.0%	7.0%
Deleveraging from Warrants	$0	$16	$12	$10	$8	$7
	$50	$17	$13	$10	$8	$7
	$100	$18	$13	$11	$9	$8
	$150	$18	$14	$11	$9	$8
	$200	$19	$14	$11	$9	$8
	$235	$19	$14	$12	$10	$8
	$270	$20	$15	$12	$10	$8

Source: Company data, Jefferies estimates

c) Valuation Relative to Peers

TGI trades at a 2% discount to peers on 2024E (FY25) P/E and a 15% discount on 2024E (FY25) EV/EBITDA.

Exhibit 9 - Relative Valuation Table (3/1/2023)

Aerospace Peers	Ticker	JEF Rating	Stock Px 3/1/2023	Consensus BUY Rating	Market Cap	Enterprise Value	P/E 2022E	P/E 2023E	P/E 2024E	EV / SALES 2022E	EV / SALES 2023E	EV / SALES 2024E	EV / EBITDA 2022E	EV / EBITDA 2023E	EV / EBITDA 2024E	Yield Dividend	Yield FCF
Spirit Aerosystems	SPR	Buy	$33.58	56%	3,534	6,820	--	-744.5x	19.0x	0.7x	0.6x	0.5x	100.5x	11.0x	7.8x	0.1%	-0.1%
Honeywell	HON	Hold	$192.88	46%	128,871	142,812	22.0x	21.3x	19.2x	3.6x	3.5x	3.7x	16.2x	15.1x	14.1x	2.1%	3.6%
Raytheon Technologies	RTX	Buy	$98.04	60%	143,624	174,896	20.5x	19.5x	16.8x	2.1x	2.0x	1.8x	15.9x	14.2x	13.0x	2.2%	3.4%
Transdigm	TDG	Buy	$750.94	70%	41,000	59,658	43.8x	33.6x	28.0x	7.6x	6.7x	6.1x	22.5x	19.2x	17.5x	0.0%	3.2%
Woodward	WWD	Hold	$100.06	23%	5,976	6,857	36.4x	31.0x	24.0x	2.5x	2.3x	2.1x	19.0x	17.3x	14.5x	0.8%	3.6%
AAR Corp.	AIR	N/C	$55.19	100%	1,902	2,113	23.2x	19.1x	12.6x	1.0x	1.1x	0.9x	13.5x	13.5x	9.0x	0.0%	-1.1%
Peer Average				60%			**29.2x**	**-103.3x**	**19.9x**	**2.9x**	**2.7x**	**2.5x**	**31.3x**	**15.0x**	**12.6x**	**0.9%**	**2.1%**
Triumph	**TGI**	**Buy**	**$12.45**	**22%**	**809**	**2,344**	**22.8x**	**30.9x**	**19.0x**	**1.8x**	**1.8x**	**1.6x**	**12.8x**	**12.3x**	**10.8x**	**0.0%**	**-2.8%**
Discount / Premium							**-22%**	**-130%**	**-5%**	**-39%**	**-34%**	**-35%**	**-59%**	**-18%**	**-15%**		

Source: Company data, Jefferies estimates, FactSet

d) Valuation Relative to History

TGI is currently trading at FY2 PE multiple of 18.5x, 9% below its 3-year average of 20.3x. On a market-relative basis, the stock is trading at a 16% premium to the S&P vs a historical average premium of 10%.

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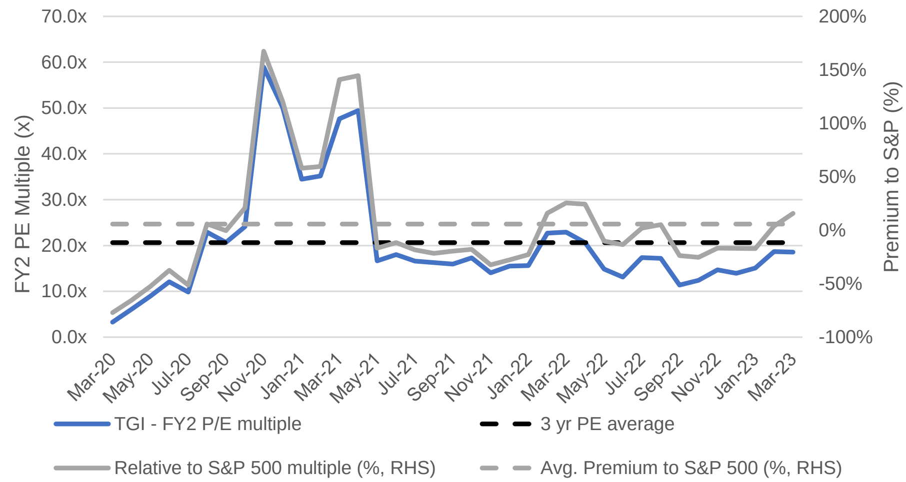
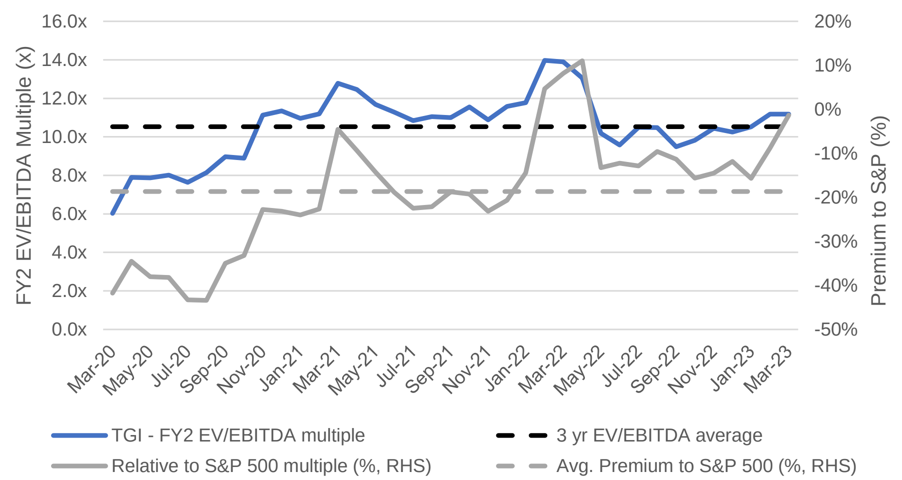
Exhibit 10 - Trading at 18.5X FY2 P/E, 16% Prem to Mkt vs. Historical Avg Prem of 10%



Source: FactSet, Jefferies estimates

On an EV/EBITDA multiple, TGI is trading at 11.2x, 4% above its 3-year avg and at a 1% discount to the S&P vs. historical average discount of 20%.

Exhibit 11 - Trading at 11.2X FY2 EV/EBITDA, 1% Disct to Mkt vs. Historical Avg Disct of 20%



Source: FactSet, Jefferies estimates

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Exhibit 12 - Annual Statement of Income ($MM)

(millions, except per share data)	2021		2022		2023E		2024E		2025E		2026E	
	dollars	% of sales	dollars	% of sales	dollars	% of sales		% of sales		% of sales		% of sales
Total Revenues	**$1,870**	100%	**$1,460**	100%	**$1,312**	100%	**$1,324**	100%	**$1,430**	100%	**$1,557**	100%
Costs and expenses												
Costs of Sales	($1,476)	79%	($1,073)	74%	($955)	73%	($1,010)	76%	($1,078)	75%	($1,159)	74%
Selling, General & Administrative	($216)	12%	($202)	14%	($197)	15%	($132)	10%	($143)	10%	($156)	10%
Depreciation and amortization	($93)	5%	($54)	4%	($34)	3%	($34)	3%	($34)	2%	($34)	2%
Acquisition and integration expenses	($53)	3%	$0	0%	$0	0%	$0	0%	$0	0%	$0	0%
Curtailments and early retirement incentive	$0	0%	($22)	1%	($3)	0%	$0	0%	$0	0%	$0	0%
Special Charge	($357)	19%	($14)	1%	$103	-8%	$0	0%	$0	0%	$0	0%
Total Operating Costs	**($2,196)**	117%	**($1,365)**	93%	**($1,086)**	83%	**($1,177)**	89%	**($1,255)**	88%	**($1,349)**	87%
Operating Profit	**($326)**	-17%	**$95**		**$226**	17%	**$147**	11%	**$175**	12%	**$208**	13%
Non recurring (pre tax):												
747-8	$0		$0		$0		$0		$0		$0	
Losson Divestitures/BBD Global Expense	$105		$0		($86)		$0		$0		$0	
Restructuring charges	$53		$22		$3		$0		$0		$0	
Curtailment & Settlement/Goodwill trade	$53		$0		$0		$0		$0		$0	
Other Impairments / Charges	$252		$9		($1)		$0		$0		$0	
EBIT excluding non-recurring items	**$108**		**$135**		**$142**		**$147**		**$175**		**$208**	
Total Interest	($171)		($136)		($130)		($137)		($137)		($137)	
Pension income	$50		$5		$34		$31		$31		$31	
Income before taxes (GAAP)	($448)		($35)		$130		$41		$69		$102	
Income before taxes (adjusted)	**($14)**		**$5**		**$46**		**$41**		**$69**		**$102**	
Taxes (GAAP rate %)	$3	-1%	$5	-14%	$7	5%	$5	12%	$9	13%	$15	15%
Taxes (Adjusted rate %)	$3	-21%	$5	105%	$7	15%	$5	12%	$9	13%	$15	15%
GAAP Net Income	($451)		($40)		$123		$36		$60		$87	
Adjusted Net Income	**($14)**		**$5**		**$43**		**$36**		**$60**		**$87**	
Diluted shares (millions)	52.7		64.6		72.4		90.7		91.3		91.9	
Adjusted EPS	**($0.03)**		**$0.79**		**$0.55**		**$0.40**		**$0.65**		**$0.95**	

Source: Company data, Jefferies estimates

Exhibit 13 - Select Operating Metrics ($MM)

	2021	2022	2023E	2024E	2025E	2026E
YoY Change						
Total Revenue Change %	**-35.5%**	**-21.9%**	**-10.1%**	**0.9%**	**8.0%**	**8.9%**
Organic Change %	-27.3%	0.2%	6.8%	5.7%	8.0%	8.9%
M&A %	-8.3%	-22.2%	-16.9%	-4.8%	0.0%	0.0%
Net Income Growth % (continuing)	1505%	-91%	-384%	-70%	64%	46%
EPS Growth % (continuing)	-101%	-2758%	-31%	-26%	63%	45%
Margin Analysis						
Gross margin %	21.0%	26.5%	27.2%	23.7%	24.6%	25.5%
SG&A as % of sales	11.6%	13.8%	15.0%	10.0%	10.0%	10.0%
Operating Margin %	-17.4%	6.5%	17.3%	11.1%	12.2%	13.4%
Segment Op. Margin % (excl. one time items)	9.0%	13.3%	14.5%	14.6%	0.0%	0.0%
Operating Margin % (excl. one time items)	5.8%	9.3%	10.8%	11.1%	12.2%	13.4%
Adj. EBITDA	$122	$169	$183	$190	$218	$251
Adj. EBITDA Margin %	6.5%	11.7%	13.9%	14.4%	15.2%	16.1%
EBT %	-24.0%	-2.4%	9.9%	3.1%	4.8%	6.6%
Tax Rate %	-0.6%	-14.0%	5.4%	12.0%	$0.13	$0.15
Net margin % (continuing)	-24.1%	-2.7%	9.4%	2.8%	4.2%	5.6%
Balance Sheet Analysis						
Net Debt / Equity	-167.0%	-171.3%	-472.5%	-351.1%	-289.1%	-260.7%
Net Debt / EBITDA	11.2x	8.0x	6.5x	6.2x	5.2x	4.4x
Cash Flow Analysis						
Free Cash Flow	($245)	($157)	($65)	$15	$53	$60
Free Cash Flow Conversion %	54%	394%	-53%	41%	88%	68%
Free Cash Flow Yield %	-58.0%	-30.4%	-11.2%	2.1%	7.2%	8.1%
Dividend Yield %	0.0%	0.0%	1.9%	1.9%	1.9%	1.9%
Valuation and Profitability						
Diluted P/E	-0.9x	-12.1x	4.8x	19.9x	12.3x	8.4x
EV/EBITDA	14.7x	11.0x	9.6x	10.0x	8.6x	7.3x
EV/Sales	1.0x	1.3x	1.3x	1.4x	1.3x	1.2x
ROIC	12%	17%	17%	18%	24%	32%
EV/IC	1.2x	1.7x	1.6x	1.9x	2.0x	2.0x

Source: Company data, Jefferies estimates

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Exhibit 14 - Sources and Uses of Funds ($MM)

(millions, except per share data)	2021	2022	2023E	2024E	2025E	2026E
Operating Activities						
Net income	($450.9)	($42.8)	$121.6	$36.5	$59.8	$87.3
Depreciation & Amortization	93.3	49.6	34.0	34.0	34.0	34.0
Other Items	197.5	(180.5)	(136.3)	(29.3)	(25.2)	(19.5)
Op cash flow pre-working capital	**($160.1)**	**($173.6)**	**$19.3**	**$41.2**	**$68.5**	**$101.8**
Change in inventory	52.6	38.8	(63.3)	18.8	26.2	(12.8)
Change in receivables	165.4	15.4	14.7	(1.5)	(13.2)	(15.9)
Change in payables	(278.2)	(17.9)	(10.7)	(18.4)	(3.8)	11.4
Changes in working capital	(60.2)	36.3	(59.3)	(1.2)	9.2	(17.3)
Cash Flow from Operations	**($220.3)**	**($137.4)**	**($40.0)**	**$40.0**	**$77.8**	**$84.5**
Investment activities						
Capital expenditures	(25.2)	(19.7)	(25.0)	(25.0)	(25.0)	(25.0)
Proceeds from sale of assets	15.9	224.5	0.0	0.0	0.0	0.0
Cash used for businesses acquired	0.0	(23.7)	0.0	0.0	0.0	0.0
Cash Flow from Investments	**($9.3)**	**$181.2**	**($25.0)**	**($25.0)**	**($25.0)**	**($25.0)**
Financing Activities						
Change in debt	225.0	(368.1)	(123.0)	0.0	0.0	0.0
Cash dividends paid	0.0	0.0	0.0	(14.1)	(14.2)	(14.3)
Dividend payment / Buyback	0.0	0.0	(11.3)	(14.1)	(14.2)	(14.3)
Cash Flow from Financing	**$225.0**	**($368.1)**	**($134.3)**	**($28.2)**	**($28.4)**	**($28.6)**
Net change in cash items	**($4.6)**	**($324.2)**	**($199.3)**	**($13.2)**	**$24.4**	**$30.9**
Cash at the beginning of the period	485.5	589.9	240.9	288.1	289.0	372.8
Cash at the end of the period	**$589.9**	**$240.9**	**$288.1**	**$289.0**	**$327.6**	**$372.8**

Source: Company data, Jefferies estimates

Exhibit 15 - Annual Balance Sheet ($MM)

(millions, except per share data)	2021	2022	2023E	2024E	2025E	2026E
Assets						
Cash and cash equivalents	$590	$241	$288	$289	$328	$373
Accounts receivable - net	194	179	164	166	179	195
Inventories and contracts in progress	400	362	425	406	380	393
Contract Assets	135	102	102	102	102	102
Deferred income tax assets	0	0	0	0	0	0
Rotable assets	19	19	19	19	19	19
Prepaid expenses	0	0	0	0	0	0
Assets held for sale	216	60	60	60	60	60
Other current assets	0	0	0	0	0	0
Total Current Assets	**1,554**	**963**	**1,059**	**1,042**	**1,068**	**1,142**
PPE	211	169	288	213	138	63
Goodwill	522	514	514	514	514	514
Intangible assets	102	85	85	85	85	85
Deferred income tax assets	0	0	0	0	0	0
Other assets	61	30	30	30	30	30
Total non-current assets	897	798	917	842	767	692
Total Assets	**$2,451**	**$1,761**	**$1,975**	**$1,884**	**$1,834**	**$1,833**
Liabilities						
Current portion of long- term debt	5	3	3	3	3	3
Accounts payable	179	162	151	132	129	140
Income taxes payable	0	0	0	0	0	0
Accrued liabilities	476	379	189	202	215	228
Liabilities related to assets held for sale	58	58	58	58	58	58
Total Current Liabilities	**$718**	**$602**	**$401**	**$395**	**$405**	**$429**
Long-term debt	1,952	1,586	1,463	1,463	1,463	1,463
Deferred income tax liabilities	384	301	301	301	301	301
Other long-term liabilities	215	59	59	59	59	59
Total Non-current Liabilities	2,551	1,947	1,824	1,824	1,824	1,824
Total Liabilities	**$3,270**	**$2,548**	**$2,224**	**$2,219**	**$2,228**	**$2,253**
Total Stockholders equity	**($819)**	**($787)**	**($249)**	**($335)**	**($394)**	**($420)**
Total liabilities and S/E	**$2,451**	**$1,761**	**$1,975**	**$1,884**	**$1,834**	**$1,833**

Source: Company data, Jefferies estimates

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Exhibit 16 - Quarterly Income Statement

(millions, except per share data)	2022					2023E				
	Q1	Q2	Q3	Q4	Year	Q1	Q2	Q3	Q4E	Year
Revenues	$396.6	$357.4	$319.2	$386.7	$1,460	$349.4	$307.6	$328.9	$326.2	$1,312.0
Costs and Expenses										
Costs of Sales	(294)	(262)	(232)	(285)	(1,073)	(272)	(208)	(240)	(235)	(955)
Selling, General & Administrative	(56)	(54)	(42)	(49)	(202)	(52)	(60)	(44)	(40)	(197)
Depreciation and amortization	(15)	(13)	(12)	(10)	(50)	(10)	(9)	(9)	(7)	(34)
Acquisition and integration expenses	0	0	0	(2)	(2)	0	0	0	0	0
Curtailments and early retirement incent	(4)	(4)	(5)	(6)	(19)	(1)	(2)	0	0	(3)
Special Charge	(6)	(8)	0	4	(9)	0	104	(1)	0	103
Total Operating Costs	(376)	(341)	(291)	(348)	(1,356)	(335)	(175)	(294)	(282)	(1,086)
Total Operating Profit (EBIT)	**$21**	**$16**	**$28**	**$39**	**$104**	**$15**	**$132**	**$35**	**$44**	**$226**
Non recurring (pre tax):										
747-8	0	0	0	0	0	0	0	0	0	0
Losson Divestitures/BBD Global Expens	0	0	0	0	0	0	0	0	0	0
Curtailment & Settlement/Goodwill trade	0	0	0	0	0	0	0	0	0	0
Other Impairments / Charges	0	0	0	0	0	0	0	0	0	0
Restructuring charges	4	4	5	9	22	1	2	0	0	3
EBIT excluding non-recurring items	**$25**	**$20**	**$33**	**$47**	**$126**	**$15**	**$134**	**$35**	**$44**	**$229**
Total Interest	(48)	(34)	(34)	(31)	(136)	(32)	(32)	(38)	(30)	(130)
Pension income	(2)	10	14	(18)	5	9	9	9	8	34
Income before taxes	**($29)**	**($7)**	**$8**	**($10)**	**($26)**	**($9)**	**$108**	**$6**	**$23**	**$130**
Tax	(1.2)	(1.8)	(1.1)	(0.8)	(4.9)	(1.8)	(1.8)	(0.6)	(2.9)	(7.0)
Adjusted Tax	(1.2)	(1.8)	(1.1)	(0.8)	(4.9)	(1.8)	(1.8)	(0.6)	(2.9)	(7.0)
Net earnings	**($30)**	**($9)**	**$7**	**($11)**	**($31)**	**($10)**	**$107**	**$5**	**$20**	**$123**
Diluted shares (millions)	64.3	64.5	65.1	64.6	64.6	64.8	65.3	68.5	88.0	72.4
Adjusted EPS	**$0.09**	**$0.10**	**$0.21**	**$0.39**	**$0.79**	**$0.12**	**$0.07**	**$0.12**	**$0.24**	**$0.55**

	2022					2023E				
	Q1	Q2	Q3	Q4	Year	Q1	Q2	Q3	Q4E	Year
Revenue change YoY	-19.9%	-25.8%	-25.1%	-17.2%	-21.9%	-11.9%	-13.9%	3.0%	-15.6%	-10.1%
Organic Revenue Change YoY	11.0%	-1.9%	-5.0%	-0.9%	0.2%	0.8%	12.7%	23.0%	0.5%	8.0%
Gross margin %	26.0%	26.6%	27.2%	26.4%	27.1%	22.0%	32.4%	27.0%	28.0%	27.2%
SG&A as % of sales	14.2%	15.1%	13.3%	12.7%	13.8%	14.8%	19.6%	13.5%	12.4%	15.0%
EBIT Margin (including charges) %	5.3%	4.6%	8.8%	10.0%	7.1%	4.2%	43.0%	10.7%	13.6%	17.3%
EBIT Margin (excluding one time items) %	7.9%	7.8%	10.3%	11.1%	9.3%	9.3%	9.9%	10.9%	13.2%	10.8%
EBT %	-7.3%	-2.0%	2.6%	-2.5%	-2.6%	-2.5%	35.2%	1.8%	7.1%	9.8%
Tax rate	-4.2%	-24.5%	13.2%	-8.4%	-13.0%	-20.4%	1.6%	10.2%	12.6%	5.4%
Net margin	-7.7%	-2.5%	2.3%	-2.7%	-2.9%	-3.0%	34.6%	1.6%	6.2%	9.3%
Sales By Segment										
Revenue										
Systems and Support	$258	$249	$236	$287	$1,030	$255	$274	$285	$289	$1,103
Aerospace Structures	138	109	83	100	430	95	33	44	37	209
elims	(0)	(0)	0	(0)	(0)	(0)	(0)	(0)	0	0
Total Revenue	**$397**	**$357**	**$319**	**$387**	**$1,460**	**$349**	**$308**	**$329**	**$326**	**$1,312**
Revenue YoY % change										
Systems and Support	8%	-2%	-11%	-5%	-3%	-1%	10%	21%	1%	5%
Aerospace Structures	-46%	-53%	-49%	-40%	-47%	-31%	-69%	-47%	-63%	27%
Total Revenue	-20%	-26%	-25%	-17%	-22%	-12%	-14%	3%	-16%	8%
% organic	**11%**	**-2%**	**-5%**	**-1%**	**0%**	**1%**	**13%**	**23%**	**1%**	**8%**
Operating Income										
Systems and Support	$36	$38	$41	$49	$163	$33	$43	$43	$44	$163
Aerospace Structures	11	4	(4)	3	14	(2)	6	5	1	10
Segment Operating Income	47	42	37	52	177	31	49	48	45	173
Corporate	(26)	(25)	(9)	(13)	(73)	(16)	83	(13)	(0)	53
Total Operating Income	**$21**	**$16**	**$28**	**$39**	**$104**	**$15**	**$132**	**$35**	**$44**	**$226**
Adjusted Operating Income										
Systems and Support	$36	$38	$41	$49	$163	$33	$43	$43	$44	$163
Aerospace Structures	14	8	1	8	31	15	6	5	1	27
Total segment operating income	50	46	42	57	194	48	49	48	45	190
Corporate	(19)	(18)	(9)	(13)	(59)	(15)	(19)	(12)	(1)	(48)
Total	**$30**	**$28**	**$33**	**$44**	**$135**	**$33**	**$30**	**$36**	**$43**	**$142**
Adjusted Operating Margin										
Systems and Support	13.8%	15.3%	17.2%	17.2%	15.9%	13.0%	15.8%	15.1%	15.2%	14.8%
Aerospace Structures	10.3%	7.0%	1.4%	7.7%	7.1%	15.7%	17.7%	11.5%	2.1%	12.7%
Total segment operating margin	12.5%	12.8%	13.1%	14.7%	13.3%	13.7%	16.0%	14.6%	13.7%	14.5%
Total operating margin	**7.6%**	**7.8%**	**10.3%**	**11.5%**	**9.3%**	**9.3%**	**9.9%**	**10.9%**	**13.2%**	**10.8%**

Source: Company data, Jefferies estimates

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Company Description

Triumph Group, Inc.

TRIUMPH is a Tier 1 aerospace and military supplier which has undertaken a six-year portfolio transformation to reposition the company for high-margin growth. TGI has two segments: Systems & Support and Aerospace Structures. TSS provides hydraulic, mechanical and electromechnical actuation; power and control; gearboxes; heat exchangers; fuel pumps; flight controls; and surface treatment option. Following the divestitures of its fuselage, tail and structural designs businesses, the Aerospace Structures unit focuses on interiors including insulation, ducting, reinforced thermoplastic and other aircraft interior and composite components.

Company Valuation/Risks

Triumph Group, Inc.

Our PT is based on a SOTP analysis, in which we apply a peer avg multiple to Systems & Support, in-line with the commercial aerospace peer group and a 20% disct to SPR multiple to Structures. Risks: Higher interest rate on refinanced maturities limits ability to reach positive FCF; global demand for commercial aircraft and air travel; rising rate environment leads to higher pension contribution requirements.

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Investment Recommendation Record

(Article 3(1)e and Article 7 of MAR)

Recommendation Published	March 2, 2023 , 11:43 ET.
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The expected total return (price appreciation plus yield) for Buy rated securities with an average security price consistently below $10 is 20% or more within a 12-month period as these companies are typically more volatile than the overall stock market. For Hold rated securities with an average security price consistently below $10, the expected total return (price appreciation plus yield) is plus or minus 20% within a 12-month period. For Underperform rated securities with an average security price consistently below $10, the expected total return (price appreciation plus yield) is minus 20% or less within a 12-month period.

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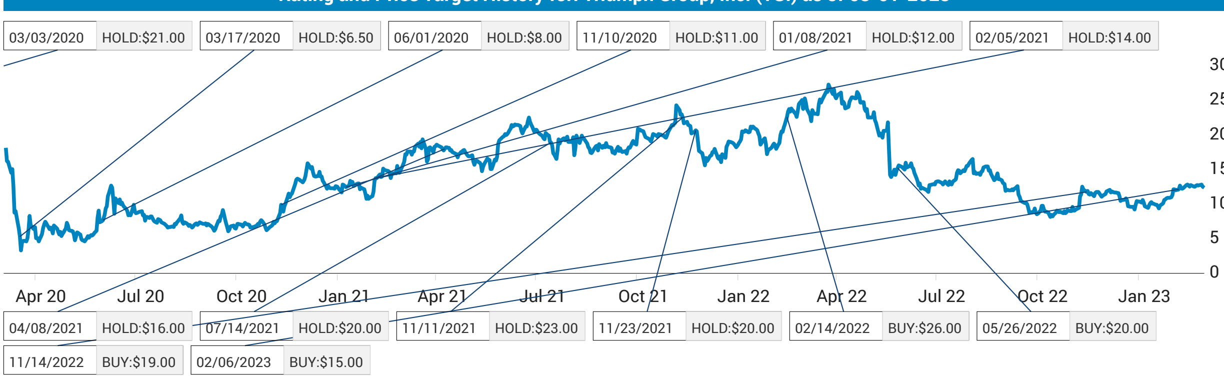
- Raytheon Technologies (RTX: $98.04, BUY)
- Spirit AeroSystems Holdings, Inc. (SPR: $33.58, BUY)
- TransDigm Group Incorporated (TDG: $750.94, BUY)
- Woodward (WWD: $100.06, HOLD)

Rating and Price Target History for: Triumph Group, Inc. (TGI) as of 03-01-2023



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Distribution of Ratings

			IB Serv./Past12 Mos.		JIL Mkt Serv./Past12 Mos.	
	Count	Percent	Count	Percent	Count	Percent
BUY	1917	58.32%	60	3.13%	15	0.78%
HOLD	1177	35.81%	8	0.68%	0	0.00%
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J.P.Morgan

North America Equity Research
09 February 2022

Triumph Group

Transition Nearly Complete

Underweight

TGI, TGI US

Price (09 Feb 22): $20.53

▲ **Price Target (Dec-22): $22.00**
Prior (Dec-22): $20.00

Triumph executed against similar top-line headwinds we saw across A&D this quarter, including slowness in Defense and minimal 787 production. Mgmt. expects the sale of Stuart to close in the first half of CY22 finishing the long exit from non-core structures and becoming a company focused on systems, support, and interiors. We will be looking to see how the company reports in its new form starting in the fiscal year beginning April 1 as well as signs of mgmt's strategic intentions for the new company. In the meantime, we raise our Dec 2022 price target by $2 to $22, reflecting the removal of the pension liability from our EV, given its decline and the minimal contributions expected.

- **Systems & Support remains the core.** S&S reported its lowest revenue quarter of the COVID era thanks to declining 787 production and defense delays. Guidance implies that Q4 will show the highest revenue of the post-COVID era and this looks like an ambitious goal, but we should see good progress. S&S posted a strong EBITDA margin of 20.1%, aided by one-time licensing revenue ($4m) and $2.7m from the Aviation Manufacturing Jobs Program (AMJP). The margin falls to 17.5% when adjusting out these items, still strong on the Q3 sales base. Triumph will book $18.3m more from the program over the next two quarters with $10m in 4Q and the remainder in FY23. We expect growth to return in FY23 on 787, continued single-aisle growth, aftermarket growth and fewer defense delays.

- **Structures becomes "Interiors".** Aerospace Structures is currently made up of the Stuart, FL facility (sale pending) and Interiors. Interiors is still suffering from low 737 and 787 production and we estimate a ~$120m contribution with no earnings but this should accelerate quickly with production. Mgmt targets a return to $175-200m of sales, though we think this might take more than a year, and then some, for sales to move higher. We model a return to profitability here in FY23 as well, though we expect it will take time to reach mgmt's goal of returning to mid-teens margins. We are not sure that Interiors will be a reportable segment going forward.

- **Cash burn improves in FY23.** We model cash burn of ~$20m in FY23, which would reflect improvement of ~$125m. ~$80m of this comes from non-recurring cash drivers fading from FY22, though we still include ~$100m of advance repayments, absent which, we expect TGI should generate cash. Following the sale of Stuart, mgmt. expects capital expenditures to fall to ~$20m annually, lower than the $25m guided for this year.

- **Our Q4 expectations are on the low end of guidance.** With 787 progress unlikely and the defense supply chain still questionable, we expect ~$400m of revenue in 4Q, below implied guidance of ~$425m. We step down in FY23, to $1.37b on the divestiture of Stuart, but we expect organic growth from both segments and underlying organic margin expansion as well. For FY24, we see double-digit top-line growth and an EBITDA margin in the mid-teens.

Aerospace & Defense

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Key Changes (FYE Mar)

	Prev	Cur
Adj. EPS - 22E ($)	0.75	0.80
Adj. EPS - 23E ($)	1.15	1.00

Quarterly Forecasts (FYE Mar)

Adj. EPS ($)

	2021A	2022E	2023E
Q1	(0.18)	0.09A	
Q2	(0.08)	0.10A	
Q3	(1.30)	0.21A	
Q4	0.10	0.40	
FY	(1.37)	0.80	1.00

Style Exposure

Quant Factors	Current %Rank	Hist %Rank (1=Top) 6M	1Y	3Y	5Y
Value	93	87	64	23	1
Growth	98	97	98	99	32
Momentum	14	2	83	84	93
Quality	86	91	80	89	100
Low Vol	92	99	100	89	86
ESGQ	7	67	27	90	100

Sources for: Style Exposure – J.P. Morgan Quantitative and Derivatives Strategy; all other tables are company data and J.P. Morgan estimates.

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See page 5 for analyst certification and important disclosures.

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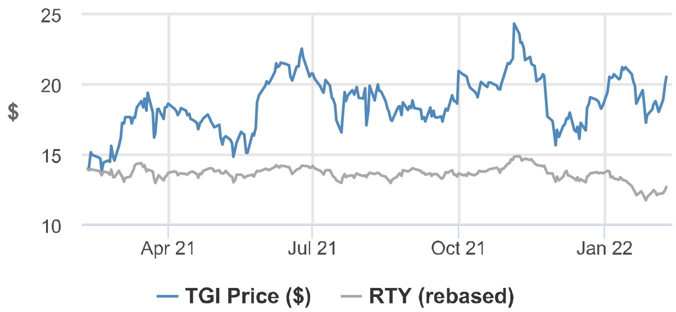
Price Performance



	YTD	1m	3m	12m
Abs	5.7%	-0.8%	-10.5%	46.6%
Rel	12.9%	3.6%	3.6%	56.0%

Company Data

Shares O/S (mn)	65
52-week range ($)	24.53-13.73
Market cap ($ mn)	1,326.85
Exchange rate	1.00
Free float(%)	97.3%
3M - Avg daily vol (mn)	0.73
3M - Avg daily val ($ mn)	13.8
Volatility (90 Day)	60
Index	RUSSELL 2000
BBG BUY|HOLD|SELL	4|3|2

Key Metrics (FYE Mar)

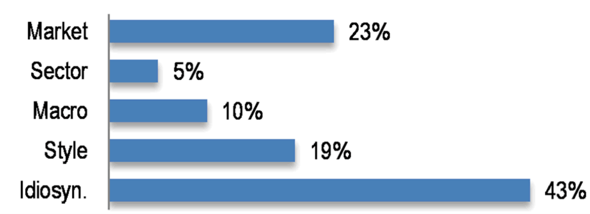
$ in millions	FY21A	FY22E	FY23E	FY24E
Financial Estimates				
Revenue	1,870	1,473	1,363	1,514
Adj. EBITDA	(271)	163	196	224
Adj. EBIT	(326)	116	158	183
Adj. net income	(73)	52	66	89
Adj. EPS	(1.37)	0.80	1.00	1.35
BBG EPS	(0.09)	0.76	1.07	1.66
Cashflow from operations	(173)	(122)	1	104
FCFF	(198)	(146)	(20)	83
Margins and Growth				
Revenue growth	(35.5%)	(21.2%)	(7.5%)	11.1%
EBITDA margin	(14.5%)	11.0%	14.4%	14.8%
EBITDA growth	(324.7%)	(159.9%)	20.4%	14.3%
EBIT margin	(17.4%)	7.8%	11.6%	12.1%
Net margin	(3.9%)	3.5%	4.8%	5.9%
Adj. EPS growth	(156.1%)	(158.9%)	24.7%	34.2%
Ratios				
Adj. tax rate	(0.6%)	341.0%	20.0%	21.3%
Interest cover	NM	1.2	1.5	1.7
Net debt/Equity	NM	NM	NM	NM
Net debt/EBITDA	NM	8.3	7.0	5.7
ROCE	(30.3%)	(28.7%)	15.6%	17.1%
ROE	9.2%	(6.5%)	(8.8%)	(13.2%)
Valuation				
FCFF yield	(18.0%)	(11.0%)	(1.5%)	6.1%
Dividend yield	0.0%	0.0%	0.0%	0.0%
EV/Revenue	1.4	1.8	2.0	1.7
EV/EBITDA	NM	16.4	13.7	11.7
Adj. P/E	NM	25.5	20.5	15.3

Summary Investment Thesis and Valuation

We rate TGI Underweight. Triumph has de-risked its portfolio by offloading problematic Structures programs, but the COVID-19 aero downturn has pressured production and MRO volume, impeding the company's cash generation. We believe that an equity offering has become more likely to reset the company's strained balance sheet.

We are increasing our Dec-22 price target to $22 based on our sum-of-the-parts analysis for Triumph after it executes its plans to divest non-core Structures. We apply a ~12.5x multiple on Triumph's FY24E EBITDA, a healthy multiple for diversified aerospace companies, and assume that proceeds from the Structures sale are used to offset debt.

Performance Drivers



Factors	6M Corr	1Y Corr
Market: MSCI US	0.51	0.50
Sect: Industrials	0.08	0.28
Ind: Capital Goods	0.30	0.39
Macro:		
Crude Oil	0.27	0.37
US 10yr yield	0.04	0.18
Credit Spread	-0.08	-0.08
Quant Styles:		
Quality	-0.68	-0.54
Size	-0.63	-0.49
LowVol	-0.61	-0.48

Source: J.P. Morgan Quantitative and Derivatives Strategy for Performance Drivers; company data, Bloomberg Finance L.P. and J.P. Morgan estimates for all other tables. Note: Price history may not be complete or exact

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Investment Thesis, Valuation and Risks

Triumph Group Inc. *(Underweight; Price Target: $22.00)*

Investment Thesis

We rate TGI Underweight. Triumph has de-risked its portfolio by offloading problematic Structures programs, but the COVID-19 aero downturn has pressured production and MRO volume, impeding the company's cash generation. We believe that an equity offering has become more likely to reset the company's balance sheet.

Valuation

We are increasing our Dec-22 price target to $22 based on our sum-of-the-parts analysis for Triumph after it executes its plans to divest non-core Structures. We apply a ~12.5x multiple on Triumph's FY24E EBITDA, a healthy multiple for diversified aerospace companies, and assume that proceeds from the Structures sale are used to offset debt.

Risks to Rating and Price Target

Upside risks include successful management cost-cutting efforts that lead to cash flow upside vs our estimates or a faster-than-expected recovery in commercial aviation. Management may also take strategic actions that create value for shareholders.

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Triumph Group: Summary of Financials

Income Statement - Annual	FY20A	FY21A	FY22E	FY23E	FY24E
Revenue	**2,900**	**1,870**	**1,473**	**1,363**	**1,514**
Operating expenses	(2,842)	(2,196)	(1,358)	(1,205)	(1,330)
Adj. EBITDA	**121**	**(271)**	**163**	**196**	**224**
D&A	(138)	(93)	(52)	(41)	(42)
Adj. EBIT	**58**	**(326)**	**116**	**158**	**183**
Net Interest	(122)	(171)	(139)	(133)	(129)
Adj. PBT	**(22)**	**(450)**	**3**	**82**	**111**
Tax	(6)	(3)	(9)	(16)	(24)
Minority Interest	-	-	-	-	-
Adj. Net Income	**124**	**(73)**	**52**	**66**	**89**
Net Income - GAAP	(28)	(452)	(6)	66	89
Reported EPS	(0.55)	(8.45)	(0.10)	1.00	1.35
Adj. EPS	**2.44**	**(1.37)**	**0.80**	**1.00**	**1.35**
DPS	**0.16**	**0.00**	**0.00**	**0.00**	**0.00**
Payout ratio	NM	0.0%	0.0%	0.0%	0.0%
Shares outstanding	51	54	65	66	66

Income Statement - Quarterly	1Q22A	2Q22A	3Q22A	4Q22E
Revenue	**397A**	**357A**	**319A**	**400**
Operating expenses	(376)A	(341)A	(291)A	(350)
Adj. EBITDA	**45A**	**28A**	**41A**	**61**
D&A	(15)A	(13)A	(12)A	(12)
Adj. EBIT	**21A**	**16A**	**28A**	**50**
Net Interest	(39)A	(34)A	(32)A	(34)
Adj. PBT	**(29)A**	**(7)A**	**8A**	**31**
Tax	(1)A	(2)A	(1)A	(5)
Minority Interest	-	-	-	-
Adj. Net Income	**6A**	**6A**	**14A**	**26**
Net Income - GAAP	(30)A	(9)A	7A	26
Reported EPS	(0.47)A	(0.14)A	0.11A	0.40
Adj. EPS	**0.09A**	**0.10A**	**0.21A**	**0.40**
DPS	**0.00A**	**0.00A**	**0.00A**	**0.00**
Payout ratio	0.0%A	0.0%A	0.0%A	0.0%
Shares outstanding	64A	65A	65A	65

Balance Sheet & Cash Flow Statement	FY20A	FY21A	FY22E	FY23E	FY24E
Cash and cash equivalents	485	590	246	175	208
Accounts receivable	359	194	144	142	158
Inventories	697	535	515	505	505
Other current assets	19	235	18	18	18
Current assets	**1,562**	**1,554**	**923**	**840**	**889**
PP&E	418	211	176	156	135
LT investments	-	-	-	-	-
Other non current assets	1,001	685	646	646	646
Total assets	**2,980**	**2,451**	**1,744**	**1,642**	**1,670**
Short term borrowings	7	5	4	4	4
Payables	458	179	309	309	309
Other short term liabilities	523	534	225	145	165
Current liabilities	**988**	**718**	**537**	**457**	**477**
Long-term debt	1,800	1,952	1,585	1,535	1,485
Other long term liabilities	974	599	406	368	336
Total liabilities	**3,762**	**3,270**	**2,528**	**2,360**	**2,299**
Shareholders' equity	(781)	(819)	(784)	(718)	(629)
Minority interests	-	-	-	-	-
Total liabilities & equity	**2,980**	**2,451**	**1,744**	**1,642**	**1,670**
BVPS	**(15.47)**	**(15.29)**	**(12.14)**	**(11.00)**	**(9.56)**
y/y Growth	*34.0%*	*(1.2%)*	*(20.6%)*	*(9.4%)*	*(13.0%)*
Net debt/(cash)	1,322	1,368	1,343	1,363	1,280
Cash flow from operating activities	**97**	**(173)**	**(122)**	**1**	**104**
o/w Depreciation & amortization	138	93	52	41	42
o/w Changes in working capital	(106)	(174)	(217)	(135)	(62)
Cash flow from investing activities	**7**	**(9)**	**172**	**(21)**	**(21)**
o/w Capital expenditure	(40)	(25)	(25)	(21)	(21)
as % of sales	*1.4%*	*1.3%*	*1.7%*	*1.5%*	*1.4%*
Cash flow from financing activities	**294**	**277**	**(392)**	**(50)**	**(50)**
o/w Dividends paid	(8)	0	0	0	0
o/w Share issue/(buyback)	0	0	0	0	0
o/w Net debt issued/(repaid)	321	154	(388)	(50)	(50)
Net change in cash	**393**	**104**	**(344)**	**(70)**	**33**
Adj. Free cash flow to firm	**57**	**(198)**	**(146)**	**(20)**	**83**
y/y Growth	*(125.7%)*	*(448.9%)*	*(26.2%)*	*(86.1%)*	*(508.4%)*

Ratio Analysis	FY20A	FY21A	FY22E	FY23E	FY24E
EBITDA margin	4.2%	(14.5%)	11.0%	14.4%	14.8%
EBIT margin	2.0%	(17.4%)	7.8%	11.6%	12.1%
Net profit margin	4.3%	(3.9%)	3.5%	4.8%	5.9%
ROE	(18.2%)	9.2%	(6.5%)	(8.8%)	(13.2%)
ROA	4.2%	(2.7%)	2.5%	3.9%	5.4%
ROCE	7.5%	(30.3%)	(28.7%)	15.6%	17.1%
Net debt/equity	NM	NM	NM	NM	NM
P/E (x)	8.4	NM	25.5	20.5	15.3
P/BV (x)	NM	NM	NM	NM	NM
EV/EBITDA (x)	21.9	NM	16.4	13.7	11.7
Dividend Yield	0.8%	0.0%	0.0%	0.0%	0.0%
Sales/Assets (x)	1.0	0.7	0.7	0.8	0.9
Interest cover (x)	1.0	NM	1.2	1.5	1.7
Operating leverage	876.5%	1866.7%	638.6%	(492.1%)	140.6%
Revenue y/y Growth	(13.8%)	(35.5%)	(21.2%)	(7.5%)	11.1%
EBITDA y/y Growth	(162.9%)	(324.7%)	(159.9%)	20.4%	14.3%
Tax rate	(26.0%)	(0.6%)	341.0%	20.0%	21.3%
Adj. Net Income y/y Growth	7.7%	(159.3%)	(171.2%)	26.1%	35.2%
EPS y/y Growth	5.5%	(156.1%)	(158.9%)	24.7%	34.2%
DPS y/y Growth	(1.5%)	(100.0%)	-	-	-
Free cashflow / share	1.12	(3.70)	(2.26)	(0.31)	1.26
P/FCF (x)	18.3	NM	NM	NM	16.3

Source: Company reports and J.P. Morgan estimates.
Note: $ in millions (except per-share data).Fiscal year ends Mar. o/w - out of which

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Triumph Group (TGI, TGI US) Price Chart

Date	Rating	Price ($)	Price Target ($)
12-Feb-19	N	22.58	25
05-Apr-19	N	21.37	28
04-Aug-19	N	24.93	30
14-Feb-20	N	24.10	29
20-Mar-20	N	4.55	10
12-Aug-20	UW	8.47	8
06-Nov-20	UW	7.63	7
04-Feb-21	UW	13.43	13
25-May-21	UW	16.49	16
23-Aug-21	UW	17.38	20

Source: Bloomberg Finance L.P. and J.P. Morgan; price data adjusted for stock splits and dividends.
Initiated coverage Dec 17, 2013. All share prices are as of market close on the previous business day.

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Equity Research May 18, 2022

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Stock Rating	**BUY** *Unchanged*
Price Target	**$24.00** ↓ *from $30.00*

TR to Target	34.1%
Price (May 18, 2022)	$17.90
52-Wk Range	$27.31-$15.11
Market Cap ($M)	$1,165
ADTV	450,726
Shares Out (M)	65
Short Interest Ratio/% Of Float	4.4%
Dividend/Yield	$0.00/0.0%
Enterprise Value ($M)	$2,513
Cash & Equivalents ($M)	$241
Total Debt ($M)	$1,589

9 Page Document

Reasons for this report

- ✓ EPS Recap Report
- ✓ Updating Estimates and PT

Triumph Group, Inc. (TGI)

So Much For a Clean FY23 Guide and Inflecting FCF

We maintain our BUY rating but lower our PT to $24 (from $30). Unfortunately the FY23 outlook was anything but clean and disappointed vs Street. The standout item, FCF, of $7.5M at the midpoint was below consensus and only slightly better than the FY22 level of $7M. An additional $70-$75M of close-out costs were a negative surprise and the primary disconnect. The revenue build into FY23 also has moving parts that are not easily reconciled. On the plus side, mgmt remained committed to doubling EBITDAP by FY25 to ~$300M but we expect guidance and messaging regarding FY23 to weigh on shares.

F4Q22 Results Recap: TGI reported F4Q22 revenues of $386.7M, down 17% YOY (2% organically) and below the Street's $405M estimate. By segment, systems & support revenues of $286.9M dipped 5% YOY (down 2% organically), with seq'l revenue growth of 20% for MRO sales and 15% for OEM sales. Aerospace structures revenues of $99.6M were down 40% YOY (up slightly organically). Consolidated operating margin of 10% was up 1990 bps YOY. Systems & support op margin of 17.2% was up 410bps YOY while aerospace structure margins of 2.7% increased 1090bps YOY. At the EBITDAP margin level consolidated margins of 11.5% increased 510bps YOY driven by a 19.2% EBITDAP margin in systems & support which was up 420bps YOY. Aerospace structure EBITDAP margins of 6.2% increased 780bps YOY. Adj. EPS of $0.39 fell short of the $0.42 consensus estimate but increased 85% seq'l. and 190% YOY. FCF fell short of the Street's $39M at $29M but was up 70% YOY.

F4Q22 Key Takeaways:

- **FCF outlook disappoints on lingering close-out charges.** TGI guided to $30-45M of core cash from operations in FY23, with capex of $30M, resulting in core FCF of $0-$15M. Actual cash flow from operations is guided to be a use of $30-40M, due to $70-$75M of projected spending for related to the closure and sale of the legacy structures business. Specifically TGI has noted expenses for stranded overhead, as well as exit costs with vendors for contracted IT systems and maintenance activities. Management expects $30M of this to occur in fiscal 1Q, and noted that it believes the actual cash outlays are likely to be below its expectations with less chance of overruns. This guidance is also net of the $104M in liquidation of customer advances TGI expects over the course of the fiscal year, though specific timing remains uncertain.
- **OEM production rate assumptions over planning period appear aggressive.** Management expects rate increases in the 737 MAX and 787 in conjunction with the A320 and A350 programs to collectively contribute $300M in revenue from FY22-FY25, or about $100M/yr. TGI's production planning contemplates 737 MAX rates reaching 45/mo in FY24 (mostly calendar 2023), with a move to 57/mo by FY26 (2025). On the 787, management believes the 787 will be re-certified and move towards a return to production in late summer, and sees potential for underlying build rates to increase to 8-10/mo by FY24. While TGI's confidence appears to be based in Boeing's (BA, NR) success in meeting the production plans it has communicated to its suppliers thus far, we believe these production ramp assumptions are optimistic relative to market expectations.
- **Commercial aerospace aftermarket trends remain healthy.** MRO sales in TSS were up 20% q/q primarily driven by commercial aero, up 37%, driven by strong growth for

EPS	2022A	2023E			2024E		
FYE Mar		New	Old	Cons	New	Old	Cons
Q1	$0.09	$0.13	*$0.34*	--	--	--	--
Q2	$0.10	$0.11	*$0.29*	--	--	--	--
Q3	$0.21	$0.08	*$0.26*	--	--	--	--
Q4	$0.39	$0.14	*$0.41*	--	--	--	--
Year	$0.79	$0.46	*$1.30*	$1.09	$1.04		$1.58

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the A320. TGI pointed to expectations for an underlying market growth rate of 3.5-5% for MRO through FY26, but noted that engine induction-related growth is outpacing the market, with the potential for LDD growth. Aftermarket activity for the wide body market has been supported by passenger to freighter conversions, but there are signs of recovery for passenger as well as int'l travel begins to recover.

- **Additional underlying core FY23 guidance assumptions.** FY23 sales guidance of $1.2B-$1.3B assumes organic growth of 8-12%, with interiors sales of > $100M for the year, implying TSS sales of around $1.1-$1.2B. The interiors sales appears to be a step back from management's indication last quarter that $175-$200M would be achievable in FY23...we believe the company may be viewing that level of sales as a longer-term target (FY25). Within TSS, TGI expects to grow OEM production by 18-22% driven by higher narrow body production rates. Given the guidance for 8-12% organic revenue growth we believe this implies limited growth for aftermarket revenues in FY23. The company expects margin expansion in TSS from improved growth, as well as pricing and efficiencies, to drive EBITDAP margins >20% for the fiscal year. From today's presentation it appears management is targeting ~$190M of total EBITDAP in FY23, implying consolidated margins of ~15% for the year.
- **Still committed to doubling core EBITDAP by FY25.** TGI reiterated its target of doubling core EBITDAP from FY22 to FY25, estimating FY22 EBITDAP of $150-$155M excluding divestitures, implying EBITDAP of $300-$310M. As management previously indicated, it expects its core levers for profitability improvement to be a combination of operating leverage as OE production rates rise and the MRO business grows, more favorable pricing terms from contract re-negotiations, improved product mix, and continued cost efficiencies, with TSS segment margins rising into the mid-20s by FY25.

	2023E		2024E	
TGI Truist Securities Ests.	New	Prior	New	Prior
Revenue	$1,266.7	$1,579.2	$1,353.3	n/a
Consensus	*$1,515.3*		*$1,562.0*	
FY EPS	$0.46	$1.30	$1.04	n/a
CY EPS (2022/2023)	$0.71	$1.30	$0.87	$1.56
Consensus	*$1.09*		*$1.58*	
FCF	($69.3)	$56.8	$84.0	n/a
FY Trading P/E Multiple	47.9x	16.8x	21.0x	n/a
CY Trading P/E Multiple (2022/2023)	30.9x	21.2x	25.1x	14.1x
Price Target	$24.00	$30.00	$24.00	$30.00
Implied P/E Multiple (CY)	33.9x	23.0x	27.5x	19.3x

Source: Company filings, FactSet, Truist Securities estimates

WESCO_UCC00003321

Triumph Group, Inc. (NYSE:TGI)

TRUIST
Truist Securities

Michael Ciarmoli - (201) 401-2293

($MM, except per-share data)
Source: Company Reports and Truist Securities research and estimates
"Required Disclosures" are on the last tab of the workbook

Last Updated: 5/18/2022

Income Statement *(in millions, except per share values)*	F2015	F2016	F2017	F2018	F2019	F2020	F2021	Jun	Sep	Dec	Mar	F2022	JunE	SepE	DecE	MarE	F2023E	F2024E
Total Revenue	**3888.722**	**3886.07**	**3533.00**	**3198.95**	**3364.93**	**2900.12**	**1869.72**	**396.65**	**357.40**	**319.25**	**386.65**	**1459.94**	**340.46**	**312.33**	**275.78**	**338.10**	**1266.67**	**1353.31**
Cost of Revenues	3141.453	3597.30	2689.82	2533.15	2924.92	2307.39	1476.27	293.68	262.34	232.33	284.72	1073.06	243.25	218.61	196.77	245.69	904.32	924.57
Gross Profit	**747.27**	**288.77**	**843.18**	**665.80**	**440.01**	**592.72**	**393.45**	**102.97**	**95.06**	**86.92**	**101.93**	**386.88**	**97.22**	**93.72**	**79.01**	**92.41**	**362.35**	**428.74**
Selling, General and Administrative	285.77	287.35	281.55	289.52	298.38	257.53	215.96	56.25	54.11	42.42	49.30	202.07	48.28	47.29	36.64	43.10	175.31	187.39
Depreciation and Amortization	158.32	177.76	176.95	158.37	149.91	138.17	93.33	15.43	12.95	11.66	9.60	49.64	11.70	11.70	11.70	11.70	46.80	46.80
Legal	-134.69	5.48	0.00	0.00	0.00	-9.26	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Curtailment Gain/loss	0.00	-1.24	0.00	-25.72	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Restructuring	0.00	36.18	42.18	40.07	31.10	25.34	53.22	4.49	3.90	4.65	6.26	19.30	0.00	0.00	0.00	0.00	0.00	0.00
Integration/ Impairment	0.00	874.36	266.30	535.23	0.00	0.00	252.38	0.00	0.00	0.00	2.31	2.31	0.00	0.00	0.00	0.00	0.00	0.00
Loss on divestiture	0.00	0.00	19.12	30.74	235.30	56.92	104.70	5.97	7.66	0.00	-4.34	9.29	0.00	0.00	0.00	0.00	0.00	0.00
Relocation	3.19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total Operating Expenses	*312.60*	*1379.88*	*786.29*	*1033.93*	*714.69*	*534.82*	*719.60*	*82.14*	*78.61*	*58.72*	*63.13*	*282.60*	*59.98*	*58.99*	*48.34*	*54.80*	*222.11*	*234.19*
Operating Income	**434.67**	**-1091.11**	**56.89**	**-465.64**	**-274.68**	**57.91**	**-326.15**	**20.83**	**16.45**	**28.20**	**38.80**	**104.28**	**37.23**	**34.74**	**30.67**	**37.60**	**140.24**	**194.55**
Interest (Expense) Other	85.38	68.04	80.50	99.44	114.62	122.13	171.40	38.56	34.18	32.32	30.80	135.86	33.00	33.00	33.00	33.00	132.00	132.00
Earnings before Taxes	**349.30**	**-1159.15**	**-23.61**	**-461.85**	**-327.19**	**-22.33**	**-448.03**	**-29.14**	**-7.28**	**8.34**	**-9.76**	**-37.84**	**12.23**	**9.74**	**7.67**	**12.60**	**42.24**	**96.55**
Provision for Income Tax	110.60	-111.19	19.34	-36.46	-5.43	5.80	2.88	1.21	1.79	1.11	0.82	4.92	3.67	2.92	2.30	3.78	12.67	28.96
Net income from continuing operations	**238.70**	**-1047.96**	**-42.95**	**-425.39**	**-321.77**	**-28.13**	**-450.91**	**-30.35**	**-9.07**	**7.24**	**-10.58**	**-42.76**	**8.56**	**6.81**	**5.37**	**8.82**	**29.57**	**67.58**
Diluted Shares	51.01	49.22	49.30	49.43	49.70	50.49	53.57	64.30	64.55	65.10	64.64	64.65	64.69	64.70	64.74	64.75	64.72	64.81
Diluted EPS (GAAP)	4.68	-21.29	-$0.87	-$8.61	-$6.47	-$0.56	-$8.42	-$0.47	-$0.14	$0.11	-$0.16	-$0.66	$0.13	$0.11	$0.08	$0.14	$0.46	$1.04
Net income (Adjusted)	**238.70**	**263.67**	**303.89**	**120.30**	**124.65**	**138.14**	**-1.61**	**5.87**	**6.41**	**13.82**	**25.62**	**51.77**	**8.56**	**6.81**	**5.37**	**8.82**	**29.57**	**67.58**
Adjusted EPS	**4.68**	**5.36**	**$6.16**	**$2.43**	**$2.49**	**$2.76**	**-$0.03**	**$0.09**	**$0.10**	**$0.21**	**$0.39**	**$0.79**	**$0.13**	**$0.11**	**$0.08**	**$0.14**	**$0.46**	**$1.04**
EBITDA Calculation																		
Operating Income	**434.67**	**-1091.11**	**56.89**	**-465.64**	**-274.68**	**57.91**	**-326.15**	**20.83**	**16.45**	**28.20**	**38.80**	**104.28**	**37.23**	**34.74**	**30.67**	**37.60**	**140.24**	**194.55**
Depreciation and Amortization	158.32	177.76	443.24	158.37	149.91	138.11	345.72	15.43	12.95	11.66	11.91	49.64	11.70	11.70	11.70	11.70	46.80	46.80
Amortization of acquired contract liabilities	-75.73	-132.36	-121.01	-125.15	-67.31	-75.28	-38.56	-1.21	-1.49	-0.94	-2.23	-5.87	-8.00	-8.00	-8.00	-8.00	-32.00	-32.00
Non-service defined benefit (pension) income						54.88	49.52	14.36	10.45	14.40	-17.75	21.45	8.00	8.00	10.00	8.00	34.00	34.00
EBITDA	513.09	-1045.71	379.13	-432.42	-192.09	175.61	30.52	49.41	38.35	53.32	30.73	169.49	48.93	46.44	44.37	49.30	189.04	243.35
Gain on Legal Settlement	-134.69	5.48	0.00	0.00	0.00	-3.86	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Jefferson Street	0.00	-1.24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Other - Curtailments, early retirement incentives, loss	0.00	0.00	19.12	209.82	326.71	124.77	128.39	5.97	7.66	0.00	-4.34	9.29	0.00	0.00	0.00	0.00	0.00	0.00
Adjusted EBITDA						296.52	158.91	55.37	46.01	53.32	26.39	181.09	48.93	46.44	44.37	49.30	189.04	243.35
Less: Non-service defined benefit (pension) income						-54.88	-49.52	-14.36	-10.45	-14.40	17.75	-21.45	-8.00	-8.00	-10.00	-8.00	-34.00	-34.00
Adjusted EBITDAP	**378.40**	**-1041.48**	**398.25**	**-222.60**	**134.62**	**241.64**	**109.39**	**41.02**	**35.56**	**38.92**	**44.14**	**159.64**	**40.93**	**38.44**	**34.37**	**41.30**	**155.04**	**209.35**
Dividend Paid	0.16	0.16	0.16	0.16	0.16	0.16	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Margin Analysis:																		
Corporate Gross Margin	0.19	0.07	24%	21%	13%	20%	21%	26%	27%	27%	26%	26%	29%	30%	29%	27%	29%	32%
SG&A	0.07	0.07	8%	9%	9%	9%	12%	14%	15%	13%	13%	14%	14%	15%	13%	13%	14%	14%
Operating Margin (GAAP)	**0.11**	**-0.28**	**2%**	**-15%**	**-8%**	**2%**	**-17%**	**5%**	**5%**	**9%**	**10%**	**7%**	**11%**	**11%**	**11%**	**11%**	**11%**	**14%**
EBITDA Margin	**0.13**	**-0.27**	**11%**	**-14%**	**-6%**	**6%**	**2%**	**12%**	**11%**	**17%**	**8%**	**12%**	**14%**	**15%**	**16%**	**15%**	**15%**	**18%**
Adjusted EBITDA Margin	**0.10**	**-0.27**	**11%**	**-7%**	**4%**	**8%**	**6%**	**10%**	**10%**	**12%**	**11%**	**11%**	**12%**	**12%**	**12%**	**12%**	**12%**	**15%**
Net Margin	0.06	-0.27	-1%	-13%	-10%	-1%	-24%	-8%	-3%	2%	-3%	-3%	3%	2%	2%	3%	2%	5%
Tax Rate	0.32	0.10	-82%	8%	2%	-26%	-1%	-4%	-25%	13%	-8%	-13%	30%	30%	30%	30%	30%	30%
Growth Rates:																		
Total Revenue, yr/yr	0.04	0.00	-9%	-9%	5%	-14%	-36%	-20%	-26%	-25%	-17%	-22%	-14%	-13%	-14%	-13%	-13%	7%
Revenue Seq'l	0.00	0.00	0%	0%	0%	0%	0%	-15%	-10%	-11%	21%	0%	-12%	-8%	-12%	23%	0%	0%
Gross Profit, yr/yr	-0.12	-0.61	192%	-21%	-34%	35%	-34%	2%	-5%	2%	-5%	-2%	-6%	-1%	-9%	-9%	-6%	18%
Selling, General and Administrative yr/yr	0.12	0.01	-2%	3%	3%	-14%	-16%	-2%	-4%	-13%	-8%	-6%	-14%	-13%	-14%	-13%	-13%	7%
Operating Income, yr/yr	0.09	-3.51	-105%	-919%	-41%	-121%	-663%	-108%	122%	-181%	-184%	-132%	79%	111%	9%	-3%	34%	39%
EBITDA, yr/yr	-0.02	-3.04	-136%	-214%	-56%	-191%	-83%	65%	55%	-832%	-281%	455%	-1%	21%	-17%	60%	12%	29%
Net Income, yr/yr	0.16	-5.39	-96%	890%	-24%	-91%	1503%	-89%	-73%	-111%	-86%	-91%	-128%	-175%	-26%	-183%	-169%	129%
Diluted EPS, yr/yr	-0.06	-5.55	-96%	888%	-25%	-91%	1411%	-91%	-78%	-109%	-87%	-92%	-128%	-175%	-25%	-183%	-169%	128%

Source: Company filings and Truist Securities research and estimates

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Triumph Group, Inc. (NYSE:TGI)

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($MM, except per-share data)

Segment Data *(in millions, except per share values)*	F2015	F2016	F2017	F2018	F2019	F2020	F2021	Jun	Sep	Dec	Mar	F2022	JunE	SepE	DecE	MarE	F2023E	F2024E
Segment Revenues																		
Systems & Support	1,318.280	1,406.097	1,379.329	1,268.264	1,326.690	1,358.648	1,056.822	258.413	248.781	236.281	286.969	1,030.444	252.918	232.017	204.865	251.157	940.957	1,005.321
Aerospace Structures	1,521.635	1,550.849	1,516.810	1,954.730	2,062.405	1,555.887	814.371	138.252	108.643	82.968	99.684	429.547	87.888	80.625	71.190	87.276	326.978	349.344
Elimination of inter-segment sales	(112.785)	(132.481)	(103.453)	(24.043)	(24.165)	(14.418)	(4.653)	(0.019)	(0.028)	-	(0.002)	(0.049)	(0.341)	(0.313)	(0.276)	(0.338)	(1.268)	(1.355)
Total	**3,888.722**	**3,886.072**	**3,532.999**	**3,198.951**	**3,364.930**	**2,900.117**	**1,869.719**	**396.646**	**357.396**	**319.249**	**386.651**	**1,459.942**	**340.465**	**312.329**	**275.779**	**338.095**	**1,266.668**	**1,353.311**
							0.565											
Segment Revenue Growth																		
Systems & Support		6.7%	-1.9%	-8.1%	4.6%	2.4%	-22.2%	7.7%	-2.1%	-10.5%	-4.9%	-2.5%	-2.1%	-6.7%	-13.3%	-12.5%	-8.7%	6.8%
Aerospace Structures		1.9%	-2.2%	28.9%	5.5%	-24.6%	-47.7%	-46.4%	-52.5%	-48.9%	-39.7%	-47.3%	-36.4%	-25.8%	-14.2%	-12.4%	-23.9%	6.8%
Elimination of inter-segment sales		17.5%	-21.9%	-76.8%	0.5%	-40.3%	-67.7%	-99.3%	-97.5%	-100.0%	-99.3%	-98.9%	1693.7%	1016.6%	n/a	16821.7%	2487.6%	6.8%
Total Revenue Growth		**-0.1%**	**-9.1%**	**-9.5%**	**5.2%**	**-13.8%**	**-35.6%**	**-19.9%**	**-25.8%**	**-25.1%**	**-17.2%**	**-21.8%**	**-14.2%**	**-12.6%**	**-13.6%**	**-12.6%**	**-13.2%**	**6.8%**
As a % of Total																		
Systems & Support	33.9%	36.2%	39.0%	39.6%	39.4%	46.8%	56.6%	65.1%	69.6%	74.0%	74.2%	70.6%	74.3%	74.3%	74.3%	74.3%	74.3%	74.3%
Aerospace Structures	39.1%	39.9%	42.9%	61.1%	61.3%	53.6%	43.6%	34.9%	30.4%	26.0%	25.8%	29.4%	25.8%	25.8%	25.8%	25.8%	25.8%	25.8%
Elimination of inter-segment sales	-2.9%	-3.4%	-2.9%	-0.8%	-0.7%	-0.5%	-0.2%	0.0%	0.0%	0.0%	0.0%	0.0%	-0.1%	-0.1%	-0.1%	-0.1%	-0.1%	-0.1%
Adj. Segment Operating Income																		
Systems & Support	231.489	245.626	257.094	232.103	207.096	141.341	141.517	35.546	39.100	40.567	49.237	164.450	42.996	40.023	35.339	43.325	161.683	193.666
Aerospace Structures	126.735	161.834	182.785	(26.937)	216.811	259.364	(260.702)	11.223	6.605	1.137	2.666	21.631	6.152	5.644	4.983	6.109	22.888	27.948
Adj. Segment Operating Income	**504.950**	**483.195**	**468.892**	**205.166**	**423.907**	**400.705**	**(119.185)**	**46.769**	**45.705**	**41.704**	**51.903**	**186.081**	**49.148**	**45.667**	**40.323**	**49.434**	**184.571**	**221.614**
Corporate	81.715	(57.826)	(109.716)	(128.579)	(323.367)	(125.298)	(171.966)	(25.937)	(25.254)	(8.858)	(13.106)	(73.155)	(11.916)	(10.932)	(9.652)	(11.833)	(44.333)	(27.066)
Other adjustments	(52.978)	(45.426)	72.098	55.668	71.783	100.834	351.687	0.310	7.557	-	(4.335)	3.532	-	-	-	-	-	-
Adj. Operating Income	**451.972**	**437.769**	**431.274**	**132.255**	**172.323**	**376.241**	**107.846**	**31.286**	**28.008**	**32.846**	**34.462**	**126.602**	**37.232**	**34.735**	**30.670**	**37.601**	**140.238**	**194.548**
Adj. Segment Operating Margin																		
Systems & Support	17.6%	17.5%	18.6%	18.3%	15.6%	10.4%	13.4%	13.8%	15.7%	17.2%	17.2%	16.0%	17.0%	17.3%	17.3%	17.3%	17.2%	19.3%
Aerospace Structures	8.3%	10.4%	12.1%	-1.4%	10.5%	16.7%	-32.0%	8.1%	6.1%	1.4%	2.7%	5.0%	7.0%	7.0%	7.0%	7.0%	7.0%	8.0%
Adj. Segment operating margin	**9.5%**	**8.9%**	**9.3%**	**4.6%**	**9.0%**	**13.7%**	**-6.4%**	**11.8%**	**12.8%**	**13.1%**	**13.4%**	**12.7%**	**14.4%**	**14.6%**	**14.6%**	**14.6%**	**14.6%**	**16.4%**
Total Adj. Operating Margin	**11.6%**	**11.3%**	**12.2%**	**4.1%**	**5.1%**	**13.0%**	**5.8%**	**7.9%**	**7.8%**	**10.3%**	**8.9%**	**8.7%**	**10.9%**	**11.1%**	**11.1%**	**11.1%**	**11.1%**	**14.4%**

Source: Company filings and Truist Securities research and estimates

WESCO_UCC00003323

Triumph Group, Inc. (NYSE:TGI)

TRUIST
Truist Securities

Michael Ciarmoli - (201) 401-2293

($MM, except per-share data)

Balance Sheet	F2014	F2015	F2016	F2017	F2018	F2019	F2020					F2021					F2022					F2023E	F2024E
(in millions, except per share values)								Jun	Sep	Dec	Mar		Jun	Sep	Dec	Mar		JunE	SepE	DecE	MarE		
Cash and cash equivalents	28.998	32.617	20.984	69.633	35.819	92.807	485.463	30.909	440.211	477.276	589.882	589.882	237.486	194.122	206.139	240.878	240.878	115.293	67.051	87.482	142.545	142.545	197.581
Trade and other receivables	517.304	521.601	444.208	311.792	376.612	392.940	359.487	256.848	233.802	167.694	194.066	194.066	190.185	175.267	158.871	178.663	178.663	272.372	312.329	275.779	318.207	318.207	238.311
Contract assets		-	-	-	37.573	326.667	244.417	203.984	193.056	158.289	134.638	134.638	144.118	150.408	150.755	101.828	101.828	102.139	93.699	96.523	81.143	81.143	85.792
Inventories	1,111.767	1,280.274	1,236.190	1,340.175	1,427.169	413.560	452.976	467.105	465.800	446.208	400.366	400.366	412.663	387.906	394.532	361.692	361.692	304.061	282.076	253.894	307.112	307.112	329.133
Rotable assets	41.666	48.820	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Asset held for sale	-	-	-	21.255	1.324	-	-	195.073	115.940	71.177	216.276	216.276	-	44.399	3.029	60.104	60.104	60.104	60.104	60.104	60.104	60.104	60.104
Prepaid expenses and other	24.897	23.069	41.259	30.064	44.428	34.446	19.289	18.708	15.727	17.857	19.206	19.206	22.788	16.278	14.922	19.437	19.437	19.631	19.828	20.026	20.226	20.226	21.047
Total Current Assets	**1,781.940**	**1,906.381**	**1,742.641**	**1,772.919**	**1,922.925**	**1,260.420**	**1,561.632**	**1,172.627**	**1,464.536**	**1,338.501**	**1,554.434**	**1,554.434**	**1,007.240**	**968.380**	**928.248**	**962.602**	**962.602**	**873.601**	**835.086**	**793.808**	**929.337**	**929.337**	**931.969**
Property and equipment	931.430	950.734	889.734	805.030	726.003	577.895	418.141	370.820	360.949	356.107	211.369	211.369	204.907	179.079	178.663	169.050	169.050	168.360	167.670	166.980	166.290	166.290	173.530
Goodwill	1,791.891	2,024.846	1,444.254	1,142.605	592.828	583.225	513.527	513.392	516.833	521.416	521.638	521.638	522.392	516.079	515.773	513.722	513.722	510.212	506.702	503.192	499.682	499.682	485.642
Intangible assets	978.171	966.365	649.612	592.364	507.681	430.954	381.968	120.928	116.886	113.040	102.453	102.453	99.445	90.430	87.679	84.850	84.850	83.305	81.760	80.215	78.670	78.670	70.490
Other assets	69.954	107.999	108.852	101.682	57.627	21.431	105.065	88.553	74.221	72.858	61.041	61.041	49.509	46.749	42.176	30.476	30.476	30.781	31.089	31.399	31.713	31.713	33.001
Total Assets	**5,553.386**	**5,956.325**	**4,835.093**	**4,414.600**	**3,807.064**	**2,873.925**	**2,980.333**	**2,266.320**	**2,533.425**	**2,401.922**	**2,450.935**	**2,450.935**	**1,883.493**	**1,800.717**	**1,752.539**	**1,760.700**	**1,760.700**	**1,666.259**	**1,622.307**	**1,575.594**	**1,705.692**	**1,705.692**	**1,694.632**
Current portion of long-term debt	49.575	42.255	42.441	160.630	16.527	8.201	7.336	7.555	7.212	6.090	5.247	5.247	4.653	3.637	3.534	3.268	3.268	3.268	3.268	3.268	3.268	3.268	3.268
Accounts payable	317.334	429.134	410.225	481.243	418.367	433.783	457.694	299.269	242.475	195.300	179.473	179.473	164.753	142.600	168.894	161.534	161.534	139.000	124.919	112.439	178.684	178.684	141.057
Contract liabilities		-	-	-	321.191	313.069	295.320	199.463	175.159	167.772	204.379	204.379	158.252	159.691	160.982	171.763	171.763	119.163	109.315	96.523	118.333	118.333	125.113
Liabilities related to assets held for sale	-	-	-	18.008	0.440	-	-	83.806	52.573	45.826	58.108	58.108	-	7.368	-	57.519	57.519	57.519	57.519	57.519	57.519	57.519	57.519
Accrued expenses	273.290	411.848	683.208	674.379	235.914	239.572	227.403	199.267	196.623	224.367	271.160	271.160	235.043	235.714	229.750	207.420	207.420	197.420	187.420	177.420	167.420	167.420	127.420
Total Current Liabilities	**640.199**	**883.237**	**1,135.874**	**1,334.260**	**992.439**	**994.625**	**987.753**	**789.360**	**674.042**	**639.355**	**718.367**	**718.367**	**562.701**	**549.010**	**563.160**	**601.504**	**601.504**	**516.369**	**482.441**	**447.169**	**525.224**	**525.224**	**454.377**
Long-term debt	1,500.808	1,326.345	1,374.879	1,035.670	1,421.757	1,480.620	1,800.171	1,557.066	2,014.595	2,013.255	1,952.296	1,952.296	1,606.287	1,606.052	1,584.989	1,586.222	1,586.222	1,566.222	1,546.222	1,526.222	1,566.222	1,566.222	1,546.222
Accrued pension and postretirement benefits	508.524	538.381	664.664	592.134	483.887	540.479	660.065	643.256	626.851	570.609	384.256	384.256	365.832	344.557	322.874	301.303	301.303	304.316	307.359	310.433	313.537	313.537	326.268
Deferred income taxes	385.188	261.100	62.453	68.107	16.582	6.964	7.439	7.487	7.493	8.028	7.491	7.491	7.456	7.479	7.426	7.386	7.386	7.386	7.386	7.386	7.386	7.386	7.386
Other noncurrent liabilities	234.756	811.478	662.279	537.956	441.865	424.549	306.169	316.532	274.801	240.505	207.378	207.378	167.443	122.488	86.128	51.708	51.708	51.708	51.708	51.708	51.708	51.708	51.708
Total Non Current Liabilities	*2,629.276*	*2,937.304*	*2,764.275*	*2,233.867*	*2,364.091*	*2,452.612*	*2,773.844*	*2,524.341*	*2,923.740*	*2,832.397*	*2,551.421*	*2,551.421*	*2,147.018*	*2,080.576*	*2,001.417*	*1,946.619*	*1,946.619*	*1,929.632*	*1,912.675*	*1,895.749*	*1,938.853*	*1,938.853*	*1,931.584*
Total Liabilities	**3,269.475**	**3,820.541**	**3,900.149**	**3,568.127**	**3,356.530**	**3,447.237**	**3,761.597**	**3,313.701**	**3,597.782**	**3,471.752**	**3,269.788**	**3,269.788**	**2,709.719**	**2,629.586**	**2,564.577**	**2,548.123**	**2,548.123**	**2,446.001**	**2,395.117**	**2,342.917**	**2,464.077**	**2,464.077**	**2,385.961**
Common stock	0.052	0.051	0.051	0.051	0.051	0.052	0.052	0.052	0.052	0.055	0.064	0.064	0.064	0.065	0.065	0.064	0.064	0.064	0.064	0.064	0.064	0.064	0.064
Additional paid in capital	866.281	851.940	851.102	846.807	851.280	867.545	804.830	796.186	794.619	835.193	978.272	978.272	966.532	968.090	970.787	973.112	973.112	975.230	977.348	979.466	981.584	981.584	990.056
Treasury stock	(19.134)	(203.514)	(199.415)	(183.696)	(179.082)	(159.154)	(36.217)	(25.188)	(20.886)	(18.037)	(12.606)	(12.606)	(0.560)	(0.007)	(0.010)	(0.096)	(0.096)	(0.096)	(0.096)	(0.096)	(0.096)	(0.096)	(0.096)
Retained earnings	1,455.620	1,686.217	630.368	579.489	146.155	(487.683)	(719.428)	(710.616)	(725.386)	(1,180.872)	(1,254.391)	(1,254.391)	(1,284.742)	(1,293.812)	(1,286.574)	(1,297.149)	(1,297.149)	(1,291.587)	(1,286.772)	(1,283.403)	(1,276.582)	(1,276.582)	(1,217.999)
Accumulated other comprehensive (loss) income	(18.908)	(198.910)	(347.162)	(396.178)	(367.870)	(794.072)	(830.501)	(1,107.815)	(1,112.756)	(706.169)	(530.192)	(530.192)	(507.520)	(503.205)	(496.306)	(463.354)	(463.354)	(463.354)	(463.354)	(463.354)	(463.354)	(463.354)	(463.354)
Total Shareholders Equity	**2,283.911**	**2,135.784**	**934.944**	**846.473**	**450.534**	**(573.312)**	**(781.264)**	**(1,047.381)**	**(1,064.357)**	**(1,069.830)**	**(818.853)**	**(818.853)**	**(826.226)**	**(828.869)**	**(812.038)**	**(787.423)**	**(787.423)**	**(779.743)**	**(772.810)**	**(767.323)**	**(758.384)**	**(758.384)**	**(691.329)**
Total Liabilities & Shareholders Equity	**5,553.386**	**5,956.325**	**4,835.093**	**4,414.600**	**3,807.064**	**2,873.925**	**2,980.333**	**2,266.320**	**2,533.425**	**2,401.922**	**2,450.935**	**2,450.935**	**1,883.493**	**1,800.717**	**1,752.539**	**1,760.700**	**1,760.700**	**1,666.259**	**1,622.307**	**1,575.594**	**1,705.692**	**1,705.692**	**1,694.632**
Total cash	28.998	32.617	20.984	69.633	35.819	92.807	485.463	30.909	440.211	477.276	589.882	589.882	237.486	194.122	206.139	240.878	240.878	115.293	67.051	87.482	142.545	142.545	197.581
Total debt	(1,550.383)	(1,368.600)	(1,417.320)	(1,196.300)	(1,438.284)	(1,488.821)	(1,807.507)	(1,564.621)	(2,021.807)	(2,019.345)	(1,957.543)	(1,957.543)	(1,610.940)	(1,609.689)	(1,588.523)	(1,589.490)	(1,589.490)	(1,569.490)	(1,549.490)	(1,529.490)	(1,569.490)	(1,569.490)	(1,549.490)
Net cash (debt)	**(1,521.385)**	**(1,335.983)**	**(1,396.336)**	**(1,126.667)**	**(1,402.465)**	**(1,396.014)**	**(1,322.044)**	**(1,533.712)**	**(1,581.596)**	**(1,542.069)**	**(1,367.661)**	**(1,367.661)**	**(1,373.454)**	**(1,415.567)**	**(1,382.384)**	**(1,348.612)**	**(1,348.612)**	**(1,454.197)**	**(1,482.439)**	**(1,442.008)**	**(1,426.945)**	**(1,426.945)**	**(1,351.909)**
Net debt to capital								**315.4%**	**305.8%**	**326.5%**	**249.2%**		**251.0%**	**241.3%**	**242.4%**	**240.3%**		**215.6%**	**208.9%**	**213.7%**	**213.4%**		
Debt to equity								-149.4%	-190.0%	-188.8%	-239.1%		-195.0%	-194.2%	-195.6%	-201.9%		-201.3%	-200.5%	-199.3%	-207.0%		
LTD-to-Capital								302.5%	211.2%	212.7%	171.9%		205.3%	206.2%	204.6%	198.2%		198.7%	199.5%	200.7%	193.5%		
Debt to EBITDA ttm								8.1	13.9	16.5	17.9		12.1	10.4	11.0	10.0		9.8	9.5	9.7	10.1		
Net Debt to EBITDA ttm								7.9	10.9	12.6	12.5		10.3	9.1	9.5	8.4		9.1	9.1	9.1	9.2		
Current ratio								1.5	2.2	2.1	2.2		1.8	1.8	1.6	1.6		1.7	1.7	1.8	1.8		
Blended avg interest rate	5.8%	6.4%	4.9%	7.1%	7.1%	8.2%	9.2%					12.5%					10.1%					9.3%	9.8%
Cash & mktble secs per share								$0.59	$8.39	$8.24	$11.01		$3.68	$2.98	$3.19	$3.73		$1.78	$1.04	$1.35	$2.20		
Net Cash per share								($29.56)	($30.41)	($29.38)	($23.61)		($21.36)	($21.93)	($21.24)	($20.86)		($22.48)	($22.91)	($22.27)	($22.04)		
Net working capital per share								$7.37	$15.06	$12.07	$15.61		$6.89	$6.44	$5.65	$5.59		$5.52	$5.45	$5.35	$6.24		
Tangible book per share								**($32.33)**	**($32.35)**	**($29.42)**	**($26.93)**		**($22.43)**	**($22.05)**	**($21.90)**	**($21.44)**		**($21.23)**	**($21.03)**	**($20.86)**	**($20.65)**		
Book value per share								**($20.14)**	**($20.28)**	**($18.47)**	**($15.28)**		**($12.80)**	**($12.73)**	**($12.56)**	**($12.18)**		**($12.05)**	**($11.94)**	**($11.85)**	**($11.72)**		
A/R Turnover								6.6	7.2	6.5	6.7		7.5	8.3	7.2	8.3		5.0	4.0	4.0	4.3		
Contract Asset Turnover								0.41	0.40	0.37	0.29		0.36	0.42	0.47	0.26		0.30	0.30	0.35	0.24		
Contract Liability Turnover								0.51	0.46	0.49	0.57		0.54	0.61	0.69	0.60		0.35	0.35	0.35	0.35		
A/R DSOs								55.2	50.6	56.5	54.1		48.8	43.8	50.4	44.0		73.0	91.3	91.3	85.9		
A/P Turnover								4.4	4.9	4.2	4.5		5.8	6.2	5.3	6.7		7.0	7.0	7.0	5.5		
Inventory Turnover								3.4	3.3	3.0	3.4		2.7	2.5	2.3	3.0		3.2	3.1	3.1	3.2		
Return on sales								-55.7%	-7.0%	-16.0%	-15.7%		-7.7%	-2.5%	2.3%	-2.7%		2.5%	2.2%	1.9%	2.6%		
T4Q ROE								49.7%	44.7%	43.8%	48.3%		65.7%	68.4%	59.2%	5.3%		4.7%	4.9%	2.8%	-3.8%		
T4Q ROA								-16.1%	-15.0%	-15.1%	-19.1%		-29.1%	-26.5%	-23.0%	-2.3%		-2.2%	-2.2%	-1.3%	1.8%		
T4Q ROIC								-16.0%	-16.8%	-18.6%	-28.9%		-36.3%	-34.1%	-27.6%	12.0%		19.1%	18.1%	16.1%	9.5%		
T4Q Asset turnover								2.0	1.7	1.6	0.8		1.5	1.5	1.4	0.8		1.5	1.5	1.4	0.8		
Working capital								424.684	457.127	418.602	414.959		438.095	420.573	384.509	378.821		437.434	469.486	417.234	446.636		
Working Capital as % of sales (Avg T4Q)								8.2%	17.2%	19.7%	22.9%		13.4%	25.7%	26.9%	27.8%		16.0%	30.7%	32.4%	34.9%		
Inventory as % of sales (Avg T4Q)								9.6%	19.6%	21.9%	23.8%		13.1%	25.0%	25.9%	26.7%		14.2%	24.7%	22.8%	22.6%		

Source: Company filings and Truist Securities research and estimates

Triumph Group, Inc. (NYSE:TGI)

TRUIST
Truist Securities

Michael Ciarmoli - (201) 401-2293

($MM, except per-share data)

Cash Flow Statement *(in millions, except per share values)*	F2014	F2015	F2016	F2017	F2018	F2019	F2020	F2021	Jun	Sep	Dec	Mar	F2022	JunE	SepE	DecE	MarE	F2023E	F2024E
Net income	206.256	238.697	(1,047.960)	(42.953)	(425.391)	(321.767)	(28.126)	(450.910)	(30.351)	(9.070)	7.238	(10.575)	(42.758)	8.562	6.815	5.369	8.820	29.567	67.583
Depreciation and amortization	164.277	158.323	177.755	176.946	158.368	149.904	138.168	93.334	15.431	12.945	11.659	11.908	51.943	11.700	11.700	11.700	11.700	46.800	46.800
Impairment of intangible assets	-	-	874.361	266.298	535.227	-	66.121	252.382	-	-	-	-	-	-	-	-	-	-	-
Amortization of acquired contract liability	(42.629)	(75.733)	(132.363)	(121.004)	(125.148)	(67.314)	(75.286)	(38.564)	(1.214)	(1.493)	(0.938)	(2.225)	(5.870)	-	-	-	-	-	-
Curtailments, settlements and early retirement incentives	1.166	-	(1.244)	-	(25.722)	-	-	-	16.078	3.968	-	31.959	52.005	-	-	-	-	-	-
Accretion of debt discount	1.946	1.577	-	-	-	4.032	14.293	-	-	-	-	-	-	-	-	-	-	-	-
Other amortization included in interest expense	6.702	8.135	3.904	5.553	11.677	8.770	11.157	23.759	4.002	1.600	1.900	1.545	9.047	1.545	1.545	1.545	1.545	6.180	6.180
Provision for doubtful accounts receivable	2.191	0.172	1.996	0.202	(0.242)	(0.495)	1.554	4.853	(0.028)	0.348	(0.073)	0.205	0.452	-	-	-	-	-	2.000
Provision (benefit) for deferred income taxes	102.869	105.277	(118.302)	9.480	(43.108)	(7.939)	2.823	(0.176)	-	-	-	-	-	-	-	-	-	-	-
Loss on sale of discontinued operations	-	-	-	19.124	30.741	235.301	56.916	104.702	5.969	7.660	-	(4.335)	9.294	-	-	-	-	-	-
Employee based-stock compensation	4.653	1.272	2.657	7.922	7.949	10.259	11.062	12.701	2.247	2.825	2.592	2.118	9.782	2.118	2.118	2.118	2.118	8.472	8.472
Other	(3.218)	1.542	(2.938)	(2.894)	(8.325)	-	-	-	-	-	-	0.025	0.025					-	-
Changes in other current assets and liabilities:																			
Accounts receivable	(46.378)	69.500	73.083	112.196	(105.104)	(89.728)	5.001	126.294	(1.321)	9.589	21.792	(27.238)	2.822	(93.709)	(39.957)	36.550	(42.428)	(139.544)	79.896
Contract assets						65.191	50.440	46.841	(4.426)	(5.214)	2.102	8.240	0.702	(0.311)	8.441	(2.824)	15.380	20.685	(4.649)
Inventories	(94.341)	49.536	294.360	(272.653)	(163.417)	(15.930)	(48.802)	35.412	(9.354)	11.137	(6.948)	30.807	25.642	57.631	21.986	28.181	(53.218)	54.580	(22.021)
Rotable assets	(6.813)	(7.153)	(0.843)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Prepaid expenses and other current assets	(0.406)	1.589	(6.958)	11.756	(4.239)	(3.144)	16.376	(0.310)	(3.633)	5.925	1.424	(4.838)	(1.122)	(0.499)	(0.504)	(0.509)	(0.514)	(2.027)	(2.109)
Accounts payable, accrued expenses and contract liabilities	(60.209)	95.167	53.914	211.560	(43.696)	(71.767)	(61.338)	(330.992)	(128.922)	(61.230)	(11.324)	12.064	(189.412)	(85.135)	(33.928)	(35.273)	78.055	(76.280)	(70.846)
Accrued pension and other postretirement benefits	(100.929)	(180.569)	(87.559)	(100.012)	(88.464)	(79.911)	(67.826)	(51.692)	(13.713)	(14.139)	(14.343)	(16.402)	(58.597)	3.013	3.043	3.074	3.104	12.234	12.731
Other/pension contribution		-	-	-	-	10.118	4.133	(0.753)	(0.279)	(0.863)	0.464	(0.293)	(0.971)	-	-	-	-	-	-
Cash Flow from Operating Activities	**135.137**	**467.332**	**83.863**	**281.521**	**(288.894)**	**(174.420)**	**96.666**	**(173.119)**	**(149.514)**	**(36.012)**	**15.545**	**32.965**	**(137.016)**	**(95.085)**	**(18.742)**	**49.931**	**24.563**	**(39.333)**	**124.037**
Capital expenditures	(206.414)	(110.004)	(80.047)	(51.832)	(42.050)	(47.099)	(39.834)	(25.178)	(2.112)	(5.369)	(8.336)	(3.843)	(19.660)	(7.500)	(7.500)	(7.500)	(7.500)	(30.000)	(40.000)
Proceeds from sale of assets	45.047	3.167	6.069	86.187	83.082	247.647	47.229	15.888	158.928	26.694	34.928	3.968	224.518	1.000	1.000	1.000	1.000	4.000	4.000
Reimbursements of capital expenditures from insurance	9.086	0.653	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Acquisitions / other	(94.456)	38.281	(54.051)	0.009	(2.818)	-	-	-	-	(23.651)	-	-	(23.651)	-	-	-	-	-	-
Cash Flow from Investing Activities	**(246.737)**	**(67.903)**	**(128.029)**	**34.364**	**38.214**	**200.548**	**7.395**	**(9.290)**	**156.816**	**(2.326)**	**26.592**	**0.125**	**181.207**	**(6.500)**	**(6.500)**	**(6.500)**	**(6.500)**	**(26.000)**	**(36.000)**
Net (decrease) increase in revolving credit facility	98.557	(46.150)	(8.256)	(110.000)	82.888	102.113	185.000	(400.000)	-	-	-		-	-	-	-	40.000	40.000	40.000
Proceeds from issuance of long-term debt	451.003	508.960	134.797	24.400	544.243	54.600	585.580	713.900	-	-	0.107	-	0.107	-	-	-	-	-	-
Retirement of debt and capital lease obligations	(416.645)	(655.860)	(80.917)	(144.144)	(387.373)	(113.425)	(449.650)	(160.035)	(350.688)	(2.825)	(25.508)	(0.988)	(380.009)	(20.000)	(20.000)	(20.000)	-	(60.000)	(60.000)
Payment of deferred financing costs / redemption premiums	(3.297)	(6.487)	(0.185)	(14.034)	(17.729)	(1.982)	(17.718)	(20.716)	-	-	(9.508)	-	(9.508)	(1.000)	(1.000)	(1.000)	(1.000)	(4.000)	(4.000)
Issuance of Equity								145.383	(7.489)	-	7.489		-						
Purchase of common stock	(19.134)	(184.380)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dividends paid	(8.344)	(8.100)	(7.889)	(7.927)	(7.943)	(7.971)	(8.078)	-	-	-	-		-	(3.000)	(2.000)	(2.000)	(2.000)	(9.000)	(9.000)
Net (repayment) proceeds of government grant	3.456	(3.198)	(5.000)	(14.570)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Repurchase of restricted shares for minimum tax obligations	(2.726)	(0.673)	(0.096)	(0.182)	(0.483)	(0.860)	(1.442)	(1.285)	(2.336)	(0.782)	(0.017)	(0.114)	(3.249)	-	-	-	-	-	-
Proceeds from exercise of stock options	0.329	0.720	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cash Flow from Financing Activities	**103.199**	**(395.168)**	**32.454**	**(266.457)**	**213.603**	**32.475**	**293.692**	**277.247**	**(360.513)**	**(3.607)**	**(27.437)**	**(1.102)**	**(392.659)**	**(24.000)**	**(23.000)**	**(23.000)**	**37.000**	**(33.000)**	**(33.000)**
Effect of exchange rate changes on cash	5.362	(0.642)	0.079	(0.780)	3.263	(1.615)	(5.097)	9.581	0.815	(1.419)	(2.683)	2.751	(0.536)	-	-	-	-	-	-
Cash and Cash Equivalents at Beginning of Period	**32.037**	**28.998**	**32.617**	**20.984**	**69.633**	**35.819**	**92.807**	**485.463**	**589.882**	**237.486**	**194.122**	**206.139**	**589.882**	**240.878**	**115.293**	**67.051**	**87.482**	**240.878**	**142.545**
Net change in cash and cash equivalents	*(3.039)*	*3.619*	*(11.633)*	*48.648*	*(33.814)*	*56.988*	*392.656*	*104.419*	*(352.396)*	*(43.364)*	*12.017*	*34.739*	*(349.004)*	*(125.585)*	*(48.242)*	*20.431*	*55.063*	*(98.333)*	*55.037*
Cash and Cash Equivalents at End of Period	**28.998**	**32.617**	**20.984**	**69.632**	**35.819**	**92.807**	**485.463**	**589.882**	**237.486**	**194.122**	**206.139**	**240.878**	**240.878**	**115.293**	**67.051**	**87.482**	**142.545**	**142.545**	**197.581**
Net Income	206.256	238.697	(1,047.960)	(42.953)	(425.391)	(321.767)	(28.126)	(450.910)	(30.351)	(9.070)	7.238	(10.575)	(42.758)	8.562	6.815	5.369	8.820	29.567	67.583
Depreciation & Amortization	121.648	82.590	45.392	55.942	33.220	82.590	62.882	54.770	14.217	11.452	10.721	9.683	46.073	11.700	11.700	11.700	11.700	46.800	46.800
Other Non-Working Capital Items	116.309	117.975	760.434	305.685	508.197	249.928	163.926	398.221	28.268	16.401	4.419	31.517	80.605	3.663	3.663	3.663	3.663	14.652	16.652
Working Capital Items	(309.076)	28.070	325.997	(37.153)	(404.920)	(195.289)	(106.149)	(174.447)	(161.369)	(53.932)	(7.297)	2.633	(219.965)	(119.011)	(40.920)	29.199	0.379	(130.352)	(6.999)
Operating Cash Flow	**135.137**	**467.332**	**83.863**	**281.521**	**(288.894)**	**(184.538)**	**92.533**	**(172.366)**	**(149.514)**	**(36.012)**	**15.545**	**32.965**	**(136.045)**	**(95.085)**	**(18.742)**	**49.931**	**24.563**	**(39.333)**	**124.037**
Capital Expenditures	(206.414)	(110.004)	(80.047)	(51.832)	(42.050)	(47.099)	(39.834)	(25.178)	(2.112)	(5.369)	(8.336)	(3.843)	(19.660)	(7.500)	(7.500)	(7.500)	(7.500)	(30.000)	(40.000)
Sale of assets	45.047	3.167	6.069	86.187	83.082	247.647	47.229	15.888	158.928	26.694	34.928	3.968	224.518	1.000	1.000	1.000	1.000	4.000	4.000
Free Cash Flow (ex sales of assets)	**(26.230)**	**360.495**	**9.885**	**315.876**	**(247.862)**	**16.010**	**99.928**	**(181.656)**	**7.302**	**(14.687)**	**42.137**	**33.090**	**68.813**	**(101.585)**	**(25.242)**	**43.431**	**18.063**	**(65.333)**	**88.037**
Free Cash Flow	**(71.277)**	**357.328**	**3.816**	**229.689**	**(330.944)**	**(221.519)**	**56.832**	**(198.297)**	**(151.626)**	**(41.381)**	**7.209**	**29.122**	**(156.676)**	**(102.585)**	**(26.242)**	**42.431**	**17.063**	**(69.333)**	**84.037**
FCF Conversion	-13%	151%	-1%	-735%	58%	-5%	-355%	40%	-24%	162%	582%	-313%	-161%	-1186%	-370%	809%	205%	-221%	130%
Operating Cash Flow Per Share	$2.56	$9.16	$1.70	$5.71	-$5.84	-$3.71	$1.83	-$3.22	-$2.33	-$0.56	$0.24	$0.51	-$2.10	-$1.47	-$0.29	$0.77	$0.38	-$0.61	$1.91
Free Cash Flow per Share	-$0.50	$7.07	$0.20	$6.41	-$5.01	$0.32	$1.98	-$3.39	$0.11	-$0.23	$0.65	$0.51	$1.06	-$1.57	-$0.39	$0.67	$0.28	-$1.01	$1.36

Source: Company filings and Truist Securities research and estimates

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Company Description

Triumph Group, Inc. (TGI) designs, develops, manufactures and repairs highly engineered aerostructures, aircraft components, sub-systems and systems. The company's products typically fall under one of a number of categories including airframe structures, components, geared products, electromechanical products, hydraulic products and systems, metal fabrication/machining/finishing, composite systems, controls & cables, thermal controls and assembly & integration services. TGI also performs maintenance, repair and overhaul (MRO) services. The business is operated under two main segments: Systems & Support (71% of F2022 sales) and Aerospace Structures (29%).

Investment Thesis

TGI remains in the midst of a complex and lengthy turnaround/restructuring, while debt/leverage levels remain high and consistent predictable cash generation has not yet been achieved. However, taking into consideration potential growth for commercial aero revenues, recent asset sales / program exits, and pension/financing initiatives, we believe TGI shares make for an attractive investment for patient, longer-term oriented value investors. We rate the shares BUY.

Valuation and Risks

Our $24 PT is equivalent to a multiple of approximately 23x applied to our fiscal year 2024 EPS estimate of $1.04, vs its five-year average of 15x and the sector peer average of 23x.

Risks to our rating and price target include ongoing production rate uncertainty surrounding the 737 MAX, 787, and A320, ability for management to continue to execute on strategic turnaround while divesting of non-core assets, and ability of management to successfully drive positive free cash while managing current debt load.

Companies Mentioned in This Note

Boeing Company (BA, NR)

Analyst Certification

I, Michael Ciarmoli , hereby certify that the views expressed in this research report accurately reflect my personal views about the subject company(ies) and its (their) securities. I also certify that I have not been, am not, and will not be receiving direct or indirect compensation in exchange for expressing the specific recommendation(s) in this report.

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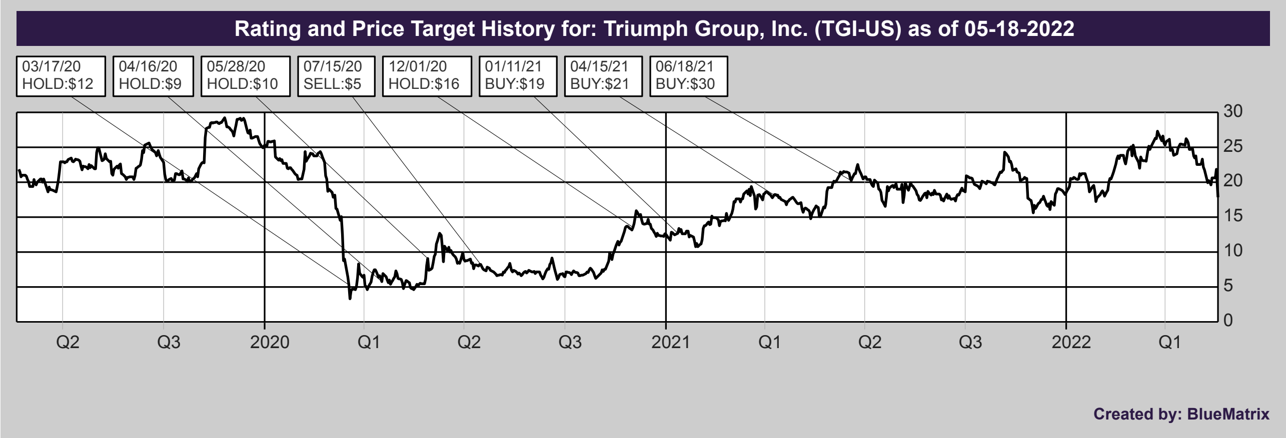

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Hold (H) – the stock's total return is expected to perform in line with the S&P 500 or relevant benchmark over the next 12-18 months (unless otherwise indicated)

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J.P.Morgan

North America Equity Research
11 February 2022

WW Grainger

4Q Call-Back Notes and Model Update

Neutral

GWW, GWW US

Price (10 Feb 22): $473.52

▲ **Price Target (Dec-22): $490.00**
Prior (Dec-22): $475.00

We provide a quick summary of post-4Q call-back notes and update our model to reflect results (click here for our initial take). Key takeaways were that (1) the softer-than-expected EA margin guide (7.5-8.2% vs 9% in '21) was driven by one-time distribution costs at MonotaRO for "relocation from Amagasaki DC to Inagawa DC," worth ~1% of its sales (~$20mm in costs). This results in the business showing flat profits in 2022, and correspondingly flat earnings from non-controlling interests, a partial offset below the line. We assume this reverses in 2023. For Zoro, the guide calls for "modest" margin expansion this year, which we believe indicates less than 50bps vs 4.6% in '21. Despite stronger GMs in 2H from focus on higher-quality growth, there is no change to targeted "HSD margins at Zoro within the next few years." (2) With January daily sales up 16% in US HTS, the year should start strong relative to the 7-10% guided for 2022, which embeds 0-2% market growth, 4-5% from price, and 300bps of share gains, while MonotaRO followed December growth of 20.5% with Jan up 17.6%, in line with full-year EA target for HT growth (Dec will also be reported as part of 1Q for GWW). For 1Q we assume organic daily sales grow 14% (13.5% HTS, 17% EA), from which normal seasonality brings us to 11% on the year (9.5% HTS, ~18% EA). (3) Recent sales strength has been driven by "lower touch" offerings (e-commerce is ~2/3 of HTS segment sales), with digital driving strong growth with mid-sized customers in particular, where revs are now ~$1.35 B vs ~$1.1 B in 2020 and $900mm in 2017 (vs $2 B in sales at its peak). It's also seeing strength in KeepStock with large customers, while branch sales are growing below the company average. (4) Gross margin benefited from positive price/cost in 4Q and the year (excluding the $118mm of pandemic-related inventory adjustments in 1H). On the flip side, freight was a headwind at 7% of sales vs the more normal 6%, and non-cash LIFO adjustment due to building inventory at higher costs was $49mm after-tax in 2021 (slightly less than half of this came in 4Q), up from $15mm and $24mm in 2020 and 2019, with no relief assumed for 2022. We believe GM progression this year could look like that in 2019, with an uptick in 1Q followed by sequential declines. (5) SG&A growth of ~9% at the midpoint of guide reflects increased marketing, wages, and healthcare costs, with T&E expenses also moving back to normal. The company continues to target SG&A growth longer term at half the rate of sales, but near-term investments and cost inflation make this difficult to achieve, with 2023 also potentially above target. And (6) "other" segment (Cromwell) is expected to have -6% margin in 2022, but guidance ranges imply something a bit more conservative than that given uncertainty around the UK economy. In the end, we come away raising estimates by ~3% at the op profit line, and our YE22 price target increases to $490 (from $475) as a result. We remain Neutral, as with positive revisions and the pullback in the stock it looks more reasonably valued vs recent history at a 0-5% discount to the market vs 5-10% premium before.

Electrical Equipment & Multi-Industry

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Key Changes (FYE Dec)

	Prev	Cur
Adj. EPS - 22E ($)	24.00	25.30
Adj. EPS - 23E ($)	26.25	27.65
Revenue - 22E ($ mn)	13,984	14,426
Revenue - 23E ($ mn)	14,876	15,334
Adj. EBITDA - 22E ($ mn)	2,008	2,058
Adj. EBITDA - 23E ($ mn)	2,143	2,203

Quarterly Forecasts (FYE Dec)

Adj. EPS ($)

	2021A	2022E	2023E
Q1	4.48	6.44	
Q2	4.25	6.62	
Q3	5.66	6.40	
Q4	5.44	5.84	
FY	19.82	25.30	27.65

Style Exposure

Quant Factors	Current %Rank	Hist %Rank (1=Top) 6M	1Y	3Y	5Y
Value	78	72	68	83	85
Growth	49	53	58	35	35
Momentum	33	49	75	43	59
Quality	5	15	21	9	9
Low Vol	7	11	12	61	15
ESGQ	3	1	1	20	2

Sources for: Style Exposure – J.P. Morgan Quantitative and Derivatives Strategy; all other tables are company data and J.P. Morgan estimates.

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Price Performance

	YTD	1m	3m	12m
Abs	-7.2%	-5.3%	-1.6%	25.8%
Rel	-1.7%	-1.8%	1.5%	10.7%

Company Data

Shares O/S (mn)	51
52-week range ($)	527.06-367.00
Market cap ($ mn)	24,338.93
Exchange rate	1.00
Free float(%)	84.6%
3M - Avg daily vol (mn)	0.25
3M - Avg daily val ($ mn)	126.5
Volatility (90 Day)	25
Index	S&P 500
BBG BUY|HOLD|SELL	6|9|3

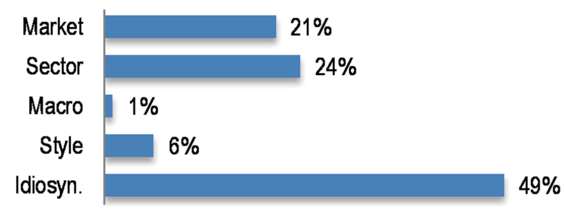
Key Metrics (FYE Dec)

$ in millions	FY21A	FY22E	FY23E
Financial Estimates			
Revenue	13,022	14,426	15,334
Adj. EBITDA	1,732	2,058	2,203
Adj. EBIT	1,547	1,883	2,033
Adj. net income	1,035	1,295	1,391
Adj. EPS	19.82	25.30	27.65
BBG EPS	19.61	24.27	27.22
Cashflow from operations	937	1,312	1,530
FCFF	682	1,012	1,205
Margins and Growth			
Revenue growth	10.4%	10.8%	6.3%
EBITDA margin	13.3%	14.3%	14.4%
EBITDA growth	14.8%	18.8%	7.0%
EBIT margin	11.9%	13.1%	13.3%
Net margin	7.9%	9.0%	9.1%
Adj. EPS growth	22.5%	27.7%	9.3%
Ratios			
Adj. tax rate	25.0%	24.5%	24.5%
Interest cover	19.9	23.4	25.0
Net debt/Equity	1.0	0.8	0.6
Net debt/EBITDA	1.2	1.0	0.9
ROCE	27.5%	32.3%	31.9%
ROE	56.2%	63.5%	56.9%
Valuation			
FCFF yield	2.8%	4.2%	5.1%
Dividend yield	1.4%	1.5%	1.5%
EV/Revenue	2.1	1.9	1.8
EV/EBITDA	15.9	13.4	12.4
Adj. P/E	23.9	18.7	17.1

Summary Investment Thesis and Valuation

GWW is the industry heavyweight in industrial distribution. It's hard to overstate the significant change that e-commerce has brought to the prior strategy. Whereas the "market expansion program" was the focus a decade ago, the size of the branch network is now down 40% from prior peak as more and more product is originated online. E-commerce comprises >50% of the total company vs 15% in '04, and new competitors such as Amazon have emerged and are making noise. The company faces increased risks on this front, first and foremost from price transparency, with "investment" in market relevant pricing required to maintain its leadership position. We see value in the shares if market outgrowth can sustain at targeted 300-400bps levels and/or margins return to historical peaks, though attaining both seems unlikely with share gains the priority in the near term, and execution on this front remains a TBD.

Performance Drivers



Factors	6M Corr	1Y Corr
Market: MSCI US	0.59	0.44
Sect: Industrials	0.37	0.55
Ind: Capital Goods	0.19	0.45
Macro:		
Non-Energy Commodity	0.13	0.28
US 10yr Breakeven	0.23	0.22
US 10yr yield	0.12	0.11
Quant Styles:		
Value	0.10	0.46
LowVol	0.25	0.33
Growth	-0.01	-0.33

Source: J.P. Morgan Quantitative and Derivatives Strategy for Performance Drivers; company data, Bloomberg Finance L.P. and J.P. Morgan estimates for all other tables. Note: Price history may not be complete or exact

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- **Model update: raise 2022/2023 estimates on higher sales.** We update our model following 4Q results, increasing our sales assumptions mostly to reflect higher expected price realization for 2022 in the HTS segment (now 4% vs 1% prior), with our margin forecast unchanged overall with an increase in HTS and a decrease in EA, part of which is offset below the line in lower NCI. Our EPS estimates are now $25.30/$27.65 for 2022/2023 (vs $24/$26.25 prior), also partly reflecting a lower tax rate. For 1Q, we estimate 13.8% organic ADS growth, with GMs at 38%, SG&A at $858mm, and 13.6% margins, resulting in EPS of $6.44 (vs Street ~$6). The table below has details on the changes.

Table 1: GWW Estimate Changes

In millions, except per share data

	2022E		2023E	
	Pre-4Q	Current	Pre-4Q	Current
Sales	$13,984	$14,426	$14,876	$15,334
y/y % chg	*7.8%*	*10.3%*	*6.4%*	*6.7%*
Gross profit	5,176	5,353	5,432	5,643
% of sales	*37.0%*	*37.1%*	*36.5%*	*36.8%*
SGA	3,343	3,469	3,459	3,610
% of sales	*23.9%*	*24.1%*	*23.3%*	*23.5%*
Op profit	1,833	1,883	1,973	2,033
% of sales	*13.1%*	*13.1%*	*13.3%*	*13.3%*
Incrementals	*28%*	*24%*	*16%*	*17%*
Net interest expense	88	88	88	88
Other expense (income)	(25)	(24)	(25)	(24)
Pretax	$1,770	$1,819	$1,910	$1,969
Tax	451	446	487	482
Rate	*25.5%*	*24.5%*	*25.5%*	*24.5%*
NI cont ops	$1,318	$1,373	$1,423	$1,487
NCI	84	71	99	88
FSP 03-6-1 adj	7	8	7	8
Net earnings, cont ops	$1,228	$1,295	$1,317	$1,391
Non-recurring, net of tax	0	0	0	0
Final Net Income	$1,139	$1,295	$1,246	$1,391
EPS, recurring	$24.00	$25.30	$26.25	$27.65
Non-recurring, net of tax	$0.00	$0.00	$0.00	$0.00
Net EPS (reported)	$24.00	$25.30	$26.25	$27.65
Shares	51	51	50	50
EBITDA	$2,008	$2,058	$2,143	$2,203
Segment Break				
HTS	$10,759	$11,197	$11,141	$11,594
EA	2955	2955	3458	3458
Other Businesses	269	274	277	282
Total revenue	$13,984	$14,426	$14,876	$15,334
HTS	$1,566	$1,662	$1,634	$1,735
EA	284	237	350	309
Other Businesses	(17)	(16)	(11)	(11)
Total segment profits	$1,833	$1,883	$1,973	$2,033
HTS	14.6%	14.8%	14.7%	15.0%
EA	9.6%	8.0%	10.1%	8.9%
Other Businesses	-6.3%	-5.8%	-4.0%	-3.9%
Total segment margins	13.1%	13.1%	13.3%	13.3%

Source: J.P. Morgan estimates.

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Investment Thesis, Valuation and Risks

WW Grainger Inc *(Neutral; Price Target: $490.00)*

Investment Thesis

GWW is the industry heavyweight in industrial distribution. It's hard to overstate the significant change that e-commerce has brought to the prior strategy. Whereas the "market expansion program" was the focus a decade ago, the size of the branch network is now down 40% from prior peak as more and more product is originated online. E-commerce comprises >50% of the total company vs 15% in '04, and new competitors such as Amazon have emerged and are making noise. The company faces increased risks on this front, first and foremost from price transparency, with "investment" in market relevant pricing required to maintain its leadership position. We see value in the shares if market outgrowth can sustain at targeted 300-400bps levels and/or margins return to historical peaks, though attaining both seems unlikely with share gains the priority in the near term, and execution on this front remains a TBD.

Valuation

Increase Dec-2022 PT to $490 (vs prior $475). On our 2023 EPS estimate, GWW shares trade at ~17x, a 10% discount to the group (ex-GE/ROP). Our Dec 2022 price target of $490 equates to ~17.7x our 2022E EPS, a ~10% discount to the group target multiple, vs a three-year average of a 5-10% discount. Our group target multiple was set to be at a 5-10% premium to the FY1 multiple for the S&P 500. Our price targets for the distributors remain centered around EV/EBITDA, with the target GWW multiple at ~12.4x, right around its average since the 2018 tax law change. This is ~10% below the average distributor target multiple vs a three-year average discount of around 5-10%.

Risks to Rating and Price Target

Upside risks include (1) stronger-than-expected economic recovery and market share gains, along with pandemic-related product sales growth sustained at stronger-than-expected levels, (2) margins stronger than expected, and (3) capital allocation (M&A/buybacks), including potential portfolio moves to unmask value of single-channel assets. Downside risks include (1) weaker-than-expected cyclical momentum, with fading market share gains, (2) margins worse than expected, and (3) large-scale M&A transactions that detract from the organic growth/share gain/capital returns story.

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WW Grainger: Summary of Financials

Income Statement - Annual	FY20A	FY21A	FY22E	FY23E	FY24E
Revenue	**11,797**	**13,022**	**14,426**	**15,334**	**-**
COGS	(7,559)	(8,302)	(9,073)	(9,690)	-
Gross profit	**4,238**	**4,720**	**5,353**	**5,643**	**-**
SG&A	(2,911)	(3,173)	(3,469)	(3,610)	-
Adj. EBITDA	**1,509**	**1,732**	**2,058**	**2,203**	**-**
D&A	(182)	(185)	(175)	(170)	-
Adj. EBIT	**1,327**	**1,547**	**1,883**	**2,033**	**-**
Net Interest	(93)	(87)	(88)	(88)	-
Adj. PBT	**1,255**	**1,485**	**1,819**	**1,969**	**-**
Tax	(319)	(371)	(446)	(482)	-
Minority Interest	(60)	(71)	(71)	(88)	-
Adj. Net Income	**869**	**1,035**	**1,295**	**1,391**	**-**
Reported EPS	12.79	19.82	25.30	27.65	-
Adj. EPS	**16.17**	**19.82**	**25.30**	**27.65**	**-**
DPS	**6.29**	**6.83**	**6.87**	**7.28**	**-**
Payout ratio	49.1%	34.5%	27.1%	26.3%	-
Shares outstanding	54	52	51	50	-

Income Statement - Quarterly	1Q22E	2Q22E	3Q22E	4Q22E
Revenue	**3,525**	**3,631**	**3,703**	**3,568**
COGS	(2,185)	(2,271)	(2,359)	(2,258)
Gross profit	**1,339**	**1,360**	**1,344**	**1,309**
SG&A	(858)	(868)	(869)	(874)
Adj. EBITDA	**525**	**535**	**519**	**479**
D&A	(44)	(44)	(44)	(44)
Adj. EBIT	**481**	**492**	**475**	**436**
Net Interest	(22)	(22)	(22)	(22)
Adj. PBT	**465**	**476**	**459**	**420**
Tax	(114)	(117)	(112)	(103)
Minority Interest	(17)	(18)	(18)	(18)
Adj. Net Income	**332**	**339**	**327**	**297**
Reported EPS	6.44	6.62	6.40	5.84
Adj. EPS	**6.44**	**6.62**	**6.40**	**5.84**
DPS	**1.72**	**1.72**	**1.72**	**1.72**
Payout ratio	26.7%	26.0%	26.8%	29.4%
Shares outstanding	51	51	51	51

Balance Sheet & Cash Flow Statement	FY20A	FY21A	FY22E	FY23E	FY24E
Cash and cash equivalents	585	241	271	480	-
Accounts receivable	1,474	1,754	1,917	2,014	-
Inventories	1,733	1,870	2,016	2,121	-
Other current assets	127	146	195	229	-
Current assets	**3,919**	**4,011**	**4,399**	**4,844**	**-**
PP&E	1,395	1,424	1,524	1,644	-
LT investments	-	-	-	-	-
Other non current assets	981	1,157	1,162	1,177	-
Total assets	**6,295**	**6,592**	**7,085**	**7,665**	**-**
Short term borrowings	8	0	0	0	-
Payables	779	816	884	930	-
Other short term liabilities	654	712	730	758	-
Current liabilities	**1,441**	**1,528**	**1,614**	**1,688**	**-**
Long-term debt	2,389	2,362	2,362	2,362	-
Other long term liabilities	372	542	533	523	-
Total liabilities	**4,202**	**4,432**	**4,509**	**4,573**	**-**
Shareholders' equity	1,828	1,857	2,219	2,669	-
Minority interests	265	304	357	423	-
Total liabilities & equity	**6,295**	**6,592**	**7,085**	**7,665**	**-**
BVPS	**34.17**	**35.75**	**43.63**	**53.38**	**-**
y/y Growth	*0.7%*	*4.6%*	*22.0%*	*22.4%*	-
Net debt/(cash)	1,812	2,121	2,091	1,882	-
Cash flow from operating activities	**1,123**	**937**	**1,312**	**1,530**	**-**
o/w Depreciation & amortization	182	185	175	170	-
o/w Changes in working capital	(170)	(443)	(272)	(162)	-
Cash flow from investing activities	**(179)**	**(226)**	**(280)**	**(305)**	**-**
o/w Capital expenditure	(197)	(255)	(300)	(325)	-
as % of sales	*1.7%*	*2.0%*	*2.1%*	*2.1%*	-
Cash flow from financing activities	**(726)**	**(1,039)**	**(1,001)**	**(1,016)**	**-**
o/w Dividends paid	(338)	(357)	(351)	(366)	-
o/w Net debt issued/(repaid)	161	(8)	0	0	-
Net change in cash	**225**	**(344)**	**30**	**208**	**-**
Adj. Free cash flow to firm	**926**	**682**	**1,012**	**1,205**	**-**
y/y Growth	*12.5%*	*(26.3%)*	*48.3%*	*19.1%*	-

Ratio Analysis	FY20A	FY21A	FY22E	FY23E	FY24E
Gross margin	35.9%	36.2%	37.1%	36.8%	-
EBITDA margin	12.8%	13.3%	14.3%	14.4%	-
EBIT margin	11.2%	11.9%	13.1%	13.3%	-
Net profit margin	7.4%	7.9%	9.0%	9.1%	-
ROE	47.2%	56.2%	63.5%	56.9%	-
ROA	14.1%	16.1%	18.9%	18.9%	-
ROCE	23.9%	27.5%	32.3%	31.9%	-
SG&A/Sales	24.7%	24.4%	24.1%	23.5%	-
Net debt/equity	0.9	1.0	0.8	0.6	-
P/E (x)	29.3	23.9	18.7	17.1	-
P/BV (x)	13.9	13.2	10.9	8.9	-
EV/EBITDA (x)	18.0	15.9	13.4	12.4	-
Dividend Yield	1.3%	1.4%	1.5%	1.5%	-
Sales/Assets (x)	1.9	2.0	2.1	2.1	-
Interest cover (x)	16.2	19.9	23.4	25.0	-
Operating leverage	(162.3%)	159.7%	201.5%	126.5%	-
Revenue y/y Growth	2.7%	10.4%	10.8%	6.3%	-
EBITDA y/y Growth	(6.7%)	14.8%	18.8%	7.0%	-
Tax rate	25.4%	25.0%	24.5%	24.5%	-
Adj. Net Income y/y Growth	(8.6%)	19.1%	25.1%	7.4%	-
EPS y/y Growth	(6.6%)	22.5%	27.7%	9.3%	-
DPS y/y Growth	5.3%	8.7%	0.5%	6.0%	-

Source: Company reports and J.P. Morgan estimates.
Note: $ in millions (except per-share data).Fiscal year ends Dec. o/w - out of which

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WW Grainger (GWW, GWW US) Price Chart

Date	Rating	Price ($)	Price Target ($)
22-Apr-19	N	308.18	303
24-Jul-19	N	278.78	297
10-Oct-19	N	283.99	301
11-Dec-19	N	323.57	340
30-Jan-20	N	327.49	335
31-Mar-20	N	255.14	274
07-Apr-20	N	251.18	270
23-Jun-20	N	303.19	291
13-Jul-20	N	311.02	298
24-Jul-20	N	338.66	310
07-Oct-20	N	367.71	362
10-May-21	N	465.64	400
10-Sep-21	N	416.54	403
04-Oct-21	N	398.25	447
05-Nov-21	N	479.83	475

Source: Bloomberg Finance L.P. and J.P. Morgan; price data adjusted for stock splits and dividends.
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EQUITY RESEARCH

COMPANY UPDATE

March 15, 2022

INDUSTRIAL/CAPITAL GOODS/INDUSTRIAL MULTI-INDUSTRY

W.W. Grainger, Inc.

Strategic Levers Align Well

Stock Rating:

OUTPERFORM

12-18 mo. Price Target	$580.00
GWW - NYSE	$497.75
3-5 Yr. EPS Gr. Rate	13%
52-Wk Range	$527.06-$387.60
Shares Outstanding	51.1M
Float	45.3M
Market Capitalization	$24,705.6M
Avg. Daily Trading Volume	287,816
Dividend/Div Yield	$6.48/1.30%
Book Value	$41.78
Fiscal Year Ends	Dec
2022E ROE	52.7%
LT Debt	$2,362.0M
Preferred	NA
Common Equity	$2,160M
Convertible Available	No

EPS Diluted	Q1	Q2	Q3	Q4	Year	Mult.
2020A	4.24	3.75	4.52	3.66	16.18	30.8x
2021A	4.48	4.27	5.65	5.44	19.84	25.1x
2022E	6.26	6.23	6.14	5.88	24.50	20.3x
2023E	--	--	--	--	27.80	17.9x

SUMMARY

We continue to favor shares for GWW's strategic operating momentum, reinforced by short-cycle dynamics. GWW's revenue linearity outperformed normal seasonality throughout 2021, delivering 12% organic growth vs. +4%/2020 pandemic year comparison, with HTS-US 4Q daily sales up 17% vs. ~10–11% market growth (GWW market estimate includes price). Strained global supply chains cultivate tailwind, with GWW's procurement excellence including scale/priority position and broad supplier base affording nimbleness and demand fulfillment; this dynamic was evident with 2020 pandemic product sales +54% to $2.4B and 2021 HTS organic sales +10.8% despite ~$350M lower pandemic product sales. GWW's consistent outperformance through the market/macro transitions supports view that differentiated supply-chain/procurement wherewithal enables accelerated customer acquisition with stickiness. More recent/current shipping-related disruptions could inure further to GWW's competitive strengths.

KEY POINTS

- GWW anticipates 3–4% long-term HTS-US market outgrowth (4.5% average outgrowth in 2020-21), with ~3%/2022E (anticipates some incremental pandemic product volume attenuation). Strategic enablers include sustained IT investment (product information & search; digitizing customer experience/interface, technical support, inventory management solutions), re-merchandising ($4.4B of product to date; +$1.5B/'21), and inventory solutions (60% of US revenue from customers with at least one solution, like KeepStock).
- Pricing and cost management were effective in 2021 with HTS realizing 5% price in 4Q (3%/3Q, 2%/1H), supporting strong margin expansion read-through in 2H21 from volume leverage and normalizing mix (from mix dilutive pandemic product); 1H21 HTS OM included $118M pandemic product write-down costs (GWW had no earnings adjustments in 2021).
- Business model focus and range of customer acquisition/retention drivers support our long-term thesis, with the leading position in the fragmented facilities MRO sector, but at just ~7% total NA market share. Supportive short cycle factors include IP/CU at cycle highs, re-accelerating in January, favorable February ISM (58.6 vs. 57.6/January), extra 1Q22 selling day.
- Medium-sized customer penetration indicates an ongoing successful initiative, with $1.4B sales, rebuilding from well <$1B at time of 2017 strategic list price reset (was $2B 10 years ago before pricing overreach in this sector estranged the market). Medium customer sales rose 25% in 4Q21 (vs. +6% compare) and GWW targets 5–6% share over time (estimates nearing 3% presently).
- Endless Assortment's simple transactional model continues to drive HT% growth profile: registered users +16% to 13M in 2021; 8.7M Zoro-US SKUs/+2.6M; ~20M Japan/MonotaRO SKUs.

Stock Price Performance

Company Description

W.W. Grainger, Inc. is a leading supplier of facilities maintenance products in North America.

UCC-189

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For analyst certification and important disclosures, see the Disclosure Appendix.

WESCO_UCC00003340

5-YEAR PRICE PERFORMANCE

Source: Bloomberg

INVESTMENT THESIS

Our Outperform rating reflects our view that GWW has solid leverage to economic normalization, including currently picking up new customers at a solid clip (inventory availability and shift to digital procurement). We think the strength of GWW's digital platforms will ultimately gain potency through the current environment.

BASE CASE ASSUMPTION

- GM mix headwinds related to pandemic customers/products
- Long-term runway around eCommerce and virtualization of supply chains

CATALYSTS

- Demand response outperforms
- Canada profitability recovery
- Macroeconomic inflation; new price accelerates

UPSIDE SCENARIO

- Accelerating stabilization in Canada profitability
- GM expands meaningfully on mix and net new price and volume
- Exceeding share gain targets

DOWNSIDE SCENARIO

- Commoditization of distribution space
- Gross margin expansion fails to materialize

PRICE TARGET CALCULATION

Our price target of $580 assumes a target multiple of ~21x '23E vs. current ~20x our '22E, and supported by structural business model girth and elegance to drive long-term customer acquisition/retention. Our price target implies upside potential of approximately 18%, including a 1.3% dividend yield.

KEY RISKS TO PRICE TARGET

Key risks to our price target include: 1) coronavirus dynamic; 2) commoditization of the distribution space; 3) gross margin expansion fails to materialize; and 4) instability in the overall economy.

ESG CONSIDERATIONS *

ESG Rating	B+
ESG Rating Environment	A-
ESG Rating Social	A-
ESG Rating Governance	B

*Environmental/Social/Governance (ESG) scores are courtesy of Refinitiv's ESG product which are designed to transparently and objectively measure a company's relative ESG performance, commitment and effectiveness, based on company-reported data. Refinitiv's ESG ratings are independent of Oppenheimer's stock ratings and are not taken into consideration when assigning a rating. For full details about Refinitiv's ESG scores, please click here

W.W. Grainger, Inc.

Annual Sales and Profits by Segment, 2016-2023E

Christopher Glynn

($ millions)

Segment Revenues	2016	2017	2018	2019	2020	2021	2022E	2023E
High-Touch Solutions (N.A.)			$8,985	$9,036	$9,221	$10,186	$11,052	$11,715
Endless Assortment			1,541	1,836	2,178	2,576	2,937	3,436
Other			695	614	398	260	273	273
Total Segment Revenues	**$10,137**	**$10,425**	**$11,221**	**$11,486**	**$11,797**	**$13,022**	**$14,261**	**$15,424**
Y-O-Y Change	1.6%	2.8%	7.6%	2.4%	2.7%	10.4%	9.5%	8.2%
Segment Profits								
High-Touch Solutions (N.A.)			1,211	1,282	1,200	1,334	1,625	1,757
Endless Assortment			139	122	175	232	229	308
Other			(6)	(16)	(48)	(19)	(8)	-
Segment Profits	**$1,267**	**$1,147**	**$1,344**	**$1,388**	**$1,327**	**$1,547**	**$1,845**	**$2,065**
Y-O-Y Change	(5.9%)	(9.5%)	17.2%	3.3%	(4.4%)	16.6%	19.3%	11.9%
OM	12.5%	11.0%	12.0%	12.1%	11.2%	11.9%	12.9%	13.4%
Adjustments to EBT:								
Interest Expense (Income), net	66	84	82	79	93	87	88	80
Other Costs (Income), net	35	15	(5)	(26)	(21)	(25)	(20)	(17)
EBT	**$1,166**	**$1,047**	**$1,267**	**$1,335**	**$1,255**	**$1,485**	**$1,777**	**$2,002**
Taxes	428	341	275	331	319	371	435	500
Tax Rate	36.7%	32.5%	21.7%	24.8%	25.4%	25.0%	24.5%	25.0%
Net Income	**$738**	**$706**	**$992**	**$1,004**	**$936**	**$1,114**	**$1,342**	**$1,501**
Net Margin	7.3%	6.8%	8.8%	8.7%	7.9%	8.6%	9.4%	9.7%
Minority Stake	(27)	(37)	(41)	(46)	(60)	(71)	(82)	(98)
Undistributed Earnings	(5)	(5)	(6)	(8)	(6)	(8)	(8)	(8)
Continuing Ops Net Income	**$706**	**$665**	**$945**	**$950**	**$870**	**$1,035**	**$1,252**	**$1,395**
Extraordinary Items	(105)	(84)	(169)	(110)	(181)	-	-	-
Net Income as Reported	**$601**	**$581**	**$776**	**$840**	**$689**	**$1,035**	**$1,252**	**$1,395**
Continuing Ops EPS	**$11.58**	**$11.46**	**$16.70**	**$17.29**	**$16.18**	**$19.84**	**$24.50**	**$27.80**
EPS Growth	(2.9%)	(1.0%)	45.7%	3.6%	(6.4%)	22.6%	23.5%	13.4%
Reported Diluted EPS	**$9.87**	**$10.02**	**$13.73**	**$15.32**	**$12.82**	**$19.84**	**$24.50**	**$27.80**
	(14.8%)	1.5%	37.0%	11.6%	(16.3%)	54.7%	23.5%	13.4%
Diluted Shares Outstanding	60.8	58.0	56.5	54.9	53.7	52.2	51.1	50.2

Source: Company Reports; Oppenheimer & Co. Estimates

W.W. Grainger, Inc.
Quarterly Sales and Profits by Segment, 2021-2022E

Christopher Glynn

($ millions)

	2021					2022				
Segment Revenues	**1Q21**	**2Q21**	**3Q21**	**4Q21**	**2021**	**1Q22E**	**2Q22E**	**3Q22E**	**4Q22E**	**2022E**
High-Touch Solutions (N.A.)	$2,397	$2,498	$2,663	$2,628	$10,186	$2,709	$2,773	$2,809	$2,761	$11,052
Endless Assortment	622	645	646	663	2,576	690	722	749	774	2,937
Other	65	64	63	68	260	68	68	68	69	273
Total Segment Revenues	**$3,084**	**$3,207**	**$3,372**	**$3,359**	**$13,022**	**$3,467**	**$3,563**	**$3,627**	**$3,604**	**$14,261**
Y-O-Y Revenue Change	2.8%	13.0%	11.7%	14.2%	10.4%	12.4%	11.1%	7.6%	7.3%	9.5%
Segment Profits										
High-Touch Solutions (N.A.)	306	282	387	359	1,334	420	416	407	381	1,625
Endless Assortment	55	58	59	60	232	55	54	56	63	229
Other	(3)	(6)	(8)	(2)	(19)	(5)	(3)	(1)	1	(8)
Segment Profits	**$358**	**$334**	**$438**	**$417**	**$1,547**	**$470**	**$467**	**$462**	**$446**	**$1,845**
Y-O-Y Profit Change	4.4%	6.0%	17.1%	41.4%	16.6%	31.4%	39.9%	5.5%	6.9%	19.3%
Adjustments to EBT:										
Interest Expense (Income), net	21.0	22.0	22.0	22.0	87.0	22.0	22.0	22.0	22.0	88.0
Other Costs (Income), net	(6.0)	(7.0)	(6.0)	(6.0)	(25.0)	(5.0)	(5.0)	(5.0)	(5.0)	(20.0)
EBT	**$343**	**$319**	**$422**	**$401**	**$1,485**	**$453**	**$450**	**$445**	**$429**	**$1,777**
Taxes	88	76	107	100	371	111	110	109	105	435
Tax Rate	25.7%	23.8%	25.4%	24.9%	25.0%	24.5%	24.5%	24.5%	24.5%	24.5%
Net Income	**$255**	**$243**	**$315**	**$301**	**$1,114**	**$342**	**$340**	**$336**	**$324**	**$1,342**
Net Margin										
Minority Stake	(17)	(18)	(18)	(18)	(71)	(18)	(20)	(21)	(23)	(82)
Undistributed Earnings	(2)	(2)	(2)	(2)	(8)	(2)	(2)	(2)	(2)	(8)
Continuing Ops Net Income	**$236**	**$223**	**$295**	**$281**	**$1,035**	**$322**	**$318**	**$313**	**$299**	**$1,252**
Extraordinary Items	-	-	-	-	-	-	-	-	-	-
Net Income as Reported	**$236**	**$223**	**$295**	**$281**	**$1,035**	**$322**	**$318**	**$313**	**$299**	**$1,252**
Continuing Ops EPS	**$4.48**	**$4.27**	**$5.65**	**$5.44**	**$19.84**	**$6.26**	**$6.23**	**$6.14**	**$5.88**	**$24.50**
EPS Growth	5.8%	13.7%	25.0%	48.6%	22.6%	39.8%	46.0%	8.6%	8.1%	23.5%
Reported Diluted EPS	**$4.48**	**$4.27**	**$5.65**	**$5.44**	**$19.84**	**$6.26**	**$6.23**	**$6.14**	**$5.88**	**$24.50**
EPS Growth	40.6%	102.8%	28.2%	74.4%	54.7%	39.8%	46.0%	8.6%	8.1%	23.5%
Diluted Shares Outstanding	52.6	52.5	52.1	51.7	52.2	51.4	51.2	51.0	50.8	51.1

Source: Company Reports; Oppenheimer & Co. Estimates

W.W. Grainger, Inc.

Analysis of Operations, 2016-2023E

Christopher Glynn

						2021					2022					
Revenue Growth	**2016**	**2017**	**2018**	**2019**	**2020**	**1Q21**	**2Q21**	**3Q21**	**4Q21**	**2021**	**1Q22E**	**2Q22E**	**3Q22E**	**4Q22E**	**2022E**	**2023E**
High-Touch Solutions (N.A.)				0.6%	2.0%	1.8%	13.7%	12.0%	14.7%	10.5%	13.0%	11.0%	5.5%	5.1%	8.5%	6.0%
Endless Assortment				19.1%	18.6%	25.4%	22.9%	12.9%	13.3%	18.3%	11.0%	12.0%	16.0%	16.8%	14.0%	17.0%
Other				(11.7%)	(35.2%)	(56.7%)	(44.3%)	(8.7%)	6.3%	(34.7%)	5.0%	6.0%	8.0%	1.3%	5.0%	0.0%
Total Revenue Growth	1.6%	2.8%	7.6%	2.4%	2.7%	2.8%	13.0%	11.7%	14.2%	10.4%	12.4%	11.1%	7.6%	7.3%	9.5%	8.2%
Segment % of Revenue	**2016**	**2017**	**2018**	**2019**	**2020**	**1Q21**	**2Q21**	**3Q21**	**4Q21**	**2021**	**1Q22E**	**2Q22E**	**3Q22E**	**4Q22E**	**2022E**	**2023E**
High-Touch Solutions (N.A.)			80.1%	78.7%	78.2%	77.7%	77.9%	79.0%	78.2%	78.2%	78.1%	77.8%	77.5%	76.6%	77.5%	76.0%
Endless Assortment			13.7%	16.0%	18.5%	20.2%	20.1%	19.2%	19.7%	19.8%	19.9%	20.3%	20.7%	21.5%	20.6%	22.3%
Other			6.2%	5.3%	3.4%	2.1%	2.0%	1.9%	2.0%	2.0%	2.0%	1.9%	1.9%	1.9%	1.9%	1.8%
Operating Margins	**2016**	**2017**	**2018**	**2019**	**2020**	**1Q21**	**2Q21**	**3Q21**	**4Q21**	**2021**	**1Q22E**	**2Q22E**	**3Q22E**	**4Q22E**	**2022E**	**2023E**
High-Touch Solutions (N.A.)			13.5%	14.2%	13.0%	12.8%	11.3%	14.5%	13.7%	13.1%	15.5%	15.0%	14.5%	13.8%	14.7%	15.0%
Endless Assortment			9.0%	6.6%	8.0%	8.8%	9.0%	9.1%	9.0%	9.0%	8.0%	7.5%	7.5%	8.2%	7.8%	9.0%
Other			(0.9%)	(2.6%)	(12.1%)	(4.6%)	(9.4%)	(12.7%)	(2.9%)	(7.3%)	(7.0%)	(4.0%)	(2.0%)	1.0%	(3.0%)	0.0%
Consolidated O.M.	13.7%	12.3%	12.0%	12.1%	11.2%	11.6%	10.4%	13.0%	12.4%	11.9%	13.6%	13.1%	12.7%	12.4%	12.9%	13.4%
Operating Profit Growth	**2016**	**2017**	**2018**	**2019**	**2020**	**1Q21**	**2Q21**	**3Q21**	**4Q21**	**2021**	**1Q22E**	**2Q22E**	**3Q22E**	**4Q22E**	**2022E**	**2023E**
High-Touch Solutions (N.A.)				5.9%	(6.4%)	(4.7%)	(1.4%)	16.2%	38.1%	11.2%	37.2%	47.5%	5.3%	6.3%	21.8%	8.2%
Endless Assortment				(12.2%)	43.4%	57.1%	38.1%	22.9%	20.0%	32.6%	0.4%	(6.6%)	(4.7%)	5.7%	(1.3%)	34.3%
Other				NM	NM	NM	NM	14.3%	(86.7%)	(60.4%)	59.3%	(54.8%)	(83.0%)	(133.1%)	(56.9%)	(100.0%)
Total Operating Profit Growth	(5.9%)	(9.5%)	17.2%	3.3%	(4.4%)	4.4%	6.0%	17.1%	41.4%	16.6%	31.4%	39.9%	5.5%	6.9%	19.3%	11.9%
Segment % of Profit	**2016**	**2017**	**2018**	**2019**	**2020**	**1Q21**	**2Q21**	**3Q21**	**4Q21**	**2021**	**1Q22E**	**2Q22E**	**3Q22E**	**4Q22E**	**2022E**	**2023E**
High-Touch Solutions (N.A.)			90.1%	92.4%	90.4%	85.5%	84.4%	88.4%	86.1%	86.2%	89.3%	89.0%	88.1%	85.6%	88.0%	85.1%
Endless Assortment			10.3%	8.8%	13.2%	15.4%	17.4%	13.5%	14.4%	15.0%	11.7%	11.6%	12.2%	14.2%	12.4%	14.9%
Other			(0.4%)	(1.2%)	(3.6%)	(0.8%)	(1.8%)	(1.8%)	(0.5%)	(1.2%)	(1.0%)	(0.6%)	(0.3%)	0.1%	(0.4%)	0.0%
Total Segments % of Profit	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Incremental Margins	**2016**	**2017**	**2018**	**2019**	**2020**	**1Q21**	**2Q21**	**3Q21**	**4Q21**	**2021**	**1Q22E**	**2Q22E**	**3Q22E**	**4Q22E**	**2022E**	**2023E**
High-Touch Solutions (N.A.)				139.2%	(44.3%)	(35.7%)	(1.3%)	18.9%	29.5%	13.9%	36.5%	48.7%	13.9%	16.9%	33.6%	20.0%
Endless Assortment				(5.8%)	15.5%	15.9%	13.3%	14.9%	12.8%	14.3%	0.3%	(4.9%)	(2.7%)	3.1%	(0.8%)	15.7%
Other				12.3%	14.8%	(11.8%)	(13.7%)	16.7%	325.0%	(21.0%)	(54.7%)	85.6%	131.7%	306.0%	83.2%	NM
Total Incremental Margins	(67.0%)	(37.6%)	8.0%	16.6%	(19.6%)	18.1%	5.1%	18.1%	29.2%	18.0%	29.3%	37.5%	9.5%	11.7%	24.1%	18.9%

Source: Company Reports; Oppenheimer & Co. Estimates

W.W. Grainger, Inc.

Consolidated Annual Income Statement 2016-2023E

Christopher Glynn

For the years ended December 31 ($ in millions)

	2016	2017	2018	2019	2020	2021	2022E	2023E
Net Sales	$10,137	$10,425	$11,221	$11,486	$11,797	$13,022	$14,261	$15,424
Revenue Growth	1.6%	2.8%	7.6%	2.4%	2.7%	10.4%	9.5%	8.2%
Cost of Goods Sold	6,013	6,314	6,873	7,089	7,559	8,302	8,977	9,672
Gross Income	$4,124	$4,111	$4,348	$4,397	$4,238	$4,720	$5,285	$5,752
Gross Margin	40.7%	39.4%	38.7%	38.3%	35.9%	36.2%	37.1%	37.3%
Selling, General & Admin Expense	2,858	2,965	3,004	3,009	2,911	3,173	3,439	3,687
Operating Profit	**$1,267**	**$1,147**	**$1,344**	**$1,388**	**$1,327**	**$1,547**	**$1,845**	**$2,065**
Y-O-Y Change	(5.9%)	(9.5%)	17.2%	3.3%	(4.4%)	16.6%	19.3%	11.9%
Operating Margin	12.5%	11.0%	12.0%	12.1%	11.2%	11.9%	12.9%	13.4%
Net Interest Expense (Income)	66	84	82	79	93	87	88	80
Other Costs (Income)	35	15	(5)	(26)	(21)	(25)	(20)	(17)
Pretax Income	**$1,166**	**$1,047**	**$1,267**	**$1,335**	**$1,255**	**$1,485**	**$1,777**	**$2,002**
Total Income Taxes	428	341	275	331	319	371	435	500
Income Tax Rate	36.7%	32.5%	21.7%	24.8%	25.4%	25.0%	24.5%	25.0%
Net Income	**$738**	**$706**	**$992**	**$1,004**	**$936**	**$1,114**	**$1,342**	**$1,501**
Minority Stake	(27)	(37)	(41)	(46)	(60)	(71)	(82)	(98)
Undistributed Earnings	(5)	(5)	(6)	(8)	(6)	(8)	(8)	(8)
Continuing Ops Net Income	**$706**	**$665**	**$945**	**$950**	**$870**	**$1,035**	**$1,252**	**$1,395**
Extraordinary Items	(105)	(84)	(169)	(110)	(181)	-	-	-
Net Income as Reported	**$601**	**$581**	**$776**	**$840**	**$689**	**$1,035**	**$1,252**	**$1,395**
Continuing Ops EPS	**$11.58**	**$11.46**	**$16.70**	**$17.29**	**$16.18**	**$19.84**	**$24.50**	**$27.80**
EPS Growth	(2.9%)	(1.0%)	45.7%	3.6%	(6.4%)	22.6%	23.5%	13.4%
Reported Diluted EPS	**$9.87**	**$10.02**	**$13.73**	**$15.32**	**$12.82**	**$19.84**	**$24.50**	**$27.80**
Basic EPS from Continuing Operations	$12.21	$12.39	$17.86	$18.62	$17.75	$21.76	$26.79	$30.51
Dividends per Share	**$4.83**	**$5.06**	**$5.36**	**$5.68**	**$5.94**	**$6.39**	**$6.71**	**$7.04**
Payout Ratio	41.7%	44.1%	32.1%	32.8%	36.7%	32.2%	27.4%	25.3%
Diluted Share Outstanding	60.8	58.0	56.5	54.9	53.7	52.2	51.1	50.2

Source: Company Reports; Oppenheimer & Co. Estimates

W.W. Grainger, Inc.
Consolidated Quarterly Income Statement, 2021-2022E

Christopher Glynn

($ millions)

	2021					2022				
	1Q21	2Q21	3Q21	4Q21	2021	1Q22E	2Q22E	3Q22E	4Q22E	2022E
Net Sales	$3,084	$3,207	$3,372	$3,359	$13,022	$3,467	$3,563	$3,627	$3,604	$14,261
Revenue Growth	2.8%	13.0%	11.7%	14.2%	10.4%	12.4%	11.1%	7.6%	7.3%	9.5%
Cost of sales	1,991	2,083	2,122	2,106	8,302	2,152	2,238	2,298	2,289	8,977
Gross Income	$1,093	$1,124	$1,250	$1,253	$4,720	$1,315	$1,325	$1,329	$1,315	$5,285
Gross Margin	35.4%	35.0%	37.1%	37.3%	36.2%	37.9%	37.2%	36.7%	36.5%	37.1%
Selling, General & Admin Expense	735	790	812	836	3,173	845	857	867	869	3,439
Operating Profit	**$358**	**$334**	**$438**	**$417**	**$1,547**	**$470**	**$467**	**$462**	**$446**	**$1,845**
Y-O-Y Change	4.4%	6.0%	17.1%	41.4%	16.6%	31.4%	39.9%	5.5%	6.9%	19.3%
Operating Margin	11.6%	10.4%	13.0%	12.4%	11.9%	13.6%	13.1%	12.7%	12.4%	12.9%
Interest Expense (Income), net	21.0	22.0	22.0	22.0	87.0	22.0	22.0	22.0	22.0	88.0
Other costs (Income), net	(6.0)	(7.0)	(6.0)	(6.0)	(25)	(5.0)	(5.0)	(5.0)	(5.0)	(20)
Pretax Income	**$343**	**$319**	**$422**	**$401**	**$1,485**	**$453**	**$450**	**$445**	**$429**	**$1,777**
Income taxes	88	76	107	100	371	111	110	109	105	435
Income Tax Rate	25.7%	23.8%	25.4%	24.9%	25.0%	24.5%	24.5%	24.5%	24.5%	24.5%
Net Income	**$255**	**$243**	**$315**	**$301**	**$1,114**	**$342**	**$340**	**$336**	**$324**	**$1,342**
Net Margin	8.3%	7.6%	9.3%	9.0%	8.6%	9.9%	9.5%	9.3%	9.0%	9.4%
Minority Stake	(17.0)	(18.0)	(18.0)	(18.0)	(71.0)	(18.0)	(20.0)	(21.0)	(23.0)	(82.0)
Undistributed Earnings	(2.0)	(2.0)	(2.0)	(2.0)	(8.0)	(2.0)	(2.0)	(2.0)	(2.0)	(8.0)
Continuing Ops Net Income	**$236**	**$223**	**$295**	**$281**	**$1,035**	**$322**	**$318**	**$313**	**$299**	**$1,252**
Non-recurring charges (after-tax)/ (Gain)	-	-	-	-	-	-	-	-	-	-
Net Income as Reported	**$236**	**$223**	**$295**	**$281**	**$1,035**	**$322**	**$318**	**$313**	**$299**	**$1,252**
Continuing Ops EPS	**$4.48**	**$4.27**	**$5.65**	**$5.44**	**$19.84**	**$6.27**	**$6.21**	**$6.14**	**$5.88**	**$24.50**
EPS Growth	5.8%	13.7%	25.0%	48.6%	22.6%	39.9%	45.6%	8.6%	8.1%	23.5%
Reported Diluted EPS	**$4.48**	**$4.27**	**$5.65**	**$5.44**	**$19.84**	**$6.27**	**$6.21**	**$6.14**	**$5.88**	**$24.50**
Dividends per Share	**$1.53**	**$1.62**	**$1.62**	**$1.62**	**$6.39**	**$1.68**	**$1.68**	**$1.68**	**$1.68**	**$6.71**
Payout Ratio	34.1%	38.0%	28.7%	29.8%	32.2%	26.8%	27.0%	27.3%	28.5%	27.4%
Shares Outstanding (Mil.) Diluted	52.6	52.5	52.1	51.7	52.2	51.4	51.2	51.0	50.8	51.1

Source: Company Reports; Oppenheimer & Co. Estimates

W.W. Grainger, Inc.

Consolidated Balance Sheet, 2016-2023E

Christopher Glynn

For the years ended December 31 ($ in millions)

	2016	2017	2018	2019	2020	2021	2022E	2023E
Assets								
Cash & Cash Equivalents	$274	$327	$538	$360	$585	$241	$241	$241
Accounts Receivable	1,223	1,325	1,385	1,425	1,474	1,754	1,927	1,977
Inventories	1,406	1,429	1,541	1,655	1,733	1,870	2,040	2,126
Deferred Income Taxes							-	-
Prepaid Expenses & Other Assets	117	125	93	115	127	146	156	166
Total Current Assets	3,020	3,206	3,557	3,555	3,919	4,011	4,364	4,510
Net Property, Plant & Equipment	1,421	1,392	1,352	1,400	1,395	1,424	1,539	1,604
Deferred Income Taxes	65	22	12	11	14		-	-
Investments in unconsolidated entities								
Goodwill, net	527	544	424	429	391	384	384	384
Sundry & Others	661	640	528	610	576	773	773	773
Total Assets	**$5,694**	**$5,804**	**$5,873**	**$6,005**	**$6,295**	**$6,592**	**$7,060**	**$7,271**
Liabilities & Shareholders' Equity								
Accounts Payable	650	732	678	719	779	816	839	935
Accrued Expenses & Other Curr. Liab.	558	661	664	631	612	675	675	705
ST Debt plus Current Mat. of LT Debt	406	94	130	301	8		-	-
Income Taxes Payable	15	20	29	27	42	37	37	37
Total Current Liabilities	1,629	1,507	1,501	1,678	1,441	1,528	1,551	1,677
Long Term Debt	1,841	2,248	2,090	1,914	2,389	2,362	2,372	1,822
Deferred Income Taxes	126	112	103	106	110	121	121	121
Postretirement Benefits	193	110	86	247	262	421	421	421
Total Liabilities	**$3,789**	**$3,977**	**$3,780**	**$3,945**	**$4,202**	**$4,432**	**$4,465**	**$4,041**
Stockholder's Equity	**1,906**	**1,828**	**2,093**	**2,060**	**2,093**	**2,160**	**2,596**	**3,231**
Total Liabilities Plus Equity	**$5,694**	**$5,804**	**$5,873**	**$6,005**	**$6,295**	**$6,592**	**$7,060**	**$7,271**

Balance Sheet Key Statistics	2016	2017	2018	2019	2020	2021	2022E	2023E
Debt Ratios:								
Total Debt	$2,247	$2,342	$2,220	$2,215	$2,397	$2,362	$2,372	$1,822
Total Cash	274	327	538	360	585	241	241	241
Net Debt	$1,973	$2,015	$1,682	$1,855	$1,812	$2,121	$2,131	$1,581
Debt/Equity	117.9%	128.2%	106.1%	107.5%	114.5%	109.4%	91.4%	56.4%
LT Debt/ Equity	96.6%	123.0%	99.9%	92.9%	114.1%	109.4%	91.4%	56.4%
Net Debt/ Equity	103.5%	110.3%	80.4%	90.0%	86.6%	98.2%	82.1%	48.9%
Net Debt/ Capital	50.9%	52.4%	44.6%	47.4%	46.4%	49.5%	45.1%	32.9%
Working Capital Ratios:								
Inventory Turnover (COGS/End Inv.)	4.3X	4.4X	4.5X	4.3X	4.4X	4.4X	4.4X	4.6X
Avg. Days Inventory Days on Hand	85	83	82	85	84	82	83	80
Receivables Turnover (Sales/End Rec.)	8.3X	7.9X	8.1X	8.1X	8.0X	7.4X	7.4X	7.8X
Avg. Days Receivables Outstanding	44	46	45	45	46	49	49	47
Payables Turnover (sales/ AP)	15.6X	14.2X	16.6X	16.0X	15.1X	16.0X	17.0X	16.5X
Avg. Days Payables Outstanding	23	26	22	23	24	23	21	22
Cash Conversion Cycle	106	103	105	108	105	109	111	105
Trade Working Captal	$1,979	$2,023	$2,248	$2,361	$2,428	$2,808	$3,128	$3,168
Trade WC/Sales	20.4%	20.1%	20.2%	21.3%	22.0%	22.6%	23.1%	22.0%
Current Assets / Current Liability	1.9X	2.1X	2.4X	2.1X	2.7X	2.6X	2.8X	2.7X

Source: Company Reports; Oppenheimer & Co. Estimates

W.W. Grainger, Inc.

Consolidated Statement of Cash Flows 2016-2023E

Christopher Glynn

For the years ended December 31 ($ in millions)

	2016	2017	2018	2019	2020	2021	2022E	2023E
Cash Flows From Operations								
Net Income	$633	$622	$823	$895	$755	$1,114	$1,342	$1,501
Provision for Losses on Acct Rec.	16	16	7	12	22	18		
Depreciation of PP&E	249	264	257	229	182	185	185	185
Amortization of Capitalized Software								
Total D&A	249	264	257	229	182	185	185	185
Other	101	90	197	157	339	36	80	80
Subtotal	999	993	1,284	1,293	1,298	1,353	1,607	1,766
Working Capital Adjustments:								
Receivables	(46)	(103)	(79)	(42)	(121)	(324)	(173)	(50)
Inventories	(4)	(5)	(129)	(106)	(158)	(152)	(170)	(86)
Prepaid Expenses	19	(5)	(2)	(33)	(23)	(15)	(10)	(10)
Accounts Payable	73	72	(51)	32	80	54	23	96
Deferred Income Taxes	(6)	(5)	7	4	(5)	27	-	-
Current Income Taxes Payable	(4)	4	36	(3)	24	(26)	-	-
Accrued Expenses/Other Curr. Liab	(28)	106	(9)	(103)	28	20	-	30
Net Change in Working Capital	4	64	(227)	(251)	(175)	(416)	(330)	(20)
Cash Flows From Operations	**$1,003**	**$1,057**	**$1,057**	**$1,042**	**$1,123**	**$937**	**$1,277**	**$1,746**
Cash Flows From Investing								
Capital Expenditures (PP&E), net	(284)	(237)	(239)	(221)	(197)	(255)	(300)	(250)
Proceeds from Sales of PP&E	55	120	86	17	20	29		
Expenditures for Software								
Acquisitions	1							
Divestitures & Other	(34)	(29)	(13)	2	(2)		-	-
Cash Flows From Investing	**($262)**	**($146)**	**($166)**	**($202)**	**($179)**	**($226)**	**($300)**	**($250)**
Cash Flows From Financing Activities								
Net Additions to Short Term Debt	38	(339)	(5)	5	(53)			
Net Additions to Long Term Debt	254	362	(96)	(42)	214	(8)	10	(550)
Share Repurchases	(790)	(605)	(425)	(700)	(601)	(695)	(700)	(650)
Cash Dividends	(303)	(304)	(316)	(328)	(338)	(357)	(336)	(347)
Other	46	20	172	42	52	21	50	50
Cash Flows From Financing Activities	**($755)**	**($867)**	**($670)**	**($1,023)**	**($726)**	**($1,039)**	**($977)**	**($1,496)**
Exchange Rate Effect	**(2)**	**9**	**(10)**	**5**	**7**	**(16)**		
Increase (Dec) in Cash & ST Investments	**($16)**	**$52**	**$211**	**($178)**	**$225**	**($344)**	**-**	**-**
Cash and Equivalents -B.O.Y.	290	274	327	538	360	585	241	241
Cash and Equivalents -E.O.Y.	274	327	538	360	585	241	241	241
Cash Flow Key Statistics								
FCF (CFO less CapEx)	719	819	904	821	926	682	977	1,496
FCF/ Net Income	114%	132%	110%	92%	123%	61%	73%	100%
CAPEX/ Depreciation	114%	90%	93%	97%	108%	138%	162%	135%
CAPEX/ Sales	2.8%	2.3%	2.1%	1.9%	1.7%	2.0%	2.1%	1.6%

Source: Company Reports; Oppenheimer & Co. Estimates

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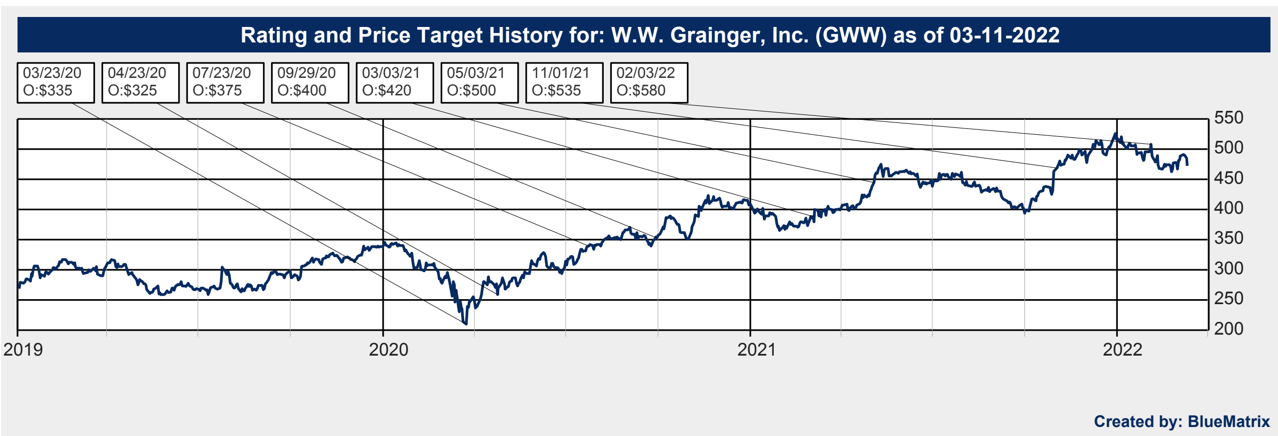

All price targets displayed in the chart above are for a 12- to- 18-month period. Prior to March 30, 2004, Oppenheimer & Co. Inc. used 6-, 12-, 12- to 18-, and 12- to 24-month price targets and ranges. For more information about target price histories, please write to Oppenheimer & Co. Inc., 85 Broad Street, New York, NY 10004, Attention: Equity Research Department, Business Manager.

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			IB Serv/Past 12 Mos.	
Rating	**Count**	**Percent**	**Count**	**Percent**
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COMPANY COMMENT

W.W. GRAINGER, INC. (GWW-NYSE)

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Market Assuming Perpetual MSD Sales Growth After Solid 4Q Print

RECOMMENDATION

Summary: We reiterate Market Perform. Our thesis is straightforward, in that we see the current risk/reward profile as fairly balanced. Specifically, at current levels we peg the "market-assumed" long term annual sales growth rate at about +5-6%, at least over the next decade. We view this as a reasonable "base case" for the business, as it basically assumes annual IP+PPI readings return to the pre-COVID +2-3% annual rate and Grainger hits its annual outgrowth target of 300-400bp. While upside may plausibly come from longer/higher inflation (ie PPI), we would argue that downside risk is equally possible, since Grainger has posted~300bp of annual outgrowth post-COVID – a period during which the company has been admittedly aided competitively by limited inventory throughout the channel (relative to their own given its scale). As such, given the "lack of asymmetry" in the setup, we remain on the sidelines for now.

(=/+) 4Q21 adjusted EPS of $5.44 beat RJ/Street $5.17/$5.24. Versus RJ, 4Q "above the line" results were in-line, as a better than expected December sales result was offset by higher than expected opex (EPS beat RJ due to tax and Other, net). Versus Street expectations, "above the line" results beat views via opex leverage (Figure 1).

(+) 4Q total organic ADS were +17% y/y vs. RJ +14%, with High-Touch volumes and pricing improving sequentially better than expected on a multi-year stack in both US and Canadian markets (Fig. 3). December was particularly strong in the US at +20% y/y. **December's momentum continued into January**, as preliminary U.S. High-Touch sales were +16% y/y (similar to December on a two-year stack). Note pandemic-related sales have returned to pre-COVID levels (~21% of total mix), so the growth is entirely core product lines.

(+) Initial FY22 guidance beat views, via better than expected sales above the line and a lower tax rate below it (~$0.30). FY22 guidance is as follows: daily sales +7.5% to +10.5% (RJ/Street +7%), GM 36.8-37.3% (RJ/Street 37.0%), EBIT margin 12.5-13.1% (RJ/Street 13.0/12.9%), and EPS $23.50-$25.50 (RJ $23.05, Street $23.63).

- By our math (and as shown in Figure 6), at current levels we estimate that the "market-assumed" long term annual sales growth rate for Grainger is about +5-6% (at least over the next decade), assuming ~20% incremental margins, normal/historical working capital and capex percentages, and a 10% cost of equity. Constructively, Grainger's FY22 guidance implies a near term growth rate roughly 2x the long term market assumption, and Grainger's favorable price-cost in FY21 augurs well if inflation rates remain elevated for a period of time. That said, Grainger's sales CAGR in the 5 years prior to COVID was roughly half this assumed forward rate, and Grainger also may be unable to sustain its current ~300bp annual outgrowth pace during COVID once its relative inventory advantages vs the channel moderate.
- **Estimates:** Our new 2022 and 2023 adjusted EPS estimates are $23.75 from $23.05 prior and $26.56 from $25.62 prior, respectively. Fig. 2 summarizes the changes to our model.

Valuation: GWW trades at 14x forward EBITDA and 1.8x forward price-sales (Fig. 4-5). Both of these valuations are ~1.5 standard deviations above their respective five-year medians.

Market Perform 3
Target Price NM

Suitability	M/ACC

MARKET DATA

Current Price (Feb-3-22)	$507.58
Market Cap (mln)	$26,242
Current Net Debt (mln)	$2,044
Enterprise Value (mln)	$28,286
Shares Outstanding (mln)	51.7
30-Day Avg. Daily Value (mln)	$133.5
Dividend	$6.48
Dividend Yield	1.3%
52-Week Range	$364.72 - $527.06
BVPS	$42.02
ROE	47.9%
Long-Term Debt (mln)	$2,362
Long-Term Debt as % of Cap	52%

KEY FINANCIAL METRICS

	1Q	2Q	3Q	4Q
Non-GAAP EPS ($, Dec FY)				
2020A	4.24	3.75	4.52	3.66
2021A	4.48	4.27	5.65	5.17
new	**4.48**	**4.27**	**5.65**	**5.44**
2022E	5.99	5.62	5.75	5.68
new	**6.09**	**5.54**	**6.24**	**5.89**
2023E	6.64	6.26	6.39	6.33
new	**6.77**	**6.23**	**6.95**	**6.61**

	2020A	2021A	2022E	2023E
Non-GAAP EPS ($, Dec FY)				
old	16.18	19.55	23.05	25.62
new	**16.18**	**19.84**	**23.75**	**26.56**
P/E (Non-GAAP)				
	31.4x	25.6x	21.4x	19.1x
GAAP EPS ($, Dec FY)				
old	12.82	19.55	23.05	25.62
new	**12.82**	**19.84**	**24.27**	**27.09**
Revenue (mln) ($, Dec FY)				
old	11,797	12,948	13,899	14,929
new	**11,797**	**13,022**	**14,298**	**15,297**
Adj. EBITDA (mln) ($, Dec FY)				
old	1,509	1,732	1,986	2,177
new	**1,509**	**1,732**	**2,029**	**2,219**
EV/EBITDA (Adj.)				
	18.7x	16.3x	13.9x	12.7x

Source: Thomson One, Raymond James & Associates. Quarterly figures may not add to full year due to rounding.
Non-GAAP EPS excludes one-time items.

UCC-190

Figure 1:

W.W. Grainger Inc Q4 2021 Results

Data Item	Last Year	This Year	RJ Est	Y/Y chg	Variance vs. RJ	EPS Delta	Comments
Organic Sales Growth (ex FX, acq's)	**5%**	**17%**	**14%**				US +17%, Canada +7% , ADS guidance implied +11.5% to 12.5% (BEAT)
High Touch (NA)	$2,292	$2,628	$2,573	15%	$55		Street $2.54b (BEAT); large cust's +16%, mid sized +25%, volume +11%, price +5%, "+650bps market outgrowth" (+475bp last qtr), Jan +16%
Endless Assortment	$585	$663	$649	13%	$14		Street $664m (IN-LINE); Monotaro +20% organic, Zoro +20%
Other/Cromwell	$64	$68	$63	6%	$5		Street $66m (MILD BEAT)
Net Sales	$2,941	$3,359	$3,285	14.2%	$74	$0.13	**Street $3,368 mil (MILD MISS); pandemic -11%, non-pandemic +28%**
Cost of Sales	$1,914	$2,106	$2,057	10.0%	$49		
Adjusted Gross Profit	$1,027	$1,253	$1,229	22.0%	$24		
Adjusted Gross Margin	34.9%	37.3%	37.4%	238 bps	-10 bps	($0.05)	Street 37.3% (IN-LINE); guidance implied 37.2% to 37.4%, High Touch 39.6% (+250 bp y/y), Endless Assort 28.5% (+60 bp y/y)
SG&A	$732	$836	$813	14.2%	$23.5		guidance was $810-815M
WM&A % of Sales	24.9%	24.9%	24.7%	0 bps	16 bps	($0.07)	Street 25.2% (BEAT)
Income from Operations, ex items	$295	$417	$416	41.4%	$1	**$0.01**	**Street $406 mil (BEAT)**
Operating Margin, ex items	10.0%	12.4%	12.7%	238 bps	-26 bps		Street 12.1% (BEAT); High Touch 13.7% (+230bp y/y), Endless Assort 9.1% (+45 bp y/y)
YOY Op Profit Pull-Thru		54%	60%				
YOY Contribution Margin		29%	35%	2919 bps	-602 bps		
Interest Income	$0	$0	$0		$0	$0.00	
Interest Expense	($21)	($22)	($22)	5%	$0	($0.00)	
Other Inc (Exp), incl restr/items	($15)	$6	$0	-140%	$6	$0.09	
Income before taxes (GAAP)	$259	$401	$394	55%	$7	$0.10	
Income Tax Provision	28.6%	24.9%	26.8%	-363 bps	-181 bps	$0.14	adjusted tax rate 24.8% (RJ 26.8%), benefit of $0.15 EPS
Net Income (Loss) Before Min. Int	$185	$301	$289	63%	$12	$0.24	
Minority Interest	($17)	($18)	($20)				
Reported Net Income (Loss)	$168	$283	$268				
Earnings Allocated to Part. Sec.	($1)	($2)	($2)				
Earnings Avail to Cmn Shrhldrs	$167	$281	$266				
Non-Recurring Items	($30)	$0	$0		$0.0	$0.00	
Adjusted Net Income (Loss)	$197	$281	$266	43%	$14.6	$0.28	
Reptd EPS	$3.12	$ 5.44	$5.17	74%			
E.P.S. effect, non-recur. items	$ (0.56)	$ -	$ -				
Diluted "Operating" EPS	**$ 3.68**	**$ 5.44**	**$ 5.17**	48%		**$0.27**	**Street $5.24 (BEAT), guidance implied $4.60 - $5.35 (BEAT)**
Avg Diluted Shares O/S	53.6	51.7	51.5	-4%		($0.02)	repurchased $170M worth of stock in 4Q (RJ $163M)
Cash Flow Statistics:							
Net A/R DSOs	46	48	46	1.9 days	1.9 days		
Inventory Days COGS	83	81	79	-1.6 days	2.4 days		
A/P Days COGS	37	35	38	-1.8 days	(2.8) days		
Cash Conversion Cycle	91	93	86	2.1 days	7.1 days		
Cash Flow Impact of Variances							
Net A/R DSOs				*($71)*	*($71)*		
Inventory Day COGS				*$37*	*($55)*		
A/P Day COGS				*($41)*	*($64)*		
Cash Conversion Cycle				*($75)*	*($190)*		
Quarterly Cash from Ops	**$336**	**$213**	**$465**	**-37%**	**($252)**		Street $417M (MISS)
Cash from Ops as % of Sales	**11%**	**6%**	**14%**	**-508 bps**	**-781 bps**		Street 12.4% (MISS)

Source: Company Reports, RJ

Figure 2:

Grainger Estimate Changes

	1Q22				FY22				FY23			
	Prior	Current	Change	EPS Effect	Prior	Current	Change	EPS Effect	Prior	Current	Change	EPS Effect
Net Sales	**$3,409**	**$3,528**	**$119**	**$0.24**	**$13,899**	**$14,298**	**$399**	**$0.76**	**$14,929**	**$15,297**	**$369**	**$0.73**
Prior Consensus	*$3,370*				*$13,946*				*$14,998*			
y/y Growth (RJ)	10.6%	14.4%			7.3%	9.8%			7.4%	7.0%		
y/y Growth (organic, ex FX)	9.7%	14.1%			7.3%	10.3%			7.8%	7.4%		
Gross Margin, ex items	37.2%	38.2%	0.9%	$0.47	37.0%	37.2%	0.2%	$0.40	36.7%	36.9%	0.2%	$0.44
y/y bps	180	275			72	94			-30	-30		
Prior Consensus	*37.1%*				*37.0%*				*36.6%*			
EBIT Margin, ex items	13.7%	13.2%	-0.5%	-$0.23	13.0%	12.8%	-0.2%	-$0.42	13.3%	13.2%	-0.1%	-$0.23
y/y bps	208	162			105	90			28	38		
Prior Consensus	*12.8%*				*12.9%*				*13.2%*			
EBITDA	**$511**	**$516**	**$5**	**$0.08**	**$1,986**	**$2,029**	**$43**	**$0.64**	**$2,177**	**$2,219**	**$42**	**$0.63**
Prior Consensus	*$495*				*$1,982*				*$2,152*			
Net Interest Expense	($23)	($22)	$1	$0.02	($95)	($93)	$2	$0.04	($98)	($94)	$4	$0.05
Tax Rate	25.5%	24.5%	-1.0%	$0.08	25.5%	24.5%	-1.0%	$0.31	25.5%	24.5%	-1.0%	$0.34
y/y bps	-16	-116			3	-48			0	0		
Net Income, ex-items	$308	$314	$6	$0.11	$1,177	$1,217	$41	$0.80	$1,288	$1,342	$54	$1.08
y/y Growth	30%	33%			15%	18%			9%	10%		
EPS	**$5.99**	**$6.09**	**$0.09**	**$0.09**	**$23.05**	**$23.75**	**$0.70**	**$0.70**	**$25.62**	**$26.56**	**$0.94**	**$0.94**
Prior Consensus	*$5.59*				*$23.63*				*$26.33*			
y/y Growth	34%	36%			18%	20%			11%	12%		
Shares	51.3	51.5	0	-$0.02	51.0	51.3	0	-$0.10	50.3	50.5	0	-$0.14
Segments												
High Touch / NA Sales	$2,626	$2,750			$11,106	$11,475			$11,617	$11,951		
y/y growth	9.6%	14.7%			4.5%	4.1%			4.6%	4.2%		
Prior Consensus	*$2,612*				*$10,764*				*$11,344*			
Endless Assortment	$718	$713			$3,559	$3,555			$4,093	$4,089		
y/y growth	15.4%	14.6%			18.0%	18.0%			15.0%	15.0%		
Prior Consensus	*$716*				*$3,077*				*$3,611*			
Other Businesses (Cromwell)	$66	$65			$263	$267			$268	$273		
y/y growth	1.3%	0.5%			2.0%	2.0%			2.0%	2.0%		
Prior Consensus	*$69*				*$270*				*$284*			

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Figure 3:

U.S. High Touch Pricing

	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Q1	+2%	+3%	+3%	+1%	+0%	(3)%	(4)%	(2)%	+2%	(2)%	+2%
Q2	+3%	+3%	+2%	+0%	(1)%	(2)%	(4)%	(1)%	+1%	(0)%	+2%
Q3	+3%	+4%	+0%	+0%	(1)%	(1)%	(5)%	+1%	+0%	+0%	+3%
Q4	+3%	+3%	(1)%	+1%	(1)%	(1)%	(5)%	+1%	(1)%	+1%	+5%

U.S. High Touch Volumes

	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Q1	+5%	+8%	+2%	+4%	+4%	+1%	+3%	+9%	+3%	+8%	+2%
Q2	+6%	+4%	+4%	+5%	+3%	(1)%	+5%	+11%	+2%	(2)%	+10%
Q3	+4%	+1%	+5%	+5%	+1%	+0%	+6%	+8%	+3%	+3%	+9%
Q4	+5%	+1%	+5%	+5%	(2)%	+1%	+11%	+5%	+3%	+3%	+12%

U.S. High Touch Organic ADS

	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Q1	+7%	+11%	+5%	+5%	+4%	(2)%	(1)%	+7%	+4%	+6%	+4%
Q2	+9%	+7%	+6%	+5%	+2%	(3)%	+1%	+10%	+2%	(2)%	+12%
Q3	+7%	+5%	+5%	+5%	+0%	(1)%	+1%	+9%	+3%	+3%	+12%
Q4	+8%	+4%	+4%	+6%	(3)%	+0%	+6%	+6%	+2%	+4%	+17%

Canada High Touch Pricing

	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Q1	+2%	+1%	+0%	+0%	+2%	+3%	(2)%	+7%	+4%	(1)%	+0%
Q2	+1%	+2%	+0%	+0%	+4%	+0%	(1)%	+10%	+3%	(2)%	+3%
Q3	+0%	+2%	+0%	+1%	+4%	(1)%	+0%	+10%	+1%	(1)%	+4%
Q4	+0%	+1%	+0%	+0%	+4%	(4)%	+4%	+8%	(2)%	(1)%	+5%

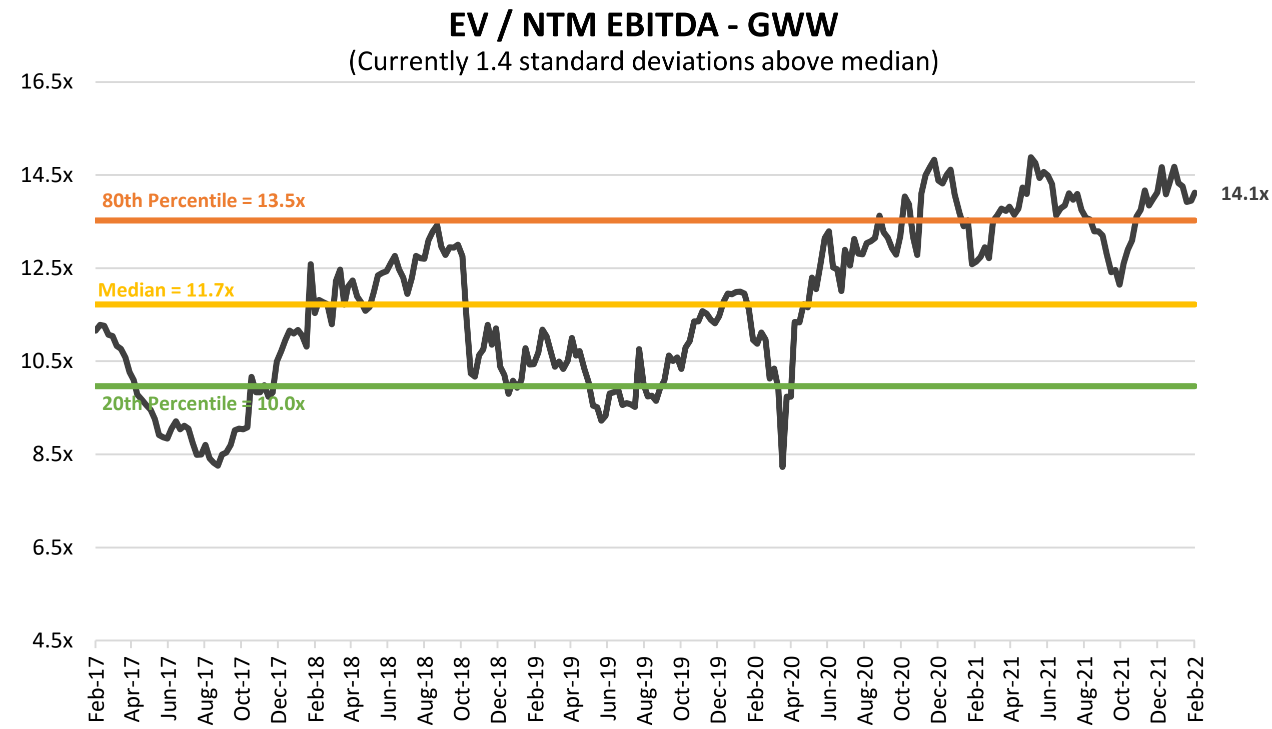
Canada High Touch Volumes

	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Q1	+11%	+13%	+6%	(2)%	(6)%	(20)%	+3%	(13)%	(24)%	(4)%	(3)%
Q2	+12%	+12%	+5%	(3)%	(10)%	(16)%	+3%	(20)%	(23)%	(18)%	+12%
Q3	+14%	+11%	+2%	+5%	(17)%	(15)%	+2%	(27)%	(16)%	(8)%	+2%
Q4	+13%	+8%	+3%	+4%	(18)%	(5)%	(4)%	(30)%	(10)%	(3)%	+3%

Canada High Touch Organic ADS

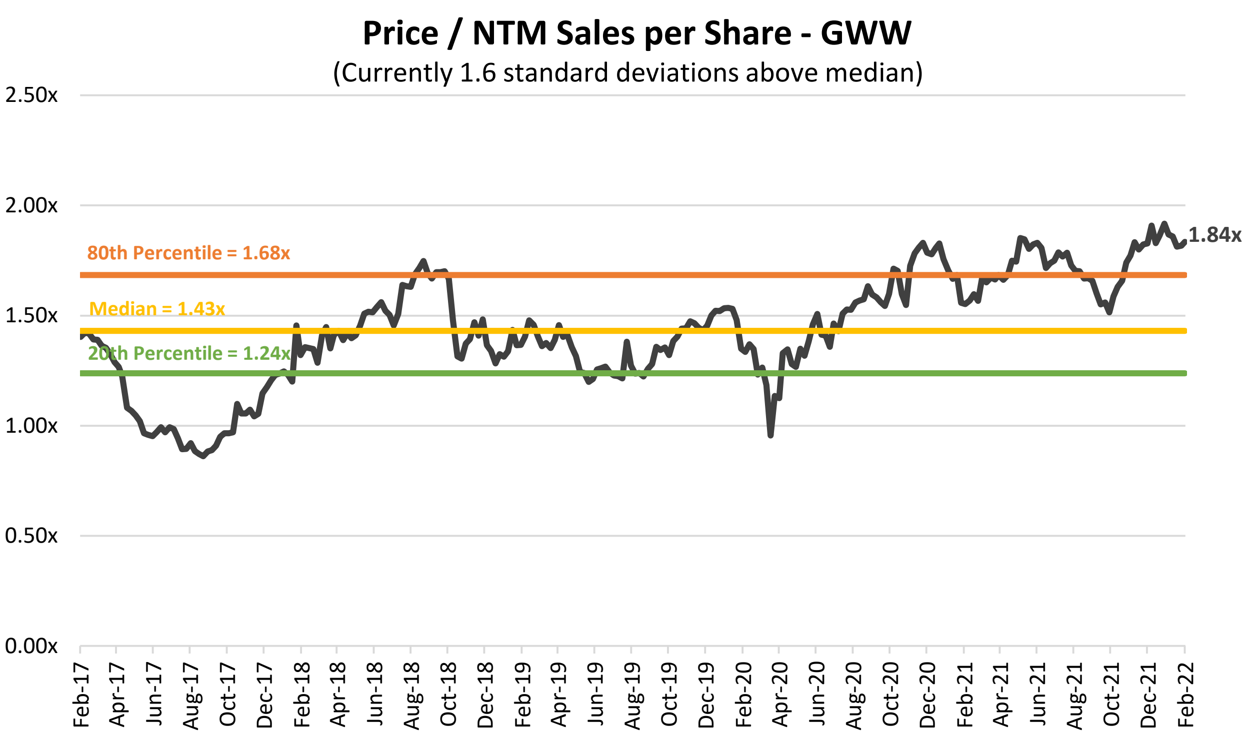
	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Q1	+13%	+14%	+6%	(2)%	(4)%	(17)%	+1%	(6)%	(20)%	(5)%	(3)%
Q2	+13%	+14%	+5%	(3)%	(6)%	(16)%	+2%	(10)%	(20)%	(19)%	+30%
Q3	+14%	+13%	+2%	+6%	(13)%	(16)%	+2%	(17)%	(15)%	(9)%	+6%
Q4	+13%	+9%	+3%	+4%	(14)%	(9)%	+0%	(22)%	(12)%	(4)%	+9%

Figure 4:



Source: FactSet, Raymond James research.

Figure 5:



Source: FactSet, Raymond James research.

Figure 6:

ESTIMATING MARKET-ASSUMED LT SALES GROWTH RATE

OUTPUT Sales Growth	**5.4%**

Inputs	
Stock Price	508
Shr O/S	52
Mkt Cap	26,264
Current trailing FCF yield	2.6%
Assumed Cost of Equity	10%
Assumed LT FCF Gr	**7.4%**
LT w/cap Sales %	22%
LT Capex Sales %	2.15%
Variable Margin	20%
Int Rate on Incremental Cash	1.0%

GWW	TTM	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Sales	$13,022	13,725	14,466	15,248	16,071	16,939	17,853	18,818	19,834	20,905	22,034
sales growth		5.4%	5.4%	5.4%	5.4%	5.4%	5.4%	5.4%	5.4%	5.4%	5.4%
EBIT	$1,547	1,688	1,836	1,992	2,157	2,330	2,513	2,706	2,909	3,124	3,349
margin	11.9%	12.3%	12.7%	13.1%	13.4%	13.8%	14.1%	14.4%	14.7%	14.9%	15.2%
Net Int Exp	$87	80	71	62	51	40	27	14	-1	-17	-34
Pre-Tax Inc	$1,355	1607	1764	1930	2105	2291	2486	2693	2910	3140	3383
Tax Rate	25.0%	24.5%	24.5%	24.5%	24.5%	24.5%	24.5%	24.5%	24.5%	24.5%	24.5%
Min Int	($79)	(92)	(107)	(124)	(144)	(167)	(194)	(226)	(263)	(305)	(355)
A/T	$1,016	1,122	1,225	1,333	1,446	1,562	1,683	1,807	1,935	2,066	2,200
D&A	$185	196	208	220	232	245	259	274	289	305	322
Capex	$255	295	311	328	346	364	384	405	426	449	474
PPE	$1,424	1,494	1,593	1,697	1,805	1,918	2,037	2,162	2,293	2,430	2,574
W/cap (drain)		-152	-160	-168	-178	-187	-197	-208	-219	-231	-243
FCF	$682	871	962	1,057	1,155	1,256	1,361	1,468	1,578	1,691	1,804
required G		28%	10%	10%	9%	9%	8%	8%	7%	7%	7%
W/Cap % sales	22%	22%	22%	22%	22%	22%	22%	22%	22%	22%	22%

GWW	Year 11	Year 12	Year 13	Year 14	Year 15	Year 16	Year 17	Year 18	Year 19	Year 20	
Sales	22,695	23,375	24,077	24,799	25,543	26,309	27,098	27,911	28,749	29,611	
sales growth	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	
EBIT	3,482	3,618	3,758	3,902	4,051	4,204	4,362	4,525	4,692	4,865	
margin	15.3%	15.5%	15.6%	15.7%	15.9%	16.0%	16.1%	16.2%	16.3%	16.4%	
Net Int Exp	-52	-72	-93	-115	-139	-163	-189	-216	-244	-273	
Pre-Tax Inc	3533	3690	3851	4018	4190	4368	4551	4740	4936	5138	
Tax Rate	24.5%	24.5%	24.5%	24.5%	24.5%	24.5%	24.5%	24.5%	24.5%	24.5%	
Min Int	(365)	(376)	(387)	(399)	(411)	(423)	(436)	(449)	(463)	(476)	
A/T	2,302	2,410	2,520	2,634	2,752	2,874	3,000	3,130	3,264	3,403	
D&A	339	355	371	387	404	420	436	452	469	486	
Capex	488	503	518	533	549	566	583	600	618	637	
PPE	2,726	2,876	3,023	3,170	3,316	3,461	3,607	3,754	3,901	4,050	
W/cap (drain)	-143	-147	-151	-156	-160	-165	-170	-175	-181	-186	
FCF	2,011	2,115	2,222	2,333	2,446	2,563	2,683	2,807	2,934	3,066	**CAGR**
required G	11%	5%	5%	5%	5%	5%	5%	5%	5%	4%	**7.4%**
W/Cap % sales	22%	22%	22%	22%	22%	22%	22%	22%	22%	22%	

Source: company information, RJ Research

W.W. Grainger, Inc.

Income Statement Model
$Million, except per share

	Q1 Mar-20	Q2 Jun-20	Q3 Sep-20	Q4 Dec-20	FY 2020	Q1 Mar-21	Q2 Jun-21	Q3 Sep-21	prelim Q4 Dec-21	prelim FY 2021
Net Sales	$3,001	$2,837	$3,018	$2,941	$11,797	$ 3,084	$ 3,207	$ 3,372	$ 3,359	$13,022
Cost of sales	$1,880	$1,821	$1,944	$1,914	$7,559	$1,991	$ 2,083	$ 2,122	$ 2,106	$8,302
Gross Prft.	$1,121	$1,016	$1,074	$1,027	$4,238	$1,093	$1,124	$1,250	$1,253	$4,720
Warehouse, mkting, admin exp (ex items)	$778	$701	$700	$732	$2,911	$735	$790	$812	$836	$3,173
Operating Income	$343	$315	$374	$295	$1,327	$358	$334	$438	$417	$1,547
Interest Income	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Interest Expense	($21)	($28)	($23)	($21)	($93)	($21)	($22)	($22)	($22)	($87)
Equity in income (loss) of unconsolidated entities-net	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Gain / (Loss) on sale of unconsol. equity or investment secs.	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Unclassified Net	($180)	($103)	$11	($15)	($287)	$6	$7	$6	$6	$25
Earnings before Tax	$142	$184	$362	$259	$947	$343	$319	$422	$401	$1,485
Income Tax Expense	($43)	$55	$106	$74	$192	$88	$76	$107	$100	$371
Net Earnings before Min Int	$185	$129	$256	$185	$755	$255	$243	$315	$301	$1,114
Minority interest	($12)	($15)	($16)	($17)	($60)	($17)	($18)	($18)	($18)	($71)
Net Income	$173	$114	$240	$168	$695	$238	$225	$297	$283	$1,043
Less: earnings allocated to partic securities	($2)	($1)	($2)	($1)	($6)	($2)	($2)	($2)	($2)	($8)
Net earnings available to common shareholders	$171	$113	$238	$167	$689	$236	$223	$295	$281	$1,035
A/T effect one-time Items	($57)	($91)	($8)	($30)	($186)	$0	$0	$0	$0	$0
Adj Net Income	$228	$204	$246	$197	$875	$236	$223	$295	$281	$1,035
Reported EPS, GAAP	$3.19	$2.10	$4.41	$3.12	$12.82	$4.48	$4.27	$5.65	$5.44	$19.84
Dil Oper EPS, ex items	**$4.24**	**$3.75**	**$4.52**	**$3.66**	**$16.18**	**$4.48**	**$4.27**	**$5.65**	**$5.44**	**$19.84**
Wtd Avg Sh	53.6	53.5	53.6	53.3	53.5	52.3	52.2	51.8	51.4	51.9
Avg Diluted Shares	53.8	53.7	53.9	53.6	53.7	52.6	52.5	52.1	51.7	52.2
D&A	$45	$50	$42	$45	$182	$43	$49	$45	$48	$185
EBITDA	$388	$365	$416	$340	$1,509	$401	$383	$483	$465	$1,732
TTM EBITDA	$1,583	$1,515	$1,534	$1,509	$1,509	$1,522	$1,540	$1,607	$1,732	$1,732
Dividends Per Share	1.44	1.44	1.45	1.53	5.86	1.53	1.62	1.62	1.62	6.39
Shipping Days	64	64	64	64	256	63	64	64	63	254
% of Sales:										
Net Sales	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Cost of sales	62.6%	64.2%	64.4%	65.1%	64.1%	64.6%	65.0%	62.9%	62.7%	63.8%
Gross Prft.	37.4%	35.8%	35.6%	34.9%	35.9%	35.4%	35.0%	37.1%	37.3%	36.2%
Warehouse, mkting, admin exp (ex items)	25.9%	24.7%	23.2%	24.9%	24.7%	23.8%	24.6%	24.1%	24.9%	24.4%
Operating Income	11.4%	11.1%	12.4%	10.0%	11.2%	11.6%	10.4%	13.0%	12.4%	11.9%
Equity in income (loss) of unconsolidated entities-net	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Gain / (Loss) on sale of unconsol. equity or investment secs.	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Unclassified Net	-6.0%	-3.6%	0.4%	-0.5%	-2.4%	0.2%	0.2%	0.2%	0.2%	0.2%
Earnings before Tax	4.7%	6.5%	12.0%	8.8%	8.0%	11.1%	9.9%	12.5%	11.9%	11.4%
Income Tax %	-30.3%	29.9%	29.3%	28.6%	20.3%	25.7%	23.8%	25.4%	24.9%	25.0%
Net Profit %	5.8%	4.0%	8.0%	5.7%	5.9%	7.7%	7.0%	8.8%	8.4%	8.0%
A/T effect one-time Items	-1.9%	-3.2%	-0.3%	-1.0%	-1.6%	0.0%	0.0%	0.0%	0.0%	0.0%
Adj Net Income	7.6%	7.2%	8.2%	6.7%	7.4%	7.7%	7.0%	8.7%	8.4%	7.9%
Statistics:										
Total Sales Growth	7.2%	-1.9%	2.4%	3.3%	2.7%	2.8%	13.0%	11.7%	14.2%	10.4%
Est Calendar Effects on Sales (shipping days)	1.6%	0.0%	0.0%	0.0%	0.4%	-1.6%	0.0%	0.0%	-1.6%	-0.8%
Total Daily Sales Growth	5.6%	-1.9%	2.4%	3.3%	2.3%	4.3%	13.0%	11.7%	15.8%	11.2%
Est Acquired Sales Growth	0.0%	0.0%	-2.2%	-2.9%	-1.3%	-2.1%	-2.2%	0.0%	0.0%	-1.1%
Est FX Effects on Sales	-0.2%	-0.3%	0.6%	1.2%	0.3%	1.5%	1.9%	0.4%	-0.8%	0.8%
Est Organic Sales Growth in local currency	5.8%	-1.7%	4.0%	5.0%	3.3%	4.9%	13.3%	11.3%	16.5%	11.5%
Gross Profit y/y Growth	2.3%	-9.4%	-2.3%	-5.0%	-3.6%	-2.5%	10.6%	16.4%	22.0%	11.4%
Operating Profit y/y Growth	-6.0%	-16.4%	10.3%	-3.9%	-4.4%	4.4%	6.0%	17.1%	41.4%	16.6%
YOY EBITDA Contrib Mrg	-17%	121%	27%	-27%	-35%	16%	5%	19%	30%	18%
TTM Operating Efficiency Ratio	1.45	1.43	1.45	1.46	1.46	1.47	1.46	1.46	1.49	1.49
YOY OP Pull-Thru	-88%	59%	-140%	22%	38%	-54%	18%	36%	54%	46%
SEQ Op Profit Pull-Thru	90%	27%	102%	168%		95%	-77%	83%	-700%	
Pre-tax Income y/y Growth	-59.5%	-49.7%	12.4%	52.4%	-21.7%	141.5%	73.4%	16.6%	54.8%	56.8%
Y/Y Growth EBITDA	-8.1%	-15.7%	4.8%	-6.8%	-6.7%	3.4%	4.9%	16.1%	36.8%	14.8%
Seq Growth TTM EBITDA	-2.1%	-4.3%	1.3%	-1.6%		0.9%	1.2%	4.4%	7.8%	
Net Income y/y Growth	-31.6%	-56.2%	3.0%	63.1%	-18.1%	37.6%	97.4%	23.8%	68.5%	50.1%
EPS (b/f items) y/y Growth	-6.0%	-19.2%	6.0%	-5.7%	-6.4%	5.7%	13.9%	25.0%	48.5%	22.6%

	Est Q1 Mar-22	Est Q2 Jun-22	Est Q3 Sep-22	Est Q4 Dec-22	Est FY 2022	Est Q1 Mar-23	Est Q2 Jun-23	Est Q3 Sep-23	Est Q4 Dec-23	Est FY 2023	Est FY 2024
Net Sales	$ 3,528	$ 3,606	$ 3,599	$3,566	$14,298	$ 3,771	$ 3,857	$ 3,848	$ 3,821	$15,297	$16,313
Cost of sales	$2,181	$2,247	$2,296	$2,257	$8,981	$2,342	$2,415	$2,467	$2,430	$9,655	$10,353
Gross Prft.	$1,347	$1,359	$1,302	$1,308	$5,317	$1,429	$1,442	$1,381	$1,390	$5,643	$5,960
Warehouse, mkting, admin exp (ex items)	$881	$929	$825	$855	$3,490	$915	$966	$857	$890	$3,629	$3,768
Operating Income	$467	$430	$478	$453	$1,827	$514	$476	$524	$500	$2,014	$2,192
Interest Income	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Interest Expense	($22)	($22)	($23)	($25)	($93)	($24)	($22)	($23)	($25)	($94)	($94)
Equity in income (loss) of unconsolidated entities-net	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Gain / (Loss) on sale of unconsol. equity or investment secs.	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Unclassified Net	$9	$9	$9	$9	$35	$9	$9	$9	$9	$35	$35
Earnings before Tax	$453	$416	$463	$437	$1,769	$498	$462	$509	$485	$1,954	$2,133
Income Tax Expense	$111	$102	$113	$107	$434	$122	$113	$125	$119	$479	$523
Net Earnings before Min Int	$342	$314	$350	$330	$1,336	$376	$349	$384	$366	$1,476	$1,610
Minority interest	($20)	($21)	($21)	($21)	($83)	($23)	($25)	($25)	($25)	($98)	($115)
Net Income	$322	$293	$328	$309	$1,252	$353	$324	$360	$341	$1,378	$1,495
Less: earnings allocated to partic securities	($2)	($2)	($2)	($2)	($9)	($2)	($2)	($2)	($2)	($9)	($10)
Net earnings available to common shareholders	$320	$291	$326	$307	$1,244	$351	$322	$357	$339	$1,369	$1,486
A/T effect one-time Items	$7	$7	$7	$7	$26	$7	$7	$7	$7	$26	$26
Adj Net Income	$314	$284	$319	$300	$1,217	$344	$315	$351	$332	$1,342	$1,459
Reported EPS, GAAP	$6.21	$5.66	$6.37	$6.01	$24.27	$6.90	$6.36	$7.08	$6.74	$27.09	$29.83
Dil Oper EPS, ex items	**$6.09**	**$5.54**	**$6.24**	**$5.89**	**$23.75**	**$6.77**	**$6.23**	**$6.95**	**$6.61**	**$26.56**	**$29.30**
Wtd Avg Sh	51.2	51.0	50.7	50.5	50.8	50.3	50.1	49.8	49.6	49.9	49.0
Avg Diluted Shares	51.5	51.3	51.2	51.0	51.3	50.8	50.6	50.4	50.3	50.5	49.8
D&A	$49	$50	$51	$52	$202	$50	$51	$52	$53	$206	$204
EBITDA	$516	$480	$529	$505	$2,029	$563	$527	$576	$553	$2,219	$2,396
TTM EBITDA	$1,847	$1,943	$1,989	$2,029	$2,029	$2,077	$2,124	$2,171	$2,219	$2,219	$2,396
Dividends Per Share	1.62	1.99	1.99	1.99	7.58	1.99	2.38	2.38	2.38	9.12	10.36
Shipping Days	64	64	64	63	255	64	64	63	63	254	256
% of Sales:											
Net Sales	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Cost of sales	61.8%	62.3%	63.8%	63.3%	62.8%	62.1%	62.6%	64.1%	63.6%	63.1%	63.5%
Gross Prft.	38.2%	37.7%	36.2%	36.7%	37.2%	37.9%	37.4%	35.9%	36.4%	36.9%	36.5%
Warehouse, mkting, admin exp (ex items)	25.0%	25.8%	22.9%	24.0%	24.4%	24.3%	25.1%	22.3%	23.3%	23.7%	23.1%
Operating Income	13.2%	11.9%	13.3%	12.7%	12.8%	13.6%	12.3%	13.6%	13.1%	13.2%	13.4%
Equity in income (loss) of unconsolidated entities-net	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Gain / (Loss) on sale of unconsol. equity or investment secs.	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Unclassified Net	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%
Earnings before Tax	12.9%	11.5%	12.9%	12.3%	12.4%	13.2%	12.0%	13.2%	12.7%	12.8%	13.1%
Income Tax %	24.5%	24.5%	24.5%	24.5%	24.5%	24.5%	24.5%	24.5%	24.5%	24.5%	24.5%
Net Profit %	9.1%	8.1%	9.1%	8.7%	8.8%	9.4%	8.4%	9.3%	8.9%	9.0%	9.2%
A/T effect one-time Items	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%
Adj Net Income	8.9%	7.9%	8.9%	8.4%	8.5%	9.1%	8.2%	9.1%	8.7%	8.8%	8.9%
Statistics:											
Total Sales Growth	14.4%	12.4%	6.7%	6.2%	9.8%	6.9%	7.0%	6.9%	7.2%	7.0%	6.6%
Est Calendar Effects on Sales (shipping days)	1.6%	0.0%	0.0%	0.0%	0.4%	0.0%	0.0%	-1.6%	0.0%	-0.4%	0.8%
Total Daily Sales Growth	12.8%	12.4%	6.7%	6.2%	9.4%	6.9%	7.0%	8.5%	7.2%	7.4%	5.9%
Est Acquired Sales Growth	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Est FX Effects on Sales	-1.3%	-1.3%	-0.8%	-0.2%	-0.9%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Est Organic Sales Growth in local currency	14.1%	13.7%	7.5%	6.4%	10.3%	6.9%	7.0%	8.5%	7.2%	7.4%	5.9%
Gross Profit y/y Growth	23.3%	20.9%	4.2%	4.4%	12.7%	6.0%	6.1%	6.1%	6.3%	6.1%	5.6%
Operating Profit y/y Growth	30.4%	28.6%	9.1%	8.7%	18.1%	10.0%	10.7%	9.7%	10.4%	10.2%	8.9%
YOY EBITDA Contrib Mrg	26%	24%	20%	19%	23%	20%	19%	19%	19%	19%	17%
TTM Operating Efficiency Ratio	1.50	1.51	1.52	1.52	1.52	1.53	1.54	1.55	1.55	1.55	1.58
YOY OP Pull-Thru	43%	41%	76%	65%	47%	57%	55%	58%	58%	57%	56%
SEQ Op Profit Pull-Thru	53%	-323%	-85%	-417%		50%	-281%	-79%	-252%		
Pre-tax Income y/y Growth	32.2%	30.4%	9.7%	9.0%	19.2%	9.9%	11.1%	10.0%	10.9%	10.5%	9.1%
Y/Y Growth EBITDA	28.6%	25.2%	9.4%	8.6%	17.2%	9.2%	9.8%	8.9%	9.6%	9.4%	8.0%
Seq Growth TTM EBITDA	6.6%	5.2%	2.3%	2.0%		2.3%	2.3%	2.2%	2.2%		
Net Income y/y Growth	35.5%	30.2%	10.6%	9.1%	20.1%	9.4%	10.7%	9.5%	10.4%	10.0%	8.5%
EPS (b/f items) y/y Growth	35.8%	29.6%	10.5%	8.3%	19.7%	11.3%	12.6%	11.3%	12.3%	11.8%	10.3%

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W.W. Grainger, Inc.

Balance Sheet Model

$Million, except per share

								prelim	Est	Est	Est	Est	Est	Est	Est	Est	Est
Assets:	Mar-20	Jun-20	Sep-20	Dec-20	Mar-21	Jun-21	Sep-21	Dec-21	Mar-22	Jun-22	Sep-22	Dec-22	Mar-23	Jun-23	Sep-23	Dec-23	Dec-24
Cash and cash equivalents	$1,492	$1,603	$859	$585	$562	$547	$328	$241	$441	$451	$450	$446	$377	$386	$385	$382	$408
Trade accounts Rec, Net	$1,613	$1,460	$1,485	$1,474	$1,576	$1,634	$1,742	$1,754	$1,842	$1,877	$1,899	$1,901	$1,968	$2,007	$2,030	$2,037	$2,176
Inventories	$1,615	$1,695	$1,780	$1,733	$1,675	$1,707	$1,786	$1,870	$1,811	$1,816	$1,908	$1,980	$1,893	$1,900	$1,995	$2,078	$2,174
Deferred income tax asset	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Prepaid exp and other current assets	$194	$160	$149	$127	$121	$169	$149	$146	$146	$146	$146	$146	$146	$146	$146	$146	$146
Total current assets	$4,914	$4,918	$4,273	$3,919	$3,934	$4,057	$4,005	$4,011	$4,239	$4,290	$4,402	$4,472	$4,385	$4,439	$4,557	$4,643	$4,904
PP&E, net of depreciation	$1,357	$1,365	$1,394	$1,395	$1,441	$1,436	$1,429	$1,424	$1,449	$1,474	$1,499	$1,524	$1,549	$1,574	$1,599	$1,624	$1,724
Deferred income taxes	$10	$10	$11	$14	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Goodwill	$361	$365	$369	$391	$388	$390	$387	$384	$384	$384	$384	$384	$384	$384	$384	$384	$384
Other assets and intangibles, net	$535	$536	$536	$576	$570	$579	$569	$773	$766	$759	$752	$745	$738	$731	$724	$717	$689
Total Assets	$7,177	$7,194	$6,583	$6,295	$6,333	$6,462	$6,390	$6,592	$6,838	$6,907	$7,037	$7,125	$7,056	$7,128	$7,264	$7,368	$7,701
Liabilities:																	
Short-term debt	$17	$15	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Curr maturities of LT debt	$21	$21	$12	$8	$7	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Trade accounts payable	$863	$770	$836	$779	$887	$954	$933	$816	$972	$1,029	$1,010	$875	$1,069	$1,132	$1,112	$968	$1,068
Accrued comp and benefits	$177	$212	$201	$240	$219	$285	$259	$319	$251	$320	$276	$339	$268	$343	$296	$363	$388
Accrued contributions to employees' profit plan	$19	$33	$48	$67	$20	$0	$0	$0	$22	$0	$0	$0	$24	$0	$0	$0	$0
Accrued expenses	$384	$312	$324	$305	$310	$321	$336	$356	$355	$361	$359	$378	$380	$386	$383	$405	$432
Income taxes	$19	$25	$20	$42	$88	$29	$22	$37	$101	$33	$23	$39	$108	$35	$25	$42	$45
Total current liabilities	$1,500	$1,388	$1,441	$1,441	$1,531	$1,589	$1,550	$1,528	$1,700	$1,743	$1,668	$1,630	$1,848	$1,896	$1,816	$1,778	$1,933
Long-Term Debt	$3,303	$3,301	$2,388	$2,389	$2,373	$2,375	$2,372	$2,362	$2,399	$2,435	$2,615	$2,734	$2,397	$2,417	$2,595	$2,716	$2,716
Deferred Income Taxes	$99	$103	$112	$110	$87	$88	$88	$121	$121	$121	$121	$121	$121	$121	$121	$121	$121
Accrued empl.-related benefit costs/Other	$245	$250	$267	$262	$262	$269	$263	$421	$421	$421	$421	$421	$421	$421	$421	$421	$421
Total Liabilities	$5,147	$5,042	$4,208	$4,202	$4,253	$4,321	$4,273	$4,432	$4,641	$4,720	$4,825	$4,907	$4,787	$4,856	$4,953	$5,037	$5,191
Shareholder's Equity:																	
Preferred stock	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Common Stock	$55	$55	$55	$55	$55	$55	$55	$55	$55	$55	$55	$55	$55	$55	$55	$55	$55
Add'l Contributed Capital	$1,192	$1,192	$1,192	$1,192	$1,192	$1,192	$1,192	$1,192	$1,192	$1,192	$1,192	$1,192	$1,192	$1,192	$1,192	$1,192	$1,192
Retained Earnings and non-controlling interest	$8,720	$8,842	$9,065	$9,283	$9,445	$9,614	$9,832	$10,045	$10,282	$10,472	$10,697	$10,903	$11,154	$11,357	$11,596	$11,817	$12,795
Unearned restricted stock comp	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Accumulated other comprehensive earnings	($217)	($217)	($217)	($217)	($217)	($217)	($217)	($217)	($217)	($217)	($217)	($217)	($217)	($217)	($217)	($217)	($217)
Treasury Stock	($7,720)	($7,720)	($7,720)	($8,220)	($8,395)	($8,503)	($8,745)	($8,915)	($9,115)	($9,315)	($9,515)	($9,715)	($9,915)	($10,115)	($10,315)	($10,515)	($11,315)
Total Stockholder's Equity	$2,030	$2,152	$2,375	$2,093	$2,080	$2,141	$2,117	$2,160	$2,197	$2,187	$2,212	$2,218	$2,269	$2,272	$2,311	$2,332	$2,510
Total Liabilities & Shareholder Equity	$7,177	$7,194	$6,583	$6,295	$6,333	$6,462	$6,390	$6,592	$6,838	$6,907	$7,037	$7,125	$7,056	$7,128	$7,264	$7,368	$7,701
Statistics:																	
Cash (including marketable securities) % of sales	49.7%	56.5%	28.5%	19.9%	18.2%	17.1%	9.7%	7.2%	12.5%	12.5%	12.5%	12.5%	10.0%	10.0%	10.0%	10.0%	10.0%
Net Receiv, in DSOs	49.0	47.0	44.9	45.7	46.6	46.5	47.1	47.6	47.6	47.5	48.1	48.6	47.6	47.5	48.1	48.6	48.6
Yr/Yr Increase in Net Receivables	8.6%	-2.9%	-0.7%	3.4%	-2.3%	11.9%	17.3%	19.0%	16.9%	14.8%	9.0%	8.4%	6.9%	7.0%	6.9%	7.2%	6.8%
Allowance for Bad Debt Exp	1.7%	1.7%	1.7%	1.7%	1.7%	1.7%	1.7%	1.7%	1.7%	1.7%	1.7%	1.7%	1.7%	1.7%	1.7%	1.7%	1.7%
Inv, in days CGS	78.4	84.9	83.6	82.6	76.8	74.8	76.8	81.0	75.8	73.8	75.8	80.0	73.8	71.8	73.8	78.0	76.0
Inv Turns	4.7	4.3	4.4	4.4	4.8	4.9	4.8	4.5	4.8	4.9	4.8	4.6	4.9	5.1	4.9	4.7	4.8
Sales-to-(A/R + Inventory) [co. goal > 3.0]	3.7	3.6	3.7	3.7	3.8	3.8	3.8	3.7	3.9	3.9	3.8	3.7	3.9	3.9	3.8	3.7	3.8
Payables, in DCGS	41.9	38.6	39.2	37.1	40.7	41.8	40.1	35.4	40.7	41.8	40.1	35.4	41.7	42.8	41.1	36.4	37.4
Cash Conversion Cycle, in days	85.5	93.3	89.2	91.2	82.7	79.5	83.8	93.3	82.7	79.5	83.8	93.3	79.7	76.5	80.8	90.3	87.3
Yr/Yr Increase Inv	6.0%	10.4%	17.1%	0.0	3.7%	0.7%	0.3%	0.1	8.1%	6.4%	6.8%	0.1	4.6%	4.6%	4.6%	0.0	0.0
Yr/Yr Increase Payables	16.5%	-1.3%	15.6%	0.1	2.8%	23.9%	11.6%	0.0	9.5%	7.9%	8.2%	0.1	10.0%	10.1%	10.1%	0.1	0.1
Current Ratio	3.3	3.5	3.0	2.7	2.6	2.6	2.6	2.6	2.5	2.5	2.6	2.7	2.4	2.3	2.5	2.6	2.5
Working Capital as % of TTM Sales	20.2%	20.5%	20.8%	20.6%	19.9%	19.5%	20.6%	21.6%	19.9%	19.2%	19.8%	21.0%	19.2%	18.8%	19.4%	20.6%	20.1%
Int-bearing Debt % Cap	62.2%	60.8%	50.3%	53.4%	53.4%	52.6%	52.8%	52.2%	52.2%	52.7%	54.2%	55.2%	51.4%	51.5%	52.9%	53.8%	52.0%
Net Int-bearing Debt % Total Cap	34.4%	31.6%	32.3%	40.4%	40.8%	40.5%	45.5%	46.9%	42.6%	42.9%	44.9%	46.2%	43.3%	43.3%	45.0%	46.2%	44.2%
LTD % Equity	164.6%	155.1%	101.1%	114.5%	114.4%	110.9%	112.0%	109.4%	109.2%	111.4%	118.2%	123.3%	105.6%	106.4%	112.3%	116.5%	108.2%
TTM GMROI (5pt inv)	2.80	2.66	2.55	2.48	2.45	2.51	2.60	2.68	2.77	2.86	2.84	2.83	2.84	2.86	2.86	2.87	2.90
Book Value per Sh	$37.87	$40.22	$44.31	$39.27	$39.77	$41.02	$40.87	$42.02	$42.94	$42.92	$43.61	$43.93	$45.13	$45.40	$46.38	$47.01	$51.53
Tangible Book	$21.16	$23.38	$27.43	$21.13	$21.45	$22.45	$22.41	$19.51	$20.46	$20.49	$21.21	$21.57	$22.82	$23.12	$24.14	$24.81	$29.50
DuPont Analysis:																	
TTM NI Mgn (From Ops)	7.9%	7.5%	7.6%	7.4%	7.4%	7.4%	7.5%	7.9%	8.3%	8.5%	8.5%	8.5%	8.6%	8.6%	8.7%	8.8%	8.9%
Asset Turnover (TTM)	1.6	1.6	1.8	1.9	1.9	1.9	2.0	2.0	2.0	2.0	2.0	2.0	2.1	2.1	2.1	2.1	2.1
ROA, end	12.9%	12.2%	13.5%	13.9%	13.9%	14.0%	14.9%	15.7%	16.3%	17.0%	17.0%	17.1%	17.7%	17.9%	18.0%	18.2%	18.9%
Assets/Equity, end	3.5	3.3	2.8	3.0	3.0	3.0	3.0	3.1	3.1	3.2	3.2	3.2	3.1	3.1	3.1	3.2	3.1
ROE, end	**45.8%**	**40.7%**	**37.5%**	**41.8%**	**42.5%**	**42.1%**	**44.9%**	**47.9%**	**50.6%**	**53.7%**	**54.2%**	**54.9%**	**55.0%**	**56.3%**	**56.7%**	**57.6%**	**58.1%**

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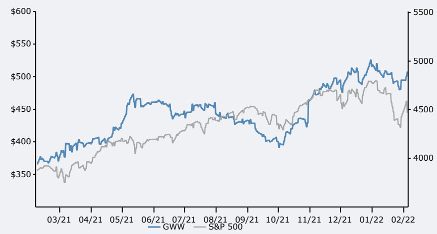
W.W. Grainger, Inc.
Annual Calculated Cash Flow Statement

	2015	2016	2017	2018	2019	Mar-20	Jun-20	Sep-20	Dec-20	2020	Mar-21	Jun-21	Sep-21	prelim Dec-21	prelim 2021	Est Mar-22	Est Jun-22	Est Sep-22	Est Dec-22	Est 2022	Est 2023	Est 2024
OPERATING ACTIVITIES																						
Net Earnings	$785	$633	$622	$823	$895	$185	$129	$256	$185	$755	$255	$243	$315	$301	$1,114	$320	$291	$326	$307	$1,244	$1,369	$1,486
Provision for losses on AR	10	16	16	7	12	6	8	4	4	22	4	4	4	6	18					0	0	0
Deferred Inc taxes / tax uncertainties	4	(6)	(5)	7	4	(7)	7	9	(14)	(5)	(11)	3	1	34	27					0	0	0
Depreciation & Amortization (total)	228	249	264	257	229	45	50	42	45	182	43	49	45	48	185	49	50	51	52	202	206	204
Stock-Based Compensation	47	36	33	47	40	9	17	10	10	46	8	17	8	9	42					0	0	0
Tax Benefit of Stock Incentive Plans	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0					0	0	0
Net Gains on sales of PPE	3	34	12	(25)	(6)	3	107	(6)	2	106	(5)	1	1	(3)	(6)					0	0	0
Writeoff of Unconsolidated Entity	0	0	0	156	123	177	0	0	10	187	0	0	0	0	0					0	0	0
Income from Unconsolidated Equity	12	31	38	19	0	0	0	0	0	0	0	0	0	0	0					0	0	0
(Increase) in Marketable Securities	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(Increase) in Net Receivables	(3)	(46)	(103)	(79)	(42)	(217)	104	(32)	24	(121)	(121)	(59)	(118)	(26)	(324)	(88)	(35)	(22)	(2)	(147)	(136)	(138)
(Increase) in Inventories	(38)	(4)	(5)	(129)	(106)	19	(163)	(78)	64	(158)	52	(30)	(86)	(88)	(152)	59	(6)	(91)	(72)	(110)	(99)	(96)
(Increase) in Deferred Inc Tax Asset	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(Increase) in Other Current Assets	16	19	(5)	(2)	(33)	(26)	(11)	8	6	(23)	(5)	(3)	7	(14)	(15)	0	0	0	0	0	0	0
(Increase) in Non-Current Def Inc Tax Asset	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Increase in Trade Accounts Payable	23	73	72	(51)	32	155	(76)	66	(65)	80	85	93	(11)	(113)	54	156	57	(19)	(135)	59	94	100
Increase in Other NIBCLs	(91)	48	120	19	(149)	(36)	48	19	71	102	(61)	(51)	(6)	72	(46)	17	(15)	(55)	97	44	54	55
Increase in Other Liabilities	(6)	(6)	(3)	8	43	(69)	12	13	(6)	(50)	50	2	1	(13)	40	0	0	0	0	0	0	0
Operating Cash Flow	$990	$1,076	$1,057	$1,057	$1,042	$244	$232	$311	$336	$1,123	$294	$269	$161	$213	$937	$513	$343	$189	$246	$1,291	$1,488	$1,610
INVESTING ACTIVITIES																						
(Increase) in Gross PP&E (CAPEX)	(359)	(284)	(237)	(239)	(221)	(50)	(43)	(59)	(45)	(197)	(73)	(74)	(50)	(58)	(255)	(74)	(75)	(76)	(77)	(302)	(306)	(304)
Proceeds from Sale of Assets		55	120	86	17	0	13	9	(2)	20	15	2	0	12	29					0	0	0
(Investment) in Unconsolidated Entities	(20)	(34)	(35)	(15)	2	(2)	0	0	0	(2)	0	0	0	0	0	0	0	0	0	0	0	0
(Increase) in Goodwill	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cash paid for business acquisitions	(464)	1	0	0	0	0	0	0	0	0	0	0	0	0	0					0	0	0
(Increase) in Other Assets/Intangibles	0	0	6	2	0	0	0	0	0	0	0	0	0	0	0	7	7	7	7	28	28	28
Investing Cash Flow	($843)	($262)	($146)	($166)	($202)	($52)	($30)	($50)	($47)	($179)	($58)	($72)	($50)	($46)	($226)	($67)	($68)	($69)	($70)	($274)	($278)	($276)
FINANCING ACTIVITIES																						
Increase in Debt	1556	292	24	(101)	(37)	1119	(4)	(946)	(8)	161	0	(8)	0	0	(8)	37	36	180	120	372	(18)	(0)
Purchase of Treasury Stock	(1400)	(790)	(605)	(425)	(700)	(100)	(1)	0	(500)	(601)	(175)	(108)	(242)	(170)	(695)	(200)	(200)	(200)	(200)	(800)	(800)	(800)
Additions to Equity Capital	88	46	20	153	42	14	0	17	21	52	6	-2	0	16	20					0	0	0
Exchange Rate effects	(21)	(2)	9	(9)	5	(15)	0	6	16	7	(9)	1	(3)	(5)	(16)					0	0	0
Dividends Paid	(306)	(303)	(304)	(316)	(328)	(78)	(86)	(82)	(92)	(338)	(81)	(95)	(85)	(96)	(357)	(83)	(101)	(101)	(100)	(385)	(455)	(508)
Financing Cash Flow	($83)	($757)	($858)	($699)	($1,018)	$940	(91)	($1,005)	($563)	($719)	($259)	($212)	($330)	($255)	($1,056)	($246)	($265)	($121)	($181)	($813)	($1,273)	($1,308)
Change in Cash	63	57	53	192	(178)	1132	111	(744)	(274)	225	(23)	(15)	(219)	(88)	(345)	200	10	(1)	(4)	205	(64)	26
Beginning Cash	227	290	274	327	538	360	1492	1603	859	360	585	562	547	328	585	241	441	451	450	241	446	382
Ending Cash	290	348	327	519	360	1492	1603	859	585	585	562	547	328	240	240	441	451	450	446	446	382	408
Gross Cash Flow (Inc. + Dpn. & Amort.)	1013	882	887	1079	1124	230	179	298	230	937	298	292	360	349	1299	369	341	377	359	1445	1574	1690
Free Cash Flow before div (Ops less CAI	**631**	**792**	**819**	**818**	**821**	**194**	**189**	**252**	**291**	**926**	**221**	**195**	**111**	**155**	**682**	**439**	**268**	**113**	**169**	**989**	**1182**	**1306**
EBITDA Conversion percentage		**52%**	**58%**	**51%**	**51%**					**61%**					**39%**					**49%**	**53%**	**55%**
Cash Flow from Operations	990	1076	1057	1057	1042	244	232	311	336	1123	294	269	161	213	937	513	343	189	246	1291	1488	1610
Per Share Calculations:																						
Gross Cash Flow (Inc. + Dpn&Amort.)	$ 15.41	$ 14.49	$ 15.29	$ 19.09	$ 20.47	$ 4.28	$ 3.33	$ 5.53	$ 4.29	$ 17.45	$ 5.67	$ 5.56	$ 6.91	$ 6.75	$ 24.89	$ 7.16	$ 6.64	$ 7.37	$ 7.03	$ 28.20	$ 31.16	$ 33.92
Net Cash Flow (Opns. less CAPEX)	$ 9.59	$ 13.02	$ 14.13	$ 14.47	$ 14.95	$ 3.61	$ 3.52	$ 4.68	$ 5.43	$ 17.24	$ 4.20	$ 3.71	$ 2.13	$ 3.00	$ 13.07	$ 8.52	$ 5.22	$ 2.21	$ 3.32	$ 19.31	$ 23.39	$ 26.22
Cash Flow from Operations	$ 15.05	$ 17.69	$ 18.22	$ 18.69	$ 18.98	$ 4.54	$ 4.32	$ 5.77	$ 6.27	$ 20.91	$ 5.59	$ 5.12	$ 3.09	$ 4.12	$ 17.95	$ 9.96	$ 6.68	$ 3.70	$ 4.83	$ 25.20	$ 29.44	$ 32.33
Shares Outstanding	65.8	60.8	58.0	56.5	54.9	53.8	53.7	53.9	53.6	53.7	52.6	52.5	52.1	51.7	52.2	51.5	51.3	51.2	51.0	51.3	50.5	49.8

WESCO_UCC00003359

COMPANY DESCRIPTION

W. W. Grainger, Inc., headquartered in Lake Forest, Illinois, is the largest distributor of maintenance, repair, and operating (MRO) supplies in North America, although the company also has International operations largely in Japan and Europe. The company uses its network of branches, catalog, and website to distribute its products. Grainger's customers come from a wide variety of industries, including heavy and light manufacturing, retailing, commercial services, government, and agriculture/mining.



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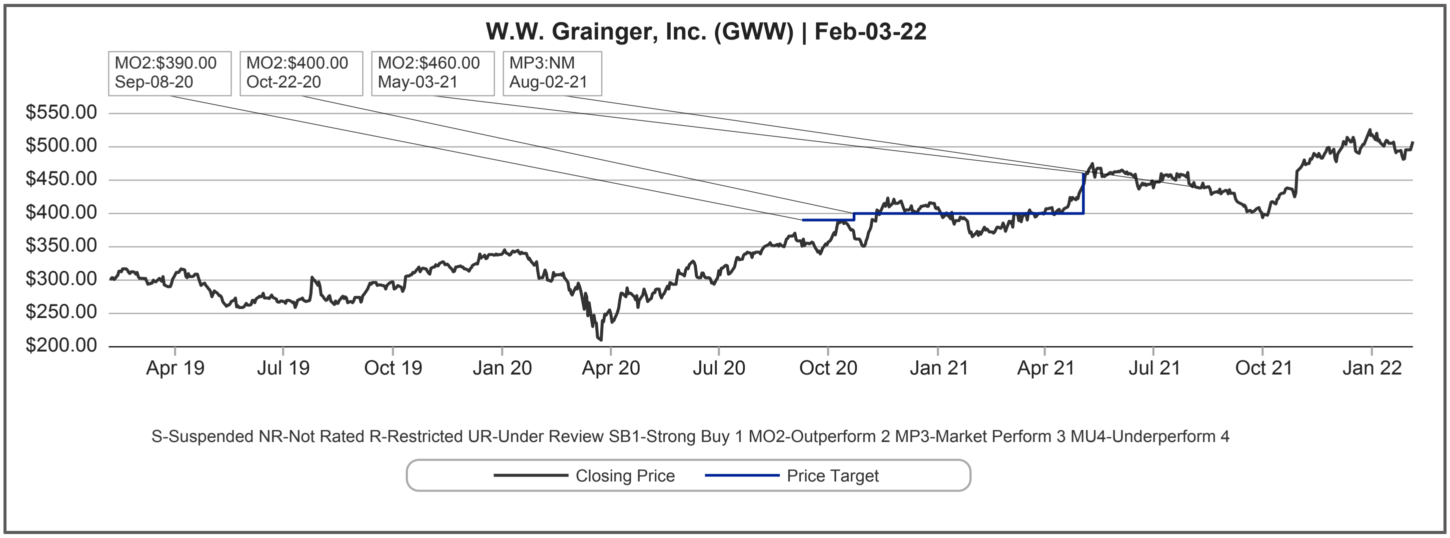

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W.W. Grainger, Inc.
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Market Perform (Hold)	316	34%	53	21%	42	13%	8	15%
Underperform (Sell)	20	2%	2	1%	5	25%	0	0%
Total Number of Companies	941	100%	255	100%	230		77	

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February 4, 2022

W.W. Grainger, Inc.

High Touch Solutions Drives 4Q21 Beat; 2022 Guidance Upside

Our view: After distributor peers FAST and MSM stumbled, Underperform-rated Grainger's 4Q21 operating beat and upside guidance was a clear standout. In a quarter where most industrial manufacturers are struggling with ongoing supply chain woes, it is a decidedly good time to be a distributor. Price/cost was positive during the quarter and Grainger is targeting gross margin expansion of 50-100 bps in 2022. Looking ahead, the company expects some slowing in Endless Assortment, which actually helps total company margins. We believe that margin pressures from ecommerce are still lurking but it is evidently not a market focus at the moment.

Key points:

What's changed/actionable: Healthy 4Q21 results with guidance above relatively low-expectations. On the heels of mixed to weak results from key peers Fastenal and MSC Industrial, Grainger's 4Q21 32c operating beat stood out to the positive. High Touch NA drove the upside on sales and margin strength, while Endless Assortment margins modestly missed our estimates and detracted from EPS. Price/cost was positive for the company and for High Touch. Grainger is leveraging its scale to cope with supply chain pressures and looks to be outgrowing as a result. The company also proactively is building inventory to set the company up for 2022. Given the inflationary environment, most of Grainger's recent purchases were at higher costs. As a result, the company's annual non-cash LIFO adjustment is larger than it has been historically and is around $49 million. Guidance was initiated 87c/3.7% above consensus at the midpoint. We are raising our 2022 EPS estimates $2.20 to $24.00, introducing our 2023 estimate at $26.95, and raising our price target $40 to $432.

Biggest Surprise: Outsized operating beat and guidance firmly above expectations. We are surprised at how Grainger is weathering the inflationary environment posting a 32c operating beat vs. our estimates. Guidance was also firmly above consensus with impressive margin expectations. It appears that 2022 will come down to execution as the demand environment remains robust.

Implications/Read-Across: High Touch US January daily sales up 16% Y/Y with non-pandemic sales up 20% reinforces that the industrial macro remains strong. Given Grainger's short-cycle nature, we believe the update is a modest positive read-across to the majority of our sector that the industrial macro remains strong even with supply chain and inflationary pressures. Lastly, in a quarter where most industrial manufacturers are struggling with ongoing supply chain woes, it is a decidedly good time to be a distributor. This is a positive for WCC.

Valuation below the midpoint of its historical relative P/E range. GWW is trading at 21.2x our 2022 EPS estimate, a 13% discount to peers, below the midpoint of its (25%)-5% historical relative P/E range. Our $432 price target assumes shares trade to a 25% discount to our 24.0x 2022 group target multiple, and supports our Underperform rating.

Underperform

NYSE: GWW; USD 507.58

Price Target USD 432.00 ↑ 392.00

WHAT'S INSIDE

☐ Rating/Risk Change	☑ Price Target Change
☐ In-Depth Report	☑ Est. Change
☐ Preview	☑ News Analysis

Scenario Analysis*

Downside Scenario	Price Target	Current Price	Upside Scenario
363.00	432.00	507.58	539.00
↓ 27%	↓ 14%		↑ 7%

*Implied Total Returns

Key Statistics

Shares O/S (MM):	69.1	Market Cap (MM):	35,074
Dividend:	5.58	Yield:	1.1%
		Avg. Daily Volume:	253,634

RBC Estimates

FY Dec	2020A	2021A	2022E	2023E
Revenue	11,797.0	13,022.0	14,211.4	15,064.9
Prev.		12,878.5	13,716.2	
EPS, Adj Diluted	16.17	19.84	24.00	26.95
Prev.		19.45	21.80	
P/AEPS	31.4x	25.6x	21.1x	18.8x

Revenue	Q1	Q2	Q3	Q4
2021	3,084.0A	3,207.0A	3,372.0A	3,359.0A
Prev.				3,215.5E
2022	3,451.4E	3,484.2E	3,637.2E	3,638.5E
Prev.	3,354.4E	3,399.1E	3,571.5E	3,391.2E
2023	3,673.0E	3,708.4E	3,810.9E	3,872.6E
EPS, Adj Diluted				
2021	4.48A	4.27A	5.65A	5.44A
Prev.				5.06E
2022	5.70E	5.81E	6.33E	6.17E
Prev.	5.20E	5.52E	5.88E	5.20E
2023	6.52E	6.58E	6.99E	6.86E

All values in USD unless otherwise noted.
Priced as of prior trading day's market close, EST (unless otherwise noted).

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Capital Markets

Key Takeaways from Grainger's 4Q21 Results

Initiates 2022 Guidance Range Above Consensus

Grainger's 2022 gross margin outlook incorporates a structural ~30 bps headwind from faster growth in lower-margin Endless Assortment. This headwind should repeat in the coming years.

Initiates 2022 EPS guidance that is 87c/3.7% above consensus at the midpoint. Grainger issued upside 2022 EPS guidance of $23.50-$25.50, 87c/3.7% above consensus and $2.70/12.4% above our previous $21.80 estimate at the midpoint. We note that this $2.00 range is exceptionally wide, but likely a result of the uncertain operating environment. Total net sales are expected to be $14.1-$14.5 billion vs. consensus at $13.9 billion and our previous $12.9 billion estimate. 2022 daily sales growth is expected to be up 7.5%-10.5% Y/Y. Lastly, gross profit margins are expected to be 36.8%-37.3%, which captures consensus of 37.0%, but is above our previous 36.6% estimate. By segment, Grainger expects 6.5%-9.5% Y/Y growth in HTS NA, with HTS US specifically outgrowing the market by 300 bps and growing 7%-10% Y/Y. Grainger expects Endless Assortment to grow ~14% and 18.5% in local currency terms with both Zoro and MonotaRO expected to grow high-teens (in local currency). Notable, the expansion in gross profit margins is expected to be driven entirely by HST NA, as management expects flat gross margins in EA as gross profit expansion in Zoro is offset by declines at MonotaRO. Additional guidance items are included in Exhibit 1.

At the peak of COVID in 2020, pandemic-related sales represented ~30% of US-specific sales, and for 2020 they were 28%. In 1Q21, the mix was down to 25%, 22% in 2Q21, 22% in 3Q21, and 21% in 4Q21. For reference, in 2019 pandemic-related sales were 19% of the mix.

EA operating margin guidance reflects increased investment in distribution center capacity at MonotaRO and modest Zoro OM expansion.

Exhibit 1 - Grainger 2022 Guidance

	2019A	2020A	2021A	2022 Guidance (As of February 3, 2022)
Sales *($ billions)*	**$11.5**	**$11.8**	**$13.0**	**$14.1 – $14.5**
Daily growth	*2.5%*	*2.3%*	*11.3%*	*7.5% - 10.5%*
Organic daily growth		*3.6%*	*12.7%*	
Gross Profit Margin	**38.3%**	**35.9%**	**36.2%**	**36.8% – 37.3%**
bps vs. prior year	*(50)*	*(235)*	*30*	*50– 100*
Operating Margin	**12.1%**	**11.2%**	**11.9%**	**12.5% – 13.1%**
bps vs. prior year	*10*	*(80)*	*65*	*65 - 125*
Tax Rate	**24.8%**	**25.3%**	**25.0%**	**24.0% - 25.0%**
EPS	**$17.29**	**$16.18**	**$19.84**	**$23.50 - $25.50**
% vs. prior year	*3.5%*	*(6.4)%*	*22.6%*	*18.5% - 28.5%*

Sales Expectations

- HTS-NA revenue growth ~6.5-9.5%
  - Assumes HTS - U.S. revenue growth of 7-10% on market growth of 4-7%
- Endless Assortment revenue growth ~14% (18.5% in local currency [1] and local days)
  - Both Zoro and MonotaRO growth expected in high-teens in local currency

Profitability Expectations

- Gross profit margin expansion
- Modest SG&A leverage in HTS-NA offset by continued DC investment at MonotaRO
- Strong earnings and continued pace of share repurchases drives EPS growth

	2019A	2020A	2021A	2022 Guidance
High-Touch Solutions N.A.	**14.2%**	**13.0%**	**13.1%**	**14.4% - 15.0%**
Endless Assortment	**6.6%**	**8.0%**	**9.0%**	**7.5% - 8.2%**
Total Company	**12.1%**	**11.2%**	**11.9%**	**12.5% – 13.1%**

($ millions)	2019A	2020A	2021A	2022 Guidance
Operating Cash Flow	**$1,042**	**$1,123**	**$937**	**$1,100 – $1,300**
CapEx(1)	**$221**	**$197**	**$255**	**$275 - $325**
Share Repurchases	**$700**	**$601**	**$695**	**$600 – $800**

Source: Company reports

- **Implied FCF conversion for 2022 in the low- to mid-70%s was underwhelming.** While sales and earnings guidance for 2022 were ahead of expectations, FCF guidance is more underwhelming. Grainger expects 2022 FCF at the midpoint of its guide of roughly $900 million, implying conversion in the low- to mid-70%s. We highlight how the robust sales growth could be a factor as Grainger builds working capital.

- **Cromwell expected to further reduce operating losses in 2022.** The troubled Cromwell business (3% of total sales) is expected to close 2022 with operating margin of -6%. Notably, Cromwell's improvement plan is behind management's original expectations, and has been driven by business closures in the UK and a slowdown in the aerospace industry, one of Cromwell's major end markets.

- **Consistent with 2021, Grainger expects a similar LIFO adjustment as they continue to see cost inflation and build inventory.** Grainger increased its inventory base significantly in the 4Q21 to set the company up for 2022. Given the inflationary environment, most of Grainger's recent purchases were at higher costs. As a result, the company's LIFO adjustment is larger than it has seen historically and is around $49 million. As a reminder, this is a non-cash adjustment.

Price/Cost Positive

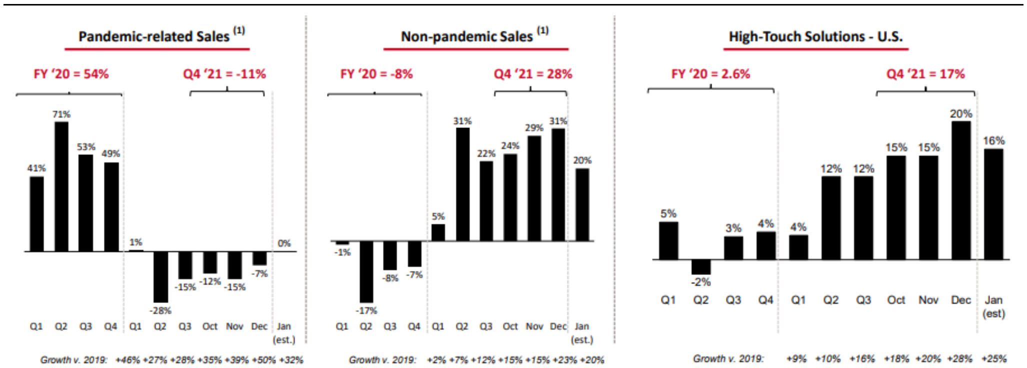
Price/cost was positive across the company and in HTS NA specifically in 4Q21. Grainger mentioned in its press release that price/cost was favorable company-wide in 4Q21, and HTS NA also saw positive price cost in the quarter. On the topic of contracts and adjusting pricing, a typical Grainger contract lasts around three years and each year there are several pricing reset dates (around three on average) where prices are adjusted up or down. This helps address the sector-wide fear over longer-term contracts where costs have dramatically increased.

Monthly Cadence and January Update Better than Expected

Monthly progression of HTS US sales modestly better than expected with January tracking up a solid 16% Y/Y vs. our expectation for a moderation to MSD% growth. HTS US daily sales were up 15% Y/Y in October, 15% in November, 20% in December, and preliminary January is tracking up a strong 16% vs. our expectation for a moderation to MSD% growth. In January, pandemic sales were flat Y/Y and non-pandemic sales look solid at up 20%, both of which show upside vs. our estimates.

Preliminary January HTS US daily sales up 16% Y/Y were ahead of our MSD% estimate.

Exhibit 2 - Grainger HTS US Segment Daily Sales Trends by Product



Source: Company reports

4Q21 by the Numbers

Healthy 32c 4Q21 operating beat vs. our estimate on HTS NA strength. Grainger reported 4Q21 EPS of $5.44, a healthy 20c headline beat vs. $5.24 consensus, and also strongly above our $5.06 estimate. Organic sales were up 16.9% Y/Y and were better than our 11.7% estimate. HTS NA drove the upside at up 16.3% vs. our 10.5% estimate (volumes up 11.4% vs. our 7.0% estimate and price up 4.9% vs. our 3.5% estimate). EA sales also surprised to the upside with organic sales up 20.6% Y/Y vs. our 17.5% estimate. At the operating line it was a 32c beat vs. our model with HTS NA +30c (better sales and margins), EA -2.5c (better sales and weaker margins), and Other +4c (better sales and margins). Below the line, Other added 1.5c and tax added 4c. Incrementals of 29% were below our 36% estimate, and pull-through of 54% was also below our 58% estimate. FCF conversion of only 55% was well below the historical 142% 4Q average due to a build in working capital.

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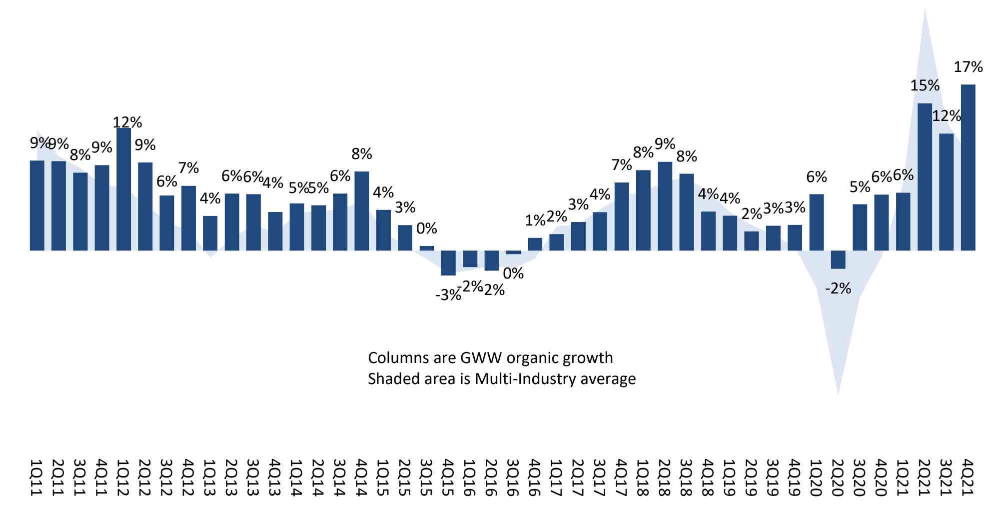
Grainger's 4Q21 organic sales were up 16.9% Y/Y and were above our 11.7% estimate.

Exhibit 3 - Grainger Organic Growth vs. Multi-Industry Sector Average



Source: Company reports, RBC Capital Markets estimates; Note: Current quarter organic growth is an estimate for the sector, but an actual for Grainger

Upcoming Catalysts / Key Points to Monitor

Grainger plans to hold an analyst meeting in the fall. The company will unveil long-term targets during the analyst meeting.

Amazon Business is now in at least eight international markets (Germany, UK, India, Japan, France, Italy, Spain, and Canada).

Amazon Business remains a threat to the broader company as well as UK-based Cromwell and Japan-based MonotaRO. Amazon Business is now live in at least eight major international markets: Germany in Dec-2016, UK in Apr-2017, India in Sept-2017, Japan in Sept-2017, France in Feb-2018, Italy in June-2018, Spain in June-2018, and Canada in Oct-2019. We note that now Amazon Business will be competing directly with Grainger's Cromwell (~3% of total sales) in the UK/Europe and Grainger's 51% stake in Japan-based MonotaRO (~5% of total sales after accounting for 51% ownership).

- **Amazon Business hits $25 billion in annualized sales/GMV as of Mar-2021.** The company is showing clear hyper-growth, and the current run-rate in sales compares to just +$1 billion in run-rate sales as of May-2016 and +$10 billion in run-rate sales as of Sept-2018. Since the Sept-2018 update, Amazon Business has been growing at a +50% CAGR. Note that third-party sellers make up +50% of Amazon Business sales/GMV.

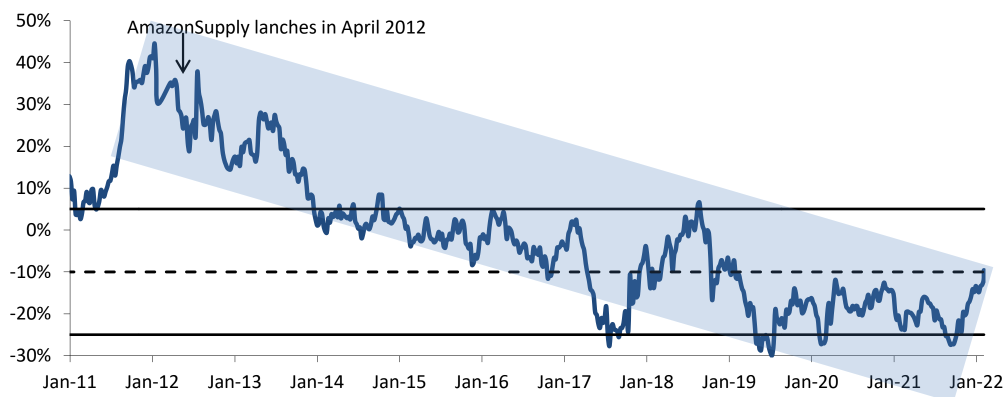
Berkshire's eSupply likely to further the trend of pricing deflation resulting from the growth of online offerings. In the summer of 2017, Warren Buffett's Berkshire Hathaway quietly acquired MROP distributor Production Tool Supply (PTS) and created a new wholesale division named Berkshire eSupply. While PTS in its own right was sizable and noted it was a top-100 distributor in the US with +1000 suppliers and +1 million SKUs across three strategic DCs (Detroit, LA, and Houston), the goal of the purchase seems to be to become a "third-party supply base" for distributors that enables smaller mom & pop distributors to build websites and provides other services to help them compete against larger peers. Thus, Berkshire is not competing directly against Amazon, for example, but rather aiding smaller mom & pop shops in their battle against bigger peers.

GWW Shares Have Been Steadily De-Rating Lower Since 2012

We expect GWW to experience more multiple compression due to the secular degradation of its once profitable branch-centric business model. GWW has seen among the most intense relative P/E multiple compression in the Multi-Industry sector in the years following the initial recovery from the 2008-2009 downturn. GWW has compressed from a heady +40% relative P/E premium to peers in late-2011/early-2012 to trading at a discount to peers currently, and this has all happened in a fairly linear and unforgiving fashion. We attribute this to the consistent fraying of its more profitable branch-centric business model, with the long shadow of Amazon/ecommerce influencing the mix shift to more competition for lower margin and more capital-intensive online/direct ship sales. We expect that Grainger is in the middle-innings of a painful multi-year reset of its business model, and believe these headwinds will continue to pressure margins over the near term. We are however mindful that Grainger will eventually adjust appropriately, and should return to being a more formidable player in the highly fragmented industrial MRO distribution market.

GWW shares have seen among the most multiple compression in the Multi-Industry sector over the past several years as it has compressed to trading at a discount to peers vs. the heady +40% relative P/E premium it once commanded in 2012.

Exhibit 4 - Grainger's Steady De-Rating vs. Multi-Industry Peers since 2012



Source: FactSet, Note: Based on consensus estimates

Valuation

Valuation below the midpoint of its historical relative P/E range. GWW currently trades at 21.2x our 2022 EPS estimate, a 13% discount to peers, below the midpoint of its (25%)-5% historical relative P/E range.

EV/EBITDA is at a 17% discount to Multi-Industry peers. On a 2022 EV/EBITDA basis, GWW is trading at a 17% discount to its large-cap Multi-Industry peers at 14.2x vs. 17.1x.

DCF implies a $439 valuation. Our DCF analysis implies a $439 valuation per share, assuming a 6.3% weighted average cost of capital with a 1.2 beta, 4.0% annual sales growth from 2024-2027, and a 1.5% terminal growth rate.

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Capital Markets

Exhibit 5 - Grainger Quarterly Income Statement ($ in millions)

$ in millions	2020				2021				2022E				2023E			
	Mar	Jun	Sep	Dec	Mar	Jun	Sep	Dec	Mar	Jun	Sep	Dec	Mar	Jun	Sep	Dec
Segment Revenues																
United States	2,307.0	2,169.0	2,347.0	2,247.0												
Canada	129.0	107.0	116.0	124.0												
Other Businesses	698.0	680.0	687.0	697.0												
Intramarket Sales	(133.0)	(119.0)	(132.0)	(127.0)												
High-Touch Solutions (N.A.)	2,355.0	2,197.0	2,377.0	2,292.0	2,397.0	2,498.0	2,663.0	2,628.0	2,675.1	2,697.8	2,849.4	2,812.0	2,808.8	2,832.7	2,946.3	2,952.6
Endless Assortment	496.0	525.0	572.0	585.0	622.0	645.0	646.0	663.0	709.7	722.4	723.5	755.8	794.9	809.1	798.8	846.5
Other	150.0	115.0	69.0	64.0	65.0	64.0	63.0	68.0	66.7	64.0	64.3	70.7	69.4	66.6	65.8	73.5
Total Revenues	**3,001.0**	**2,837.0**	**3,018.0**	**2,941.0**	**3,084.0**	**3,207.0**	**3,372.0**	**3,359.0**	**3,451.4**	**3,484.2**	**3,637.2**	**3,638.5**	**3,673.0**	**3,708.4**	**3,810.9**	**3,872.6**
Cost of sales	1,880.0	1,821.0	1,944.0	1,914.0	1,990.7	2,083.0	2,122.0	2,106.0	2,176.1	2,203.8	2,292.5	2,284.9	2,304.8	2,334.5	2,390.6	2,420.3
Selling and administrative	778.0	701.0	700.0	732.0	735.3	790.0	812.0	836.0	842.2	842.2	873.8	895.8	887.1	888.8	907.4	948.5
Segment operating income																
United States	346.0	318.0	354.0	287.0												
Canada	(2.0)	(2.0)	1.0	(1.0)												
Other Businesses	39.0	31.0	44.0	41.0												
Corporate expense	(40.0)	(32.0)	(25.0)	(32.0)												
High-Touch Solutions (N.A.)	321.0	286.0	333.0	260.0	306.0	282.0	387.0	359.0	376.3	385.5	422.6	406.6	409.1	418.9	451.7	441.7
Endless Assortment	35.0	42.0	48.0	50.0	55.0	58.0	59.0	60.0	59.9	57.7	53.8	53.3	71.1	68.7	63.4	63.9
Other	(13.0)	(13.0)	(7.0)	(15.0)	(3.0)	(6.0)	(8.0)	(2.0)	(3.1)	(5.0)	(5.6)	(2.1)	1.0	(2.6)	(2.2)	(1.8)
Total Operating Income	**343.0**	**315.0**	**374.0**	**295.0**	**358.0**	**334.0**	**438.0**	**417.0**	**433.1**	**438.2**	**470.8**	**457.8**	**481.2**	**485.1**	**512.9**	**503.8**
Equity in Affiliates	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Other expenses	4.0	7.0	5.0	5.0	6.0	7.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Interest expense, net	(21.0)	(28.0)	(23.0)	(21.0)	(21.0)	(22.0)	(22.0)	(22.0)	(22.0)	(22.0)	(22.0)	(22.0)	(22.0)	(22.0)	(22.0)	(22.0)
Pretax income	**326.0**	**294.0**	**356.0**	**279.0**	**343.0**	**319.0**	**422.0**	**401.0**	**417.1**	**422.2**	**454.8**	**441.8**	**465.2**	**469.1**	**496.9**	**487.8**
Tax	(84.0)	(76.2)	(94.2)	(65.0)	(88.1)	(76.0)	(107.0)	(100.0)	(102.2)	(103.4)	(111.4)	(108.2)	(114.0)	(114.9)	(121.7)	(119.5)
Net income	**242.0**	**217.8**	**261.8**	**214.0**	**254.9**	**243.0**	**315.0**	**301.0**	**314.9**	**318.8**	**343.4**	**333.6**	**351.2**	**354.1**	**375.2**	**368.3**
Earnings Allocated to Partic. Securities	2.0	1.0	2.0	1.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Earnings per share (basic)	4.25	3.77	4.55	3.68	4.51	4.27	5.69	5.47	5.73	5.84	6.36	6.21	6.56	6.62	7.04	6.90
Earnings per share (diluted)	**4.24**	**3.75**	**4.52**	**3.66**	**4.48**	**4.27**	**5.65**	**5.44**	**5.70**	**5.81**	**6.33**	**6.17**	**6.52**	**6.58**	**6.99**	**6.86**
Shares outstanding (basic)	53.6	53.5	53.6	53.3	52.3	52.2	51.8	51.4	51.1	50.8	50.5	50.2	50.2	50.2	50.2	50.2
Shares outstanding (diluted)	53.8	53.7	53.9	53.6	52.6	52.5	52.1	51.7	51.4	51.1	50.8	50.5	50.5	50.5	50.5	50.5
Minority Interest	12.0	15.0	16.0	17.0	17.0	18.0	18.0	18.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0
Nonrecurring (after-tax)																
Margin Analysis:																
Gross margin	37.4%	35.8%	35.6%	34.9%	35.5%	35.0%	37.1%	37.3%	37.0%	36.7%	37.0%	37.2%	37.3%	37.0%	37.3%	37.5%
Operating margin	11.4%	11.1%	12.4%	10.0%	11.6%	10.4%	13.0%	12.4%	12.5%	12.6%	12.9%	12.6%	13.1%	13.1%	13.5%	13.0%
Pretax margin	10.9%	10.4%	11.8%	9.5%	11.1%	9.9%	12.5%	11.9%	12.1%	12.1%	12.5%	12.1%	12.7%	12.6%	13.0%	12.6%
Net income margin	8.1%	7.7%	8.7%	7.3%	8.3%	7.6%	9.3%	9.0%	9.1%	9.1%	9.4%	9.2%	9.6%	9.5%	9.8%	9.5%
Cost of sales	62.6%	64.2%	64.4%	65.1%	64.5%	65.0%	62.9%	62.7%	63.0%	63.3%	63.0%	62.8%	62.7%	63.0%	62.7%	62.5%
SG&A	25.9%	24.7%	23.2%	24.9%	23.8%	24.6%	24.1%	24.9%	24.4%	24.2%	24.0%	24.6%	24.2%	24.0%	23.8%	24.5%
Tax rate	25.8%	25.9%	26.5%	23.3%	25.7%	23.8%	25.4%	24.9%	24.5%	24.5%	24.5%	24.5%	24.5%	24.5%	24.5%	24.5%
EBITDA:																
EBIT	343.0	315.0	374.0	295.0	358.0	334.0	438.0	417.0	433.1	438.2	470.8	457.8	481.2	485.1	512.9	503.8
D&A	45.0	50.0	42.0	45.0	43.0	49.0	45.0	48.0	51.6	51.5	47.3	50.4	54.2	54.0	49.6	52.9
EBITDA	**388.0**	**365.0**	**416.0**	**340.0**	**401.0**	**383.0**	**483.0**	**465.0**	**484.7**	**489.6**	**518.1**	**508.2**	**535.4**	**539.1**	**562.5**	**556.8**

Source: Company Reports; RBC Capital Markets estimates

	2020				2021				2022E				2023E			
Operating margin analysis	Mar	Jun	Sep	Dec	Mar	Jun	Sep	Dec	Mar	Jun	Sep	Dec	Mar	Jun	Sep	Dec
United States	15.0%	14.7%	15.1%	12.8%												
Canada	-1.6%	-1.9%	0.9%	-0.8%												
Other Businesses	5.6%	4.6%	6.4%	5.9%												
High-Touch Solutions (N.A.)	13.6%	13.0%	14.0%	11.3%	12.8%	11.3%	14.5%	13.7%	14.1%	14.3%	14.8%	14.5%	14.6%	14.8%	15.3%	15.0%
Endless Assortment	7.1%	8.0%	8.4%	8.5%	8.8%	9.0%	9.1%	9.0%	8.4%	8.0%	7.4%	7.0%	8.9%	8.5%	7.9%	7.5%
Other	-8.7%	-11.3%	-10.1%	-23.4%	-4.6%	-9.4%	-12.7%	-2.9%	-4.6%	-7.9%	-8.7%	-2.9%	1.4%	-3.9%	-3.3%	-2.4%
Segment operating margin	12.8%	12.2%	13.2%	11.1%												
OP margin incl. corp. exp.	**11.4%**	**11.1%**	**12.4%**	**10.0%**	**11.6%**	**10.4%**	**13.0%**	**12.4%**	**12.5%**	**12.6%**	**12.9%**	**12.6%**	**13.1%**	**13.1%**	**13.5%**	**13.0%**

Source: RBC Capital Markets estimates, Company reports

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Exhibit 6 - Grainger Annual Income Statement ($ in millions)

$ in millions	2007	2008	2014	2015	2016	2017	2018	2019	2020	2021	2022E	2023E
Segment Revenues												
United States	5,352.5	6,057.8	7,926.1	7,963.4	7,870.1	7,960.1	8,588.1	8,815.0	9,070.0			
Canada	636.5	728.0	1,075.8	890.5	733.8	752.9	653.4	529.0	476.0			
Other Businesses		111.7	1,182.2	1,405.8	1,885.0	2,120.3	2,440.6	2,651.0	2,762.0			
Intramarket Sales	(5.7)	(47.5)	(222.0)	(286.3)	(351.7)	(408.4)	(461.1)	(509.0)	(511.0)			
High-Touch Solutions (N.A.)	-	-	-	-	-	-	-	9,036.0	9,221.0	10,186.0	11,034.3	11,540.4
Endless Assortment	-	-	-	-	-	-	-	1,836.0	2,178.0	2,576.0	2,911.4	3,249.2
Other	-	-	-	-	-	-	-	614.0	398.0	260.0	265.7	275.3
Total Revenues	**6,418.0**	**6,850.0**	**9,962.0**	**9,973.4**	**10,137.2**	**10,424.9**	**11,221.0**	**11,486.0**	**11,797.0**	**13,022.0**	**14,211.4**	**15,064.9**
Cost of sales	3,814.4	4,041.8	5,637.6	5,742.0	6,010.7	6,313.7	6,872.9	7,089.0	7,559.0	8,301.7	8,957.3	9,450.1
Selling and administrative	1,933.0	2,025.6	2,967.1	2,931.1	2,859.7	2,964.5	3,004.4	3,009.0	2,911.0	3,173.3	3,454.1	3,631.8
Segment operating income												
United States	669.4	840.4	1,444.3	1,413.1	1,336.1	1,206.9	1,346.5	1,396.0	1,305.0			
Canada	40.8	54.3	87.6	31.6	(40.5)	(37.3)	(14.8)	3.0	(4.0)			
Other Businesses		(11.8)	29.6	53.7	93.0	110.7	152.9	113.0	155.0			
Corporate expense	(97.3)	(100.2)	(146.9)	(152.7)	(121.7)	(133.7)	(140.9)	(124.0)	(129.0)			
High-Touch Solutions (N.A.)	-	-	-	-	-	-	-	1,282.0	1,200.0	1,334.0	1,591.0	1,721.5
Endless Assortment	-	-	-	-	-	-	-	122.0	175.0	232.0	224.7	267.1
Other	-	-	-	-	-	-	-	(16.0)	(48.0)	(19.0)	(15.8)	(5.6)
Total Operating Income	**670.7**	**782.7**	**1,414.5**	**1,345.7**	**1,266.8**	**1,146.6**	**1,343.8**	**1,388.0**	**1,327.0**	**1,547.0**	**1,800.0**	**1,983.0**
Equity in Affiliates	2.0	3.6	-	-	-	-	-	-	-	-	-	-
Other expenses	0.0	(3.7)	(4.7)	(17.2)	(34.8)	(20.0)	4.7	26.0	21.0	25.0	24.0	24.0
Interest expense, net	9.1	(9.4)	(8.0)	(32.4)	(65.6)	(79.6)	(82.3)	(79.0)	(93.0)	(87.0)	(88.0)	(88.0)
Pretax income	**681.8**	**773.2**	**1,401.8**	**1,296.1**	**1,166.4**	**1,047.0**	**1,266.2**	**1,335.0**	**1,255.0**	**1,485.0**	**1,736.0**	**1,919.0**
Tax	(261.7)	(297.9)	(533.5)	(487.8)	(428.6)	(341.0)	(274.2)	(330.1)	(319.4)	(371.1)	(425.3)	(470.2)
Net income	**420.1**	**475.4**	**868.3**	**808.3**	**737.8**	**706.0**	**992.0**	**1,004.9**	**935.6**	**1,113.9**	**1,310.6**	**1,448.85**
Earnings Allocated to Participating Securities		9.6	9.5	7.5	5.4	4.7	6.9	8.0	6.0	8.0	8.0	8.0
Earnings per share (basic)	5.10	6.08	12.41	12.04	11.67	11.52	16.82	17.40	16.25	19.93	24.14	27.11
Earnings per share (diluted)	**4.94**	**5.96**	**12.26**	**11.93**	**11.59**	**11.46**	**16.70**	**17.30**	**16.17**	**19.84**	**24.00**	**26.95**
Shares outstanding (basic)	82.4	76.6	68.3	65.2	60.4	57.7	56.1	54.6	53.5	51.9	50.7	50.2
Shares outstanding (diluted)	85.1	78.1	69.2	65.8	60.8	58.0	56.5	55.0	53.8	52.2	51.0	50.5
Minority Interest		0.0	10.6	16.2	26.9	36.7	40.7	46.0	60.0	71.0	80.0	80.0
Nonrecurring (after-tax)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Margin Analysis:												
Gross margin	40.6%	41.0%	43.4%	42.4%	40.7%	39.4%	38.7%	38.3%	35.9%	36.2%	37.0%	37.3%
Operating margin	10.4%	11.4%	14.2%	13.5%	12.5%	11.0%	12.0%	12.1%	11.2%	11.9%	12.7%	13.2%
Pretax margin	10.6%	11.3%	14.1%	13.0%	11.5%	10.0%	11.3%	11.6%	10.6%	11.4%	12.2%	12.7%
Net income margin	6.5%	6.9%	8.7%	8.1%	7.3%	6.8%	8.8%	8.7%	7.9%	8.6%	9.2%	9.6%
Cost of sales	59.4%	59.0%	56.6%	57.6%	59.3%	60.6%	61.3%	61.7%	64.1%	63.8%	63.0%	62.7%
SG&A	30.1%	29.6%	29.8%	29.4%	28.2%	28.4%	26.8%	26.2%	24.7%	24.4%	24.3%	24.1%
Tax rate	38.4%	38.5%	38.1%	37.6%	36.7%	32.6%	21.7%	24.7%	25.5%	25.0%	24.5%	24.5%
EBITDA:												
EBIT	670.7	782.7	1,414.5	1,345.7	1,266.8	1,146.6	1,343.8	1,388.0	1,327.0	1,547.0	1,800.0	1,983.0
D&A	106.8	112.4	208.3	228.0	248.9	264.1	257.0	229.0	182.0	185.0	200.7	210.7
EBITDA	**777.5**	**895.1**	**1,622.8**	**1,573.6**	**1,515.7**	**1,410.6**	**1,600.8**	**1,617.0**	**1,509.0**	**1,732.0**	**2,000.7**	**2,193.7**

Source: Company Reports; RBC Capital Markets estimates

Operating margin analysis	2007	2008	2014	2015	2016	2017	2018	2019	2020	2021	2022E	2023E
United States	12.5%	13.9%	18.2%	17.7%	17.0%	15.2%	15.7%	15.8%	14.4%			
Canada	6.4%	7.5%	8.1%	3.5%	-5.5%	-4.9%	-2.3%	0.6%	-0.8%			
Other Businesses	0.0%	-10.6%	2.5%	3.8%	4.9%	5.2%	6.3%	4.3%	5.6%			
High-Touch Solutions (N.A.)								14.2%	13.0%	13.1%	14.4%	14.9%
Endless Assortment								6.6%	8.0%	9.0%	7.7%	8.2%
Other								-2.6%	-12.1%	-7.3%	-5.9%	-2.0%
Segment operating margin	12.0%	12.9%	15.7%	15.0%	13.7%	12.3%	13.2%	13.2%	12.3%			
OP margin incl. corp. exp.	**10.4%**	**11.4%**	**14.2%**	**13.5%**	**12.5%**	**11.0%**	**12.0%**	**12.1%**	**11.2%**	**11.9%**	**12.7%**	**13.2%**

Source: RBC Capital Markets estimates, Company reports

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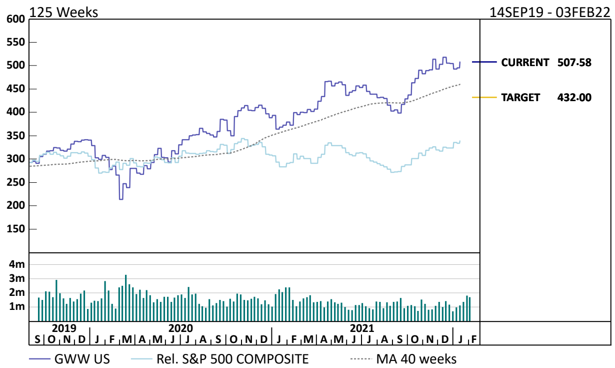
Key ESG questions

This section is intended to highlight key ESG discussion points relevant to this company, as well as our views on the outlook. Both the questions we highlight and our responses will evolve over time as the dialogue between management, analysts and investors continues to advance. We welcome any feedback on the topics.

	Our view
What are the most material ESG issues facing Grainger?	Chief among Grainger's priorities are energy efficiency, carbon reduction, renewable energy, and product stewardship. Importantly, Grainger strives to impact these critical areas for its own operations as well as its customers. Similar to other industrial distributors, Grainger strives to add value to customers by making its businesses and supply chains more efficient. During the COVID pandemic, Grainger's core industrial sales saw declines, but this lower demand was more than offset by a surge in customer demand for COVID-related PPE and cleaning supplies.
Does the company integrate ESG considerations into its strategy?	Grainger's board plays an active role in ESG, and from there the company has an ESG Leadership Council. In our view, Grainger's integration and focus on ESG is top-tier in the Multi-Industry sector. Grainger's sustainability reporting has followed GRI standards since 2017, and SASB and TCFD since 2020. In terms of how compensation is tied to ESG, the company incorporates it into discussions, but it is more "soft-wired" at this point. Grainger expects to have more "hard-wired" metrics incorporated starting in 2022.
What is diversity like at the board/ management level?	With regard to Grainger's board composition, four of the 13 directors, or 31%, are women, and 31% are considered diverse. The board is 92% independent (12 of the 13 board members are independent). The board includes a dual Chairman and CEO role. Among upper management, 33% are women and 22% are diverse (about 3,000 of roughly 15,000 employees).
What are Grainger's key goals with GHG emissions?	Since 2011, Grainger has reduced Scope 1 and Scope 2 emissions by 28%. GHG emissions were 102,020 metric tons. The company targets reducing Scope 1 and Scope 2 GHG by 30% by 2030.
Considering the importance of packaging and shipping, how does Grainger incorporate sustainability there?	Grainger works closely with suppliers to identify potential opportunities to minimize unnecessary packaging while still preventing product damage during shipping. Grainger boxes are made from 43% percent post-consumer content and certified by the Sustainable Forestry Initiative.

Target/Upside/Downside Scenarios

W.W. Grainger, Inc.



Source: Bloomberg and RBC Capital Markets estimates for Target

Valuation

Our $432 price target assumes shares trade to a 25% discount to our 24.0x target group multiple, or 18.0x our 2022 EPS estimate, at the low-end of Grainger's historical relative P/E range of (25%)-5%. Grainger's relative premium has seen meaningful compression due to the ongoing secular erosion of its branch-based business model, so we believe that a target valuation at the low-end of its historical relative range is warranted. Our price target supports our Underperform rating.

Upside scenario

A pickup in North America GDP would provide a boost to demand and likely spur higher inflation, which distributors are adept at passing through. A faster-than-expected ramp in its online business and a positive reception to pricing cuts would provide a tailwind and help combat the Amazon Business threat. Grainger could do accretive M&A with its typically strong balance sheet. Under this scenario, 2022E EPS could be ~$26.40. Shares would likely move to trading to a 15% discount to peers, implying a 20.4x multiple, yielding a $539 upside scenario.

Downside scenario

A general deterioration in macroeconomic conditions would curtail demand and likely result in a deflationary environment, which would pressure pricing and margins. There is risk Canada deteriorates and that the Amazon Business threat materializes more quickly than expected. There could also be ongoing pricing cuts and margin compression due to fierce general online competition. This would result in weaker organic revenues and operating margin contraction, resulting in ~$21.60 in 2022E EPS. Shares would likely trade below the low-end of its historical relative range to a 30% discount to peers, implying 16.8x, and this yields a $363 downside scenario.

Investment summary

As the "Marines of Industrial Distribution," Grainger continues to have a six-sigma obsession with precision and typically reinvests roughly one-third of its operating cash flow into improving the base business. That said, shares have been on a steady re-rating downslope from its heady days in 2012 when it was among the most expensive names in the Multi-Industry sector, commanding a +40% relative P/E premium to peers. We have seen some fraying of its branch-centric business model, with the long shadow of Amazon influencing the mix shift to more competition for online/direct ship. Capital intensity is increasing with the need for more DCs.

Risks to rating and price target

- **Economic conditions.** Grainger operates in cyclical industrial end markets and a meaningful pickup or slowdown in global activity would impact sales and operating margins significantly. Macro trends, including inflation/deflation, commodity costs, credit availability, currency fluctuations, and supply chain, could all materially impact results.
- **Competition and pricing.** Grainger operates in the highly fragmented and competitive industrial products distribution market. There is also a growing threat from online distributors such as Amazon Business. There is a risk that future pricing pressure may be less than expected, which could provide upside relative to our more bearish forecasts.
- **Acquisitions.** Although not a top priority at Grainger, there has been some bolt-on M&A in the past, and the deals could add to future earnings power.
- **Non-recurring events can alter sales trends.** Grainger generates 10–20% of sales from seasonal and emergency products, which can impact Y/Y sales comparisons.
- **FX rates.** Grainger generates ~25% of sales outside of the US and is therefore exposed to movements in the FX rates and the USD.
- **COVID disruptions.** The business could be disrupted by COVID impacts.

Company description

Grainger is the largest broadline distributor of maintenance, repair, and operating (MRO) supplies in North America, with a leading 6–7% market share of its key North America markets. The company operates in highly fragmented markets with a focus on the US and Canada, although its international operations have grown in recent years. Grainger estimates its total global addressable market at +$375 billion, compared to the overall global MRO distribution market at ~$570 billion. The sector typically grows with GDP. Grainger serves more than 3 million customers through 500 branches, 31 distribution centers, and 25,700 employees. The company offers approximately 1.7 million products stocked overall. Grainger was incorporated in 1928 and is headquartered in Lake Forest, Illinois.

Required disclosures

Conflicts disclosures

The analyst(s) responsible for preparing this research report received compensation that is based upon various factors, including total revenues of the member companies of RBC Capital Markets and its affiliates, a portion of which are or have been generated by investment banking activities of the member companies of RBC Capital Markets and its affiliates.

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Underperform (U): Returns expected to be materially below sector average over 12 months.
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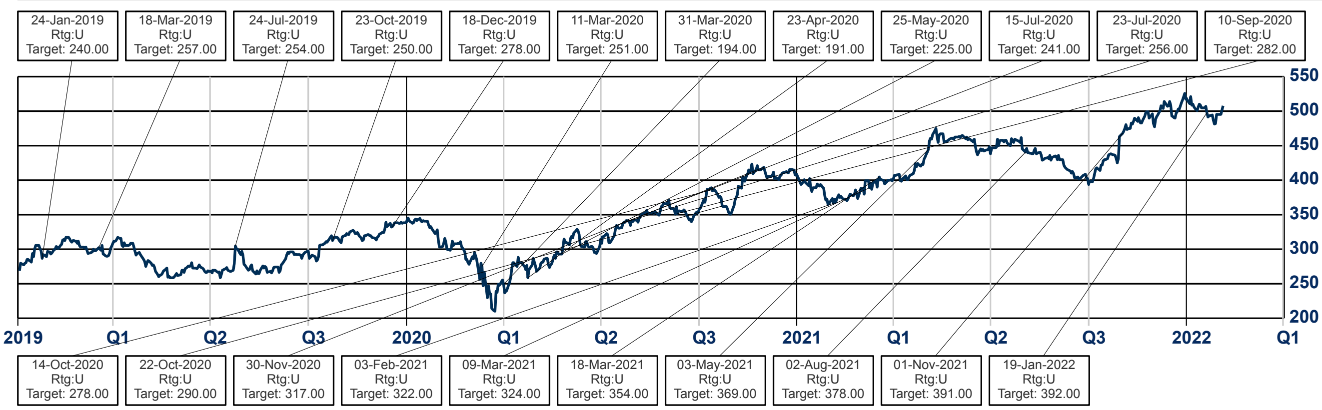
Distribution of ratings
RBC Capital Markets, Equity Research
As of 31-Dec-2021

			Investment Banking Serv./Past 12 Mos.	
Rating	**Count**	**Percent**	**Count**	**Percent**
BUY [Outperform]	**831**	**57.59**	**365**	**43.92**
HOLD [Sector Perform]	**557**	**38.60**	**180**	**32.32**
SELL [Underperform]	**55**	**3.81**	**3**	**5.45**

Rating and price target history for: W.W. Grainger, Inc., GWW US as of 03-Feb-2022 (in USD)



Legend:
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W.W. Grainger, Inc.

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Risks to rating and price target

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WOLFE RESEARCH

W.W. GRAINGER (GWW)

The Analysis Behind our GWW Upgrade and Investor Feedback

April 19, 2022

Rating:
Outperform
Price:
$490.58
Price Target:
$612.00
% Upside:
24.8%

View GWW Model
View Comp Table

Company Information

Dividend Yield	1.3%
52-Week Range	$393 - $527
Days to Cover	3.4
Market Cap. (M)	$25,070
Enterprise Value (M)	$28,415
Avg. Value Traded (MM)	$266.36
EBITDA Margin	14.5%
FCF Conversion	78.1%
ROIC	46.4%

Priced as of 04/18/22

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The Wolfe Byte

Bears worry about short-cycle sales growth in a sub-50 ISM world, but we are drawn to US safe-harbor exposure - we believe GWW can continue to gain share with margin expansion. Valuation is cheap when we account for GWW's extremely valuable eCommerce businesses.

We upgraded GWW from Peer Perform to Outperform rating on 5 April, as part of our 1Q22 earnings preview (LINK), on increasing confidence in our estimates (following upward US IP revisions), continued strong stock price performance at its listed Japanese subsidiary MonotaRO (3064-JP, NC) and a reasonable valuation. In this note, we provide more details underpinning the rating change, and feedback from investors.

The major pushback from investors can be distilled to 3 key points: 1) Stock has been a significant outperformer YTD; 2) Short cycle demand could weaken as ISM deflates back towards sub-50, with potential COVID headwinds landing on top; 3) Valuation is no longer cheap at 19x NTM EPS. While we agree that sales is on a decelerating path, we continue to view the US as a safe harbor and have become more confident that considerable market share gains can continue to provide growth tailwinds. We also see several drivers of margin expansion (price, mid-market mix, Zoro volume leverage) that could see reversion towards pre-COVID levels. *See Ex 6-20 for more details.*

GWW has been one of the strongest performers, but this has been a function of upward EPS revisions as the forward P/E multiple has remained firmly anchored with historical trend in the ~20x range. More important still, the valuation does not reflect the growing contribution of the valuable Endless Assortment eCommerce BUs: MonotaRO trades at 5.5x FY22 revenue and a similar multiple for Zoro would capitalize these two businesses at an aggregate ~$11bn. Stripping these out from the analysis, core Grainger trades at 9x EBITDA and 12x P/E – deep discounts to key distributor peers as we show in Ex 18. Our YE22 target price remains $612, which implies above-average risk/reward vs. our US Distributor coverage. *See page 2 for more details on Risk/Reward.*

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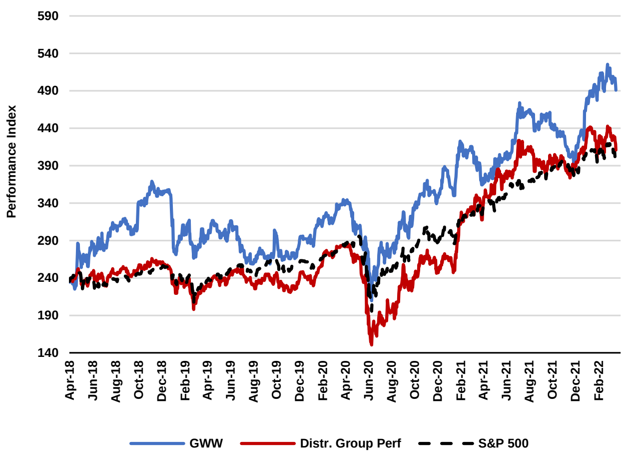
Investment Conclusion

W.W. Grainger (GWW): Outperform, $612 TP



Investment Thesis

The Right Business Model: GWW's aggressive migration from store and catalog-based sales to DC and e-Commerce business models is the right long-term strategy, in our opinion.

Portfolio Optionality: We believe GWW has multiple options to drive value centered around a deeper restructuring of its portfolio and improving performance in loss-making international operations.

Significant Earnings Potential from Single Channel: GWW is investing heavily in Zoro to expand its SKU count to 12-13m. We note a EPS potential tailwind of $2-3 over next 3 years from Zoro/MonotaRo on continued DD growth and moderating investment spend.

OP rating: We have a preference for US exposure and believe that GWW is a quality share gainer. We view GWW as too cheap when we account for its valuable eCommerce businesses.

Price Target Methodology

Bull Case	
Organic Growth (CAGR: '21-'23)	10%
OM Expansion ('21-'23)	300bps
EPS 2023e	$31.43
P/E	22x
Target Price	**$691**
Base Case	
Organic Growth (CAGR: '21-'23)	10%
OM Expansion ('21-'23)	220bps
EPS 2023e	$28.76
P/E	20x
Target Price	**$612**
Bear Case	
Organic Growth (CAGR: '21-'23)	7%
OM Expansion ('21-'23)	70bps
EPS 2023e	$22.81
P/E	16x
Target Price	**$365**

Potential Catalysts

China tariffs: 20% of US product is sourced from China. A roll back of China tariffs could represent a meaningful tailwind to street estimates.

MonatoRo Stake Optionality: GWW owns >50% of this Japanese listed company. MonotaRO trades at a significant premium that is not recognized in the current GWW multiple.

Other Margin Expansion: Other segment margins are weighed down by Zoro investment spending and international losses. We see potential for signification expansion over the next 3 years.

Industry Consolidation: The US market is highly fragmented. Further consolidation could expand Distributor multiples.

Potential Risks

Tax Policy: Biden administration could increase US corporate tax rates from 21% to 28% - this would put significant upwards pressure on GWW (and distributor sector) tax rates.

Price Pressure: Competitors could respond with a new wave of price cuts, giving way to a race to the bottom on price.

Zoro Investment Requirements Could Be Substantial: Zoro competes directly with Amazon in the small business end of the market. This could mean margins remain under pressure for longer than bulls expect.

Scenario's Commentary

Bull Case: Our 22x P/E assumes the multiple is at current levels. We bring in GWWs stake in MonotaRO at a 35% liquidity discount.

Base Case: Our 20x multiple is ahead of 5Y median multiple of 19.1x. We bring in GWWs stake in MonotaRO at a 35% liquidity discount.

Bear Case: Our 16x multiple assumes GWW sees multiple contraction on the back of the cycle turning towards trough levels. We bring in GWWs stake in MonotaRO at a 35% liquidity discount.

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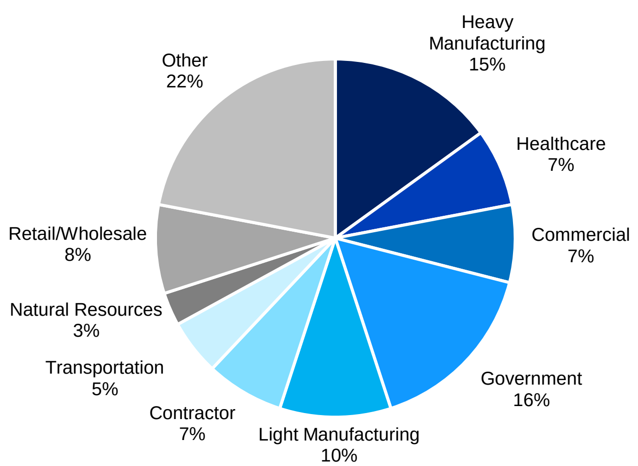
April 19, 2022

Grainger (GWW)

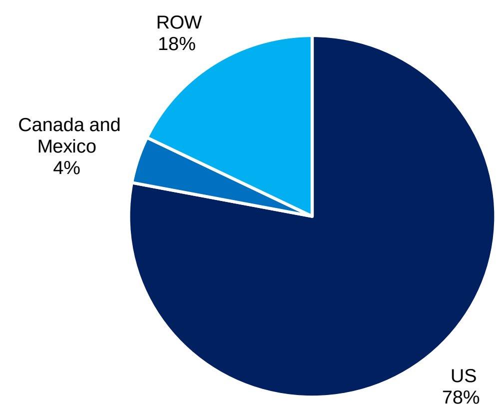
Portfolio Summary

Exhibit 1: GWW Detailed End Market Exposure



Source: Wolfe Research, Company Documents

Exhibit 2: GWW Geographic Exposure



Source: Wolfe Research, Company Documents

Exhibit 3: GWW Segment Detail

CEO: D.G. Macpherson   CFO: Deidra (Dee) Merriwether

Segment	FY22e Rev	FY22e Op. Profits	End Markets	% Of Seg Revs	Key Products & Services
High-Touch Solutions	10,752	1,480	Heavy Manufacturing	15%	**Safety & Security** - Emergency Preparedness, Facility Safety, Fire Protection, First Aid, Alarms, Fire Panels, Door
	77%	84%	Healthcare	7%	Hardware, Exit Devices, Access Controls, Locksets, Metal Detectors, Padlocks, Radios
			Commercial	7%	**Material Handling** - Carts & Trucks, Casters, Lifts, Tarps, Hoists & Rigging, Food Service, Drum & Dock, Conveyor
Endless Assortment	2,902	278	Government	16%	**Cleaning & Maintenance** - Cleaning Chemical, Equipment, Supplies, Hand & Personal Hygiene, Paper Products,
	21%	16%	Light Manufacturing	10%	Restroom Equipment, Work Uniforms
			Contractor	7%	**HVAC** - AC & Refrigeration, Air Filters, Air Treatment, Blowers, Dehumidifiers, Fans, Heating Equip, Thermostats
Other Businesses	286	0	Transportation	5%	**Lighting** - Ballasts, Batteries, Controls, Fixtures, Lamps, LED, Track Lighting
	2%	0%	Natural Resources	3%	**Electrical** - Circuit Breakers, Fuses, Tape, Cords, Relays, Solenoids, Starters, Wires, Timers, Transformers
			Retail/Wholesale	8%	**Metalworking** - Abrasives, Blades, Chemicals, Cutting Tools, Welding, Work Holders
			Other	22%	**Tools** - Chainsaws, Mixers, Cranes, Jacks, Shop Tools, Shovels, Tool Storage, Power Tools
					Power Transmission - Bearings, Belts, Brakes, Chains, Couplings, Motors, Pulleys, Sprockets

Source: Wolfe Research, Company Document

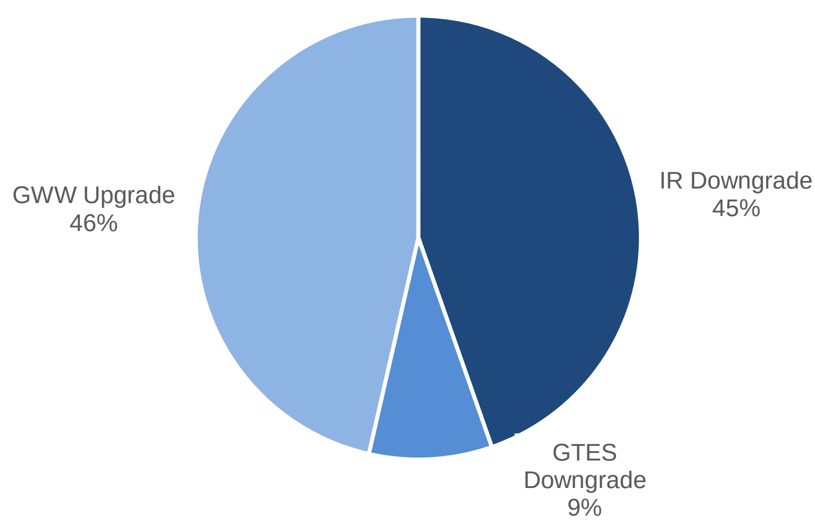
Investors Thoughts On The Upgrade

Our Grainger upgrade to OP rating on April 5 was one of 3 ratings changes that we made that day. When we polled investors on which of the three changes they disagreed with the most, 46% chose the GWW upgrade (similar in size to the IR downgrade). In this regard, we heard several concerns:

- Revenue growth could be under pressure as ISM weakens. This could lead to multiple compression.
- Stock is a COVID "winner" and therefore vulnerable to demand headwinds in a post-pandemic world.
- Stock has outperformed through 2021 and 2022 YTD. As such, the valuation has become less appealing.

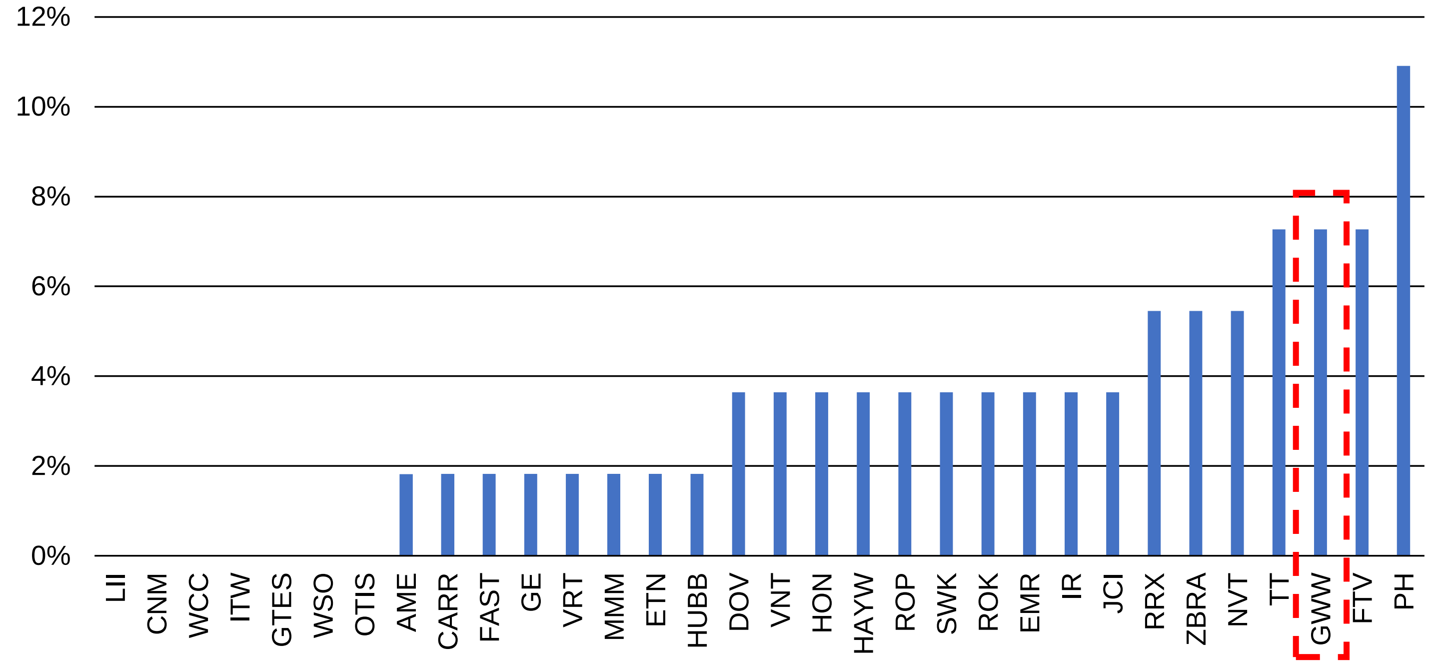
We will address many of these concerns in this feedback note. But with that said, we would highlight that GWW screened in our recent investor survey, as one of the stocks highest on the list of new long ideas (alongside PH and FTV).

Exhibit 4: Which of the 3 ratings changes do you most disagree with: Following our 1Q22 preview, we note 46% of attendees disagreed with the GWW upgrade. This compares to 45% who disagree with the IR downgrade and only 9% regarding our downgrade of GTES.



Source: Wolfe Research, Company Documents

Exhibit 5: Wolfe Multi-Industry Sentiment Survey - 1Q22: Most Likely New Long: While many investors disagreed with the upgrade, GWW screened as a stock investors are most likely to buy.



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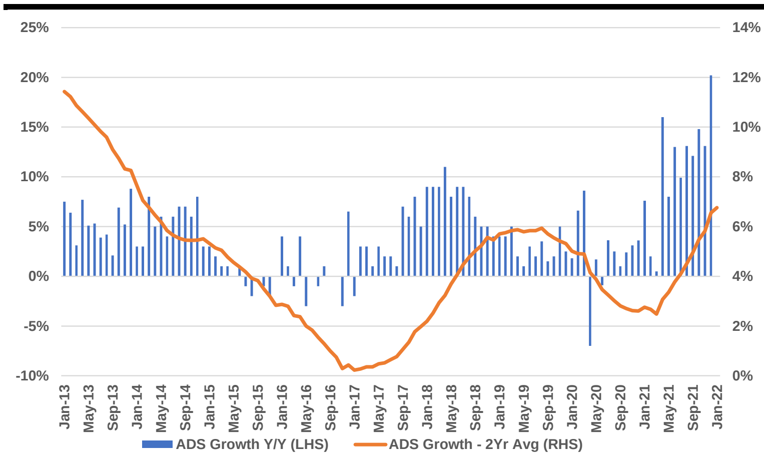
Growth Fundamentals Have Improved on Recent Share Gains

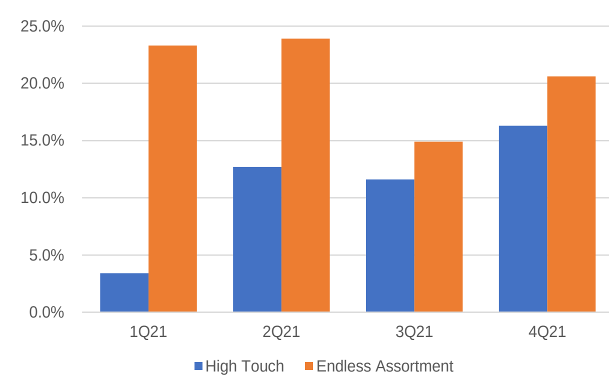
While it is clear that a slow down in the industrial sector is a risk for all companies, we continue to believe that the US remains a relative safe harbor, with growth likely to be ahead of US and China blocs through 2022. We also believe that the US industrial sector will benefit from many structural forces such as infrastructure stimulus, supply chain shortening and the recovery in O&G capex.

In this sense, GWW's elevated mix of US sales (78%) is attractive. However, we believe that GWW's share gains have been an understated part of the investment thesis. In this light, we point to ~700bps of growth outperformance over the past two years, despite pandemic-related headwinds through 2021. It is also notable that GWW has been outperforming key competitor Fastenal, especially when we adjust for fastener mix - this is a new development.

In this regard, we believe that there are increasing signs of traction in the mid-market - a high-margin customer segment on which GWW refocused back in 2017. This customer segment has been significantly outperforming national accounts and we have increasing confidence that GWW will be able to recover this business back to prior peak of $2bn, vs. $1.4bn in 2021.

Exhibit 6: Average Daily Sales – High Touch and Endless Assortment: Average daily sales on a constant currency basis in 4Q21 was +16.5%. Within High-Touch segment, the company registered both positive volume/product mix growth of +11.4% and pricing/customer mix up +4.9% with preliminary January sales growing +16%. Endless Assortment was up 20.6% on constant currency on continued customer acquisition initiatives at Zoro and MonotaRO.





Source: Wolfe Research, Company Documents

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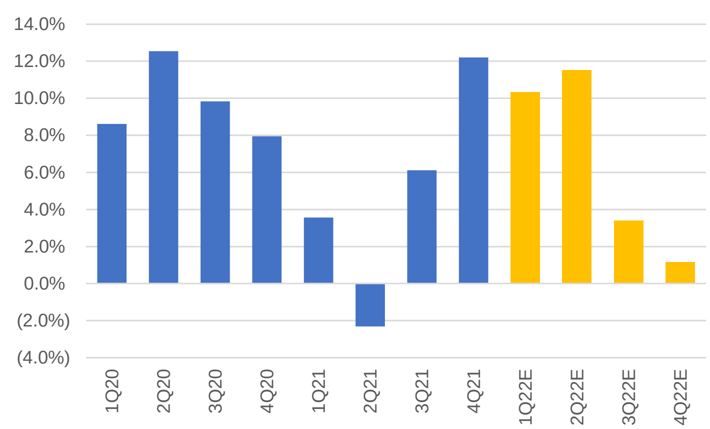
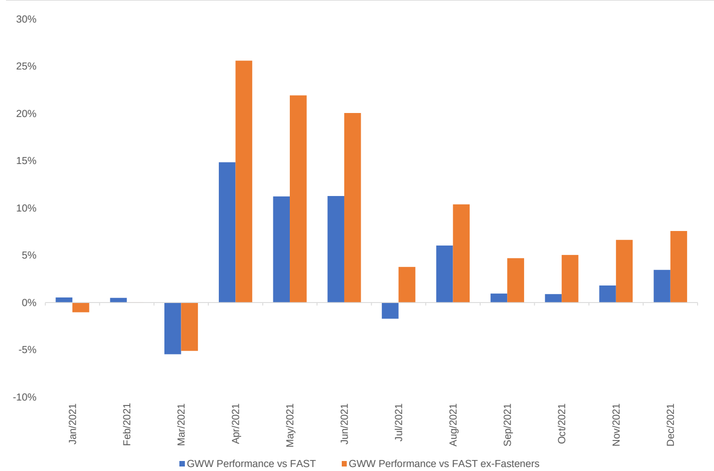
Exhibit 7: GWW High Touch US vs IP: IP has traditionally been the market growth anchor for GWW to which it aspires to outgrow by 300-400bps. This compares to the 700bps of outperformance p.a. GWW has seen vs IP in the last two years. We expect High Touch US sales to grow 9.8% in 2022 vs. 4.4% for US IP, with 2H22 to see 2pts of outgrowth; ~6% by GWW High Touch vs ~4% US IP.



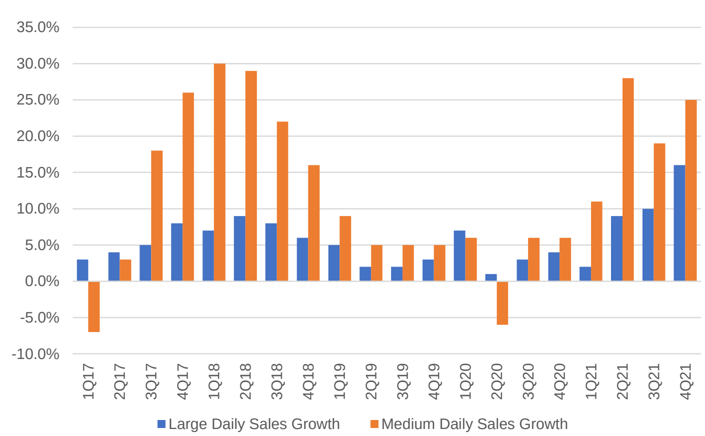
Source: Wolfe Research, Company Documents

Exhibit 8: GWW High Touch US vs FAST ADS vs FAST ADS ex-Fasteners: High Touch has generally tracked above FAST since April 2021, especially when we comp the growth to FAST daily sales ex-Fasteners to achieve an apples-to-apples growth rate.



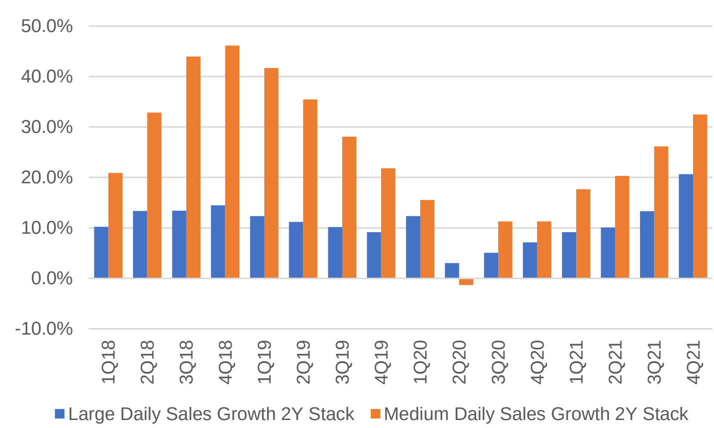
Source: Wolfe Research, Company Documents

Exhibit 9: GWW Large and Mid-Size Customer Growth: Sales growth has averaged 6% and 13% for large and mid-size customers respectively, with mid-size customers growth driven by market share gain and web pricing. Note the downturn in 1Q17 was driven by pricing adjustment and 2Q20 due to COVID slowdown.



Source: Wolfe Research, Company Documents

Exhibit 10: GWW Large and Mid-Size Customer Growth 2Y Stack: Both large and mid-sized customer growth have ramped since the lows of 2Q20 as GWW benefited from the marketing and website strategies put in place. At peak, mid-size customers made up ~$2bn/year in sales vs the $1.4bn in 2021. Management is confident in robust multiyear growth from its mid-size customer initiatives.



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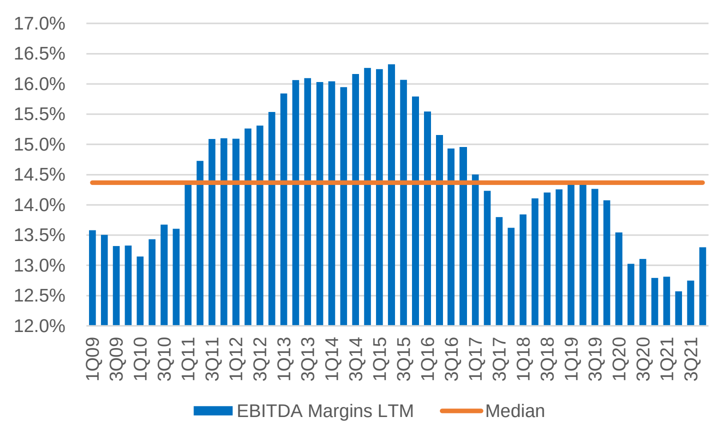
We Have More Confidence on Margin Outlook

While top-line KPIs tend to garner a disproportionate level of investor attention, we believe the prospect for margin recovery is generally under-appreciated. In this sense, we highlight that GWW's EBITDA margins are tracking well below historical levels.

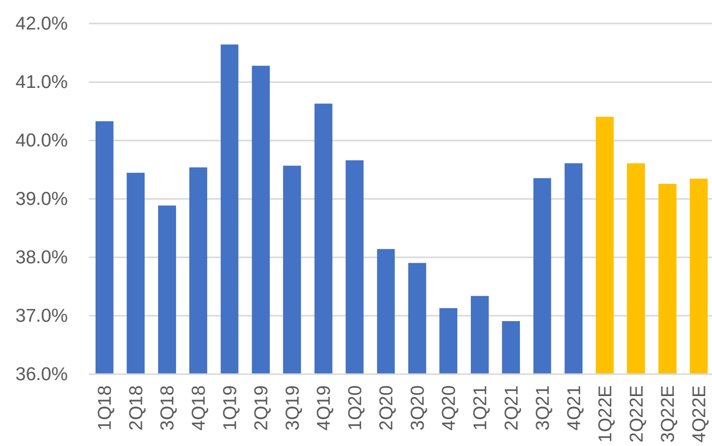
But we are confident on the outlook for improving operating leverage going forward:
- **volume tailwinds.** As we saw during early-2018, GWW has relatively high raw incremental margins and should be able to lever the mid-single volume outlook.
- **favorable mix of higher margin non-pandemic sales.** Pandemic volumes (Safety PPE and ancillary SKUs) were a driver of adverse margin mix during 2020 and also resulted in massive inventory marks that were sized at $151m between 4Q20-2Q21.
- **outlook for price tailwinds.** We believe that price accounted for ~3-4pts of the 4.9% price/customer mix in 4Q21. We see no reason why the price component cannot improve further to 5-6%, consistent with many distributor peers.
- **potential tailwind from lower freight costs,** as GWW utilizes third-party freight carriers, unlike some competitors that have captive fleets.
- **scope for substantial operating leverage at Zoro** where margins are currently tracking in the 4-5% range, vs. HSD target and ~12% at MonotaRO. Together with a return to breakeven in the UK, this could be worth a 50bps tailwind.

Exhibit 11: GWW T12M EBITDA Margin: EBITDA margin on a T12M basis stands at 13.3% as of 4Q21, a 60bps step up Q/Q but well below pre-pandemic levels, with potential for strong operating leverage in 2022 to bring us back to the 14% levels seen pre-COVID.



Source: Wolfe Research, Company Documents

Exhibit 12: GWW High Touch Gross Margin: We are just cresting back to pre-pandemic levels of ~41% gross margins in the segment, with 4Q21 margins at 39.6%. On a yearly basis, we look for 2022 High Touch gross margins to step up 130bps due to its LIFO based inventory benefit (50bps) and volume leverage.



Source: Wolfe Research, Company Documents

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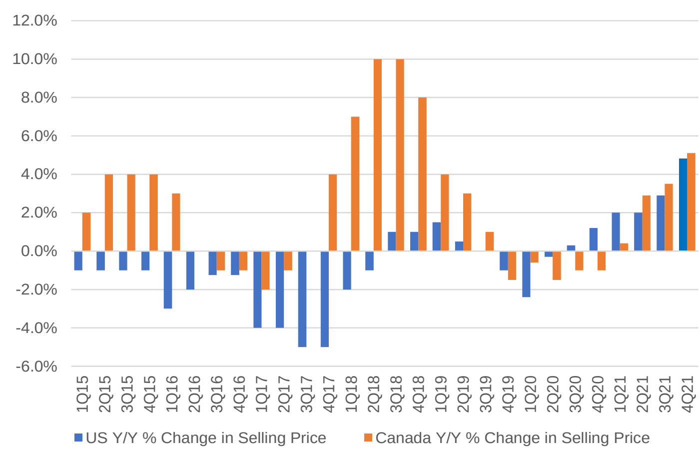
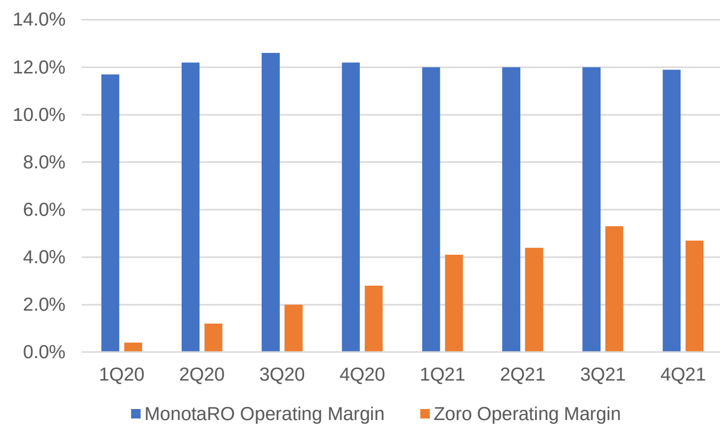
Exhibit 13: Price/Customer Mix in US and Canada: Prices have ramped up steadily through 2021 to ~5% as of 4Q21. Overall, we expect LSD price wraparound on top of other price hikes instituted in early January to point to strong operating leverage, with management confident in achieving 2019-like SG&A leverage this year.



Source: Wolfe Research, Company Documents

Exhibit 14: MonotaRO/Zoro Operating Margin: Endless Assortment is a key lever for margin expansion, with plenty of operating leverage at Zoro exemplified by its focused customer strategy and freight efficiencies – which improved margins from the 40bps seen in 1Q20 to 4.7% in 4Q21. Note that GWW is targeting HSD margin at Zoro, vs. ~12% at its sister company, MonotaRO.



Source: Wolfe Research, Company Documents

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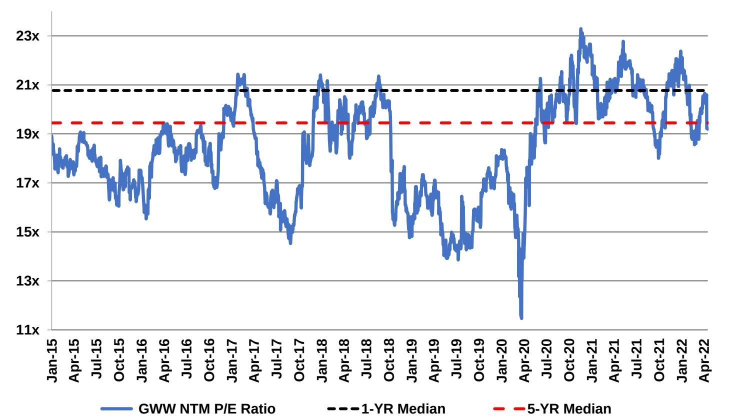
Valuation

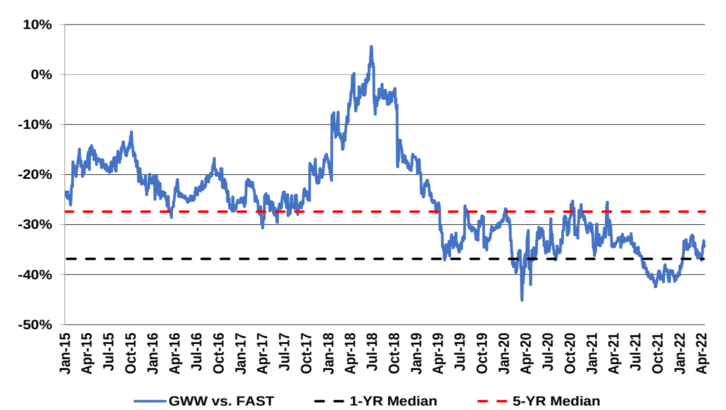
GWW has been one of the strongest performers, but this has been a function of upward EPS revisions as the forward P/E multiple has remained firmly anchored with historical trend in the ~20x range. The valuation does not reflect the growing contribution of the valuable Endless Assortment eCommerce businesses: MonotaRO trades at 5.5x FY22 revenue and a similar multiple for Zoro would capitalize these two businesses at an aggregate ~$11bn. Stripping these out from the analysis, core Grainger trades at 9x EBITDA and 12x P/E – deep discounts to key distributor peers as we show in Ex 18. Our YE22 target price remains $612, which implies above-average risk/reward vs. our US Distributor coverage.

Exhibit 15: GWW NTM P/E: GWW currently trades at 19.2x NTM P/E, between its 1Y and 5Y trend of 20.8x and 19.5x respectively.



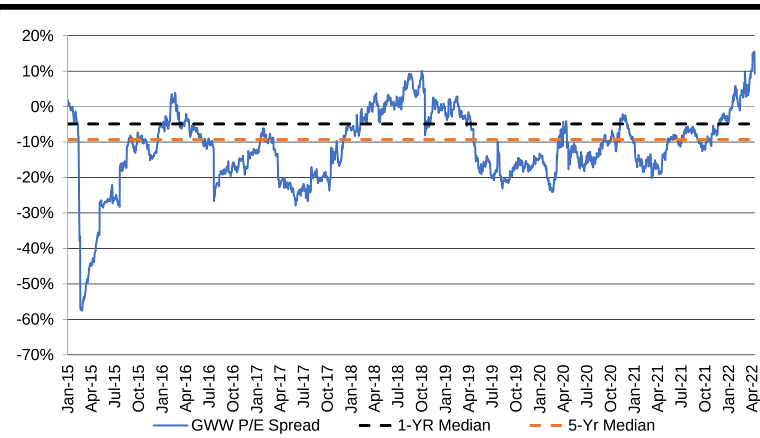
Source: Wolfe Research, Company Documents, FactSet

Exhibit 16: GWW NTM P/E Spread versus FAST: GWW currently trades at a 34% discount to FAST, which is between the 1Y discount of 37% and long-term trend of -27%. We believe the discount could reduce sharply if GWW continues to outgrow and manages to stabilize and expand margins.



Source: Wolfe Research, Company Documents, FactSet

Exhibit 17: GWW NTM P/E vs. Distributor Peers: GWW is currently valued at a premium vs its distributors peers with a valuation spread of +9%, above the 1-year and 5-year median of -5% and -9% respectively.



Source: Wolfe Research, Company Documents

Exhibit 18: GWW Valuation Ex-MonotaRO and Zoro: Grainger's 51% controlling stake in MonotaRo equates to $5.5bn and Zoro valuation at MonotaRO's 5.5x sales multiple is worth another $5.4bn. Putting it all together, core GWW then falls from 19.5x 2022 WRe, to 12.2x P/E.

Enterprise Value	
GWW Stock Price ($)	490.58
Shares ('m)	51.70
GWW Equity Capitalization ($'m)	25,363
Cash	(241.0)
Gross Debt	2,362.0
GWW EV	**27,484**
MonotaRo Stock Price (Y)	2,634.00
Shares ('m)	496.9
Equity Capitalization (Y'm)	1,308,835
JPY/USD	121.375
Equity Capitalization ($'m)	10,783
GWW Stake ($'m)	**5,500**
Zoro Sales - FY22	982.4
Multiple	5.5x
Zoro EV	**5,403**
GWW Equity Cap Ex-MonotaRO and Zoro	**14,460**
Cash	(241.0)
Gross Debt	2,284.0
GWW EV Ex-MonotaRO and Zoro	**16,503**

Metrics			
GWW EBITDA - FY22	2,084.5	GWW Earnings - FY22 ($'m)	1,300.4
Endless Assortment EBITDA - FY22	(278.5)	MonotaRO Income ($'m)	(77.2)
		Zoro Income ($'m)	(34.9)
GWW EBITDA ex-MonotaRO and Zoro	**1,806**	**GWW Earnings ex-MonotaRo and Zoro ($'m)**	**1,188**
GWW - 2022 Headline EV/EBITDA	**13.2**	**GWW - 2022 Headline P/E**	**19.5**
GWW - 2022 EV/EBITDA Ex-MonotaRO and Zoro	**9.1**	**GWW - 2022 P/E Ex-MonotaRO**	**12.2**

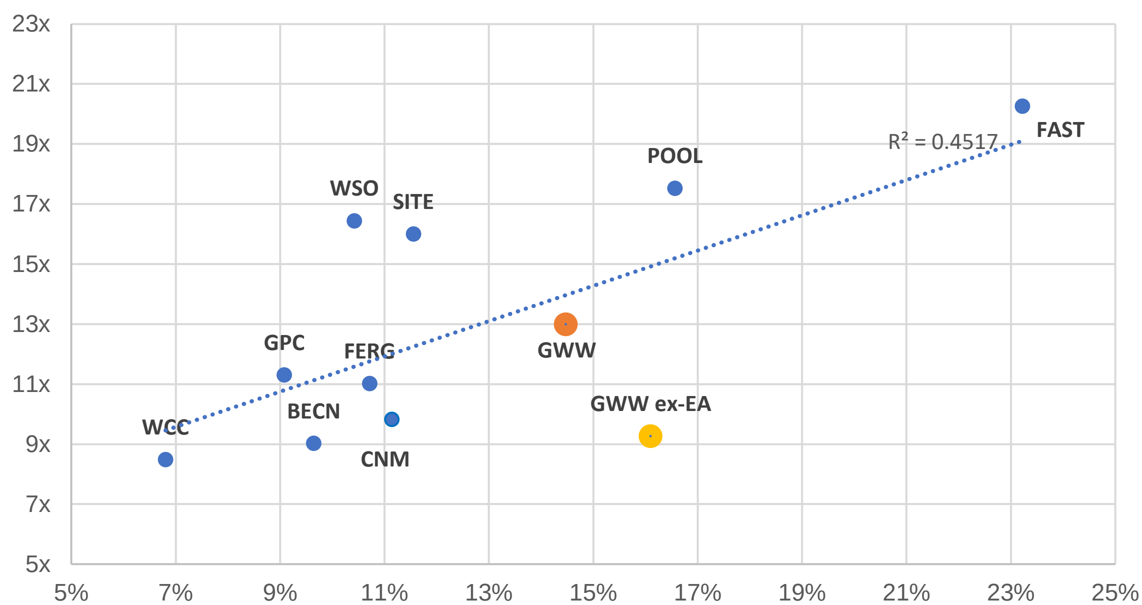
Source: Wolfe Research, Company Documents

Exhibit 19: Comping Core Grainger: GWW is vastly undervalued when we comp core GWW, which trades ~4x below peers at 12.2x P/E.

				Multiple	
Company	Ticker	Price	Market Cap (B)	P/E 2022E	EV/EBITDA 2022E
Specialty Distributors					
Grainger Ex-Monotaro/Zoro	**GWW**	**$490.58**	**$14.5**	**12.2x**	**9.1x**
Fastenal Company	FAST	$54.95	$32.2	29.3x	20.3x
WESCO International, Inc.	WCC	$123.75	$6.2	10.6x	8.5x
Genuine Parts Company	GPC	$131.14	$18.6	17.3x	11.3x
Pool Corporation	POOL	$410.49	$16.7	23.3x	17.5x
SiteOne Landscape Supply, Inc.	SITE	$144.02	$6.6	26.6x	16.0x
Watsco, Inc.	WSO	$279.56	$11.2	23.3x	16.4x
Ferguson Plc	FERG	$132.00	$28.7	14.8x	11.0x
Beacon Roofing Supply, Inc.	BECN	$58.96	$4.1	10.9x	9.0x
Median				**17.3x**	**11.3x**
Average				**18.7x**	**13.2x**

Source: Wolfe Research, Company Documents

Exhibit 20: Benchmarking Distributors EBITDA Margin to Multiple: There is a solid correlation between EBITDA margin to EBITDA multiple expansion (R^2 ex GWW = 0.6761), with FAST's 23% margin validating its 20x multiple and WCC's 7% margin to its 9x multiple. Comparatively, we estimate 16.1% EBITDA margin for High Touch in FY22, suggesting that GWW is trading well below what its margin structure would imply.



Source: Wolfe Research, Company Documents

GWW FY22 EPS Bridge

Exhibit 21: GWW FY22 Bridge

Non-Core EPS Reconciliation		Notes
FY21E EPS	**19.84**	**FY21 EPS**
Foreign Currency	(0.27)	Reflects stronger USD
Restructuring Savings	-	
M&A	-	
Inventory Adjustments	1.69	Adjusting for $118m pre-tax inventory adjustments
Price/Cost	-	Assume neutral - scope to remain positive
Amortization	-	
Tariff	-	
Interest/Below Line	(0.01)	
Tax rate	-	Assume broadly neutral
Share Count	0.17	Facrtoring in $700m repos this year
Other		
FY21E EPS - Base Adjusted	**21.41**	

FY22E Core EPS Build	Low	High	Cons	Notes
FY21E Revenue	**13,022**	**13,022**	**13,022**	
Core Revenue Growth	977	1,367	1,448	
Y/Y	*8%*	*11%*	*11.1%*	*Excludes ~3ppt of price*
Foreign Currency	(156)	(156)	(156)	
Y/Y	*-1%*	*-1%*		
Net Acquisitions	-	-	-	
Y/Y	*0.0%*	*0.0%*		
FY22E Revenue	**13,842**	**14,233**	**14,313**	Compares to guide of $14.1-14.5bn
Incremental Core Income	**146**	**273**	**227**	
Core Incremental Margin	*15.0%*	*20.0%*	*16%*	
Incremental Net Income	**111**	**206**	**171**	
Tax Rate	*25%*	*25%*	*25%*	
EPS from Core Performance	**2.14**	**3.99**	**3.30**	
DWAC	*52*	*52*	*52*	
FY21E Base-Adjusted EPS	21.41	21.41	21.41	
FY22E EPS	**23.55**	**25.40**	**24.72**	Compares to EPS guide of $23.50 - 25.50
Base Growth	*10%*	*19%*	*15%*	
Headline Growth	*19%*	*28%*	*25%*	

Source: Wolfe Research, Company Documents

Financials

Exhibit 22: GWW Divisional Summary

YE 31 December ($ million)	2015	2016	2017	2018*	2019	2020	1Q21	2Q21	3Q21	4Q21	2021	1Q22E	2Q22E	3Q22E	4Q22E	2022E	2023E
High-touch solutions (N.A.)	7,963	7,870	7,960	8,599	9,036	9,221	2,397	2,498	2,663	2,628	10,186	2,737	2,852	2,844	2,752	11,185	11,856
Canada	891	734	753	654													
Endless Assortment	1,406	1,885	2,120	2,441	1,836	2,178	622	645	646	663	2,576	710	726	730	762	2,928	3,291
Other	(286)	(352)	(408)	(461)	614	398	65	64	63	68	260	75	74	67	74	290	307
Sales	**9,973**	**10,137**	**10,426**	**11,221**	**11,486**	**11,797**	**3,084**	**3,207**	**3,372**	**3,359**	**13,022**	**3,522**	**3,652**	**3,641**	**3,587**	**14,402**	**15,453**
High-touch solutions (N.A.)	*0.5%*	*-1.9%*	*1.5%*	*7.6%*	*N/A*	*N/A*	*3.1%*	*12.7%*	*11.6%*	*11.6%*	*9.7%*	*14.0%*	*14.3%*	*6.8%*	*4.7%*	*9.7%*	*6.0%*
Canada	*-9.2%*	*-16.3%*	*1.2%*	*-13.8%*	*N/A*	*N/A*											
Endless Assortment	*20.5%*	*15.3%*	*15.0%*	*12.7%*	*N/A*	*N/A*	*-1.6%*	*0.0%*	*0.0%*	*6.2%*	*1.3%*	*1.6%*	*0.0%*	*0.0%*	*0.0%*	*0.4%*	*0.0%*
Other	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*	*0.0%*	*25.0%*	*7.0%*	*3.0%*	*8.9%*	*15.0%*	*15.0%*	*7.0%*	*7.0%*	*11.0%*	*6.0%*
Organic Sales Growth YoY	***1.3%***	***-1.0%***	***3.9%***	***7.2%***	***3.3%***	***3.6%***	***6.2%***	***14.2%***	***11.5%***	***12.5%***	***11.1%***	***14.9%***	***15.1%***	***9.0%***	***7.5%***	***11.6%***	***7.3%***
High-touch solutions (N.A.)	1,564	1,487	1,421	1,523	1,468	1,343	341	317	422	394	1,474	441	454	458	449	1,802	2,020
Canada	53	(8)	18	28													
Endless Assortment	82	165	195	330	136	192	60	63	64	65	252	67	71	72	68	279	331
Other	(124)	(128)	(214)	(281)	(6)	(39)	2	(1)	(3)	3	1	(1)	0	1	3	4	18
EBITDA ex-items	**1,575**	**1,516**	**1,420**	**1,601**	**1,598**	**1,496**	**403**	**379**	**483**	**462**	**1,727**	**508**	**525**	**531**	**520**	**2,084**	**2,368**
High-touch solutions (N.A.)	*19.6%*	*18.9%*	*17.9%*	*17.7%*	*16.2%*	*14.6%*	*14.2%*	*12.7%*	*15.8%*	*15.0%*	*14.5%*	*16.1%*	*15.9%*	*16.1%*	*16.3%*	*16.1%*	*17.0%*
Canada	*6.0%*	*-1.1%*	*2.4%*	*4.3%*													
Endless Assortment	*5.8%*	*8.8%*	*9.2%*	*13.5%*	*7.4%*	*8.8%*	*9.6%*	*9.8%*	*9.9%*	*9.8%*	*9.8%*	*9.5%*	*9.8%*	*9.9%*	*8.9%*	*9.5%*	*10.1%*
Other	*N/A*	*N/A*	*N/A*	*N/A*	*-1.0%*	*-9.8%*	*3.1%*	*-1.6%*	*-4.8%*	*4.4%*	*0.4%*	*-0.8%*	*0.3%*	*1.9%*	*4.3%*	*1.4%*	*5.7%*
EBITDA Margin	***15.8%***	***15.0%***	***13.6%***	***14.3%***	***13.9%***	***12.7%***	***13.1%***	***11.8%***	***14.3%***	***13.8%***	***13.3%***	***14.4%***	***14.4%***	***14.6%***	***14.5%***	***14.5%***	***15.3%***
High-touch solutions (N.A.)	1,413	1,321	1,215	1,347	1,282	1,200	306	282	387	359	1,334	405	418	422	413	1,658	1,871
Canada	32	(41)	(37)	(15)													
Endless Assortment	55	93	111	153	122	175	55	58	59	60	232	61	65	66	61	252	297
Other	(153)	(122)	(132)	(140)	(16)	(48)	(3)	(6)	(8)	(2)	(19)	(5)	(4)	(3)	(1)	(14)	-
Operating Income Ex-Items	**1,347**	**1,251**	**1,157**	**1,344**	**1,388**	**1,327**	**358**	**334**	**438**	**417**	**1,547**	**461**	**478**	**484**	**473**	**1,895**	**2,168**
High-touch solutions (N.A.)	*17.7%*	*16.8%*	*15.3%*	*15.7%*	*14.2%*	*13.0%*	*12.8%*	*11.3%*	*14.5%*	*13.7%*	*13.1%*	*14.8%*	*14.7%*	*14.8%*	*15.0%*	*14.8%*	*15.8%*
Canada	*3.5%*	*-5.5%*	*-4.9%*	*-2.3%*													
Endless Assortment	*3.9%*	*4.9%*	*5.2%*	*6.3%*	*6.6%*	*8.0%*	*8.8%*	*9.0%*	*9.1%*	*9.0%*	*9.0%*	*8.6%*	*8.9%*	*9.0%*	*8.0%*	*8.6%*	*9.0%*
Other	*N/A*	*N/A*	*N/A*	*N/A*	*-2.6%*	*-12.1%*	*-4.6%*	*-9.4%*	*-12.7%*	*-2.9%*	*-7.3%*	*-7.0%*	*-6.0%*	*-5.0%*	*-2.0%*	*-5.0%*	*0.0%*
Segment Margin	***13.5%***	***12.3%***	***11.1%***	***12.0%***	***12.1%***	***11.2%***	***11.6%***	***10.4%***	***13.0%***	***12.4%***	***11.9%***	***13.1%***	***13.1%***	***13.3%***	***13.2%***	***13.2%***	***14.0%***

Source: Wolfe Research, Company Documents

Exhibit 23: GWW Income Statement

YE 31 December ($ million)	2015	2016	2017	2018*	2019	2020	1Q21	2Q21	3Q21	4Q21	2021	1Q22E	2Q22E	3Q22E	4Q22E	2022E	2023E
Sales	**9,973**	**10,137**	**10,426**	**11,221**	**11,486**	**11,797**	**3,084**	**3,207**	**3,372**	**3,359**	**13,022**	**3,522**	**3,652**	**3,641**	**3,587**	**14,402**	**15,453**
YoY total revenue growth	*0.1%*	*1.6%*	*2.8%*	*7.6%*	*2.4%*	*2.7%*	*2.8%*	*13.0%*	*11.7%*	*14.2%*	*10.4%*	*14.2%*	*13.9%*	*8.0%*	*6.8%*	*10.6%*	*7.3%*
YoY organic revenue growth	*1.3%*	*-1.0%*	*3.9%*	*7.2%*	*3.3%*	*3.6%*	*6.2%*	*14.2%*	*11.5%*	*12.5%*	*11.1%*	*14.9%*	*15.1%*	*9.0%*	*7.5%*	*11.6%*	*7.3%*
Cost of sales	5,742	6,023	6,332	6,872	7,089	7,559	1,991	2,083	2,122	2,106	8,302	2,203	2,301	2,306	2,293	9,103	9,757
Gross Profit	**4,231**	**4,115**	**4,094**	**4,349**	**4,397**	**4,238**	**1,093**	**1,124**	**1,250**	**1,253**	**4,720**	**1,320**	**1,350**	**1,335**	**1,294**	**5,299**	**5,697**
Margin	*42.4%*	*40.6%*	*39.3%*	*38.8%*	*38.3%*	*35.9%*	*35.4%*	*35.0%*	*37.1%*	*37.3%*	*36.2%*	*37.5%*	*37.0%*	*36.7%*	*36.1%*	*36.8%*	*36.9%*
SG&A	2,931	2,995	3,049	3,191	3,135	3,219	735	790	812	836	3,173	859	872	852	821	3,404	3,528
D&A	228	249	264	257	229	182	43	49	45	48	185	47	47	47	47	189	200
Reported Operating Income	**1,300**	**1,119**	**1,045**	**1,158**	**1,262**	**1,019**	**358**	**334**	**438**	**417**	**1,547**	**461**	**478**	**484**	**473**	**1,895**	**2,168**
Margin	*13.0%*	*11.0%*	*10.0%*	*10.3%*	*11.0%*	*8.6%*	*11.6%*	*10.4%*	*13.0%*	*12.4%*	*11.9%*	*13.1%*	*13.1%*	*13.3%*	*13.2%*	*13.2%*	*14.0%*
Exceptional Items	47	147	111	186	126	308	-	-	-	-	-	-	-	-	-	-	-
Core Operating Income	**1,347**	**1,267**	**1,156**	**1,344**	**1,388**	**1,327**	**358**	**334**	**438**	**417**	**1,547**	**461**	**478**	**484**	**473**	**1,895**	**2,168**
Margin	*13.5%*	*12.5%*	*11.1%*	*12.0%*	*12.1%*	*11.2%*	*11.6%*	*10.4%*	*13.0%*	*12.4%*	*11.9%*	*13.1%*	*13.1%*	*13.3%*	*13.2%*	*13.2%*	*14.0%*
D&A	228	249	264	257	229	182	43	49	45	48	185	47	47	47	47	189	200
Core EBITDA	**1,575**	**1,516**	**1,420**	**1,601**	**1,617**	**1,509**	**401**	**383**	**483**	**465**	**1,732**	**508**	**525**	**531**	**520**	**2,084**	**2,368**
Margin	*15.8%*	*15.0%*	*13.6%*	*14.3%*	*14.1%*	*12.8%*	*13.0%*	*11.9%*	*14.3%*	*13.8%*	*13.3%*	*14.4%*	*14.4%*	*14.6%*	*14.5%*	*14.5%*	*15.3%*
Yoy																	
Loss (gain) on extinguishment of debt	-	(31)	(38)	(19)	-	-	-	-	-	-	-	-	-	-	-	-	-
Other (Income)/Expenses	(17)	(4)	1	24	26	21	6	7	6	6	25	6	6	6	6	25	25
Net Interest	1	1	3	6	5	3	0	0	0	0	1	0	0	0	0	1	4
Pre-Tax Income	**1,251**	**1,019**	**930**	**1,080**	**1,205**	**947**	**343**	**319**	**422**	**401**	**1,486**	**445**	**463**	**468**	**457**	**1,834**	**2,108**
Taxes	466	386	313	258	314	192	88	76	107	100	371	109	113	115	112	449	548
Effective Rate	*37.2%*	*37.9%*	*33.6%*	*23.9%*	*26.1%*	*20.3%*	*25.7%*	*23.8%*	*25.3%*	*25.0%*	*25.0%*	*24.5%*	*24.5%*	*24.5%*	*24.5%*	*24.5%*	*26.0%*
Continuing Income	**786**	**633**	**618**	**823**	**891**	**755**	**255**	**243**	**315**	**301**	**1,115**	**336**	**349**	**354**	**345**	**1,385**	**1,560**
Adjustments	(1)	73	43	121	59	114	(19)	(20)	(20)	(20)	(79)	(21)	(22)	(22)	(20)	(84)	(98)
Headline Income	**784**	**705**	**660**	**944**	**950**	**869**	**236**	**223**	**295**	**281**	**1,036**	**316**	**328**	**332**	**325**	**1,300**	**1,462**
DWAC	*66*	*61*	*58*	*57*	*55*	*54*	*53*	*53*	*52*	*52*	*52*	*52*	*52*	*52*	*52*	*52*	*51*
Headline EPS	**11.92**	**11.59**	**11.39**	**16.69**	**17.29**	**16.18**	**4.49**	**4.25**	**5.67**	**5.44**	**19.84**	**6.06**	**6.32**	**6.41**	**6.30**	**25.11**	**28.40**
Yoy	*-3%*	*-3%*	*-2%*	*47%*	*4%*	*-6%*	*6%*	*13%*	*25%*	*49%*	*23%*	*35%*	*48%*	*13%*	*16%*	*27%*	*13%*
GAAP EPS - Diluted	**11.58**	**9.87**	**9.94**	**13.73**	**15.21**	**12.82**	**4.49**	**4.25**	**5.67**	**5.44**	**19.84**	**6.06**	**6.32**	**6.41**	**6.30**	**25.11**	**28.40**

Source: Wolfe Research, Company Documents

WOLFE RESEARCH

April 19, 2022

Exhibit 24: GWW Balance Sheet

YE 31 December ($ million)	2015	2016	2017	2018*	2019	2020	1Q21	2Q21	3Q21	4Q21	2021	1Q22E	2Q22E	3Q22E	4Q22E	2022E	2023E
Cash & liquid assets	290	274	327	538	360	585	562	547	328	241	241	169	124	209	269	269	581
Short-term investments	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Accounts receivable	1,210	1,223	1,325	1,385	1,425	1,474	1,576	1,634	1,742	1,754	1,754	1,896	1,965	1,901	1,873	1,873	1,970
Inventory	1,414	1,406	1,429	1,541	1,655	1,733	1,675	1,707	1,786	1,870	1,870	1,956	2,043	2,047	2,036	2,036	2,183
Other	135	117	125	93	115	127	121	169	149	146	146	146	146	146	146	146	146
Current Assets	**3,049**	**3,020**	**3,206**	**3,557**	**3,555**	**3,919**	**3,934**	**4,057**	**4,005**	**4,011**	**4,011**	**4,166**	**4,278**	**4,303**	**4,324**	**4,324**	**4,879**
PP&E	1,431	1,421	1,392	1,352	1,400	1,395	1,441	1,436	1,429	1,424	1,424	1,462	1,503	1,544	1,585	1,585	1,762
Goodwill	582	527	544	424	429	391	388	390	387	384	384	384	384	384	384	384	384
Intangible Assets- Net	712	661	569	460	304	228	224	232	233	238	238	232	226	219	213	213	188
Other	84	65	93	80	317	362	346	347	336	535	535	535	535	535	535	535	535
Total Assets	**5,858**	**5,694**	**5,804**	**5,873**	**6,005**	**6,295**	**6,333**	**6,462**	**6,390**	**6,592**	**6,592**	**6,779**	**6,926**	**6,986**	**7,041**	**7,041**	**7,749**
Short term debt	600	406	94	130	301	8	7	-	-	-	-	-	-	-	-	-	-
Accounts payable	583	650	732	678	719	779	887	954	933	816	816	981	1,054	1,014	933	933	1,010
Other	605	573	681	693	658	654	637	635	617	712	712	661	651	661	714	714	722
Current Liabilities	**1,789**	**1,629**	**1,507**	**1,501**	**1,678**	**1,441**	**1,531**	**1,589**	**1,550**	**1,528**	**1,528**	**1,642**	**1,705**	**1,675**	**1,647**	**1,647**	**1,732**
Long term debt	1,388	1,841	2,248	2,090	1,914	2,389	2,373	2,375	2,372	2,362	2,362	2,362	2,362	2,362	2,362	2,362	2,362
Deferred Income taxes	154	126	112	103	106	110	87	88	88	121	121	121	121	121	121	121	121
Other	174	193	110	86	247	262	262	269	263	421	421	421	421	421	421	421	421
Total Liabilities	**3,505**	**3,789**	**3,977**	**3,780**	**3,945**	**4,202**	**4,253**	**4,321**	**4,273**	**4,432**	**4,432**	**4,546**	**4,609**	**4,579**	**4,551**	**4,551**	**4,636**
Common Stock	55	55	55	55	55	55	55	55	55	55	55	55	55	55	55	55	55
Paid-in capital	1,000	1,030	1,040	1,134	1,182	1,239	1,248	1,247	1,255	1,270	1,270	1,270	1,270	1,270	1,270	1,270	1,270
Retained Earnings	6,802	7,114	7,405	7,869	8,405	8,779	8,948	9,089	9,301	9,500	9,500	9,748	10,008	10,272	10,530	10,530	11,713
Other	(5,505)	(6,293)	(6,673)	(6,965)	(7,582)	(7,980)	(8,171)	(8,250)	(8,494)	(8,665)	(8,665)	(8,840)	(9,015)	(9,190)	(9,365)	(9,365)	(9,925)
Shareholders' Equity	**2,353**	**1,906**	**1,828**	**2,093**	**2,060**	**2,093**	**2,080**	**2,141**	**2,117**	**2,160**	**2,160**	**2,233**	**2,318**	**2,407**	**2,490**	**2,490**	**3,113**
Total Liabilities & Equity	**5,858**	**5,694**	**5,804**	**5,873**	**6,005**	**6,295**	**6,333**	**6,462**	**6,390**	**6,592**	**6,592**	**6,779**	**6,926**	**6,986**	**7,041**	**7,041**	**7,749**

Source: Wolfe Research, Company Documents

Exhibit 25: GWW Cash Flow Statement

YE 31 December ($ million)	2015	2016	2017	2018*	2019	2020	1Q21	2Q21	3Q21	4Q21	2021	1Q22E	2Q22E	3Q22E	4Q22E	2022E	2023E
Net Income	769	606	581	782	845	695	238	225	297	283	1,044	318	329	334	327	1,307	1,469
Depreciation & Amortization	228	249	264	257	229	182	43	49	45	48	185	47	47	47	47	189	200
Deferred taxes	(2)	(6)	(5)	7	19	-	(11)	3	1	34	27	-	-	-	-	-	-
Non-cash debt	-	34	-	146	(3)	-	-	-	-	-	-	-	-	-	-	-	-
Working Capital	(15)	23	(90)	(145)	(249)	(199)	64	(23)	(208)	(213)	(380)	(62)	(85)	20	(41)	(168)	(166)
Other	32	97	306	29	201	445	(40)	15	26	61	61	(51)	(10)	10	53	2	8
Operating Cash Flow	**1,012**	**1,003**	**1,057**	**1,076**	**1,042**	**1,123**	**294**	**269**	**161**	**213**	**937**	**252**	**282**	**411**	**386**	**1,330**	**1,510**
Capex	(374)	(284)	(237)	(239)	(221)	(197)	(73)	(74)	(50)	(58)	(255)	(79)	(82)	(82)	(82)	(325)	(352)
Free Cash Flow	**638**	**719**	**819**	**837**	**821**	**926**	**221**	**195**	**111**	**155**	**682**	**172**	**200**	**329**	**304**	**1,005**	**1,158**
FCF Margin	*6.4%*	*7.1%*	*7.9%*	*7.5%*	*7.1%*	*7.8%*	*7.2%*	*6.1%*	*3.3%*	*4.6%*	*5.2%*	*4.9%*	*5.5%*	*9.0%*	*8.5%*	*7.0%*	*7.5%*
Acquisitions	(463)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Disposals	15	55	120	86	17	20	-	-	-	-	-	-	-	-	-	-	-
Other	(12)	(33)	(29)	(13)	-	(2)	15	2	-	-	17	-	-	-	-	-	-
Cash Flow Pre Financing	**178**	**741**	**910**	**910**	**838**	**944**	**236**	**197**	**111**	**155**	**699**	**172**	**200**	**329**	**304**	**1,005**	**1,158**
Equity issuance	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Stock repurchase	(1,420)	(790)	(605)	(425)	(700)	(601)	(175)	(108)	(242)	(170)	(695)	(175)	(175)	(175)	(175)	(700)	(560)
Dividends	(308)	(303)	(304)	(316)	(328)	(338)	(81)	(95)	(85)	(96)	(357)	(85)	(85)	(84)	(84)	(338)	(353)
Other	111	78	(43)	165	17	38	14	(4)	-	34	44	15	15	15	15	61	67
Movement on Net Debt	**(1,441)**	**(274)**	**(43)**	**333**	**(173)**	**43**	**(6)**	**(10)**	**(216)**	**(77)**	**(309)**	**(72)**	**(45)**	**85**	**60**	**28**	**312**
Cash & short-term investment	290	274	327	538	360	585	562	547	328	241	241	169	124	209	269	269	581
Gross Debt	1,989	2,247	2,342	2,220	2,215	2,397	2,380	2,375	2,372	2,362	2,362	2,362	2,362	2,362	2,362	2,362	2,362
Net Debt	**(1,699)**	**(1,973)**	**(2,015)**	**(1,682)**	**(1,855)**	**(1,812)**	**(1,818)**	**(1,828)**	**(2,044)**	**(2,121)**	**(2,121)**	**(2,193)**	**(2,238)**	**(2,153)**	**(2,093)**	**(2,093)**	**(1,781)**

Source: Wolfe Research, Company Documents

DISCLOSURE SECTION

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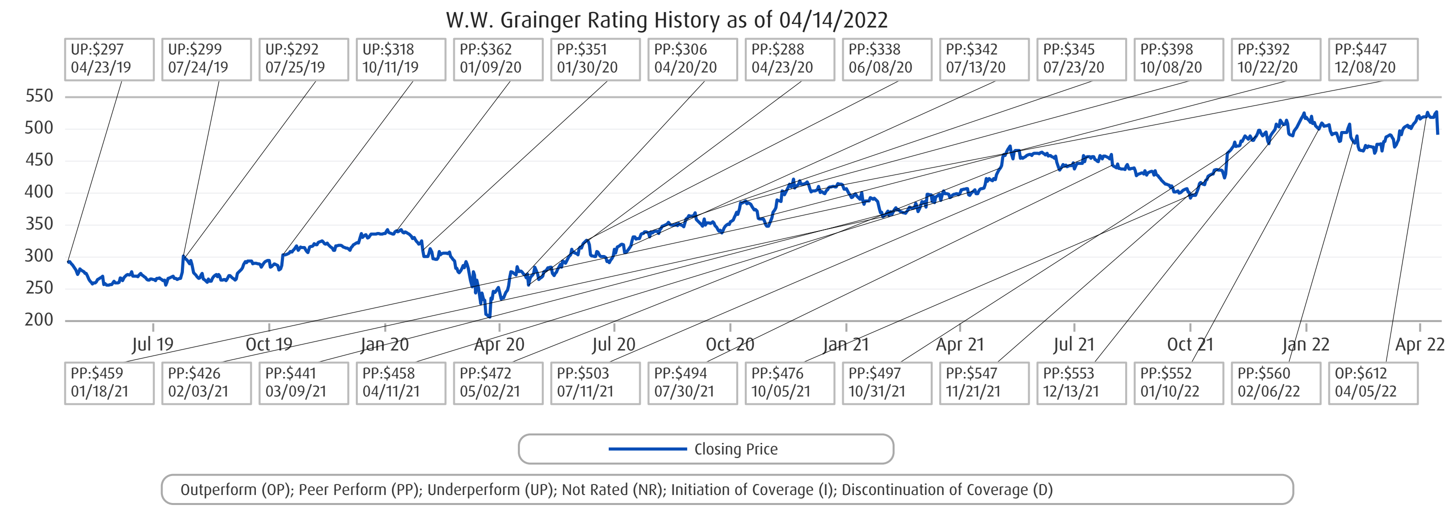
Important Disclosures:

Price Chart(s) with Ratings and Target Price History



Wolfe Research, LLC Fundamental Valuation Methodology:

Company:	Fundamental Valuation Methodology:
W.W. Grainger	Forward P/E

Wolfe Research, LLC Fundamental Recommendation, Rating and Target Price Risks:

Company:	Risks That May Impede Achievement of the Recommendation, Rating or Target Price:
W.W. Grainger	Downside risk: Industrial production decline, single channel model fails to gain traction

Wolfe Research, LLC Research Disclosures:

Company:	Research Disclosures:
W.W. Grainger	None

Other Disclosures:

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Underperform:	8%	4% Investment Banking Clients within the previous 12 months

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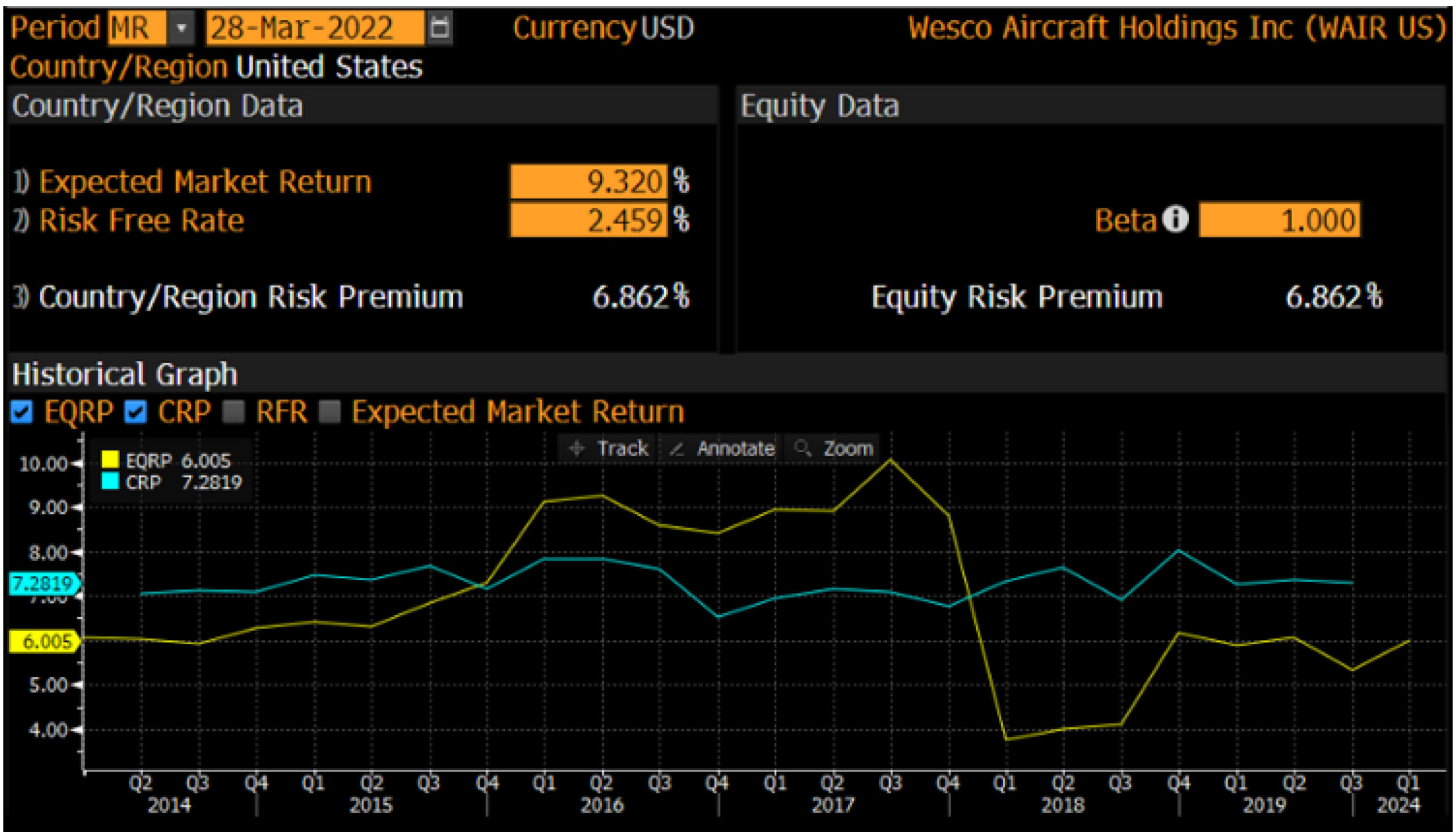
Exhibit 194
To be Produced Natively

Exhibit 195

To be Filed Under Seal


Period MR 28-Mar-2022
Currency USD
Wesco Aircraft Holdings Inc (WAIR US)
Country/Region United States
Country/Region Data
Equity Data
1) Expected Market Return 9.320 %
2) Risk Free Rate 2.459 %
Beta 1.000
3) Country/Region Risk Premium 6.862 %
Equity Risk Premium 6.862 %
Historical Graph
EQRP CRP RFR Expected Market Return
Track Annotate Zoom
EQRP 6.005
CRP 7.2819
10.00
9.00
8.00
7.2819
6.005
5.00
4.00
Q2 Q3 Q4 Q1 Q2 Q3 Q4 Q1 Q2 Q3 Q4 Q1 Q2 Q3 Q4 Q1 Q2 Q3 Q4 Q1 Q2 Q3 Q1
2014
2015
2016
2017
2018
2019
2024

UCC-196

UCC-197

Corporate Marginal Tax Rates - By country

Source: KPMG (until 2021), PWC (in 2022 & 2023)

From: January 2024 Update

Download as an excel file instead: https://www.stern.nyu.edu/~adamodar/pc/datasets/countrytaxrates.xls

Country	2016	2017	2018	2019	2020	2021	2022	2023
Afghanistan	20.00%	20.00%	20.00%	20.00%	20.00%	20.00%	20.00%	20.00%
Albania	15.00%	15.00%	15.00%	15.00%	15.00%	15.00%	15.00%	15.00%
Algeria	26.00%	26.00%	26.00%	26.00%	26.00%	26.00%	26.00%	26.00%
Andorra	NA	10.00%	10.00%	10.00%	10.00%	10.00%	10.00%	10.00%
Angola	30.00%	30.00%	30.00%	30.00%	30.00%	25.00%	25.00%	25.00%
Anguilla	NA	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Antigua and Barbuda	NA	25.00%	25.00%	25.00%	25.00%	25.00%	25.00%	25.00%
Argentina	35.00%	35.00%	30.00%	30.00%	30.00%	25.00%	35.00%	35.00%
Armenia	20.00%	20.00%	20.00%	20.00%	18.00%	18.00%	18.00%	18.00%
Aruba	25.00%	25.00%	25.00%	25.00%	25.00%	25.00%	25.00%	25.00%
Australia	30.00%	30.00%	30.00%	30.00%	30.00%	30.00%	30.00%	30.00%
Austria	25.00%	25.00%	25.00%	25.00%	25.00%	25.00%	24.00%	24.00%
Azerbaijan	NA	20.00%	20.00%	20.00%	20.00%	20.00%	20.00%	20.00%
Bahamas	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Bahrain	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Bangladesh	25.00%	25.00%	25.00%	25.00%	25.00%	32.50%	32.50%	30.00%
Barbados	25.00%	25.00%	30.00%	5.50%	5.50%	5.50%	5.50%	5.50%
Belarus	18.00%	18.00%	18.00%	18.00%	18.00%	18.00%	18.00%	18.00%
Belgium	33.99%	33.99%	29.00%	29.00%	25.00%	25.00%	25.00%	25.00%
Benin	NA	30.00%	30.00%	30.00%	30.00%	30.00%	30.00%	30.00%
Bermuda	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Bolivia	25.00%	25.00%	25.00%	25.00%	25.00%	25.00%	25.00%	25.00%
Bonaire, Saint Eustatius and Saba	0.00%	25.00%	25.00%	25.00%	25.00%	25.00%	25.00%	25.00%
Bosnia and Herzegovina	10.00%	10.00%	10.00%	10.00%	10.00%	10.00%	10.00%	10.00%
Botswana	22.00%	22.00%	22.00%	22.00%	22.00%	22.00%	22.00%	22.00%
Brazil	34.00%	34.00%	34.00%	34.00%	34.00%	34.00%	34.00%	34.00%
Brunei Darussalam	NA	18.50%	18.50%	18.50%	18.50%	18.50%	18.50%	18.50%
Bulgaria	10.00%	10.00%	10.00%	10.00%	10.00%	10.00%	10.00%	10.00%
Burkina Faso	NA	27.50%	28.00%	28.00%	28.00%	28.00%	28.00%	28.00%
Burundi	NA	30.00%	30.00%	30.00%	30.00%	30.00%	30.00%	30.00%
Cambodia	20.00%	20.00%	20.00%	20.00%	20.00%	20.00%	20.00%	20.00%
Cameroon	33.00%	33.00%	33.00%	33.00%	33.00%	33.00%	33.00%	33.00%
Canada	26.50%	26.50%	26.50%	26.50%	26.50%	26.50%	25.00%	26.50%
Cayman Islands	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Chile	24.00%	25.50%	26.00%	27.00%	27.00%	27.00%	27.00%	27.00%
China	25.00%	25.00%	25.00%	25.00%	25.00%	25.00%	25.00%	25.00%
Colombia	25.00%	34.00%	33.00%	33.00%	32.00%	31.00%	35.00%	35.00%
Congo	NA	NA	NA	NA	30.00%	28.00%	28.00%	28.00%
Congo (Democratic Republic of the)	NA	35.00%	35.00%	35.00%	35.00%	30.00%	30.00%	30.00%
Costa Rica	30.00%	30.00%	30.00%	30.00%	30.00%	30.00%	30.00%	30.00%
Croatia	20.00%	18.00%	18.00%	18.00%	18.00%	18.00%	18.00%	18.00%
Curacao	22.00%	22.00%	22.00%	22.00%	22.00%	22.00%	22.00%	22.00%
Cyprus	12.50%	12.50%	12.50%	12.50%	12.50%	12.50%	12.50%	12.50%
Czech Republic	19.00%	19.00%	19.00%	19.00%	19.00%	19.00%	19.00%	19.00%
Denmark	22.00%	22.00%	22.00%	22.00%	22.00%	22.00%	22.00%	22.00%
Djibouti	NA	25.00%	25.00%	25.00%	25.00%	25.00%	25.00%	25.00%
Dominica	NA	25.00%	25.00%	25.00%	25.00%	25.00%	25.00%	25.00%
Dominican Republic	27.00%	27.00%	27.00%	27.00%	27.00%	27.00%	27.00%	27.00%
Ecuador	22.00%	22.00%	25.00%	25.00%	25.00%	25.00%	25.00%	25.00%
Egypt	22.50%	22.50%	23.00%	22.50%	22.50%	22.50%	22.50%	22.50%
El Salvador	30.00%	30.00%	30.00%	30.00%	30.00%	30.00%	30.00%	30.00%

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Estonia	20.00%	20.00%	20.00%	20.00%	20.00%	20.00%	20.00%	20.00%
Ethiopia	NA	30.00%	30.00%	30.00%	30.00%	30.00%	30.00%	30.00%
Fiji	20.00%	20.00%	20.00%	20.00%	20.00%	20.00%	20.00%	20.00%
Finland	20.00%	20.00%	20.00%	20.00%	20.00%	20.00%	20.00%	20.00%
France	33.30%	33.33%	33.00%	31.00%	28.00%	26.50%	25.00%	25.00%
Gabon	NA	30.00%	30.00%	30.00%	30.00%	30.00%	30.00%	30.00%
Gambia	NA	31.00%	31.00%	31.00%	31.00%	27.00%	27.00%	27.00%
Georgia	15.00%	15.00%	15.00%	15.00%	15.00%	15.00%	15.00%	15.00%
Germany	29.72%	29.79%	30.00%	30.00%	30.00%	30.00%	30.00%	30.00%
Ghana	25.00%	25.00%	25.00%	25.00%	25.00%	25.00%	25.00%	25.00%
Gibraltar	10.00%	10.00%	10.00%	10.00%	10.00%	10.00%	10.00%	10.00%
Greece	29.00%	29.00%	29.00%	28.00%	24.00%	24.00%	22.00%	22.00%
Grenada	NA	30.00%	30.00%	28.00%	28.00%	28.00%	28.00%	28.00%
Guatemala	25.00%	25.00%	25.00%	25.00%	25.00%	25.00%	25.00%	25.00%
Guernsey	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Honduras	30.00%	25.00%	25.00%	25.00%	25.00%	25.00%	25.00%	25.00%
Hong Kong SAR	16.50%	16.50%	16.50%	16.50%	16.50%	16.50%	16.50%	16.50%
Hungary	19.00%	9.00%	9.00%	9.00%	9.00%	9.00%	9.00%	9.00%
Iceland	20.00%	20.00%	20.00%	20.00%	20.00%	20.00%	20.00%	20.00%
India	34.61%	34.61%	35.00%	30.00%	30.00%	30.00%	30.00%	30.00%
Indonesia	25.00%	25.00%	25.00%	25.00%	25.00%	22.00%	22.00%	22.00%
Iraq	15.00%	15.00%	15.00%	15.00%	15.00%	35.00%	15.00%	15.00%
Ireland	12.50%	12.50%	12.50%	12.50%	12.50%	12.50%	12.50%	12.50%
Isle of Man	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Israel	25.00%	24.00%	23.00%	23.00%	23.00%	23.00%	23.00%	23.00%
Italy	31.40%	24.00%	24.00%	24.00%	24.00%	24.00%	24.00%	24.00%
Ivory Coast	NA	25.00%	25.00%	25.00%	25.00%	25.00%	25.00%	25.00%
Jamaica	25.00%	25.00%	25.00%	25.00%	25.00%	25.00%	25.00%	25.00%
Japan	30.86%	30.86%	30.86%	30.62%	30.62%	30.62%	23.20%	30.62%
Jersey	20.00%	20.00%	20.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Jordan	20.00%	20.00%	20.00%	20.00%	20.00%	20.00%	20.00%	20.00%
Kazakhstan	20.00%	20.00%	20.00%	20.00%	20.00%	20.00%	20.00%	20.00%
Kenya	30.00%	30.00%	30.00%	30.00%	30.00%	30.00%	30.00%	30.00%
Korea, Republic of	24.20%	22.00%	25.00%	25.00%	25.00%	25.00%	25.00%	24.00%
Kuwait	15.00%	15.00%	15.00%	15.00%	15.00%	15.00%	15.00%	15.00%
Kyrgyzstan	NA	10.00%	10.00%	10.00%	10.00%	10.00%	10.00%	10.00%
Latvia	15.00%	15.00%	20.00%	20.00%	20.00%	20.00%	20.00%	20.00%
Lebanon	15.00%	15.00%	15.00%	17.00%	17.00%	17.00%	17.00%	17.00%
Libya	20.00%	20.00%	20.00%	20.00%	20.00%	20.00%	24.00%	24.00%
Liechtenstein	12.50%	12.50%	12.50%	12.50%	12.50%	12.50%	12.50%	12.50%
Lithuania	15.00%	15.00%	15.00%	15.00%	15.00%	15.00%	15.00%	15.00%
Luxembourg	29.22%	27.08%	26.01%	24.94%	24.94%	24.94%	24.94%	24.94%
Macau	12.00%	12.00%	12.00%	12.00%	12.00%	12.00%	12.00%	12.00%
Macedonia	10.00%	10.00%	10.00%	10.00%	10.00%	10.00%	10.00%	10.00%
Madagascar	NA	20.00%	20.00%	20.00%	20.00%	20.00%	20.00%	20.00%
Malawi	30.00%	30.00%	30.00%	30.00%	30.00%	30.00%	30.00%	30.00%
Malaysia	24.00%	24.00%	24.00%	24.00%	24.00%	24.00%	24.00%	24.00%
Malta	35.00%	35.00%	35.00%	35.00%	35.00%	35.00%	35.00%	35.00%
Mauritania	NA	NA	NA	NA	NA	25.00%	25.00%	25.00%
Mauritius	15.00%	15.00%	15.00%	15.00%	15.00%	15.00%	15.00%	15.00%
Mexico	30.00%	30.00%	30.00%	30.00%	30.00%	30.00%	30.00%	30.00%
Moldova	12.00%	12.00%	12.00%	12.00%	12.00%	12.00%	12.00%	12.00%
Monaco	NA	33.33%	33.00%	33.00%	33.00%	33.00%	33.00%	33.00%
Mongolia	NA	25.00%	25.00%	25.00%	25.00%	25.00%	25.00%	25.00%
Montenegro	9.00%	9.00%	9.00%	9.00%	9.00%	9.00%	15.00%	15.00%
Morocco	31.00%	31.00%	31.00%	31.00%	31.00%	31.00%	31.00%	32.00%
Mozambique	32.00%	32.00%	32.00%	32.00%	32.00%	32.00%	32.00%	32.00%
Myanmar	NA	25.00%	25.00%	25.00%	25.00%	25.00%	22.00%	22.00%
Namibia	32.00%	32.00%	32.00%	32.00%	32.00%	32.00%	32.00%	32.00%
Netherlands	25.00%	25.00%	25.00%	25.00%	25.00%	25.00%	25.80%	25.80%
New Zealand	28.00%	28.00%	28.00%	28.00%	28.00%	28.00%	28.00%	28.00%

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Nicaragua	NA	30.00%	30.00%	30.00%	30.00%	30.00%	30.00%	30.00%
Nigeria	30.00%	30.00%	30.00%	30.00%	30.00%	30.00%	30.00%	30.00%
Norway	25.00%	24.00%	23.00%	22.00%	22.00%	22.00%	22.00%	22.00%
Oman	12.00%	15.00%	15.00%	15.00%	15.00%	15.00%	15.00%	15.00%
Pakistan	32.00%	31.00%	30.00%	30.00%	35.00%	29.00%	29.00%	29.00%
Palestinian Territory	NA	15.00%	15.00%	15.00%	15.00%	15.00%	15.00%	15.00%
Panama	25.00%	25.00%	25.00%	25.00%	25.00%	25.00%	25.00%	25.00%
Papua New Guinea	30.00%	30.00%	30.00%	30.00%	30.00%	30.00%	30.00%	30.00%
Paraguay	10.00%	10.00%	10.00%	10.00%	10.00%	10.00%	10.00%	10.00%
Peru	28.00%	29.50%	29.50%	29.50%	29.50%	29.50%	29.50%	29.50%
Philippines	30.00%	30.00%	30.00%	30.00%	30.00%	30.00%	25.00%	25.00%
Poland	19.00%	19.00%	19.00%	19.00%	19.00%	19.00%	19.00%	19.00%
Portugal	21.00%	21.00%	21.00%	21.00%	21.00%	21.00%	21.00%	21.00%
Qatar	0.00%	10.00%	10.00%	10.00%	10.00%	10.00%	10.00%	10.00%
Romania	16.00%	16.00%	16.00%	16.00%	16.00%	16.00%	16.00%	16.00%
Russia	20.00%	20.00%	20.00%	20.00%	20.00%	20.00%	20.00%	20.00%
Rwanda	NA	30.00%	30.00%	30.00%	30.00%	30.00%	30.00%	30.00%
Saint Kitts and Nevis	NA	33.00%	33.00%	33.00%	33.00%	33.00%	33.00%	33.00%
Saint Lucia	NA	30.00%	30.00%	30.00%	30.00%	30.00%	30.00%	30.00%
Saint Vincent and the Grenadines	NA	32.50%	33.00%	30.00%	30.00%	30.00%	30.00%	30.00%
Samoa	27.00%	27.00%	27.00%	27.00%	27.00%	27.00%	27.00%	27.00%
Saudi Arabia	20.00%	20.00%	20.00%	20.00%	20.00%	20.00%	20.00%	20.00%
Senegal	NA	30.00%	30.00%	30.00%	30.00%	30.00%	30.00%	30.00%
Serbia	15.00%	15.00%	15.00%	15.00%	15.00%	15.00%	15.00%	15.00%
Sierra Leone	30.00%	30.00%	30.00%	30.00%	30.00%	30.00%	30.00%	25.00%
Singapore	17.00%	17.00%	17.00%	17.00%	17.00%	17.00%	17.00%	17.00%
Sint Maarten (Dutch part)	34.50%	34.50%	35.00%	35.00%	35.00%	35.00%	35.00%	35.00%
Slovakia	22.00%	21.00%	21.00%	21.00%	21.00%	21.00%	21.00%	21.00%
Slovenia	17.00%	19.00%	19.00%	19.00%	19.00%	19.00%	19.00%	19.00%
Solomon Islands	NA	30.00%	30.00%	30.00%	30.00%	30.00%	30.00%	30.00%
South Africa	28.00%	28.00%	28.00%	28.00%	28.00%	28.00%	27.00%	27.00%
Spain	25.00%	25.00%	25.00%	25.00%	25.00%	25.00%	25.00%	25.00%
Sri Lanka	15.00%	28.00%	28.00%	28.00%	28.00%	24.00%	24.00%	24.00%
St Maarten	34.50%	34.50%	35.00%	35.00%	35.00%	35.00%	35.00%	35.00%
Sudan	35.00%	35.00%	35.00%	35.00%	35.00%	35.00%	35.00%	35.00%
Suriname	34.50%	36.00%	36.00%	36.00%	36.00%	36.00%	36.00%	36.00%
Swaziland	NA	27.50%	28.00%	27.50%	27.50%	27.50%	27.50%	27.50%
Sweden	22.00%	22.00%	22.00%	21.40%	21.40%	20.60%	20.60%	20.60%
Switzerland	17.92%	17.77%	18.00%	18.00%	14.84%	14.93%	18.00%	14.60%
Syria	22.00%	28.00%	28.00%	28.00%	28.00%	28.00%	28.00%	28.00%
Taiwan	17.00%	17.00%	20.00%	20.00%	20.00%	20.00%	20.00%	20.00%
Tanzania	30.00%	30.00%	30.00%	30.00%	30.00%	30.00%	30.00%	30.00%
Thailand	20.00%	20.00%	20.00%	20.00%	20.00%	20.00%	20.00%	20.00%
Trinidad and Tobago	25.00%	25.00%	25.00%	25.00%	30.00%	30.00%	30.00%	30.00%
Tunisia	25.00%	25.00%	25.00%	25.00%	25.00%	15.00%	15.00%	15.00%
Turkey	20.00%	20.00%	22.00%	22.00%	22.00%	20.00%	23.00%	25.00%
Turkmenistan	NA	20.00%	20.00%	20.00%	20.00%	20.00%	20.00%	20.00%
Turks and Caicos Islands	NA	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Uganda	30.00%	30.00%	30.00%	30.00%	30.00%	30.00%	30.00%	30.00%
Ukraine	18.00%	18.00%	18.00%	18.00%	18.00%	18.00%	18.00%	18.00%
United Arab Emirates	55.00%	55.00%	55.00%	55.00%	55.00%	55.00%	0.00%	25.00%
United Kingdom	20.00%	19.00%	19.00%	19.00%	19.00%	19.00%	25.00%	25.00%
United States	40.00%	40.00%	27.00%	27.00%	27.00%	27.00%	25.00%	25.00%
Uruguay	25.00%	25.00%	25.00%	25.00%	25.00%	25.00%	25.00%	25.00%
Uzbekistan	7.50%	7.50%	7.50%	7.50%	7.50%	7.50%	15.00%	15.00%
Vanuatu	0.00%	34.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Venezuela	34.00%	34.00%	34.00%	34.00%	34.00%	34.00%	34.00%	34.00%
Vietnam	22.00%	20.00%	20.00%	20.00%	20.00%	20.00%	20.00%	20.00%
Yemen	20.00%	20.00%	20.00%	20.00%	20.00%	20.00%	20.00%	20.00%
Zambia	35.00%	35.00%	35.00%	35.00%	35.00%	35.00%	35.00%	35.00%
Zimbabwe	25.75%	25.00%	25.00%	25.00%	24.00%	24.00%	24.72%	24.72%

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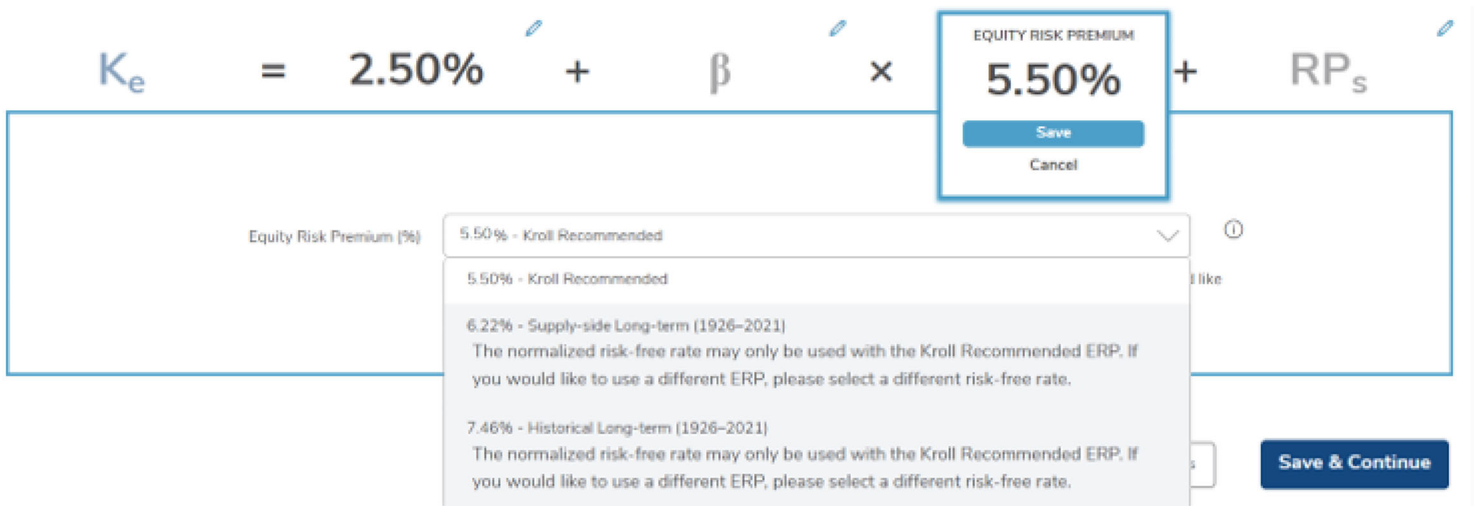
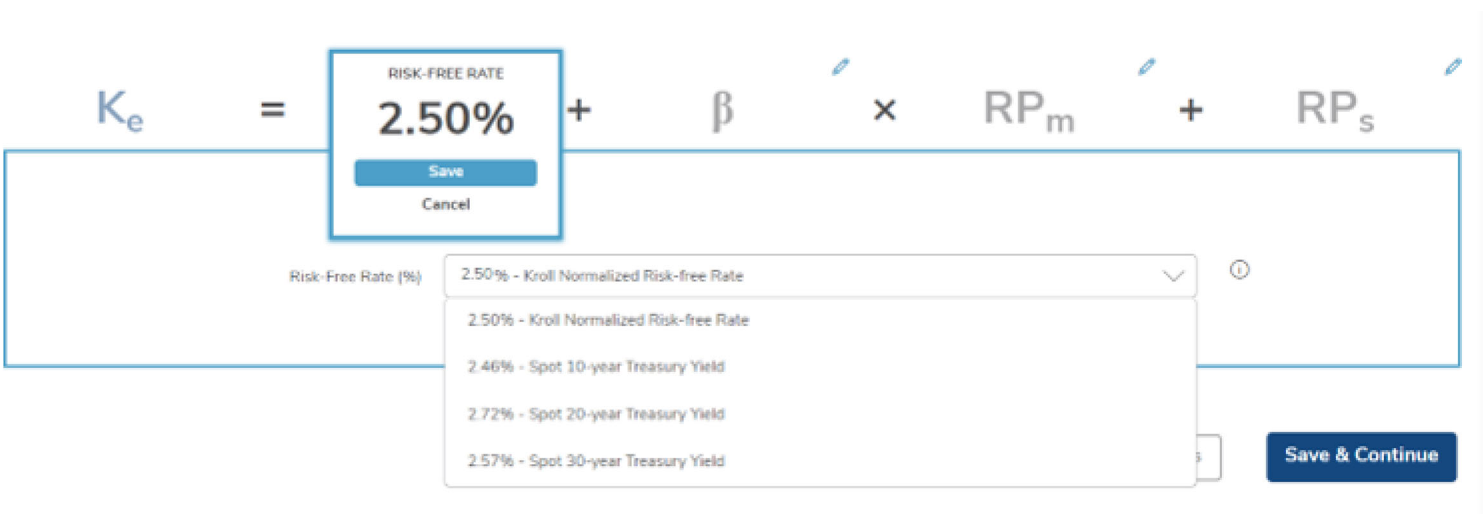
Updated in January 2024
By Aswath Damodaran

Exhibit 198

To be Produced Natively


K_e = 2.50% + β ×
EQUITY RISK PREMIUM
5.50%
Save
Cancel
+ RP_s
Equity Risk Premium (%)
5.50% - Kroll Recommended
5.50% - Kroll Recommended
6.22% - Supply-side Long-term (1926–2021)
The normalized risk-free rate may only be used with the Kroll Recommended ERP. If you would like to use a different ERP, please select a different risk-free rate.
7.46% - Historical Long-term (1926–2021)
The normalized risk-free rate may only be used with the Kroll Recommended ERP. If you would like to use a different ERP, please select a different risk-free rate.
Save & Continue

UCC-199


K_e = RISK-FREE RATE 2.50% + β × RP_m + RP_s
Save
Cancel
Risk-Free Rate (%)
2.50% - Kroll Normalized Risk-free Rate
2.50% - Kroll Normalized Risk-free Rate
2.46% - Spot 10-year Treasury Yield
2.72% - Spot 20-year Treasury Yield
2.57% - Spot 30-year Treasury Yield
Save & Continue

UCC-200

Market Value of Common Equity ($USD in Millions) 1500

CRSP Decile (Select a Size Premium)

Decile	Market Cap of Smallest Company ($USD in millions)	Market Cap of Largest Company ($USD in millions)	Size Premium (Return in Excess of CAPM)
6	2,170.315	3,276.553	
7	**1,306.402**	**2,164.524**	**1.34%**
8	629.118	1,306.038	
Deciles Size Grouping			
Low Cap	**629.118**	**3,276.553**	**1.22%**

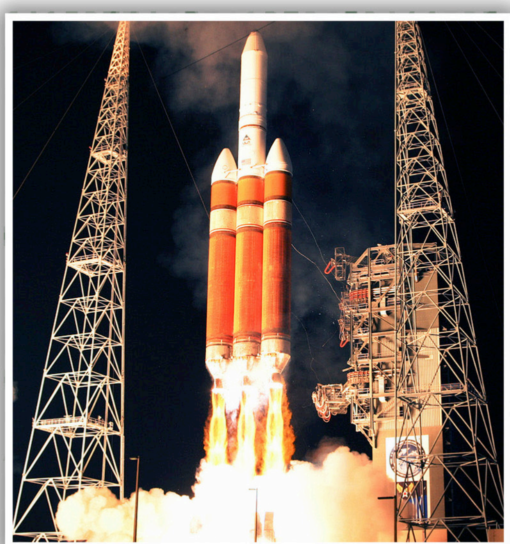
UCC-201

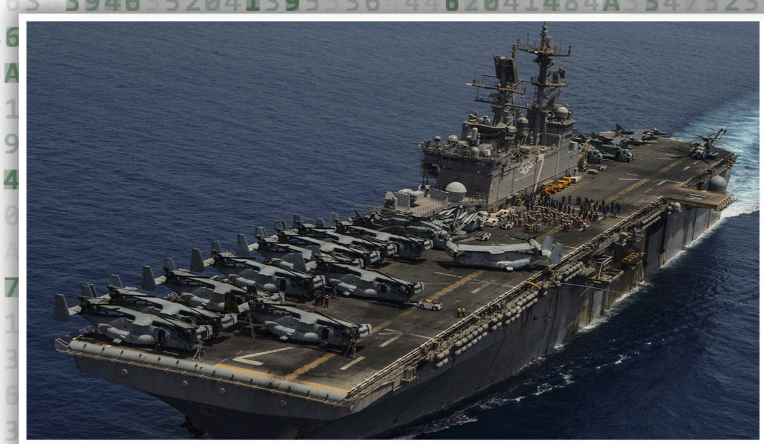
UCC-202

CONGRESS OF THE UNITED STATES
CONGRESSIONAL BUDGET OFFICE

CBO

Long-Term Implications of the 2021 Future Years Defense Program





SEPTEMBER 2020

At a Glance

As part of the President's budget request, the Department of Defense (DoD) develops a plan called the Future Years Defense Program (FYDP) that reflects DoD's expectations about its programs and costs over the next five years. In this report, the Congressional Budget Office analyzes DoD's plans for 2021 through 2025 as presented in the 2021 FYDP and projects how those plans would affect defense costs through 2035.

- In his proposed budget, the President requested a total of $706 billion for DoD in fiscal year 2021—4 percent less than was appropriated in 2020 after removing the effects of inflation. Of that total, $637 billion is designated for the base budget, which is intended to fund normal, peacetime activities. The remaining $69 billion is designated for emergency activities and overseas contingency operations (OCO)—that is, temporary, war-related activities, such as operations in Afghanistan and elsewhere.

- About 70 percent of the OCO funding for 2021 is designated for base-budget and enduring activities (for example, regular maintenance activities that support overseas operations and are likely to continue regardless of the size of the forces deployed overseas). Designating appropriations in that way makes the request compliant with the funding caps set by the Bipartisan Budget Act of 2019 (Public Law 116-37). For 2022 through 2025, when those caps will no longer be in effect, DoD plans to request funding for those activities in the base budget.

- According to estimates provided in the 2021 FYDP, total funding would be relatively flat through 2025, averaging about $707 billion per year in 2021 dollars. The relative amounts allocated for day-to-day operations, the acquisition (including development and procurement) of new weapons, and upkeep of infrastructure would also remain nearly unchanged over the FYDP period.

- On the basis of DoD's cost estimates, CBO projects that the inflation-adjusted cost of DoD's plans would increase by 10 percent in the 10 years beyond the FYDP period, to $781 billion in 2035. Nearly 70 percent of that increase would be for operation and maintenance and for military personnel.

- Using costs that reflect historical experience, CBO projects that the cost of implementing DoD's plans could be about 2 percent higher than DoD estimates over the FYDP period and about 3 percent higher than CBO projected using DoD's estimates over the full 15-year period, 2021 to 2035.

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www.cbo.gov/publication/56526

Contents

Notes

Unless this report indicates otherwise, all years referred to are federal fiscal years, which run from October 1 to September 30 and are designated by the calendar year in which they end.

Dollar amounts are expressed in 2021 dollars. To remove the effects of inflation, the Congressional Budget Office adjusted amounts with its projections of the gross domestic product price index as of the date the Administration submitted its budget request for 2021. Those projections are published in *The Budget and Economic Outlook: 2020 to 2030* (January 2020), which is available on CBO's website (www.cbo.gov/publication/56020).

In this report, "cost" refers to total obligational authority (TOA), a financial measure used by the Department of Defense (DoD) to identify the funding available for its programs. TOA differs from budget authority most notably in its adjustment for the timing of rescissions and lapses of prior-year budget authority. In recent years, the difference between TOA and discretionary budget authority in DoD's budget request for the coming year has generally been $1 billion or less.

Numbers in the text and tables may not add up to totals because of rounding.

Previous editions of this report, which CBO publishes annually, are available on CBO's website (https://go.usa.gov/xEnE6).

The photographs in the foreground on the cover show the following (clockwise from top left): A Boeing Delta IV Heavy launch vehicle lifts off from Launch Complex 37 at Cape Canaveral Air Force Station, Florida (Carleton Bailie, courtesy of the U.S. Air Force); Major Paul Lopez flies an F-22 Raptor at the 2019 Chicago Air and Water Show (Second Lieutenant Samuel Eckholm, courtesy of the U.S. Air Force); U.S. Army soldiers fire an M777 Howitzer at the National Training Center in Fort Irwin, California (specialist Kamryn Guthrie, courtesy of the U.S. Army); and the U.S.S. *Iwo Jima* (courtesy of the U.S. Navy). The background image on the cover is © SkillUp, Frontpage/Shutterstock.com.

Long-Term Implications of the 2021 Future Years Defense Program

Summary

In most years, the Department of Defense (DoD) produces a five-year plan, called the Future Years Defense Program (FYDP), that is associated with the budget it submits to the Congress. The 2021 FYDP, issued in March 2020, comprises DoD's request for appropriations in 2021 and a series of planned budgets for 2022 through 2025. This report describes the Congressional Budget Office's analysis of the FYDP and summarizes DoD's expectations about the costs of its plans for 2021 through 2025. Because decisions made in the near term can have consequences for the defense budget in the longer term, CBO projected the costs of the 2021 plan through 2035.

What Are DoD's Budget Plans Under the 2021 FYDP?

The proposed budget for DoD in 2021 totals $706 billion, about 4 percent less than was appropriated in 2020 after removing the effects of inflation. Of that total, $637 billion is designated for the base budget, which is intended to fund normal, peacetime activities, such as day-to-day military and civilian operations and the development and procurement of weapon systems. The remaining $69 billion is designated for overseas contingency operations (OCO)—a funding category intended for temporary, war-related activities, such as operations in Afghanistan and elsewhere. Of the $69 billion requested for OCO, however, only $20.5 billion would be for direct war costs; $32.5 billion would be for enduring activities (such as other military missions that are part of the United States' long-term global presence), and $16.0 billion would be for base-budget costs. The allocation between base and OCO funding for 2021 is structured to comply with the statutory caps on discretionary spending, which do not limit OCO funding.[1]

For the remaining four years of the FYDP, DoD indicated it would request about the same amount of total funding in real terms (that is, after adjusting for the effects of inflation) as it had in 2021: an average of $707 billion per year. Within DoD's total budget, the relative amounts allocated for day-to-day operations, the acquisition (including development and procurement) of new weapons, and upkeep of infrastructure would also remain nearly unchanged over the FYDP period. However, because the limits on discretionary funding are set to expire in 2021, the enduring and base-budget activities currently covered by OCO funding would be included in the base budget for the following years. As a result, much less funding would be designated for OCO—about $19 billion in 2022 and 2023 and $9 billion in 2024 and 2025.

What Is the Potential Cost of DoD's Plans for 2026 Through 2035?

Unlike DoD's estimates for the cost of its plans over the FYDP period, CBO's projections indicate that costs after 2025 would increase faster than inflation. In CBO's estimation, those costs would reach $781 billion (in 2021 dollars) by 2035, an increase of 10 percent in real terms over the 10 years following 2025 (see Figure 1).

The key factors that would lead to increases in DoD's costs are as follows:

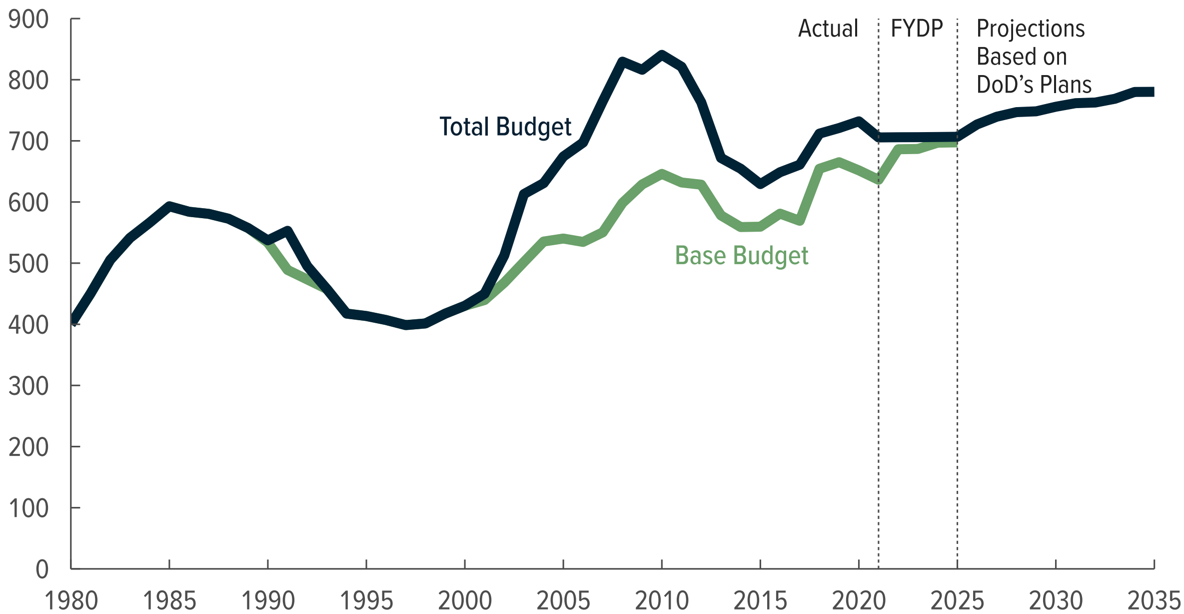
- The costs of compensation for military personnel and of operation and maintenance (O&M) are projected to increase at historical rates, growing faster than inflation; and
- The costs for the acquisition of weapon systems are projected to increase to meet the department's modernization objectives and maintain the current size of the force.

1. Those caps were set by the Budget Control Act of 2011 (Public Law 112-25) as amended by the Bipartisan Budget Act of 2019 (P.L. 116-37).

Figure 1.

Historical Funding for DoD's Activities and Projected Costs Under the 2021 FYDP

Billions of 2021 Dollars



Source: Congressional Budget Office.

Before 2026, funding for the total budget (which includes funding designated for OCO or as an emergency requirement) and funding for the base budget are shown separately. DoD indicated that about 70 percent of the amount it designated for OCO in 2021 would be shifted to the base budget starting in 2022 when the caps under the Budget Control Act of 2011 will have expired. DoD characterized the small amounts designated for OCO from 2022 through 2025 as "placeholders" because actual costs will depend on how overseas operations change over time.

DoD = Department of Defense; FYDP = Future Years Defense Program; OCO = overseas contingency operations.

Of the $74 billion increase in annual costs that CBO projects between 2025 and 2035, about 20 percent is for military personnel costs, 50 percent is for O&M costs, and nearly 30 percent is for costs to develop and purchase weapon systems.

What Are Uncertainties in the Cost of DoD's Plans Through 2035?

In many areas of DoD's budget, costs have historically grown more rapidly than they are projected to grow in the 2021 FYDP. For example, DoD projects that the costs of military health care will grow more slowly over the FYDP period than CBO's forecast of the cost of health care in the general economy would indicate. Similarly, DoD has frequently underestimated costs for O&M and the acquisition of weapon systems.

To assess the possible effects of such factors, CBO prepared an alternative projection of the costs of implementing DoD's 2020 plans using estimates that better reflect the patterns of growth in DoD's costs over the past several decades. According to those estimates, total costs from 2021 through 2025 would be $77 billion (or 2 percent) higher than DoD indicated in the 2021 FYDP, and total costs from 2021 through 2035 would be $376 billion (or 3 percent) higher than CBO projected using DoD's estimates (see Table 1).

More generally, DoD's projections of costs in the FYDP and CBO's projections through 2035 are estimates of the long-term costs of executing DoD's plans as they stood when DoD was preparing its 2021 budget and supporting documents. However, international events, Congressional decisions, and other factors could change those plans. For example, policymakers may seek to offset costs that have been incurred in responding to the 2020 coronavirus pandemic or to increase funding to prepare for future pandemics by decreasing military

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Table 1.

Increases in DoD's Costs Under Alternative Policies and Projection Methods

	Total Increase (Billions of 2021 dollars)	
	2021–2025	2021–2035
	Areas in Which Different Policies Could Be Adopted	
Military pay increases at the rate of the ECI starting in 2022[a]	-3	-13
Civilian pay increases at the rate of the ECI starting in 2022	11	38
	Areas in Which CBO Used Different Projection Methods	
MHS costs grow at the projected rate of health care costs in the general economy starting in 2022	6	30
Other O&M costs (adjusted for the size of the force) experience cost growth starting in 2022 consistent with cost growth since 1980[b]	26	143
Major acquisition programs experience cost growth consistent with cost growth since 1970	37	177
Total	**77**	**376**
Memorandum:		
Projected total cost of DoD's plans using DoD's estimates for 2020 through 2025	3,532	11,109
Projected total cost of DoD's plans using CBO's alternative policies and methods	3,609	11,485

Source: Congressional Budget Office.

DoD = Department of Defense; ECI = employment cost index for wages and salaries of workers in the private sector, as defined by the Bureau of Labor Statistics; FYDP = Future Years Defense Program; MHS = Military Health System; O&M = operation and maintenance.

a. DoD projected that military pay would increase at a slower rate from 2022 through 2025 than the ECI growth that was projected at the time the 2021 FYDP was prepared. However, that growth in military pay is higher than current projections of the ECI that incorporate the economic impact of the coronavirus pandemic. Military pay raises that follow the new, slower growth in the ECI would decrease costs relative to the 2021 FYDP.

b. "Other O&M" is the sum of the O&M and revolving and management fund appropriation titles minus costs for civilian compensation and the MHS.

budgets. Furthermore, even if DoD's plans generally remained unchanged, many program-level policies that underlie DoD's projections of its costs might not come to pass. For those reasons, CBO's projections should not be viewed as predictions of future funding for DoD; rather, the projections are estimates of the costs of executing the department's 2020 plans under the premise that those plans would not change.

Costs for contingency operations are even more uncertain than costs in the base budget because they depend on how ongoing conflicts evolve and whether new conflicts will arise. As outlined in the 2021 FYDP, DoD plans for operations in the Middle East to subside, reducing its projected direct war costs by roughly half by 2025. CBO used DoD's projection for that year ($9 billion) for the cost of OCO in each year between 2026 and 2035.

Costs of the 2021 Future Years Defense Program Through 2035

CBO analyzed the costs of DoD's plans over the FYDP period—2021 through 2025—and projected the costs of those plans over an additional 10 years, through 2035. In most previous assessments of the long-term implications of DoD's plans, CBO focused on the department's base budget because it is the portion of the budget relevant to long-term plans. However, in its 2019 analysis of the 2020 defense budget, CBO began including both the base and OCO budgets in its assessment. Beginning in 2022, the cost of most of the activities that have been designated as OCO in 2021 will be included in the base budget, and the rest—direct war costs for 2021 and what DoD refers to as "placeholder" estimates of direct war costs for 2022 to 2025—makes up only a very small fraction (between 1 percent and 3 percent) of planned budgets. Because those remaining OCO amounts are small, including them reflects DoD's expectation of continued conflict but does not distort CBO's projections of long-term costs that are better reflected by base budgets.

How CBO Projected the Costs of DoD's Plans Beyond the FYDP Period

CBO's analysis of the long-term costs of DoD's plans is based on the estimates DoD provided in the 2021 FYDP for the years 2021 through 2025. Using DoD's estimates as a starting point, CBO projected the costs of DoD's plans for the subsequent 10 years, 2026 through 2035. CBO incorporated its estimates of how the economy will change in the future in its projections of those costs.[2] To align DoD's funding with those economic projections, CBO divided it into three categories (which are described below in the section "Categories of Funding" and discussed in greater detail later in the report).

Projection Methods. CBO's projections for 2026 through 2035 are based as much as possible on policies underlying DoD's estimate of costs in the 2021 FYDP, current laws regarding the compensation of military personnel, and the longer-term acquisition plans that DoD publishes in Selected Acquisition Reports and other official documents, such as the Navy's 30-year shipbuilding plan.[3] For the parts of DoD's budget in which such policies and cost estimates have not been specified, CBO generally based its projections on trends in prices and compensation anticipated for the broader economy (see Table 2).[4]

CBO's projections also incorporate the assumption that the size and composition of the military and the number of civilian personnel would remain unchanged after 2025, unless DoD has specified otherwise. For example, because DoD plans to increase the number of Navy ships over the coming decades, CBO's projections incorporate an increase in personnel to support that larger fleet. Additionally, CBO's projections reflect the assumption that for any major weapon system expected to reach the end of its service life before 2035 but for which DoD has not yet announced a replacement, DoD would develop and purchase a generally similar but more modern system.

Dollar amounts in this report are expressed in 2021 dollars. To remove the effects of inflation over the 15-year projection period, CBO adjusted estimates of DoD's costs with the projections of the gross domestic product (GDP) price index that CBO published in January 2020, shortly before the FYDP was released. Although CBO has since changed those projections of inflation to account for economic disruptions caused by the pandemic, CBO used the prepandemic projections in this analysis because they better reflect the cost trends that DoD incorporated into the FYDP, especially over the FYDP period, and because they allow for easier comparison of CBO's projections with the FYDP. If the amounts were adjusted using the current projections of the GDP price index, they would be slightly higher than those adjusted with the January inflation projections, but the difference is never larger than 1 percent over the FYDP period and decreases thereafter.

Categories of Funding. Nearly all of DoD's funding is provided in appropriations under seven public law titles: military personnel; operation and maintenance; procurement; research, development, test, and evaluation (RDT&E); military construction; family housing; and revolving and management funds. For simplicity, CBO organized DoD's funding into three broad categories according to the types of activities that are funded:

- *Operation and support (O&S)*, which includes operation and maintenance, military personnel, and revolving and management funds;
- *Acquisition*, which includes procurement and RDT&E; and
- *Infrastructure*, which includes military construction and family housing.

CBO's estimates of the costs of O&S and infrastructure over the 2026–2035 period are based primarily on the

2. See Congressional Budget Office, "10-Year Economic Projections" (January 2020), www.cbo.gov/about/products/budget-economic-data#4. Data are arranged by fiscal year in Table 3 in that file. In this report, constant growth was assumed after 2030 to extend those economic projections by five years, to 2035.

3. Because DoD has not published plans for many minor programs extending beyond the FYDP period, CBO estimated costs for those programs on the basis of historical correlations between funding for major and minor programs.

4. For a more detailed discussion of CBO's methods for projecting costs for the individual components of DoD's budget, see Congressional Budget Office, *An Analysis of the Obama Administration's Final Future Years Defense Program* (April 2017), www.cbo.gov/publication/52450.

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Table 2.

Methods Used by CBO to Project the Cost of DoD's Plans Beyond the 2021 FYDP

Area of DoD's Budget	CBO's Methods
Military Pay	After 2025, the rate of growth matches CBO's projection of the growth rate for the ECI
Civilian Pay	After 2025, the rate of growth matches CBO's projection of the growth rate for the ECI
Military Health System	After 2025, projected costs track with CBO's projection of the growth rate for health care spending in the broader economy
Operation and Maintenance (Excluding civilian pay and the MHS)	After 2025, projected costs grow at the historical average rate for operation and maintenance
Acquisition	Projected costs are estimated on a program-by-program basis using information from DoD or CBO's estimates, which are based on previous programs
Military Construction	After 2025, projected costs equal the historical average and thereafter grow at CBO's projection of the growth rate for construction costs in the broader economy

Source: Congressional Budget Office.

This table does not show the methods that CBO used to produce alternative cost estimates. Those alternatives are based on historical trends and show how DoD's costs might differ from the estimates provided in the 2021 FYDP.

DoD = Department of Defense; ECI = employment cost index for wages and salaries of workers in the private sector, as defined by the Bureau of Labor Statistics; FYDP = Future Years Defense Program; MHS = Military Health System.

size of the force, historical cost growth, and economic factors such as inflation as measured by the employment cost index (ECI) for wages and salaries of workers in the private sector and the GDP index. CBO's projections of acquisition costs are based primarily on how spending in a number of separate DoD acquisition programs is expected to change over the projection period. About two-thirds of the acquisition costs in CBO's projections are based on either DoD's long-term program plans or on CBO's expectations about the way other major components of DoD's acquisition portfolio might unfold over the coming years. The other third of acquisition costs—primarily for smaller programs—are based on historical relationships between major acquisition efforts and the total acquisition budget.

DoD's 2021 FYDP includes estimates of OCO costs for 2022 through 2025 that are not allocated by appropriation title. For this analysis, CBO allocated the costs of OCO to individual titles in 2022 and the ensuing years using the same proportions by appropriation title that DoD used in its OCO request for 2021.[5] CBO used DoD's projection for 2025—$9 billion—for the cost of OCO each year for 2026 through 2035.

DoD's Estimates of Costs in the 2021 FYDP

The proposed budget for DoD in 2021 is about 4 percent smaller than the amount appropriated for 2020, after removing the effects of inflation. That reduction includes a $2 billion (or less than 1 percent) decrease for O&S, a $14 billion (or about 5 percent) decrease for acquisition, and an $11 billion (or nearly 60 percent) decrease in for infrastructure. However, more than half of the decrease in infrastructure funding would occur because more than $6 billion was appropriated in 2020 to rebuild facilities damaged by Hurricanes Florence and Michael.

5. For a more detailed discussion of CBO's methods for distributing OCO funding among the appropriation titles in DoD's budget, see Congressional Budget Office, *Long-Term Implications of the 2019 Future Years Defense Program* (February 2019), Box 1, p. 4, www.cbo.gov/publication/54948.

The annual cost of DoD's plans would be nearly constant over the five-year FYDP period, increasing by only 0.2 percent—from $705.5 billion in 2021 to $707.1 billion in 2025 (in 2021 dollars). Although DoD's total funding request would remain roughly constant according to the FYDP, funding designated for the base budget would increase by about 8 percent from 2021 to 2022 once the overall limits on discretionary funding expire. That increase reflects DoD's plans to request that funds for certain base-budget and enduring activities—which have been included in the OCO budget—be moved to the base budget starting in 2022.[6]

Under DoD's plans the costs for O&S and acquisition would also change little through 2025. Costs for O&S, which account for slightly less than two-thirds of DoD's budget, would average $455 billion over the FYDP period, and costs for acquisition, which account for about one third, would average $242 billion (after factoring in DoD's planned OCO-to-base shift).[7] Funding for infrastructure costs would vary from a low of $8 billion to a high of $11 billion, accounting for between 1.2 percent and 1.6 percent of DoD's total costs over the FYDP period.

CBO's Projections of DoD's Costs for 2026 Through 2035

On the basis of DoD's estimates in the FYDP, CBO projects that the costs of the department's plans over the 10 years following 2025 would increase at an average annual rate of 1 percent (in real terms), rising from DoD's estimate of $707 billion in 2025—the end of the FYDP period—to $781 billion in 2035 (see Figure 1 on page 2). The average annual increase from 2021 through 2035 would be 0.7 percent. Although those rates would lead to substantial increases over the long term, they are lower than the estimates of 3 percent to 5 percent real growth per year that DoD has put forth as necessary to support the Administration's defense strategy.[8]

Costs for O&S, acquisition, and infrastructure would all contribute to the increase in the cost of DoD's plans after 2025 (see Figure 2). Costs for O&S would rise steadily, from DoD's estimate of $455 billion in 2025 to $505 billion in 2035—an increase of 11 percent. Likewise, costs for acquisition would increase by about 9 percent over that period—from DoD's estimate of $242 billion in 2025 to $263 billion in 2035—but they would exhibit more year-to-year variation. Most of the increase in acquisition costs would occur in the first few years beyond the FYDP period. In CBO's projections, costs for infrastructure increase steadily after the FYDP period, from DoD's estimate of $10 billion in 2025 to $12 billion in 2035.

CBO's Estimates of DoD's Costs Under Alternative Assumptions

DoD's estimates through 2025 incorporate some assumptions that yield lower costs than would be anticipated on the basis of an analysis of historical trends. For example, the Congress has often provided a larger military pay raise than DoD requested, and weapon systems have often cost more than DoD estimated. To assess the effect of such factors, CBO estimated how DoD's costs would change if the projection methods CBO used for O&S for 2026 through 2035 were also applied to the FYDP period and if costs to acquire weapon systems were to grow as they have in the past.

Using those alternative policies and projection methods increased the estimated cost of DoD's plans by $77 billion (or about 2 percent) over the FYDP period. It also increased CBO's estimate of the cost of DoD's plans over the full 15-year period, 2021 through 2035, by $376 billion (or about 3 percent). Nearly half of the increase over the 15-year period was in acquisition costs (see Table 1 on page 3).

Projected Costs of Operation and Support

Funding for O&S is the sum of the appropriations for three public law titles: military personnel, O&M, and revolving and management funds. (In its analysis, CBO includes the relatively small amount that DoD requested

6. CBO classifies OCO spending as "enduring" if it supports operations or activities that would occur whether or not the United States was at war or if it is used to procure facilities or equipment that would continue to need funding whether or not the United States was at war.

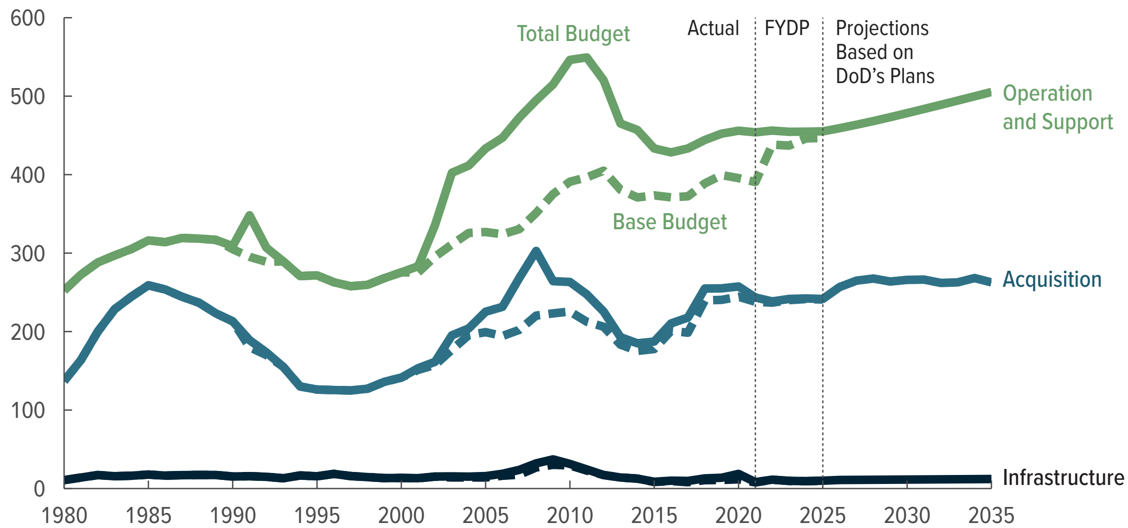
7. For a discussion of the OCO-to-base shift, see Congressional Budget Office, *Long-Term Implications of the 2019 Future Years Defense Program* (February 2019), p. 1, www.cbo.gov/publication/54948.

8. For example, see Paul McLeary, "Flatline: SecDef Esper Says DoD Budgets Must Grow 3–5%" (February 6, 2020), https://tinyurl.com/y3y374vv.

Figure 2.

DoD's Costs for Operation and Support, Acquisition, and Infrastructure Under the 2021 FYDP

Billions of 2021 Dollars



Source: Congressional Budget Office.

Funding for operation and support is the sum of the appropriations for military personnel, operation and maintenance, and revolving and management funds. Acquisition funding is the sum of the appropriations for procurement and for research, development, test, and evaluation. Infrastructure funding is the sum of the appropriations for military construction and family housing.

Before 2026, funding for the total budget (which includes funding designated for OCO or as an emergency requirement) and funding for the base budget are shown separately.

DoD = Department of Defense; FYDP = Future Years Defense Program; OCO = overseas contingency operations.

for revolving and management funds with the O&M appropriation because those two titles involve similar activities.) O&S funding can be separated into three general types of costs, regardless of which public law title funds them:

- *Compensation*, which consists of pay and cash benefits for military personnel and DoD's civilian employees as well as the costs of retirement benefits. Those costs fall under the appropriations for military personnel and O&M (for civilian employees).

- The *Military Health System (MHS)*, which provides medical care for military personnel, military retirees, and their families. Those costs also fall under the appropriations for military personnel and O&M.

- *Other O&M*, which covers costs such as those for base operations, fuel, depot maintenance, and spare parts. Those costs fall entirely under the appropriation for O&M.

CBO based its projection of DoD's O&S costs on the anticipated growth in those three categories of costs. A sum of the costs in CBO's three categories would exceed total O&S funding because the cost of compensation for military and civilian personnel who work in the military health system would be counted twice: once in the compensation category and again in the MHS category. When discussing the categories in isolation, CBO included those costs in both categories to present a more complete picture of each category's costs, but CBO corrected for that double-counting in its presentation of overall O&S costs.

O&S Costs in the 2021 FYDP

Nearly two-thirds of DoD's total budget request for 2021—$454 billion—was for O&S: $163 billion for military personnel and $290 billion for O&M. Adjusted

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for inflation, the amount requested for O&S in 2021 is $2 billion less than the amount enacted for 2020—a decrease of less than 1 percent. (O&S costs in CBO's analysis are expressed in terms of the total budget, including both base-budget funding and funding designated for OCO.) In real terms, O&S costs would vary only slightly over the next four years, ending the FYDP period less than $2 billion higher than they would be in 2021.

Although total O&S funding would be only $1.3 billion higher in 2025 than it would be in 2021, military personnel costs would be $4.8 billion higher as a result of real increases in compensation costs and an increase of 16,000 in the number of service members (from 2.149 million to 2.165 million). That growth in military personnel costs would be offset by what DoD expects to be a $3.5 billion decrease in O&M costs, which would mark a departure from a decades-long trend of real growth in O&M costs per service member. The number of civilian employees—809,000 in 2021—would not change over the FYDP period.[9]

Compensation. Within the O&S category, total funding for compensation would increase by 2.0 percent (in real terms) over the FYDP period (see Table 3). In its 2021 budget, DoD requested a 3.0 percent pay raise for military personnel, which equals the increase in the ECI (a measure of the cost of compensating workers that is reported by the Bureau of Labor Statistics) that was expected when the FYDP was prepared. DoD requested a 1.0 percent pay raise for civilian employees in 2021, which, in real terms, would result in a decline in civilian pay for that year. DoD's FYDP reflects the assumption that from 2022 through 2025, pay for military personnel would increase by 2.6 percent per year and pay for civilian personnel would increase by 2.1 percent per year in current dollars. Both of those amounts are below the average annual increase in the ECI of 3.4 percent that CBO projected at the time the FYDP was released.[10] After adjusting for inflation, DoD's costs for military compensation would increase by a total of 3.1 percent from 2021 through 2025, and costs for civilian compensation would be nearly unchanged.

The economic disruption caused by the coronavirus pandemic is expected to result in slower growth in the ECI over the FYDP period, however. CBO now projects average annual growth in the ECI of 2.4 percent for 2021 through 2025, which is lower than DoD's plans for military pay raises but higher than its plans for civilian pay raises. The potential effect of that change is discussed later in the report in the section "Differences Between DoD's O&S Estimates and Historical Experience."

Military Health System. Costs for the MHS would remain virtually constant (in real terms) during the FYDP period under DoD's projection. Those costs consist of military personnel costs (for uniformed health care providers), direct care costs (for government health care facilities, including civilian employees), purchased care costs (for private-sector providers), pharmaceutical costs, and TRICARE for Life accrual payments (for health care for military retirees and their families). The FYDP reflects DoD's plans to shift health care for service members' families and retirees away from military medical facilities to private providers. The result would be a decrease in the number of government medical personnel (military and civilian) assigned to the MHS and a corresponding decrease in costs for military personnel and direct care. In DoD's projections, decreases in military personnel and direct care costs are offset by increased costs for purchased care, pharmaceuticals, and TRICARE for Life accrual payments. The projection of constant health care costs over the next five years stands in contrast to the economywide growth in medical costs that CBO projects for that period.

Other O&M. DoD estimated that total O&M spending would decrease by about 1.2 percent (in real terms) over the FYDP period. Because civilian compensation would be unchanged and the O&M portion of MHS funding would increase over that time, the remainder of O&M spending, which CBO categorizes as "Other O&M," would shrink by about 2 percent over the FYDP period. Other O&M funds a wide range of activities such as training, maintenance of equipment, operation of military bases, fuel, and contractor support. The cost reduction DoD anticipates in Other O&M over the FYDP period can be attributed to its expectation that

9. CBO estimates that about 85 percent of DoD civilians are compensated with O&M and revolving and management funds. The remainder are compensated with funds appropriated for procurement, RDT&E, military construction, or family housing.

10. See Congressional Budget Office, "10-Year Economic Projections" (January 2020), www.cbo.gov/about/products/budget-economic-data#4.

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Table 3.

DoD's Operation and Support Costs, by Appropriation Title and as Categorized by CBO

Billions of 2021 Dollars

	President's Budget Request, 2021	FYDP, 2025	CBO's Projections Based on DoD's Plans, 2035
		Appropriation Title	
Military Personnel			
Military compensation	155	159	169
TRICARE for Life accrual payments	8	9	13
Total	**163**	**168**	**182**
Operation and Maintenance[a]			
Civilian compensation	81	81	89
Operation and maintenance in the MHS	26	27	33
Other operation and maintenance	183	179	201
Total	**290**	**287**	**323**
Total Appropriations for Operation and Support	**454**	**455**	**505**
		CBO's Categories	
Compensation[b]			
Military personnel	163	168	182
Civilian personnel[c]	81	81	89
Total	**244**	**249**	**271**
Military Health System[d]			
Military pay in the MHS	9	8	8
Civilian pay in the MHS	6	6	7
Operation and maintenance in the MHS	26	27	33
TRICARE for Life accrual payments	8	9	13
Total	**50**	**50**	**61**
Other Operation and Maintenance	183	179	201

Source: Congressional Budget Office.

Funding for operation and support is the sum of the appropriations for military personnel, operation and maintenance, and revolving and management funds.

DoD = Department of Defense; FYDP = Future Years Defense Program; MHS = Military Health System.

a. CBO included the relatively small amount in DoD's budget for revolving and management funds with the operations and maintenance appropriation because those two titles involve similar activities.

b. Compensation consists of pay, cash benefits, and accrual payments for retirement benefits. For civilians, it also includes DoD's contributions for health insurance.

c. These amounts do not include compensation for civilian personnel funded from accounts other than operation and maintenance.

d. These amounts do not include MHS spending from accounts other than operation and support.

OCO costs for direct war requirements will be about 60 percent lower in 2025 than in 2021 (after adjusting for inflation). DoD may also expect that it will be able to achieve some improvements in efficiency and to eliminate some programs, as specified in plans that it has developed.[11] Achieving such reductions runs counter to historical trends, however.

11. For example, see Chief Management Officer, Department of Defense, *Fiscal Year (FY) 2020 Annual Performance Plan and FY 2018 Annual Performance Report* (February 2019), https://go.usa.gov/xmSnZ (PDF, 10 MB).

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Projections of O&S Costs for 2026 Through 2035

In CBO's projections beyond the 2021 FYDP period, O&S costs rise steadily after 2025, from DoD's estimate of $455 billion in that year to $505 billion in 2035, which is an average annual rate of 1.0 percent above inflation (see Figure 2 on page 7). Compensation, MHS, and Other O&M costs would all increase.

Compensation. CBO based its projections of compensation costs beyond 2025 on current law, which sets military pay raises equal to the growth in the ECI unless the Congress or the President acts to provide different amounts. According to CBO's long-term economic projections, the ECI is expected to increase at an average annual rate of 1.1 percentage points above economywide inflation. Other elements of military compensation, including housing allowances and subsistence allowances, would also increase faster than inflation, resulting in an overall real increase of $10 billion in military compensation by 2035. Increases in accrual charges for retiree health care would add an additional $4 billion to military personnel costs by 2035. CBO projects that civilian pay would also rise with the ECI, maintaining parity with military pay increases and resulting in an increase of $8 billion in real terms by 2035. In total, compensation would increase by 10 percent (in real terms) after 2025, from $249 billion to $271 billion (see Table 3 on page 9, lower panel).

Military Health System. In its projections for the Military Health System, CBO incorporated costs that would grow at the same rate as the costs of health care in the general economy, except for the portion of MHS costs designated for the compensation of military personnel and federal civilians (which CBO assumed would grow at the rate of the ECI, as discussed above). Combined, those changes would yield an average annual increase in MHS costs of about 2 percent above economywide inflation. At that rate, costs for the MHS would grow by 22 percent from 2025 to 2035, from $50 billion to about $61 billion (see Figure 3).

Other O&M. In its projection for Other O&M, CBO estimated that costs would increase faster than inflation, consistent with long-standing trends.[12] Between 1980 and 2020, DoD's Other O&M costs have more than doubled in real terms after adjusting for changes in the size of the military, increasing annually by about $1,600 per active-duty service member. Because it is not practical to make individual estimates of the costs of the thousands of activities that Other O&M comprises, CBO's projections reflect overall growth in those costs that is consistent with that historical trend. That results in an average annual increase of 1.2 percent in real terms after 2025, which would cause annual costs for Other O&M to increase by $22 billion (or 12 percent) by 2035.

Uncertainty in Projections of O&S Costs

CBO's projections are not meant to predict future budgets. They are extrapolations of DoD's estimates in the FYDP, made on the premise that the primary aspects of the current defense plan would remain unchanged. But DoD's plans could change for many reasons. Moreover, projections of economic factors that affect DoD's costs—such as changes in the ECI or health care costs—are rarely perfect, which could also cause DoD's actual costs to differ from CBO's projections. For example, the coronavirus pandemic is expected to slow the growth in the ECI relative to earlier projections.

Differences Between DoD's O&S Estimates and Historical Experience

DoD's actual costs could differ from its estimated costs not only because of the previously described uncertainties but also because several of DoD's estimates about O&S costs over the FYDP period are counter to recent trends. Those estimates result in lower projected rates of growth over the FYDP period in all three categories of O&S costs when compared with CBO's estimates for 2026 through 2035.

- DoD planned for a 1 percent pay raise for its civilian workers in 2021 (in contrast to the 3 percent pay raise requested for military personnel), but civilian raises have usually been equal to or only slightly smaller than those for military personnel.[13]
- DoD projected that O&M costs for the MHS would increase at less than half the rate that CBO projects for health care costs in the economy as a whole.

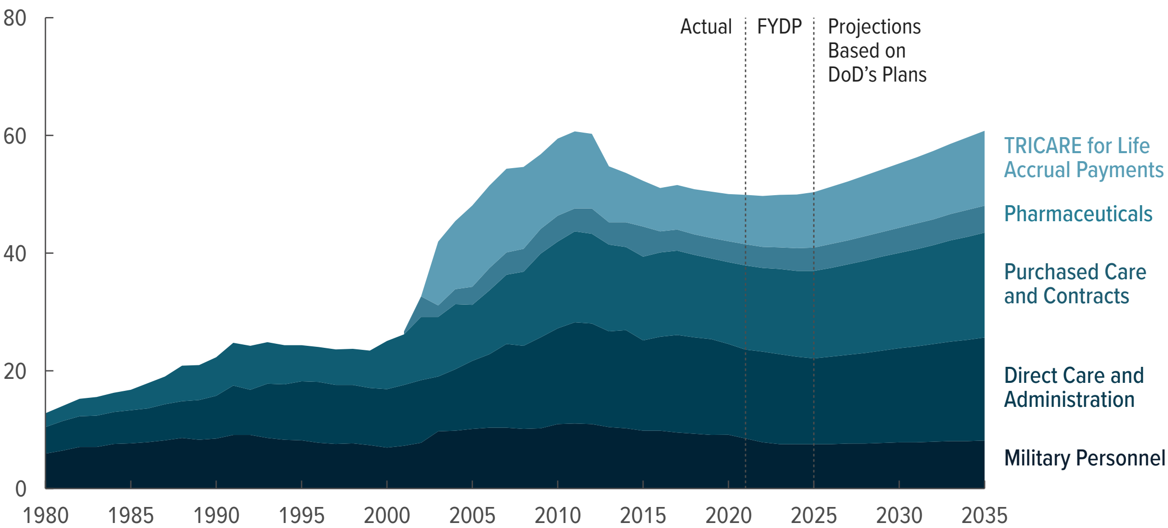
12. For a more detailed discussion of CBO's approach to analyzing "Other O&M" costs, see Congressional Budget Office, *An Analysis of the Obama Administration's Final Future Years Defense Program* (April 2017), www.cbo.gov/publication/52450.

13. For example, although the 2020 budget request included no pay raise for civilians, an overall average pay increase of 3.1 percent for civilian federal employees was provided in 2020. Military personnel received the same percentage raise.

Figure 3.

Costs of the Military Health System Under the 2021 FYDP

Billions of 2021 Dollars



Source: Congressional Budget Office.

Before 2001, pharmaceutical costs were not identified separately but were embedded in the costs of two categories: "Purchased Care and Contracts" and "Direct Care and Administration." In 2001 and later years, most pharmaceutical costs are identified separately, but some are embedded in the category "TRICARE for Life Accrual Payments."

DoD = Department of Defense; FYDP = Future Years Defense Program.

- DoD planned for Other O&M costs to fall by about 2 percent (in real terms) over the FYDP period even though those costs (adjusted for changes in the size of the force) have increased for decades despite DoD's many efforts over the years to improve efficiency and eliminate unnecessary activities. Although some decrease can be attributed to the reduction in direct war costs funded with OCO appropriations, CBO estimates that if Other O&M costs grew at their historical rate, they would exceed the amounts projected in the FYDP.

In addition, DoD's plans called for military pay to increase more slowly than the average annual increase in the ECI that was projected at the time the FYDP was prepared, even though military pay raises have matched or exceeded growth in the ECI in 20 of the past 30 years. However, the economic effects of the coronavirus pandemic have resulted in a slower projected growth in the ECI than DoD included in the FYDP—an average of 2.3 percent per year instead of 2.6 percent per year from 2022 through 2025. If military pay raises match the new ECI projections, DoD's costs for military compensation would be slightly lower than anticipated in the FYDP (see Table 1 on page 3). Despite the decrease in projected growth in the ECI, civilian raises matching the smaller ECI raises for the military would still be larger than the civilian raises anticipated in the FYDP.

Even with slower than anticipated growth in the ECI, DoD's overall costs for O&S would be higher if the growth rates in other parts of O&S over the FYDP period matched the historical growth rates CBO used in its projections of defense costs beyond the FYDP period instead of those incorporated in DoD's plan. Cumulative O&S costs would be $40 billion (or about 2 percent) higher than DoD's plan from 2021 to 2025 and $198 billion (or about 3 percent) higher than CBO's extension of the FYDP from 2021 to 2035 (see Table 1 on page 3, first four rows). CBO estimates that 13 percent of the difference in the cumulative costs for 2021 through 2035 would be attributable to compensation, 15 percent to the MHS, and 72 percent to Other O&M.

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Projected Costs of Acquisition

Acquisition funding comprises appropriations for procurement and RDT&E. That funding is used to develop and buy new weapon systems and other major equipment, to upgrade the capabilities or extend the service life of existing weapon systems, and to support research on future technologies.

CBO used two approaches to project acquisition costs. For major programs involving the acquisition of new weapon systems or upgrades to existing systems, CBO projected costs and schedules on a program-by-program basis. For smaller programs and general research-and-development activities, CBO made aggregate projections on the basis of policies either stated or implied in DoD's planning documents or on the basis of historical relationships between total acquisition funding and the funding for major programs. (CBO's projections for programs did not account for growth in the costs above DoD's estimates; the agency explored the effect that historical cost growth in acquisition programs could have in alternative projections discussed below.)

CBO based its program-by-program projections not only on the 2021 FYDP but also on detailed plans, such as Selected Acquisition Reports, that the services have issued for some major systems (for example, the Air Force's new trainer aircraft). For other major systems (for example, a new armed reconnaissance aircraft for the Army), CBO based its estimates on more general descriptions the services have provided about schedules and costs for development and procurement. For still other systems (for instance, future fighters that the Navy and Air Force are considering putting into service in the 2030s), there are no detailed schedules or cost estimates, but their acquisition can be anticipated if DoD is to maintain the current size of the force when today's weapons reach the end of their service lives. In those cases, CBO based its cost estimates on the premise that the services would replace retiring weapon systems with similar but more technologically advanced ones.

Acquisition Costs in the 2021 FYDP

In DoD's budget request for 2021, $243 billion (or about one-third of its budget request) was for acquisition: $137 billion for procurement and $107 billion for RDT&E. The amount requested in the budget for acquisition in 2021 is 5 percent less than the amount appropriated for 2020 (after adjusting for inflation). Acquisition costs under the 2021 FYDP would remain fairly steady, averaging $241 billion annually for 2022 through 2025 after adjusting for inflation. After a small dip in 2022, costs for procurement would increase steadily to $150 billion at the end of the FYDP period (see Figure 4). That amount is 8 percent higher than the inflation-adjusted average of total procurement costs (base budget and OCO) over the past 20 years. The increase in procurement costs would be offset by a 14 percent decrease in RDT&E costs over the FYDP period, to $92 billion in 2025. Despite that decrease, however, costs for RDT&E would still be substantial compared with past costs: Annual funding for RDT&E has averaged about $73 billion since 1980, after adjusting for inflation. Costs for RDT&E in the 2021 FYDP would also be higher than average funding since 2000 ($86 billion).

The Army's acquisition costs would decrease by about 8 percent, from $38 billion in 2021 to $35 billion in 2025 (see Figure 5 on page 14). Procurement would increase by 2 percent as the Army began purchasing new weapons for conflicts against technologically advanced adversaries. Under the Army's plans, annual costs for combat vehicles would nearly double—from $3.7 billion in 2021 to $7.3 billion in 2025—as purchases of Armored Multi-Purpose Vehicles (AMPVs) increased and purchases of replacements for Bradley fighting vehicles began. Costs for aircraft procurement would decrease by 26 percent over the FYDP period as current programs were completed, and missile procurement costs would be 3 percent lower in 2025 than in 2021. Funding for RDT&E would decrease by 27 percent over the FYDP period as the development of new aircraft, offensive missiles, and missile defense systems was completed and production was begun.

Acquisition costs for the Department of the Navy (including the Marine Corps) would increase by about 2 percent, from slightly less than $79 billion in 2021 to just over $80 billion in 2025. Procurement would *increase* by nearly $6 billion (or 10 percent) and RDT&E would *decrease* by $4 billion (or 18 percent) over that time. Most of the increase in procurement costs would be for ships as the Navy continued its efforts to increase the size of the fleet. Purchases of new long-range missiles for use against technologically advanced adversaries would also contribute to increased procurement costs.

The Department of the Air Force (including the newly established Space Force) would also have increased

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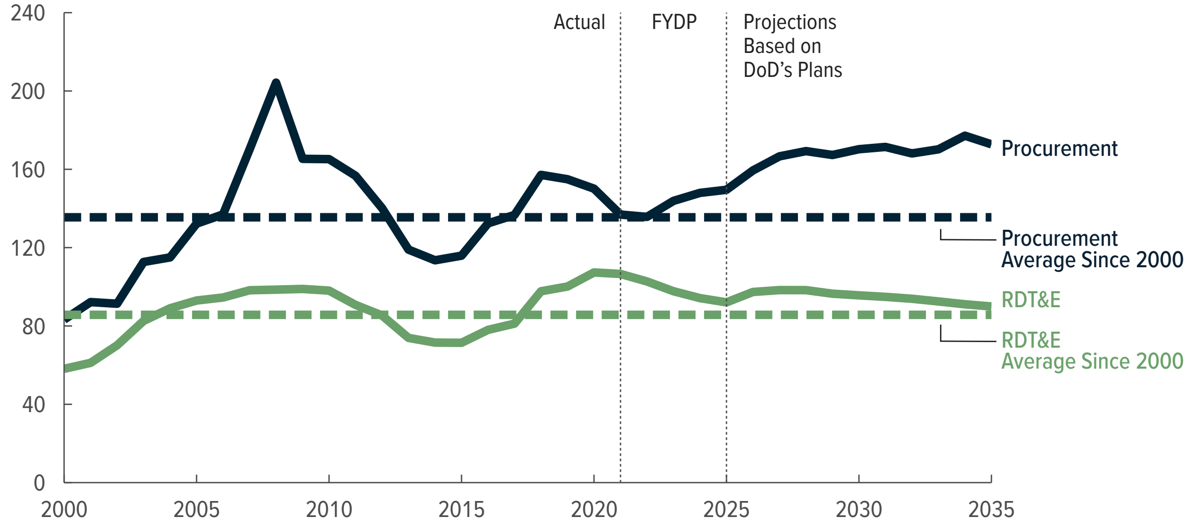
Figure 4.

DoD's Acquisition Costs Under the 2021 FYDP, by Appropriation Title

Billions of 2021 Dollars



Source: Congressional Budget Office.

Acquisition funding is the sum of the appropriations for procurement and RDT&E.

DoD = Department of Defense; FYDP = Future Years Defense Program; RDT&E = research, development, test, and evaluation.

costs for procurement and decreased costs for RDT&E from 2021 to 2025. Procurement costs would increase by about 20 percent, from $27 billion to $33 billion. Almost all of that increase would be for aircraft (in particular, the new advanced trainer and the B-21 bomber) and space systems. The Air Force's costs for RDT&E would decrease from $37 billion to $32 billion, leaving its total acquisition costs nearly unchanged. The Space Force has taken on space-related activities previously conducted by the Air Force and is expected to eventually take on some or all of DoD's space-related activities, but because the details of those changes are not yet clear and would probably have little effect on overall acquisition costs, CBO did not incorporate them into this analysis. (For example, in CBO's projections, costs for future Navy communications satellites remain with the Navy, although developing and fielding those satellites may eventually become the responsibility of the Space Force.)

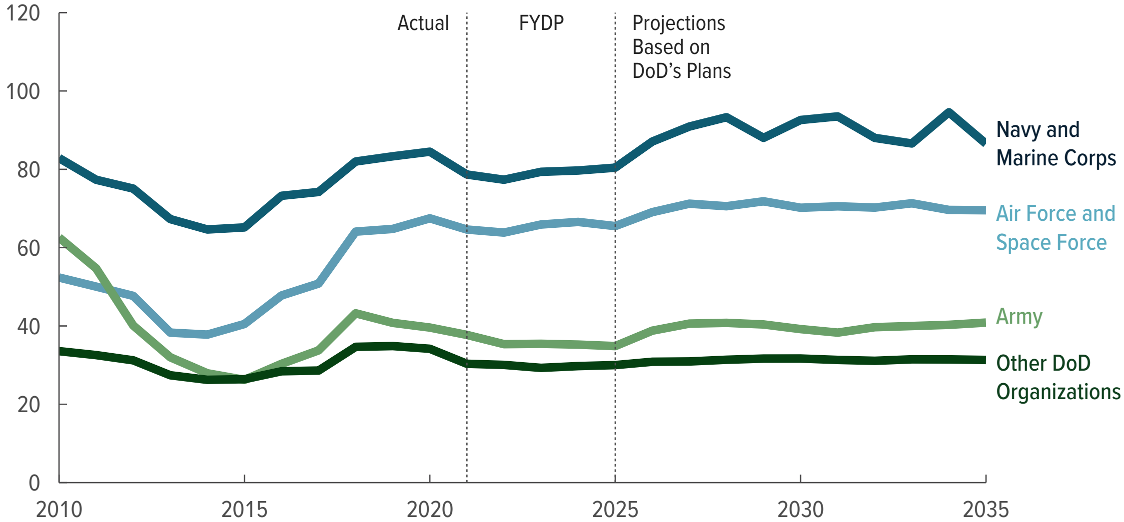
The Air Force's acquisition costs described above do not include costs for classified activities performed outside of the Air Force that are funded through the service's procurement and RDT&E accounts. Those costs, which totaled $32 billion in the 2021 budget request, are included when CBO refers to total acquisition costs for DoD, however. CBO estimated that those costs would decrease slightly (in real terms) over the FYDP period.

DoD's budget also includes defensewide acquisition funding, which is allocated to defense agencies other than the three military departments. Under the 2021 FYDP, acquisition costs for defensewide programs would be nearly constant, averaging $30 billion from 2021 through 2025. The agencies funded by defensewide appropriations carry out activities in conjunction with the services—for example, performing advanced research, developing missile defenses (the Missile Defense Agency), developing some of DoD's space systems (the recently established Space Development Agency), overseeing special operations, and managing financial and information systems. Costs for the Missile Defense Agency would average slightly less than 30 percent of defensewide costs over the FYDP period. Costs for the Space Development Agency (SDA) would increase from about $290 million in 2021 to $1.8 billion in 2025 as that organization works toward fielding new constellations of satellites. Although in the future the SDA may

Figure 5.

DoD's Acquisition Costs Under the 2021 FYDP, by Military Department

Billions of 2021 Dollars



Source: Congressional Budget Office.

Acquisition funding is the sum of the appropriations for procurement and RDT&E.

Funding shown for the Air Force does not include approximately $30 billion each year for classified activities not carried out by that service.

DoD = Department of Defense; FYDP = Future Years Defense Program; RDT&E = research, development, test, and evaluation.

become part of the Space Force, for this analysis CBO included its costs in defensewide acquisition.

Projections of Acquisition Costs for 2026 Through 2035

In CBO's projections, DoD's acquisition costs rise sharply in the years immediately after the FYDP period, from $242 billion in 2025 to $268 billion in 2028 (see Figure 2 on page 7). Costs would vary slightly from year to year thereafter, averaging $265 billion from 2029 through 2035. Costs for procurement would be $24 billion (or 16 percent) higher in 2035 than in 2025. Costs for RDT&E would increase from $92 billion in 2025 to $98 billion in 2027 and then steadily decrease to $90 billion in 2035.

For the Army, acquisition costs would increase rapidly in the first two years after the FYDP period, growing from $35 billion in 2025 to $41 billion 2027 (see Figure 5). Most of that increase would be attributable to procurement costs, which would rise from $26 billion to $31 billion over that period. Procurement costs would vary slightly from year to year after 2027, averaging $31 billion per year through 2035. RDT&E costs would remain nearly unchanged, averaging about $9 billion per year.

The Army has defined six broad acquisition priorities that encompass nearly all of its weapon systems. Those objectives are to acquire new long-range precision weapons, a new armored combat vehicle, a new vertical-lift aircraft, an improved communications network for combat units, improved air-and-missile defense systems, and improved infantry weapons and other equipment for soldiers. Although the Army has not defined the specific systems that would be acquired, CBO's projections beyond the FYDP period include notional programs to satisfy those objectives. Most of the increase in projected procurement costs after 2025 would be for new armored vehicles and aircraft. The projections also reflect the Army's plans to purchase new, long-range missiles and to continue improvements to its air-and-missile defense systems and digital network systems.

For the Navy (including the Marine Corps), CBO estimates that acquisition costs would increase by 8 percent in the first year after the FYDP period, from $80 billion in 2025 to $87 billion in 2026. The Navy's acquisition costs would reach $93 billion in 2028 and then range from $87 billion to $93 billion through 2035. Costs for shipbuilding would account for most of the increase as the Navy continued to increase the size of its fleet and to replace two of its most expensive classes of ships: aircraft carriers and ballistic missile submarines.[14] Average annual shipbuilding costs for 2026 through 2035 would be about $9 billion (or 41 percent) higher than the average over the FYDP period. Average annual costs for missiles would be 35 percent higher after the FYDP period, CBO estimates, as the Navy began purchasing three new long-range weapons: a conventional hypersonic missile, a surface-launched nuclear cruise missile, and a submarine-launched ballistic missile to replace the Trident D5 nuclear missile. Aircraft-related costs would increase slightly after the FYDP period, but then decrease sharply after 2031 as current programs to acquire new aircraft (such as the F-35 Joint Strike Fighter and the CH-53K helicopter) and to modify existing aircraft were completed. The cost of the Navy's RDT&E, which would drop by almost 20 percent over the FYDP period, would return to its 2021 amount ($21 billion) by 2028 and average about that amount over the last seven years of the projection period.

For the Air Force (including the Space Force), CBO projects that acquisition costs would increase by 9 percent in the first two years beyond the FYDP period, from $66 billion in 2025 to $72 billion in 2027. The Air Force's acquisition costs would remain fairly steady thereafter, averaging about $71 billion per year through 2035. Those amounts do not include the classified activities that are funded through the Air Force's acquisition budget but not carried out by the service. CBO projected that those "pass-through" amounts would grow slowly after 2025, averaging $33 billion per year through 2035. The growth in the Air Force's costs would result primarily from increased procurement of several new weapon systems—including fighters (the F-35A), bombers (the B-21), supersonic trainers (the Advanced Pilot Training aircraft), nuclear cruise missiles (the Long-Range Standoff Weapon), and intercontinental ballistic missiles (the Ground-Based Strategic Deterrent)—and from costs to develop new systems for achieving air superiority that would be fielded in the 2030s. Costs for space systems would average $5.2 billion per year in the 10 years beyond the FYDP period, almost 60 percent more than the average during the FYDP period.

In CBO's projections, defensewide acquisition costs vary between $31 billion and $32 billion per year from 2025 to 2035. Missile defense costs would increase by 12 percent in the first four years beyond the FYDP period but almost return to the 2025 amount at the end of the projection period. Other costs, such as those for other defense agencies, would increase very slowly (by about 0.5 percent annually in real terms).

Uncertainty in Projections of Acquisition Costs

Like the projections of O&S costs, the projections of DoD's acquisition costs are subject to considerable uncertainty. One major source of uncertainty is the possibility that DoD's plans and their associated costs would change. Changes in acquisition plans, sometimes substantial, can result from a variety of factors. For example, the funding constraints imposed by the Budget Control Act led DoD to curtail the acquisition spending it had planned in earlier FYDPs. Changes in the military capability of perceived adversaries can also motivate changes in DoD's acquisition plans. For example, DoD had no plans to purchase thousands of mine-resistant vehicles until they became necessary in the face of roadside bombs in Iraq, nor did it have programs to counter hypersonic weapons until China began testing such weapons several years ago.

Uncertainty about the 2021 FYDP is heightened because DoD is in the early stages of shifting its emphasis from counterinsurgency operations to more technologically advanced warfare. For example, the Army has yet to define detailed acquisition plans (such as might be found in a Selected Acquisition Report) for many of its acquisition priorities, which are focused on improving capabilities against adversaries with modern militaries. The shift in DoD's emphasis is also reflected in the relatively large amounts of funding requested for RDT&E in the early years of the 2021 FYDP period and in the Administration's plans to rapidly field advanced (but not yet well-defined) systems, such as hypersonic cruise missiles, unmanned ships and underwater vehicles, and integrated networks of independent sensors for battlefield reconnaissance.

14. See Congressional Budget Office, *An Analysis of the Navy's Fiscal Year 2020 Shipbuilding Plan* (October 2019), www.cbo.gov/publication/55685, and *How CBO Estimates the Cost of New Ships* (April 2018), www.cbo.gov/publication/53785.

CBO

Plans for the fielding of future space systems are particularly uncertain. The SDA has outlined plans for several satellite constellations that would provide an array of capabilities including communications, missile defense, surveillance and reconnaissance, and tracking of ground targets. If pursued, those plans are likely to be costly. However, they might enable DoD to lower costs in other areas. For example, the Air Force might be able to retire some of its reconnaissance aircraft. Because of the great uncertainties, CBO did not include those systems in its projections.

Differences Between DoD's Acquisition Estimates and Historical Experience

Growth in the costs of weapons programs could also cause acquisition costs to differ from the projections discussed above. According to analyses by the RAND Corporation and the Institute for Defense Analyses (IDA), DoD has tended to underestimate the costs of its major weapons programs.[15] Actual costs could be higher than early estimates for many reasons, including the following:

- Underestimates of costs in DoD's initial plans;
- Changes in economic factors, such as the costs of labor and raw materials;
- Changes in performance requirements, which can result in the need for costly design changes during development;
- Lower-than-anticipated annual funding, which can increase total costs by disrupting established plans and schedules and by stretching programs (and their associated overhead costs) over longer periods; and
- Unanticipated technological challenges posed by new systems.

CBO's projections of long-term acquisition costs is based on DoD's estimates of development and procurement costs and on the number of units to be purchased per year and in total, as specified in DoD's long-range plans. To illustrate how growth in the costs of acquisition programs might affect the total costs of DoD's 2021 budget plans, however, CBO prepared alternative estimates using historical patterns of growth in DoD's costs. For those estimates, CBO applied cost-growth factors derived from RAND's and IDA's research to the portfolio of large weapons programs, excluding those for Navy ships, in the 2021 FYDP.[16] For Navy ships, CBO used detailed estimates prepared for its annual analysis of the Navy's shipbuilding plans. Using the resulting cost estimates instead of DoD's cost estimates raises total projected acquisition costs by 3.5 percent over the FYDP period and by 6.1 percent over the 2026–2035 period. That equates to an additional $7 billion per year, on average, over the 2021–2025 period and an additional $14 billion per year, on average, for 2026 through 2035 (see Table 1 on page 3, fifth row). Because uncertainty about costs is greater in the more distant future, the potential increases are larger for the years beyond the FYDP period.

Projected Costs of Infrastructure

The budget for infrastructure comprises appropriations for military construction and family housing, which provide funds for building and renovating DoD's facilities. Appropriations for military construction cover facilities such as buildings, runways, and piers used by the military. Appropriations for family housing cover a portion of the housing on military installations.[17]

Infrastructure Costs in the 2021 FYDP

DoD requested a total of $8.2 billion for infrastructure in 2021, which is about 35 percent less than the amount

15. See Mark V. Arena and others, *Historical Cost Growth of Completed Weapon System Programs*, TR-343-AF (RAND Corporation, 2006), www.rand.org/pubs/technical_reports/TR343.html; David L. McNicol and Linda Wu, *Evidence on the Effect of DoD Acquisition Policy and Process on Cost Growth of Major Defense Acquisition Programs*, IDA Paper P-5126 (Institute for Defense Analyses, September 2014), https://apps.dtic.mil/dtic/tr/fulltext/u2/a609472.pdf (826 KB); and Obaid Younossi and others, *Is Weapon System Cost Growth Increasing? A Quantitative Assessment of Completed and Ongoing Programs*, MG-588-AF (RAND Corporation, 2007), www.rand.org/pubs/monographs/MG588.html.

16. For details about how CBO applies those cost-growth factors, see Congressional Budget Office, *An Analysis of the Obama Administration's Final Future Years Defense Program* (April 2017), pp. 47–50, www.cbo.gov/publication/52450.

17. Since the enactment of the Military Housing Privatization Initiative in 1996, the costs to operate and maintain most military housing have been transferred to private companies. In the budget, costs for that privatized housing have been shifted to housing allowances in the military personnel appropriation. See the Office of the Assistant Secretary of Defense for Sustainment, "Facilities Management—Military Housing Privatization Initiative" (accessed September 1, 2020), www.acq.osd.mil/eie/FIM/Housing/Housing_index.html.

appropriated in 2020, excluding the $6.4 billion (in 2021 dollars) in disaster relief funding that was appropriated to rebuild facilities damaged by Hurricanes Florence and Michael. Requested infrastructure funding makes up 1.2 percent of DoD's total request in 2021. The base-budget portion of DoD's request for infrastructure totaled $7.8 billion—$6.5 billion for military construction and $1.4 billion for family housing.

Under the 2021 FYDP, annual infrastructure costs would jump to $11.4 billion in 2022 and then vary between $9.4 billion and $10.1 billion through 2025. Military construction costs would increase by 44 percent from 2021 to 2022, from $6.8 billion to $9.9 billion, then average $8.3 billion per year over the final three years of the FYDP period. Appropriations for family housing would rise by about 8 percent in 2022 and then remain nearly constant through 2025.

Projections of Infrastructure Costs for 2026 Through 2035

In CBO's projections, infrastructure costs in DoD's base budget increase by an average of 1.9 percent per year after the FYDP period, reaching $12.1 billion in 2035. Those increases are based on CBO's projection of real growth in the cost of construction projects in the general economy.

Uncertainty in Projections of Infrastructure Costs

The primary source of uncertainty in current projections of infrastructure costs is whether the Congress will authorize a new round of Base Realignment and Closure (BRAC)—a process in which DoD closes and consolidates bases to streamline its allocation of resources and cut costs. The last round of BRAC began in 2005, but the Congress has not supported DoD's efforts to implement a new round since then.[18] Infrastructure costs would change if a new round of BRAC was authorized, but the magnitude and timing of those changes cannot be estimated with confidence.

18. The Congress prohibited spending on an additional round of BRAC in the National Defense Authorization Act of 2020 (P.L. 116–92, December 2019).

List of Tables and Figures

Tables

Figures

About This Document

The Congressional Budget Office prepared this report at the request of the Chairman and Ranking Member of the Senate Committee on the Budget. In keeping with CBO's mandate to provide objective, impartial analysis, the report makes no recommendations.

David Arthur and F. Matthew Woodward coordinated the preparation of this report with guidance from David Mosher and Edward G. Keating. Elizabeth Bass, Michael Bennett, Eric Labs, and Adam Talaber contributed to the analysis. Eric Labs fact-checked the manuscript.

Mark Doms and Robert Sunshine reviewed the report. Caitlin Verboon was the editor, and Jorge Salazar was the graphics editor. An electronic version of the report and supplemental data are available on CBO's website (www.cbo.gov/publication/56526).

CBO continually seeks feedback to make its work as useful as possible. Please send any comments to communications@cbo.gov.

Phillip L. Swagel
Director
September 2020

CBO

Congressional Budget Office
Nonpartisan Analysis for the U.S. Congress

The 2022 Long-Term Budget Outlook

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At a Glance

Each year, the Congressional Budget Office publishes a report presenting its budget projections and economic forecast for the next 30 years under the assumption that current laws governing taxes and spending generally do not change. This report is the latest in the series.

- **Deficits.** At 3.9 percent of gross domestic product (GDP), the projected deficit in 2022 is much smaller than those recorded in 2020 and 2021, because federal spending in response to the coronavirus pandemic has waned and revenues have risen sharply. Nevertheless, in CBO's projections, federal deficits over the 2022–2052 period average 7.3 percent of GDP (more than double the average over the past half-century) and generally grow each year, reaching 11.1 percent of GDP in 2052. That projected growth in total deficits is largely driven by increases in interest costs: Net interest outlays more than quadruple over the period, rising to 7.2 percent of GDP in 2052. Primary deficits—that is, deficits excluding net outlays for interest—grow from 2.3 percent of GDP in 2022 to 3.9 percent in 2052.

- **Debt.** By the end of 2022, federal debt held by the public is projected to equal 98 percent of GDP. The rapid growth of nominal GDP—which reflects both high inflation and the continued growth of real GDP (that is, GDP adjusted to remove the effects of inflation)—helps hold down the amount of debt relative to the nation's output in 2022 and 2023. In CBO's projections, debt as a percentage of GDP begins to rise in 2024, surpasses its historical high in 2031 (when it reaches 107 percent), and continues to climb thereafter, rising to 185 percent of GDP in 2052.

  Debt that is high and rising as a percentage of GDP could slow economic growth, push up interest payments to foreign holders of U.S. debt, heighten the risk of a fiscal crisis, elevate the likelihood of less abrupt adverse effects, make the U.S. fiscal position more vulnerable to an increase in interest rates, and cause lawmakers to feel more constrained in their policy choices.

- **Spending.** In CBO's projections, outlays in 2022 are 23.5 percent of GDP—less than last year's total—and they continue to decline in 2023 and 2024 as federal spending in response to the pandemic diminishes. Outlays then steadily increase, reaching 30.2 percent of GDP in 2052. Rising interest costs and growth in spending on the major health care programs and Social Security—driven by the aging of the population and growth in health care costs per person—boost federal outlays significantly over the 2025–2052 period.

- **Revenues.** In CBO's projections, revenues rise to 19.6 percent of GDP in 2022, one of the highest levels ever recorded, because of sizable increases in collections of individual income taxes. After falling in relation to the size of the economy for the next few years, revenues increase in 2026, largely because of scheduled changes in tax rules. They continue to rise after 2030 as an increasing share of income is pushed into higher tax brackets. In 2052, revenues reach 19.1 percent of GDP.

Future economic conditions are uncertain. But even if they were more favorable than CBO currently projects, debt in 2052 would probably be much higher than it is today. Moreover, according to CBO's analysis, if future paths for spending and revenues were more consistent with such paths in the past, debt in 2052 would probably be much higher than CBO projects.

In this year's projections, debt as a percentage of GDP is lower in most years than CBO projected last year. In the current projections, federal debt rises from 98 percent of GDP in 2022 to 180 percent in 2051. Those amounts are lower than CBO's previous projections—by 4 percentage points and 22 percentage points, respectively.

Contents

Notes

The Congressional Budget Office's extended baseline projections follow the agency's 10-year baseline budget projections and then extend most of the concepts underlying those projections for an additional 20 years. In accordance with statutory requirements, CBO's projections reflect the assumptions that current laws generally remain unchanged, that some mandatory programs are extended after their authorizations lapse, and that spending on Medicare and Social Security continues as scheduled even if their trust funds are exhausted.

The budget projections in this report are based on CBO's economic projections and include the effects of legislation enacted through April 8, 2022. The economic projections reflect economic developments through March 2, 2022. The projections do not include budgetary or economic effects of subsequent legislation, economic developments, administrative actions, court rulings, or regulatory changes.

Unless this report indicates otherwise, all years referred to are federal fiscal years, which run from October 1 to September 30 and are designated by the calendar year in which they end. Budgetary values, such as the ratio of debt or deficits to gross domestic product (GDP), are calculated on a fiscal year basis; economic variables, such as GDP or interest rates on Treasury securities, are calculated on a calendar year basis.

When October 1 (the first day of the fiscal year) falls on a weekend, certain payments that ordinarily would have been made on that day are instead made at the end of September and thus are shifted into the previous fiscal year. In this report, budget projections have been adjusted to exclude the effects of those timing shifts.

Numbers in the text, tables, and figures may not add up to totals because of rounding.

Unless this report specifies otherwise, Medicare outlays are presented net of premiums paid by beneficiaries and other offsetting receipts, which reduce outlays for the program.

In this report, the term "additional cost growth" is used instead of "excess cost growth" (which was used in past reports) to describe the amount by which the growth rate of nominal health care spending per person (adjusted to remove the effects of demographic changes) exceeds the growth rate of potential GDP per person.

Detailed projections about the size of the U.S. population and its age and sex composition are presented in a companion report; see Congressional Budget Office, *The Demographic Outlook: 2022 to 2052* (July 2022), www.cbo.gov/publication/57975.

Supplemental information files—the data underlying the tables and figures in this report, supplemental budget projections, and the economic variables underlying those projections—are posted on CBO's website (www.cbo.gov/publication/57971#data). Previous editions of this report are also available on the website (https://go.usa.gov/xmezZ).

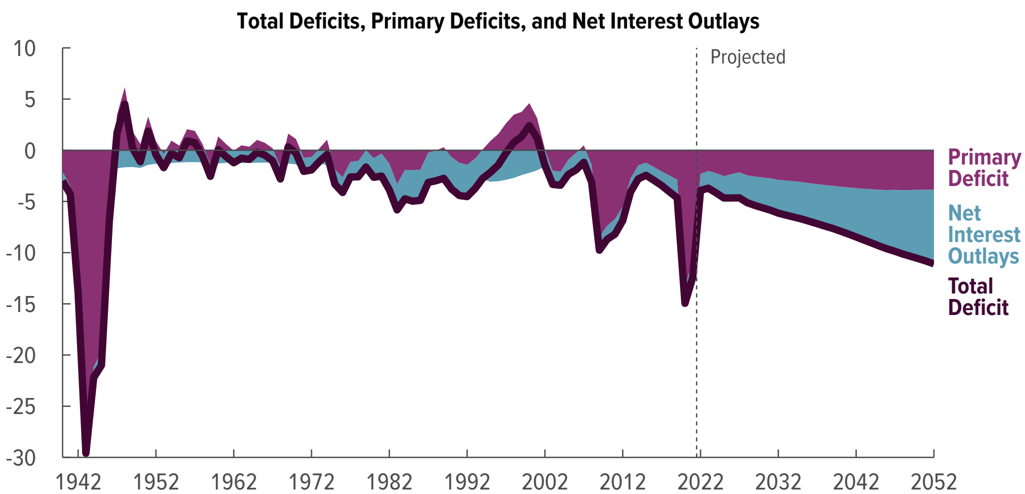
Visual Summary

In this report, the Congressional Budget Office describes its projections of what the federal budget would look like over the next 30 years if current laws generally remained unchanged; it also presents the economic forecast underlying those projections. The United States faces a challenging fiscal outlook according to those extended baseline projections, which show budget deficits and federal debt held by the public growing steadily in relation to gross domestic product (GDP) over the next three decades.

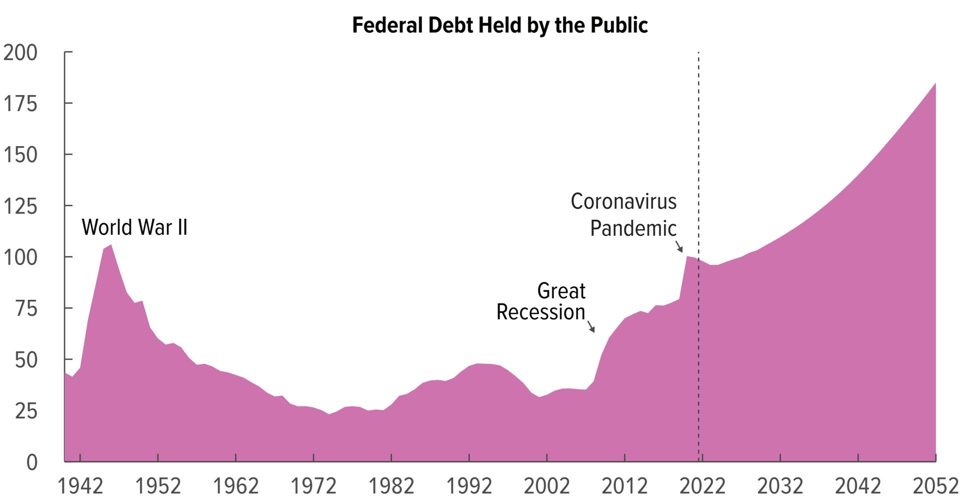
Deficits and Debt

Federal deficits are projected to nearly triple over the next 30 years, from 4 percent of GDP in 2022 to 11 percent in 2052. Such persistently growing deficits would cause federal debt held by the public, which is already high, to continue to rise even further. In CBO's projections, such debt reaches 185 percent of GDP in 2052.

Percentage of Gross Domestic Product



Net interest outlays more than quadruple as a percentage of GDP over the 2022–2052 period in CBO's projections, reaching 7.2 percent of GDP in 2052. Primary deficits (which exclude net interest costs) grow in most years and reach 3.9 percent of GDP at the end of the projection period; they exceed the 50-year average of 1.5 percent of GDP throughout the period.



Debt is projected to rise in relation to GDP over the 30-year period, and it is on track to grow even larger after 2052.

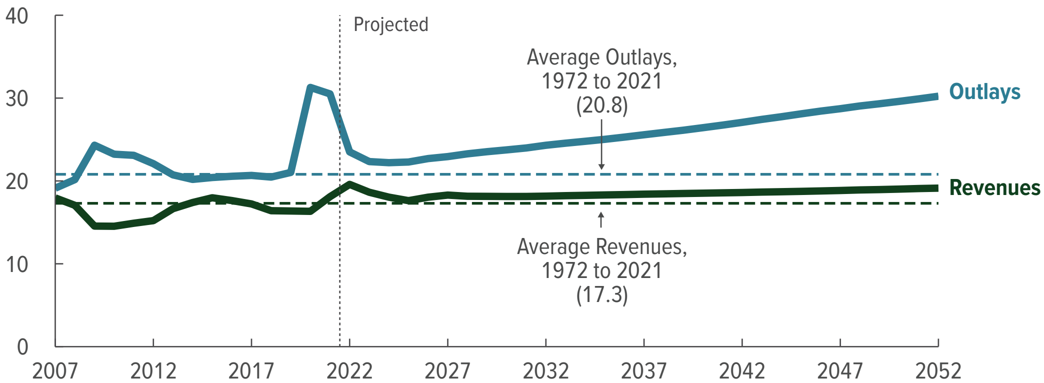
See Figure 1-1 on page 6

Spending and Revenues

In CBO's projections, federal spending grows from an average of 23 percent of GDP over the 2022–2032 period to an average of 29 percent of GDP over the 2043–2052 period. Federal revenues increase from an average of 18 percent of GDP over the 2022–2032 period to an average of 19 percent over the 2043–2052 period.

Total Outlays and Revenues

Percentage of Gross Domestic Product

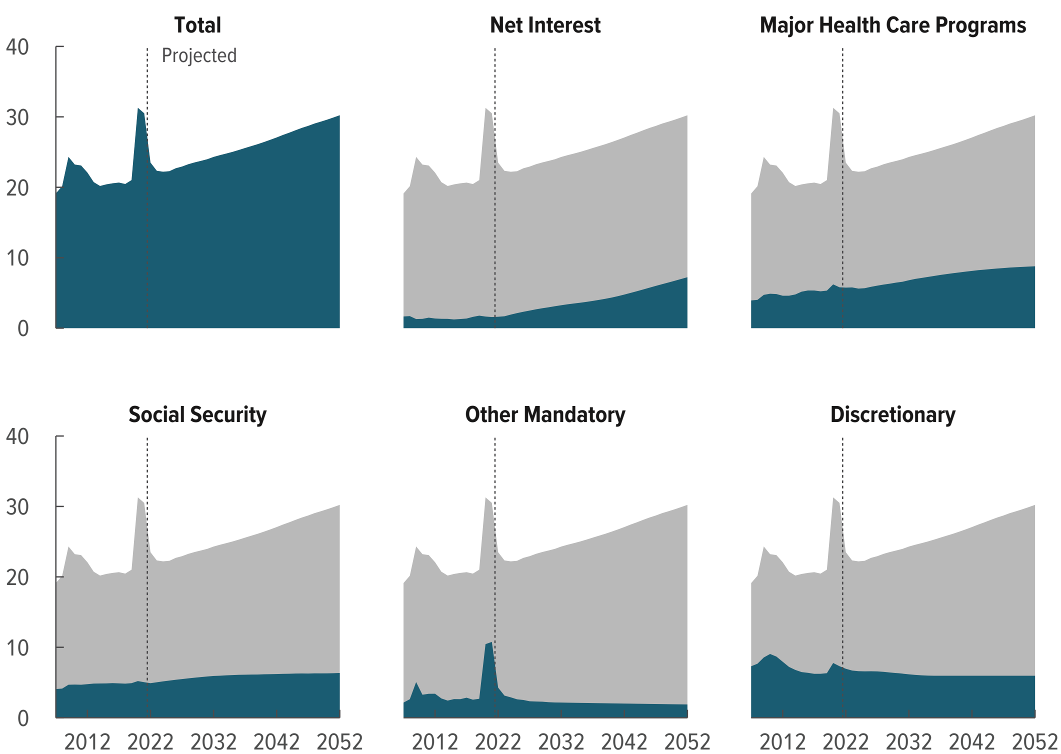


The gap between outlays and revenues widens over the long term. Outlays increase faster than revenues—mainly because of rising interest costs and growth in spending for Medicare and Social Security—resulting in ever-larger budget deficits.

See Figure 2-1 on page 16

Outlays, by Category

Percentage of Gross Domestic Product



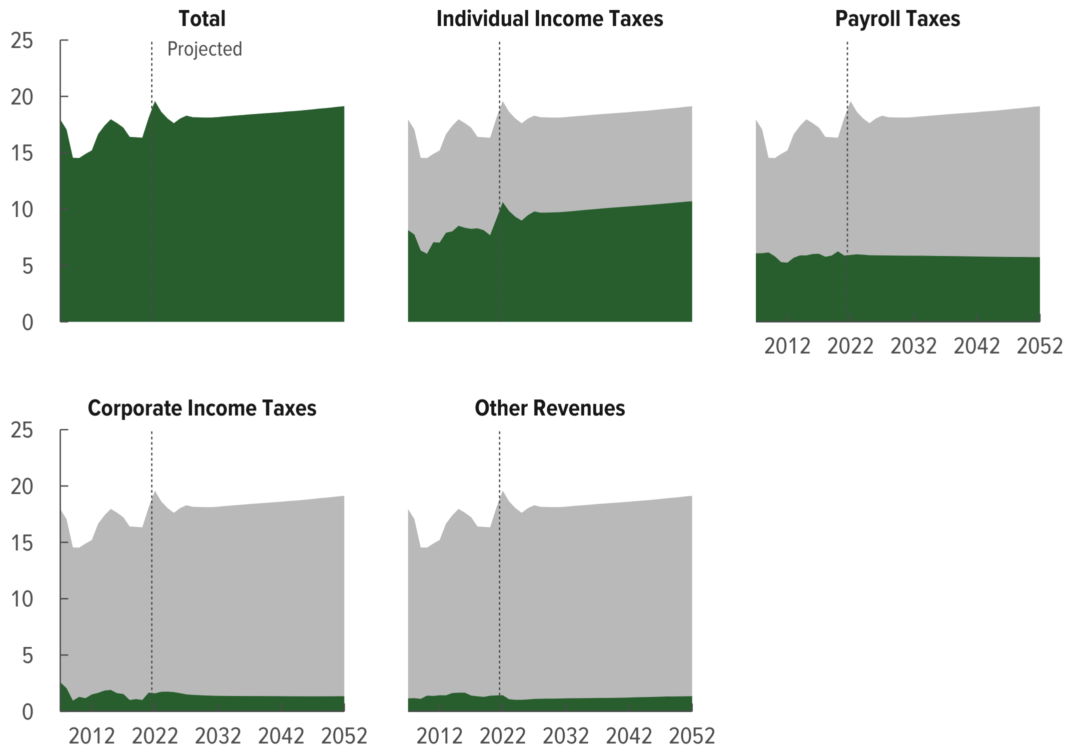
Rising interest rates and mounting debt cause net interest outlays to increase from 1.6 percent of GDP in 2022 to 7.2 percent in 2052 in CBO's projections. Outlays for the major health care programs also rise, from 5.8 percent of GDP in 2022 to 8.8 percent in 2052. Likewise, outlays for Social Security increase in almost every year of the period.

See Figure 2-2 on page 17

Spending and Revenues (Continued)

Revenues, by Source

Percentage of Gross Domestic Product

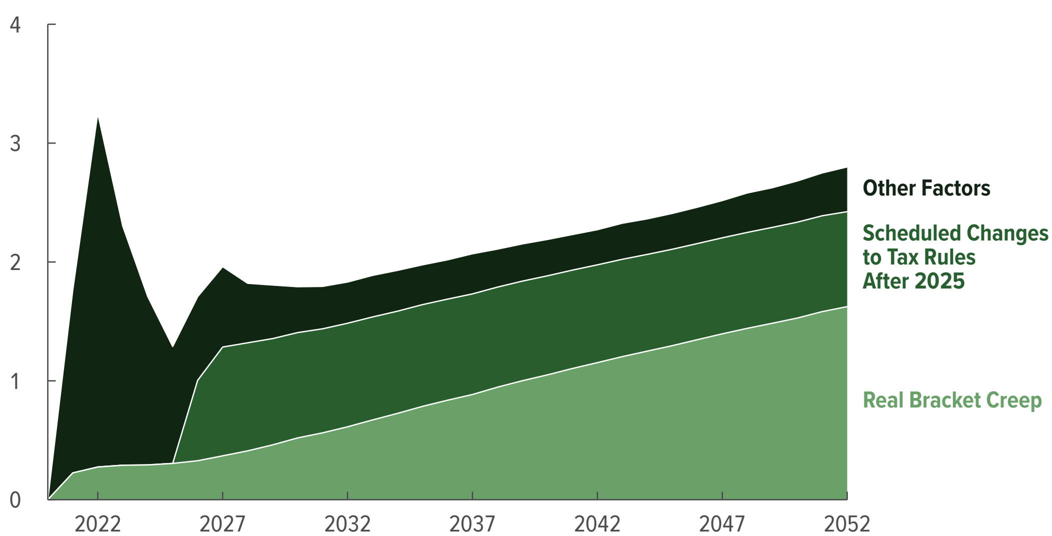


Measured as a percentage of GDP, revenues in 2022 are projected to be at one of the highest levels ever recorded. As temporary factors that boosted tax receipts fade, revenues fall in relation to the size of the economy for the next few years. They increase in 2026, largely because of the scheduled expiration of some provisions of the 2017 tax act.

See Figure 2-6 on page 22

Composition of Changes in Revenues, 2020 to 2052

Percentage of Gross Domestic Product



Over the long term, the largest source of growth in tax revenues is real bracket creep—the process in which, as income rises faster than prices, a larger proportion of income becomes subject to higher tax rates.

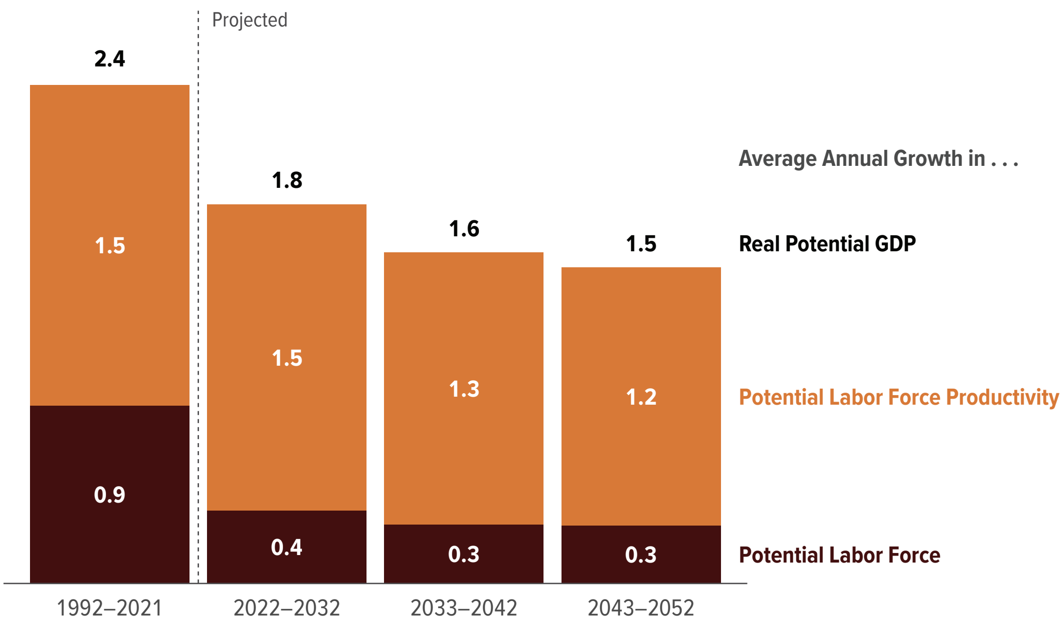
See Figure 2-7 on page 23

The Economy

In CBO's projections, real potential GDP (that is, the maximum sustainable output of the economy, adjusted to remove the effects of inflation) grows more slowly throughout the 2022–2052 period than it has, on average, over the past 30 years. Beginning in 2028 and continuing through the end of the projection period, potential output and actual output grow at the same rate, and the level of real GDP remains about 0.5 percent below the level of real potential GDP. That gap between real GDP and real potential GDP reflects the agency's assessment that actual output falls short of potential output by more and for longer during and after economic downturns than actual output exceeds potential output during economic booms.

The growth of real potential GDP is determined by the growth of the potential labor force (the labor force adjusted for fluctuations in the business cycle) and the growth of potential labor force productivity (potential output per member of the potential labor force).

Composition of the Growth of Real Potential GDP
Percent



Real potential GDP is projected to grow more slowly over the next 30 years than it did over the past 30 years, mostly because the potential labor force is projected to grow more slowly than it has in the past. From 2022 to 2052, the growth of real potential GDP slows primarily because the growth of potential labor force productivity slows in those years.

See Figure 3-2 on page 27

Chapter 1: Deficits and Debt

Overview

If current laws governing taxes and spending generally remained unchanged, the federal budget deficit, measured in relation to gross domestic product (GDP), would nearly triple over the next 30 years, the Congressional Budget Office projects. Those growing deficits are projected to drive up federal debt held by the public substantially. As a percentage of GDP, such debt in 2052 would far exceed any previously recorded level and be on track to increase further (see Figure 1-1).

As federal spending in response to the coronavirus pandemic wanes and revenues rise sharply, this year's budget deficit is set to be much smaller than those recorded in 2020 and 2021. Nevertheless, in CBO's projections, federal deficits are large by historical standards and generally grow over the next 30 years, reaching 11.1 percent of GDP in 2052.[1] In the past 100 years, the deficit has been that large only during World War II and during the pandemic in 2020 and 2021. The projected growth in deficits is largely driven by increases in interest costs. Over that period, deficits average 7.3 percent of GDP, more than double the average over the past half-century.

Those persistently increasing deficits generate high-and-rising debt in the agency's projections. Measured in relation to GDP, federal debt held by the public dips over the next two years but then rises, reaching 110 percent at the end of 2032—the highest it has ever been. Debt continues to climb thereafter and reaches 185 percent of GDP at the end of 2052.

Such high and rising debt could have significant economic and financial consequences. It could, among other things, slow economic growth, drive up interest payments to foreign holders of U.S. debt, elevate the risk of a fiscal crisis, increase the likelihood of less abrupt adverse effects, make the U.S. fiscal position more vulnerable to an increase in interest rates, and cause lawmakers to feel more constrained in their policy choices.

CBO estimated the size of changes in spending or revenues that would be needed if lawmakers wanted to achieve certain targets for federal debt held by the public. The size of those changes would depend on the level of debt that lawmakers wanted to achieve and when the changes were implemented. In addition, how and when lawmakers responded to high and rising debt would determine who bore the burden of the changes in spending or taxes and who realized the economic benefits of those changes.

Even if federal laws remained unchanged, CBO's budget projections would be subject to considerable uncertainty. Those projections depend on the agency's economic projections and many other factors, including the course of the ongoing pandemic. Developments that diverged from those underlying CBO's projections could lead to budgetary outcomes that were very different from those reported here. That uncertainty increases in later years of the projection period because changes in the economy, demographics, and a variety of other factors are more difficult to anticipate over longer time horizons.

This analysis does not account for some contingencies that could have significant effects on the budget—for example, an economic depression (such as the Great Depression of the 1930s), a catastrophe or major war, unexpectedly significant effects of climate change, or the development of a previously underused natural resource. Such occurrences could create conditions in the next 30 years that are substantially better or worse than those reflected in the historical data on which CBO based its analysis.

Deficits and Debt Through 2052

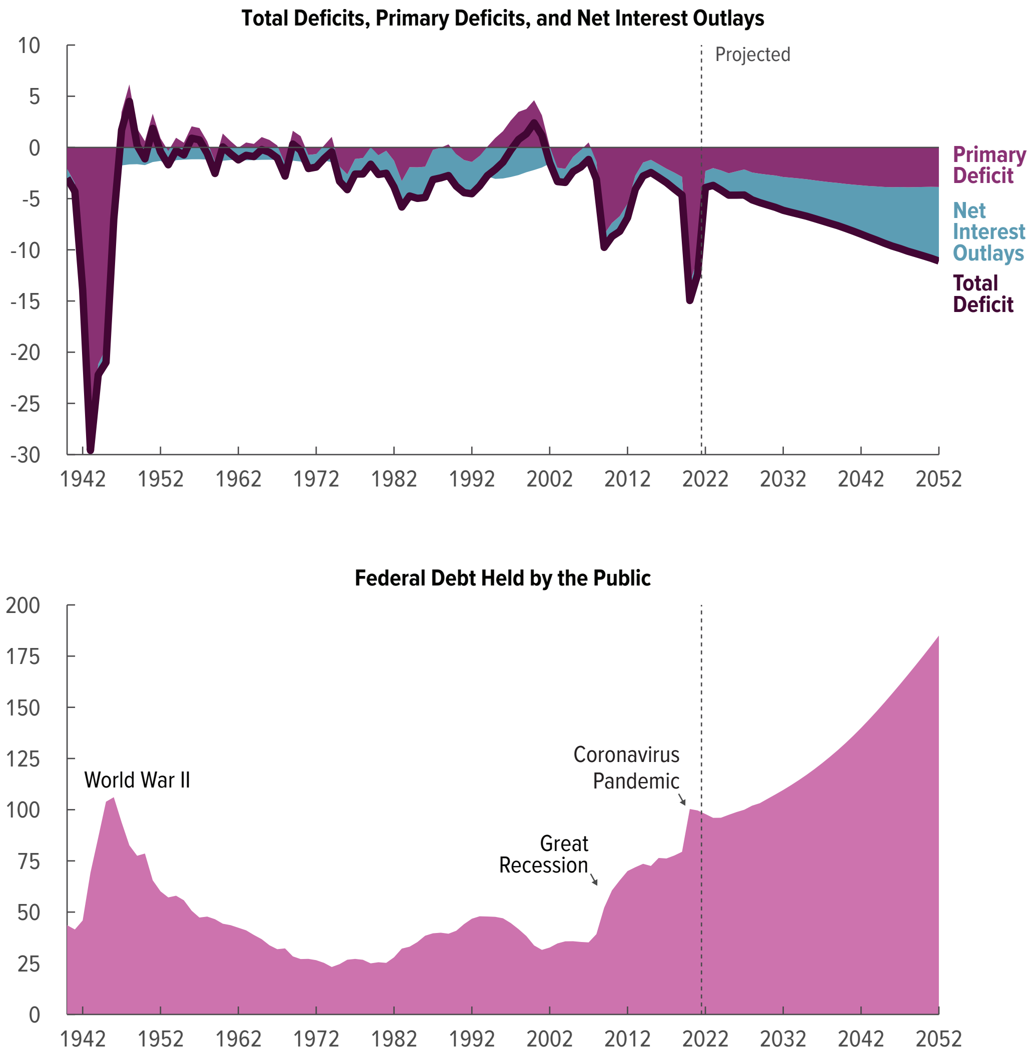
In CBO's projections, deficits drop below 4.0 percent of GDP for a few years and then generally rise again through 2052. Similarly, debt measured as a percentage of GDP dips for two years before increasing through 2052 as the federal government persistently incurs budget deficits that are large relative to the size of the economy.

1. The long-term projections of federal spending, revenues, deficits, and debt in this report are consistent with the baseline budget projections and the economic forecast for 2022 to 2032 that CBO published in May 2022. See Congressional Budget Office, *The Budget and Economic Outlook: 2022 to 2032* (May 2022), www.cbo.gov/publication/57950.

Figure 1-1.

Deficits and Debt

Percentage of GDP



In CBO's projections, primary deficits grow in most years and reach 3.9 percent of GDP in 2052; they exceed the 50-year average of 1.5 percent of GDP throughout the projection period. Driven up by large and sustained primary deficits and rising interest rates, net interest outlays more than quadruple as a percentage of GDP over the 2022–2052 period, reaching 7.2 percent of GDP in 2052.

Those persistently growing deficits push federal debt held by the public, which is already high, further up throughout the 30-year period—to 185 percent of GDP in 2052. Such debt would continue to rise thereafter.

Data source: Congressional Budget Office. See www.cbo.gov/publication/57971#data.

Primary deficits exclude net outlays for interest.

GDP = gross domestic product.

Deficits

The total deficit—that is, the deficit including net outlays for interest—in 2022 is estimated to be 3.9 percent of GDP, significantly smaller than it was in 2021. In CBO's projections, the total deficit declines to 3.7 percent of GDP in 2023 before increasing again. Over the 2043–2052 period, those deficits average 10.0 percent of GDP—almost three times the 3.5 percent of GDP they averaged over the past 50 years (see Table 1-1). Moreover, in years in the past half-century when unemployment was relatively low, as it is in CBO's projections, the average total deficit was even smaller.

Primary deficits—that is, deficits excluding net outlays for interest—capture the aspects of federal spending and revenues that policymakers can, in principle, affect directly through legislation; thus, they are the main mechanism through which lawmakers can influence the trajectory of federal debt and net interest outlays. In CBO's extended baseline projections, the primary deficit grows from 2.3 percent of GDP in 2022 to 3.9 percent of GDP in 2052, exceeding the 1.5 percent of GDP such deficits averaged over the past 50 years in every year of the projection period. Persistently large primary deficits increase federal debt and, in turn, net interest outlays in

Table 1-1.

Key Projections in CBO's Extended Baseline

Percentage of Gross Domestic Product

		Projected Annual Average		
	2022	2023–2032	2033–2042	2043–2052
Revenues				
Individual income taxes	10.6	9.6	10.0	10.5
Payroll taxes	5.9	5.9	5.8	5.8
Corporate income taxes	1.6	1.5	1.4	1.3
Other[a]	1.4	1.1	1.2	1.3
Total Revenues	**19.6**	**18.1**	**18.4**	**18.9**
Outlays				
Mandatory				
Social Security	4.9	5.5	6.1	6.3
Major health care programs[b]	5.8	6.2	7.6	8.6
Other	4.3	2.4	2.1	1.9
Subtotal	14.9	14.2	15.8	16.8
Discretionary	7.0	6.5	6.0	6.0
Net interest	1.6	2.6	4.0	6.2
Total Outlays	**23.5**	**23.2**	**25.8**	**28.9**
Deficit	**-3.9**	**-5.1**	**-7.4**	**-10.0**
Debt Held by the Public at the End of the Period	**98**	**110**	**140**	**185**
Memorandum:				
Social Security				
Revenues[c]	4.5	4.6	4.6	4.5
Outlays[d]	4.9	5.5	6.1	6.3
Contribution to the Federal Deficit[e]	**-0.4**	**-1.0**	**-1.5**	**-1.8**
Medicare				
Revenues and offsetting receipts[c]	2.3	2.3	2.8	3.1
Outlays[d]	3.8	4.6	6.1	7.1
Contribution to the Federal Deficit[e]	**-1.5**	**-2.3**	**-3.4**	**-4.1**
Gross Domestic Product at the End of the Period (Trillions of dollars)	24.7	36.7	52.6	74.5

Data source: Congressional Budget Office. See www.cbo.gov/publication/57971#data.

This table provides the information specified in section 3111 of S. Con. Res. 11, the Concurrent Resolution on the Budget for Fiscal Year 2016.

The extended baseline projections, which generally reflect current law, follow CBO's 10-year baseline budget projections and then extend most of the concepts underlying those projections for an additional 20 years.

When October 1 (the first day of the fiscal year) falls on a weekend, certain payments that ordinarily would have been made on that day are instead made at the end of September and thus are shifted into the previous fiscal year. All projections have been adjusted to exclude the effects of those timing shifts.

a. Consists of excise taxes, remittances to the Treasury from the Federal Reserve System, customs duties, estate and gift taxes, and miscellaneous fees and fines.

b. Consists of outlays for Medicare (net of premiums and other offsetting receipts), Medicaid, and the Children's Health Insurance Program, as well as subsidies for health insurance purchased through the marketplaces established under the Affordable Care Act and related spending.

c. Includes all payroll taxes for the program except for those paid by the federal government on behalf of its employees; those payments are intragovernmental transactions. For Social Security, income taxes paid on Social Security benefits, which are credited to the trust funds, are included; for Medicare, premiums and other offsetting receipts are included. Amounts shown do not include any interest credited to the trust funds.

d. Does not include outlays related to the administration of the program, which are discretionary. For Social Security, outlays do not include intragovernmental offsetting receipts stemming from the employer's share of payroll taxes paid to the Social Security trust funds by federal agencies on behalf of their employees.

e. The contribution to the deficit shown here differs from the change in the trust fund balance for the program. It does not include intragovernmental transactions, interest earned on balances, or outlays related to the administration of the program.

later years of the projection period. Combined with rising interest rates, large and sustained primary deficits cause net interest outlays measured as a percentage of GDP to more than quadruple over the period: They rise from 1.6 percent of GDP in 2022 to 7.2 percent in 2052.

Federal Debt Held by the Public

Measured in relation to the size of the economy, debt dips from 100 percent of GDP at the end of 2021 to 96 percent in 2023 in CBO's projections. The rapid growth of nominal GDP over that period—which reflects both high inflation and the growth of real GDP (that is, GDP adjusted to remove the effects of inflation)—helps hold down debt measured as a percentage of GDP. After 2023, debt rises. It reaches 185 percent of GDP in 2052—far higher than its historical peak of 106 percent of GDP recorded in 1946, immediately after World War II—and is on track to rise higher still.

Consequences of High and Rising Federal Debt

If federal debt continued to rise in relation to GDP at the pace that CBO projects it would under current law, the economy would be affected in two significant ways in the long term:

- That debt path would raise borrowing costs throughout the economy, reduce private investment, and slow the growth of economic output over time.
- Rising interest costs associated with that debt would drive up interest payments to foreign holders of U.S. debt, decreasing the nation's net international income.

Persistently rising debt would also pose significant risks to the fiscal and economic outlook.[2] Such a debt path would have the following effects:

- It would elevate the risk of a fiscal crisis—that is, a situation in which investors lose confidence in the U.S. government's ability to service and repay its debt, causing interest rates to increase abruptly, inflation to spiral upward, or other disruptions to occur.
- It would increase the likelihood of less abrupt, but still significant, adverse effects, such as creating widespread expectations of higher rates of inflation, eroding confidence in the U.S. dollar as the dominant international reserve currency, or making it more difficult to secure financing for public and private activities in international markets.
- It would make the United States' fiscal position more vulnerable to an increase in interest rates because costs to service federal debt rise more for a given increase in interest rates when debt is higher than they do when it is lower.
- Policymakers might feel constrained from implementing deficit-financed fiscal policy to respond to unforeseen events or for other purposes, such as to promote economic activity or strengthen national defense.

Slower Economic Growth

High and rising federal debt such as that resulting from the federal borrowing in CBO's extended baseline projections would, over time, push up borrowing costs in all sectors of the economy, reduce private investment, and slow the growth of GDP, all else being equal.

Higher debt tends to lead to higher interest rates and thus increased borrowing costs in both the public and private sectors. When the government borrows, it does so from people and businesses whose savings would otherwise finance private investment in productive capital, such as housing and commercial structures. The portion of private savings used to buy Treasury securities is no longer available to fund such investment, so the borrowing costs of both the private and public sectors increase.

On net, an increase in government borrowing reduces private investment. The increases in borrowing costs reduce private investment, but at least three other effects tend to boost private investment and partially offset that reduction:

- Additional government borrowing strengthens the incentive to save—in part, by driving up interest rates—but the increase in private saving is not as large as the increase in government borrowing; national saving (or the amount of domestic resources available for investment) thus declines.[3]
- Higher interest rates tend to attract more foreign capital to the United States, and some of those funds become available for private investment.

2. For a fuller discussion of federal debt and the consequences of its growth, see Congressional Budget Office, *Federal Debt: A Primer* (March 2020), www.cbo.gov/publication/56165.

3. In CBO's assessment, another reason that an increase in government borrowing would strengthen the incentive to save is that some people would expect policymakers to raise taxes or cut spending in the future to cover the cost of paying interest on the additional federal debt. As a result, some of those people would increase their saving to prepare for paying higher taxes or receiving less in benefits. See Jonathan Huntley, *The Long-Run Effects of Federal Budget Deficits on National Saving and Private Domestic Investment*, Working Paper 2014-02 (Congressional Budget Office, February 2014), www.cbo.gov/publication/45140.

- Borrowing that supports increased high-quality and effective federal investment typically boosts private-sector productivity, investment, and output. However, the increasing deficits and debt in CBO's projections result primarily from increases in noninvestment spending. For instance, federal spending for Social Security, Medicare, and Medicaid for people age 65 or older, which accounts for less than 30 percent of all federal noninterest spending in 2022, accounts for more than 40 percent in 2052.

In CBO's assessment, the increases in private investment stemming from those three factors would not be as large as the reduction in private investment stemming from the additional government borrowing.

The reduction in private investment would slow economic growth. If investment in capital goods declined, workers would, on average, have less capital to use in their jobs. As a result, they would be less productive, their compensation would be lower, and they would thus be less inclined to work. Those effects would increase over time as federal borrowing grew.

Increased Interest Payments to Foreign Holders of U.S. Debt

If federal debt continued to rise, the government would spend more on interest payments. Larger outlays for interest would include an increase in payments to foreign investors, who currently hold roughly one-third of all federal debt held by the public (or 45 percent of such debt not held by the Federal Reserve). The increases in interest payments to foreign investors would, in turn, reduce the nation's net international income—the difference between the nation's income (as measured by its gross national product, or GNP) and its total production (as measured by GDP).[4] Typically, the nation's net international income is positive—that is, GNP exceeds GDP. When net international income falls, national income also declines, all else being equal.

Greater Risk of a Fiscal Crisis

The likelihood of a fiscal crisis increases as federal debt continues to rise, because mounting debt could erode investors' confidence in the U.S. government's fiscal position. Such an erosion of confidence would undermine the value of Treasury securities and drive up interest rates on federal debt as investors demanded higher yields to purchase those securities. Concerns about the government's fiscal position could lead to a sudden and potentially spiraling increase in people's expectations for inflation, a large drop in the value of the dollar, or a loss of confidence in the government's ability or commitment to repay its debt in full, all of which would make a fiscal crisis more likely.

A fiscal crisis could lead to a financial crisis. In a fiscal crisis, dramatic increases in Treasury rates would reduce the market value of outstanding government securities, and the resulting losses incurred by holders of those securities—including mutual funds, pension funds, insurance companies, and banks—could be large enough to cause some financial institutions to fail. Because the United States plays a central role in the international financial system, such a crisis could spread globally.

Risk Factors. The risk of a fiscal crisis depends on factors beyond the amount of federal debt. Ultimately, it is the cost of servicing the debt and the ability to refinance it as needed that matter. Among the factors affecting those two things are investors' assessment of the outlook for the budget and the economy, which can change over time, and their expectations about domestic and international financial conditions, including interest rates and exchange rates. The relationships between those factors and the risk of a crisis are uncertain and can shift—depending, in part, on the state of the economy.

Because the risk of a fiscal crisis depends on many uncertain and shifting factors, CBO cannot quantify the probability that a fiscal crisis would occur. In CBO's assessment, no tipping point exists at which the debt-to-GDP ratio would become so high that it made a crisis likely or imminent; nor is there a fixed point at which interest costs would become so high in relation to GDP that they were unsustainable.

Risk of a Crisis in the Near Term. The risk of a fiscal crisis in the near term appears to be low despite the larger deficits and higher debt stemming from the pandemic. The near-term risk is mitigated by certain characteristics of the U.S. financial system. For example, the Federal Reserve conducts independent monetary policy, government debt is issued in U.S. dollars, the dollar holds

4. Whereas GDP is the value of all final goods and services produced within the borders of the United States (whether the labor and capital used to produce them are supplied by residents or nonresidents), GNP is the value of all final goods and services produced by labor and capital supplied by residents of the United States, regardless of where that labor and capital are located.

a central place in the global financial system, and few investments can provide returns comparable to those of Treasury securities at similarly low levels of risk.

In addition, concern about a fiscal crisis in the near term is not currently apparent in financial markets. However, financial markets do not always fully reflect risks on the horizon, and the risk of a fiscal crisis could change suddenly in the wake of unexpected events. For example, a sudden rise in interest rates could cause investors to become concerned about the government's fiscal position over the long term as their uncertainty grew about whether the rise was temporary or signaled a long-term trend.

Options for Responding to Such a Crisis. If a fiscal crisis occurred, policymakers would have several options to respond, though choosing among them would involve difficult trade-offs. One policy option would be to dramatically cut noninterest spending or increase taxes, either of which could have adverse effects on the economy in the short run.

A second option would be for the Federal Reserve to fund deficits through the purchase of Treasury securities. That option, if pursued extensively, would raise inflation—and notably so, relative to the inflation expectations that were incorporated in the interest rates on existing debt—thereby reducing the real cost of financing outstanding debt. Such an action would also put downward pressure on the value of the dollar. High inflation over an extended period could, therefore, undermine the role of the dollar in international currency markets, depending on the attractiveness of other currencies. Such a development would lead to even higher inflation and declines in real wealth and in purchasing power.

A third option would be to restructure the debt (that is, modify the contractual terms of existing obligations) so that repayment was feasible. Restructuring the debt is, however, generally viewed as less likely than the other two options because it would undermine investors' confidence in the government's commitment to repay its debt in full.

Increased Likelihood of Less Abrupt Adverse Effects

Even in the absence of an abrupt fiscal crisis, high and rising debt could have persistent adverse effects on the economy beyond those incorporated in CBO's extended baseline projections, including a gradual decline in the value of Treasury securities and other domestic assets. High and rising debt could lead to increases in people's inflation expectations. Increases in federal borrowing could also lead to an erosion of confidence in the U.S. dollar as the dominant international reserve currency. Such developments would, among other things, make it more difficult to finance public and private activity.

Greater Vulnerability of U.S. Fiscal Position to an Increase in Interest Rates

A larger amount of debt makes the United States' fiscal position more vulnerable to an increase in interest rates than it would be if the amount was smaller. Debt of the amounts in CBO's extended baseline projections increases the risk that interest costs would be substantially greater than projected—even without a fiscal crisis—if interest rates were higher than those underlying the agency's projections. (The average interest rate on federal debt in CBO's projections increases from 1.8 percent in 2022 to 3.1 percent in 2032 and to 4.2 percent in 2052.) Conversely, lower interest rates would result in interest costs that were less than those in CBO's projections. (For further discussion of the potential effects of alternative interest rates on federal debt, see Chapter 4.)

Increased Perception of Fiscal Constraints Among Policymakers

The size of budget deficits and debt could influence policymakers' choices. Policies that increase spending or reduce revenues can provide support to the economy during challenging times, such as the current pandemic. Furthermore, increased high-quality and effective federal investment—which may require the federal government to borrow more and thus result in higher deficits and debt—would boost private-sector productivity and output (though it would only partially mitigate the adverse consequences of that additional borrowing).[5]

However, if policymakers perceived that debt was already very high, they could feel constrained from using deficit-financed fiscal policy to respond to unforeseen events, promote economic activity, or further other goals. They might not feel as hindered if debt was lower (or if the increases in deficits and debt that would result

5. See Congressional Budget Office, *Effects of Physical Infrastructure Spending on the Economy and the Budget Under Two Illustrative Scenarios* (August 2021), www.cbo.gov/publication/57327, and *The Macroeconomic and Budgetary Effects of Federal Investment* (June 2016), www.cbo.gov/publication/51628.

from policy changes were smaller). High debt could also undermine national security if it compromised the international geopolitical role of the United States or if policymakers felt constrained from increasing national security spending to prepare for or respond to an international crisis.

Other Consequences

Certain risks arise from the interaction of fiscal and monetary policy implemented in response to higher debt. For example, the Federal Reserve's large-scale purchases of Treasury securities and other financial assets in response to the pandemic pose risks to the outlook for interest rates. In CBO's baseline projections, the Federal Reserve begins reducing its holdings of Treasury securities in 2022, which puts modest upward pressure on long-term interest rates. There is, however, some risk that long-term interest rates would rise rapidly. It is also possible that concern about an adverse reaction by market participants could cause the Federal Reserve to delay reducing its holdings of Treasury securities, thereby causing long-term interest rates to remain lower for longer than CBO projects.

The Size and Timing of Policy Changes Needed to Meet Various Targets for Debt

CBO estimated the size of changes in spending or revenues (or both) that would be needed if lawmakers wanted to achieve certain targets for federal debt held by the public. The agency also assessed the extent to which the size of the necessary adjustments would change if the implementation of policies aimed at reducing deficits was delayed. Finally, it examined how waiting to resolve the long-term fiscal imbalance would affect the economy and different generations of the U.S. population.

The Size of Policy Changes

The size of policy changes necessary to achieve a given debt target would depend on the level of debt that lawmakers wanted to achieve. If lawmakers wanted debt in 2052 to remain at roughly its level at the end of this fiscal year (about 100 percent of GDP), they could, for example, cut noninterest spending or raise revenues (or do both) to reduce the deficit in each year beginning in 2027 by an amount equal to 2.8 percent of GDP, which would amount to $800 billion, or about $2,400 per person, in 2027.

The changes would need to be larger if lawmakers wanted to achieve a lower debt target. For example, to reduce debt to its approximate level in 2019 (80 percent of GDP) by 2052, lawmakers would need to increase revenues or cut noninterest spending (or adopt some combination of those two actions) to reduce the deficit by an amount equal to 3.5 percent of GDP each year starting in 2027.

In those examples, the projected effects on debt include both the direct effects of the policy changes and the feedback to the federal budget that would result from faster economic growth. The policy changes examined here are illustrative, and the results do not reflect any assumptions about specific changes. Any policy change could alter productivity growth or people's incentives to work and save, which would, in turn, affect overall economic output and feed back into the federal budget.

The Timing of Policy Changes

The longer policymakers waited to address high and rising debt, the greater the policy changes required to achieve long-term objectives would be. Reducing deficits sooner would result in a smaller accumulated debt and therefore less risk to long-term economic growth and stability. But reducing deficits sooner might also lead to economic and financial disruptions if people had insufficient time to plan for or to adjust to the new measures, or if such a reduction occurred when the economy was weak. In addition, there may be favorable effects of delaying deficit reduction. If the policies that resulted in large deficits supported the economy during challenging times or increased high-quality and effective federal investment, changing those policies to reduce deficits sooner would dampen those effects.

CBO estimated the extent to which the size of the necessary policy adjustments would change if deficit reduction was delayed until 2032 or 2037. If lawmakers sought to reduce debt as a share of GDP to 80 percent in 2052 and if the necessary policy changes did not take effect until 2032, the annual reduction in the primary deficit would need to amount to 4.3 percent of GDP rather than the 3.5 percent that would accomplish the same goal if the changes were made starting in 2027. If, instead, lawmakers chose to wait until 2037 to implement the policies, even larger changes would be necessary; in that case, the required annual reduction in the primary deficit would amount to 5.7 percent of GDP.

Effects on Different Generations

How lawmakers responded to high and rising debt would determine who bore the burden of the changes in spending or taxes and who realized the economic benefits of those changes.[6] In general, if policymakers postponed fiscal tightening and if debt as a share of GDP continued to rise, future generations—who CBO projects would have higher incomes, in aggregate and on average, than earlier generations—would bear more of the burden of the changes necessary to stabilize debt. Earlier generations—particularly people in those generations who have higher income and more wealth—would bear less of the burden. Within any given generation, who bore the brunt of the burden would depend on the specific policies implemented and on how long policymakers waited to implement those policies.

Uncertainty of CBO's Long-Term Projections

The long-term budget outlook is highly uncertain. CBO's budget projections depend on the agency's economic projections and demographic projections, both of which are themselves uncertain. Even if future tax and spending policies did not vary from those specified in current law, budgetary outcomes over the next 30 years would undoubtedly differ from those in CBO's extended baseline projections because of unexpected changes in the economy and demographics, among other factors. Not only can small changes in some factors, compounding over many years, greatly affect projected budgetary outcomes decades into the future, but the pandemic's effects on long-term trends are unknown. Furthermore, the effectiveness of monetary and fiscal policy and the response of global financial markets to the substantial projected increases in federal deficits and debt are also uncertain.

Uncertainty About Budgetary Outcomes

Developments that vary from what CBO projects could lead to budgetary outcomes that are very different from those in the baseline projections. (For a discussion of how changes in economic conditions, spending, or revenues could cause budgetary outcomes to differ from those in CBO's budget projections, see Chapter 4.) That uncertainty increases in later years of the projection period because changes in the economy, demographics, and a variety of other factors are more difficult to anticipate over longer time horizons.

Moreover, outcomes will depend on future legislative action, which could increase or decrease budget deficits. For example, CBO's baseline projections reflect the scheduled expiration of several individual income tax provisions contained in Public Law 115-97 (referred to as the 2017 tax act in this report). If the scheduled expirations did not occur and, instead, current tax policies continued, much larger deficits and greater debt would result. Also, in accordance with CBO's standard procedures for projecting discretionary spending, funding provided for 2022 by the Infrastructure Investment and Jobs Act (P.L. 117-58) continues each year with adjustments for inflation in the agency's baseline projections. If, instead, only the funding amounts stated in that law were included in CBO's projections, the deficit, including the associated debt-service costs, would be smaller, and debt would be lower.

Uncertainty About the Economic Outlook

CBO's economic projections are subject to a high degree of uncertainty, including uncertainty about the course of the ongoing pandemic. In particular, projections of economic output and labor market conditions are highly uncertain: Growth in the labor force or in labor force productivity could be faster or slower than expected. Other key sources of uncertainty are future monetary policy and the path of interest rates. For example, uncertainty about the path of interest rates contributes to the uncertainty of the agency's estimates of the impact that higher deficits and debt would have on the economy.

Uncertainty About the Demographic Outlook

CBO's demographic projections for the next 30 years are subject to significant uncertainty because, compounded over many years, even small changes in rates of fertility, mortality, or net immigration—such as any long-term effects that may result from the pandemic—could greatly affect outcomes later in the projection period.[7] For example, because many immigrants are of working age, if immigration rates were higher or lower than CBO projected, the size of the labor force would be larger or smaller than it is in CBO's projections. Changes in fertility rates would have larger effects in later years of the projection period, once members of the affected generations reach working age. Changes in mortality rates, which would probably most affect the size of the older population, would result in outlays for the major health care programs and Social Security that differed from those in CBO's projections.

6. See Congressional Budget Office, *The Economic Effects of Waiting to Stabilize Federal Debt* (April 2022), www.cbo.gov/publication/57867.

7. For the agency's latest demographic projections, see Congressional Budget Office, *The Demographic Outlook: 2022 to 2052* (July 2022), www.cbo.gov/publication/57975.

Potential Developments and Their Possible Effects on the Budget

The sources of uncertainty discussed above are not the only ones associated with long-term budget projections. Other plausible but unpredictable developments could also increase or decrease federal debt in relation to CBO's projections. Such contingencies include a severe economic depression; catastrophes, such as a major natural disaster or world war; effects of climate change that are more significant than expected; or the development of previously underused natural resources.

A Severe Economic Downturn

In general, when economic output rises or falls, the federal budget is affected. For example, economic downturns can reduce revenues significantly and raise some outlays, such as those for unemployment insurance and nutrition assistance. In addition, downturns have historically prompted policymakers to enact legislation that further reduces revenues and increases federal spending—as they did during the pandemic—to help people suffering from the weak economy, to bolster the financial position of state and local governments, and to stimulate additional economic activity and employment. For instance, federal debt measured relative to the size of the economy doubled from 35 percent of GDP in 2007 to 70 percent in 2012 as a result of the financial crisis and its aftermath.

Severe economic downturns—like the Great Depression of the 1930s—are rare; for that reason and others, their size and timing cannot be readily predicted, and CBO's projections do not account for their possibility. The agency's long-term projections of output and unemployment do, however, reflect economic trends from the end of World War II to the present, a period that included several economic downturns that were not fully offset by upturns of similar magnitude.

Catastrophes or Wars

The federal government also faces implicit obligations in the case of catastrophes and could spend large sums to fight a major war. However, because such events are rare and unpredictable, it is very difficult to estimate the probability of their occurring in the future and their possible effects on the budget.

Small-scale natural and manmade disasters occur fairly often in the United States; they may seriously damage local communities and economies, but they rarely have significant, lasting impacts on the national economy.

By contrast, a catastrophe—such as another pandemic or a massive earthquake—could affect budgetary outcomes by reducing economic growth over several years or by leading to substantial increases in federal spending. For instance, federal debt measured as a percentage of GDP rose by 20 percentage points from 2019 to 2021 in response to the pandemic and the recession it brought about.

The United States' involvement in a major war could also have a significant impact on the economy and federal budget. For example, federal debt held by the public measured in relation to GDP rose by about 60 percentage points during World War II. Geopolitical events, including Russia's invasion of Ukraine, add to the uncertainty of the economic outlook, particularly the outlook for inflation.

Climate Change

In CBO's assessment, climate change will reduce GDP, on net. Some aspects of climate change will have positive effects on output in some parts of the country—warmer temperatures will increase the productivity of agricultural land in some areas by extending growing seasons, for example—but the negative effects in other areas are projected to outweigh those positive effects. Similarly, the net effects of climate change on labor productivity, labor supply, and the private sector's production costs are all expected to reduce output, on net, even though some of those factors will be positive in some instances. Other aspects of climate change are entirely negative. For instance, wildfires, floods, hurricanes, and tropical storms reduce the nation's output of goods and services by damaging and destroying buildings, equipment, and inventory.[8]

In CBO's projections, real GDP in 2052 is 1.0 percent lower than it would have been if climatic conditions from 2022 to 2052 were the same as they were at the end of the 20th century.[9] Any projection that attempts to account for the impact of climate change on the economy or on the budget is highly uncertain. CBO's projection is in the middle of a range of likely outcomes,

8. See Congressional Budget Office, *Budgetary Effects of Climate Change and of Potential Legislative Responses to It* (April 2021), www.cbo.gov/publication/57019.

9. For additional information about the methods that CBO used to estimate the effects of climate change on GDP, see Evan Herrnstadt and Terry Dinan, *CBO's Projection of the Effect of Climate Change on U.S. Economic Output*, Working Paper 2020-06 (Congressional Budget Office, September 2020), www.cbo.gov/publication/56505.

reflecting a variety of economic and scientific uncertainties. The agency also expects climate change to have various effects on the United States that are not directly reflected in economic output.

Though CBO's extended baseline projections incorporate some effects of climate change, unexpected and significant changes to the climate still pose a sizable risk to the federal budget. In the future, if weather-related disasters increased in frequency or magnitude, lawmakers could respond by increasing funding above the amounts in CBO's projections.[10] For example, increased damage from storm surges might lead the Congress to pass additional emergency supplemental appropriations for disaster relief or to approve legislation providing funding to protect infrastructure that is vulnerable to rising sea levels. Conversely, lawmakers could amend existing laws to reduce federal spending on weather-related disasters. For instance, the Congress might decide to alter flood insurance or crop insurance programs in a way that provided insured parties with a greater incentive to avoid potential damage.

Because, on net, climate change has a negative effect on the budget and the economy, successful investments in mitigation or adaptation—those that reduce the extent of climate change or its adverse consequences—can generally be expected to yield future savings to the federal budget.[11] Such savings might stem from reductions in physical damage, increases in the productivity of land and outdoor labor, or lower health care costs. Some efforts to mitigate climate change or adapt to its effects would take a long time to implement but could provide long-lasting budgetary savings in the future or provide benefits to the private sector or other governments that would not be reflected in the federal budget. Ineffective policies could, however, impose costs on federal, state, and local governments without yielding budgetary savings or other benefits to justify those costs. Determining whether a particular policy would lower harmful emissions and improve the climate trajectory can be difficult.

10. See Congressional Budget Office, *Potential Increases in Hurricane Damage in the United States: Implications for the Federal Budget* (June 2016), www.cbo.gov/publication/51518.

11. See Congressional Budget Office, *Budgetary Effects of Climate Change and of Potential Legislative Responses to It* (April 2021), www.cbo.gov/publication/57019.

Advances in the Development of Natural Resources

The future discovery and development of productive natural resources may increase federal receipts. For example, advances in combining two drilling techniques, hydraulic fracturing and horizontal drilling, have allowed access to large deposits of shale resources—that is, crude oil and natural gas trapped in shale and certain other dense rock formations. Virtually nonexistent 15 years ago, the production of oil and natural gas from shale has boomed in the United States since then. The primary budgetary impact of that increase in production is an increase in federal tax revenues.[12] Advances in the development of other resources might also contribute to federal receipts by bolstering the economy and making federally owned resources more valuable.

It is impossible to predict the discovery of new natural resources or ways to extract them—particularly discoveries that would have significant effects on the economy or the federal budget. Furthermore, the effects of any such discoveries on the federal budget would depend on the natural resource in question. The effects would also depend on the amount of private investment, government regulations, and the availability of the infrastructure necessary to access and transport those resources. As a result, CBO's projections do not account for the budgetary effects of the unexpected development of natural resources.

12. See Congressional Budget Office, *The Economic and Budgetary Effects of Producing Oil and Natural Gas From Shale* (December 2014), www.cbo.gov/publication/49815.

Chapter 2: Spending and Revenues

Overview

Under current law, spending by the federal government is projected to represent a larger percentage of gross domestic product (GDP) in coming years than it did, on average, during the past 50 years. From 1972 to 2021, total federal outlays averaged 21 percent of GDP; over the 2022–2052 period, such outlays are projected to average 26 percent of GDP (see Figure 2-1).

In CBO's projections, outlays in 2022 are 23.5 percent of GDP—less than last year's total—as federal spending in response to the coronavirus pandemic wanes.[1] Outlays increase after 2022, reaching 24.3 percent of GDP in 2032. Subsequently, total spending rises relative to the size of the economy, reaching about 30 percent of GDP in 2052. Spending has exceeded that level only once, for a three-year period during World War II. In those years, when defense spending increased sharply, total federal spending topped 40 percent of GDP. (CBO develops its extended baseline projections according to certain assumptions that are specified in law. For a discussion of those assumptions and the methods underlying the projections, see Appendix A.)

Over the 2022–2052 period, revenues measured as a percentage of GDP are projected to be higher than they have been, on average, in recent decades. Revenues averaged about 17 percent of GDP over the past 50 years. Over the next 30 years, they are projected to average about 19 percent of GDP.

In CBO's projections, revenue growth is strong in 2022, following the sharp increase in revenues observed in 2021. That strong growth results mostly from large increases in receipts from individual income taxes. From 2023 to 2025, revenues decline as a percentage of GDP as the effects of temporary factors that had boosted tax receipts in recent years fade. In 2026 and 2027, by contrast, revenues rise in relation to GDP because of changes to rules governing the individual income tax that are scheduled to occur at the end of calendar year 2025. After 2032, revenues grow faster than GDP, reaching 19.1 percent of GDP in 2052.

Spending

Total spending comprises spending on mandatory programs, discretionary spending, and net outlays for interest. In CBO's projections, federal outlays for mandatory programs, measured as a percentage of GDP, initially fall through 2025 as pandemic-related mandatory spending continues to decline. Such outlays then rise steadily to 17.0 percent of GDP in 2052. Much of that increase is driven by growth in spending on the major health care programs (see Figure 2-2).

The response to the global pandemic has also resulted in a near-term boost to discretionary spending, though pandemic-related discretionary spending will decrease this year and next. However, in CBO's projections, the effects of the Infrastructure Investment and Jobs Act (IIJA, Public Law 117-58) somewhat offset that decrease.[2] Discretionary outlays equal 6.2 percent of GDP in 2032 and 6.0 percent in 2052.

Finally, net interest costs measured as a percentage of GDP are projected to increase throughout the 2022–2052 period. Those costs increase nearly four and one-half times, from 1.6 percent of GDP in 2022 to 7.2 percent in 2052. If net interest costs followed their projected path, they would exceed all mandatory spending other than that for the major health care programs and Social Security by 2027, discretionary spending by 2047, and spending on Social Security by 2049.

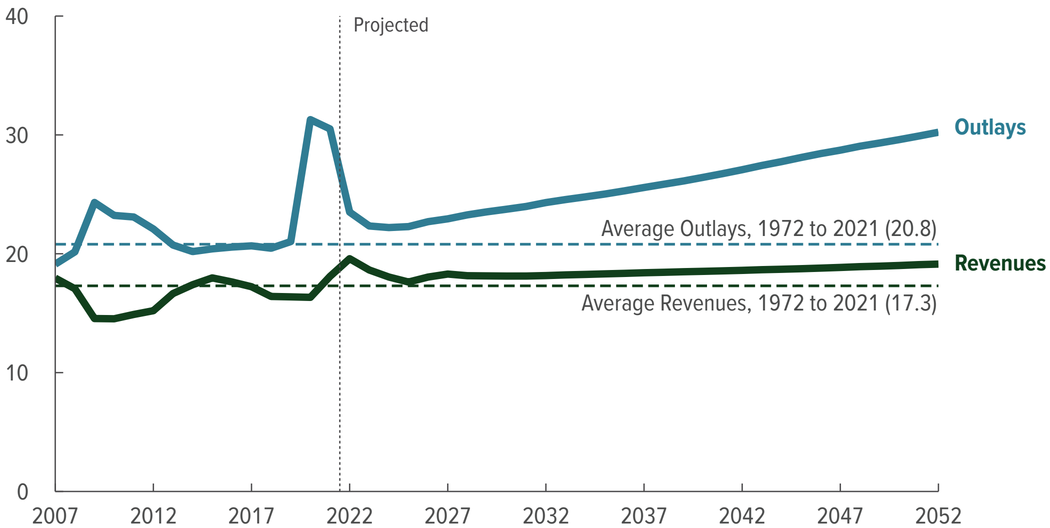
1. The budget projections in this report include the effects of legislation enacted through April 8, 2022, and are based on the Congressional Budget Office's economic projections. Those economic projections reflect economic developments through March 2, 2022. The projections do not include budgetary or economic effects of subsequent legislation, economic developments, administrative actions, court rulings, or regulatory changes.

2. For a discussion of how the IIJA affects CBO's projections of discretionary spending over the 2022–2032 period, see Congressional Budget Office, *The Budget and Economic Outlook: 2022 to 2032* (May 2022), pp. 76–77, www.cbo.gov/publication/57950.

Figure 2-1.

Total Outlays and Revenues

Percentage of Gross Domestic Product



In most years, growth in outlays is projected to outpace growth in revenues, resulting in widening budget deficits.

Data source: Congressional Budget Office. See www.cbo.gov/publication/57971#data.

Moreover, CBO projects that growth in spending on the major health care programs and on interest would reshape the spending patterns of the U.S. government by 2052 (see Figure 2-3). Net interest costs would account for a much greater portion of total federal spending in 2052 than they have historically, as would spending on the major health care programs.

Mandatory Spending

In CBO's extended baseline projections, the growth in spending on mandatory programs is driven primarily by increases in spending on the major health care programs and, especially in the first decade, by increases in spending on Social Security. Other mandatory spending is projected to decline in relation to GDP over the next 30 years, particularly in the first decade of that period.

Spending on the major health care programs climbs largely because, in CBO's estimation, health care costs per person will continue to rise. The aging of the population also contributes to the increases in spending on health care programs and on Social Security.

Major Health Care Programs. Outlays for the major health care programs consist of spending on Medicare, Medicaid, and the Children's Health Insurance Program (CHIP), as well as outlays to subsidize health insurance purchased through the marketplaces established under the Affordable Care Act and related spending.[3] Spending on Medicare, which provides health insurance to roughly 64 million people (about 85 percent of whom are at least 65 years old), will account for nearly half of that spending in 2022, CBO projects.

Over the past five decades, spending on the major health care programs has grown faster than the economy, and that trend persists in CBO's extended baseline projections.[4] In 2022, net federal spending on the major health care programs is estimated to equal 5.8 percent of GDP. In the agency's projections, net outlays for those programs increase to 8.8 percent in 2052.[5] Spending on

3. Federal subsidies for health insurance for low- and moderate-income households account for most of the outlays for subsidies for insurance purchased through the marketplaces and related spending. The related spending consists almost entirely of payments for risk adjustment (which are financed by funds collected from insurers with healthier enrollees and made to health insurers whose enrollees are in poorer health) and spending for the Basic Health Program (an optional state program that covers low-income residents outside the health insurance marketplaces).

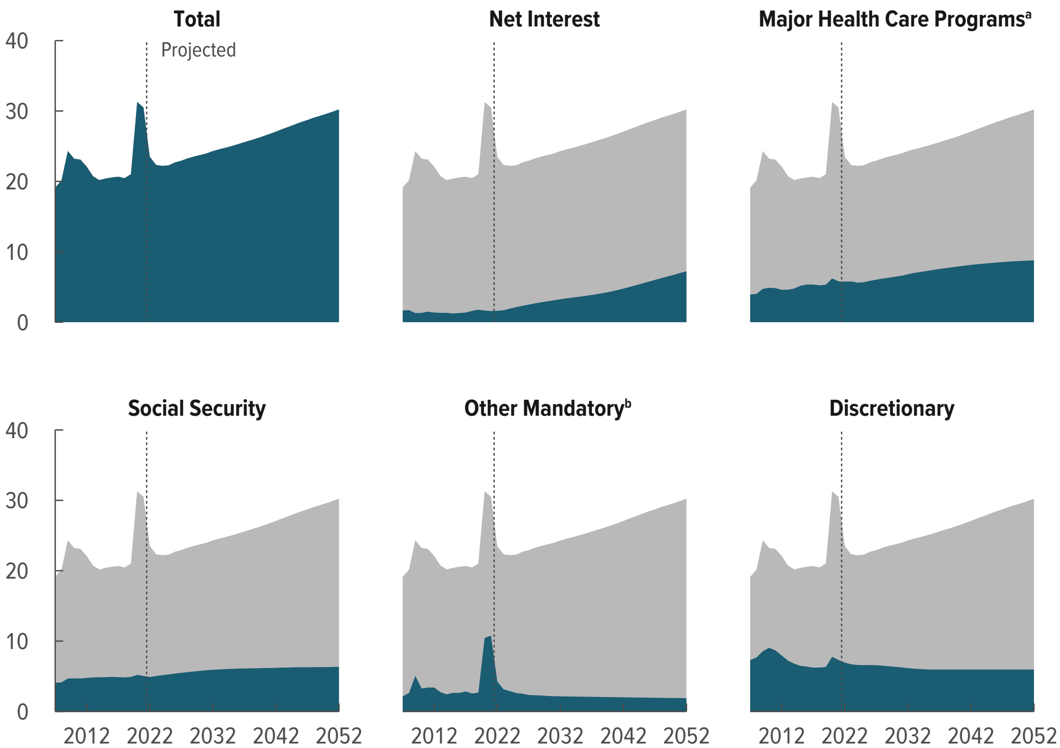
4. Since publishing *The 2021 Long-Term Budget Outlook*, CBO has refined its projections of the increase in health care costs per person. See Appendix D for a discussion of that change.

5. CBO assumes that Medicare will pay benefits as scheduled under current law (the same assumption it makes for Social Security), regardless of the amounts in the program's trust funds.

Figure 2-2.

Outlays, by Category

Percentage of GDP



Over the long term, net outlays for interest and spending on the major health care programs and Social Security are projected to rise in relation to GDP; other spending, in total, is projected to decline.

Data source: Congressional Budget Office. See www.cbo.gov/publication/57971#data.

GDP = gross domestic product.

a. Consists of spending on Medicare (net of premiums and other offsetting receipts), Medicaid, and the Children's Health Insurance Program, as well as outlays to subsidize health insurance purchased through the marketplaces established under the Affordable Care Act and related spending.

b. Consists of all mandatory spending other than that for Social Security and the major health care programs. "Other Mandatory" includes the refundable portions of the earned income tax credit, the child tax credit, and the American Opportunity Tax Credit.

Medicare (net of offsetting receipts, which are mostly premiums paid by enrollees) is the primary driver of that increase; such spending, measured as a percentage of GDP, grows by 2.9 percentage points. Spending on Medicaid and CHIP, combined with outlays to subsidize health insurance purchased through the marketplaces established under the Affordable Care Act and related spending, grows by 0.1 percentage point (see Figure 2-4).

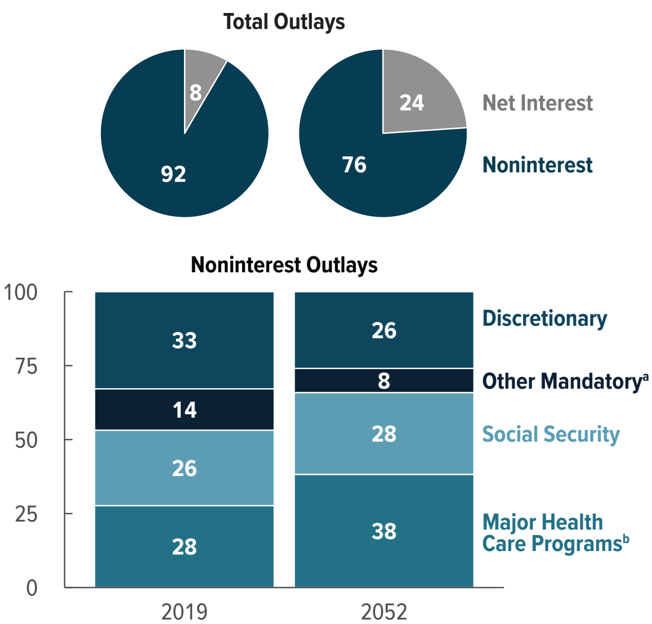
Social Security. In CBO's projections, spending on Social Security increases as a percentage of GDP over the next 30 years, continuing the trend of the past five decades. The number of Social Security beneficiaries rises from 66 million (or one-fifth of the population) in 2022 to 77 million in 2032 and then to 97 million (or over one-quarter of the projected population) in 2052. Spending on the program increases from 4.9 percent of GDP in 2022 to 5.9 percent in 2032. Spending continues to increase but slows along with the pace of population growth as members of the large baby-boom generation die; spending on Social Security reaches 6.4 percent of GDP in 2052.[6]

6. Those projections reflect the assumption that Social Security will continue to pay benefits as scheduled under current law, regardless of the status of the program's trust funds. That approach is consistent with a statutory requirement that CBO's 10-year baseline projections reflect the assumption that funding for such programs is adequate to make all payments required by law. See sec. 257(b)(1) of the Balanced Budget and Emergency Deficit Control Act of 1985, P.L. 99-177 (codified at 2 U.S.C. §907(b)(1) (2016)). The baby-boom generation comprises people born between 1946 and 1964.

Figure 2-3.

Composition of Outlays, 2019 and 2052

Percent



Net outlays for interest would, under current law, account for a greater portion of total federal outlays in 2052 than they did in 2019 (before the coronavirus pandemic), and spending on the major health care programs would account for a much larger share of all federal noninterest spending.

Data source: Congressional Budget Office. See www.cbo.gov/publication/57971#data.

a. Consists of all mandatory spending other than that for Social Security and the major health care programs. "Other Mandatory" includes the refundable portions of the earned income tax credit, the child tax credit, and the American Opportunity Tax Credit.

b. Consists of spending on Medicare (net of premiums and other offsetting receipts), Medicaid, and the Children's Health Insurance Program, as well as outlays to subsidize health insurance purchased through the marketplaces established under the Affordable Care Act and related spending.

The Social Security program is funded by dedicated tax revenues from two sources. Currently, 96 percent of the funding comes from a payroll tax; the rest is collected from income taxes on Social Security benefits. Revenues from the payroll tax and the income tax on benefits are credited to the Old-Age and Survivors Insurance (OASI) Trust Fund and the Disability Insurance (DI) Trust Fund, which finance the program's benefits. In CBO's extended baseline projections, dedicated tax revenues for the combined trust funds decline from 4.5 percent of GDP in 2022 to 4.4 percent in 2052.

A commonly used measure of Social Security's financial position is the dates by which the trust funds would be exhausted. CBO projects that the OASI trust fund would be exhausted in calendar year 2033 and that the DI trust fund would be exhausted in calendar year 2048. If their balances were combined, the Old-Age, Survivors, and Disability Insurance (OASDI) trust funds would be exhausted in calendar year 2033. CBO estimated the amounts that annual benefits would have to be reduced by for the trust funds' outlays to match their revenues in each year after the two funds were exhausted. Benefits would need to be reduced (in relation to the agency's baseline projections) by about 25 percent in 2034, an amount that would climb to about 30 percent in 2052.

Other Mandatory Programs. Before the pandemic, mandatory spending excluding that for the major health care programs and Social Security had generally remained between 2 percent and 4 percent of GDP since the mid-1960s (it was 2.7 percent of GDP in 2019, for example). Such spending includes outlays for the Supplemental Nutrition Assistance Program (SNAP), unemployment compensation, retirement programs for federal civilian and military employees, certain programs for veterans, Supplemental Security Income, and certain refundable tax credits.[7] That spending increased significantly in 2020 and 2021—to 10.4 percent and 10.8 percent of GDP, respectively—mainly because of policies enacted in response to the pandemic and the associated economic downturn.

In CBO's projections, other mandatory spending totals 4.3 percent of GDP in 2022. It then generally declines as a share of the economy, reaching 2.2 percent of GDP in 2032 and 1.9 percent in 2052.[8] The projected decline through 2032 occurs in part because the amounts of benefits for many of the programs are adjusted for inflation each year, and in CBO's economic forecast, inflation is projected to be less than the rate of growth in nominal GDP. The decline from 2032 to 2052 is partly attributable to growth in income, which decreases the number of people who qualify for refundable tax credits.

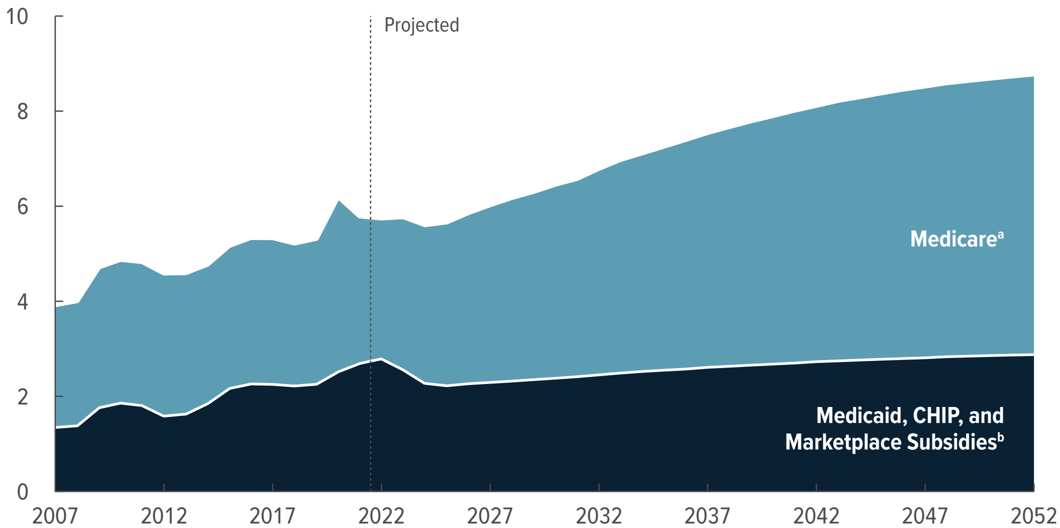
7. Refundable tax credits reduce a filer's overall income tax liability; if the credit exceeds the filer's income tax liability, the government pays all or some portion of that excess to the taxpayer (and the payment is treated as an outlay in the budget). See Congressional Budget Office, *Refundable Tax Credits* (January 2013), www.cbo.gov/publication/43767.

8. Sec. 257(b)(2) of the Deficit Control Act, which governs CBO's baseline projections, makes exceptions regarding current law for some programs, such as SNAP, that have expiring authorizations but that are assumed to continue as currently authorized.

Figure 2-4.

Composition of Outlays for the Major Health Care Programs

Percentage of Gross Domestic Product



Spending on Medicare is projected to account for more than four-fifths of the increase in spending on the major health care programs over the next 30 years.

Data source: Congressional Budget Office. See www.cbo.gov/publication/57971#data.

CHIP = Children's Health Insurance Program.

a. Net of premiums and other offsetting receipts.

b. "Marketplace Subsidies" refers to outlays to subsidize health insurance purchased through the marketplaces established under the Affordable Care Act and related spending.

Causes of Growth in Mandatory Spending. Rising health care costs per person and the aging of the population are the primary reasons for the sharp rise in projected spending on the major health care programs over the next 30 years. The aging of the population also contributes to the increase in spending on Social Security.

In CBO's estimation, if, over the 2022–2052 period, health care costs per person (adjusted for demographic changes) grew at the rate of potential GDP per person—which would mean that costs grew more slowly than the agency currently projects—and the population was not aging, then spending on the major health care programs would be 6.4 percent of GDP in 2052, or 0.3 percentage points lower than the agency currently projects for 2022.[9] And if the effects of the aging of the population alone were excluded, then spending on Social Security would be 4.9 percent of GDP in 2052, the same as the agency projects for 2022 (see Figure 2-5).

9. Potential GDP is the maximum sustainable output of the economy. The analysis of the causes of the growth in spending on the major health care programs encompasses gross spending on Medicare and does not reflect receipts credited to the program from premiums and other sources.

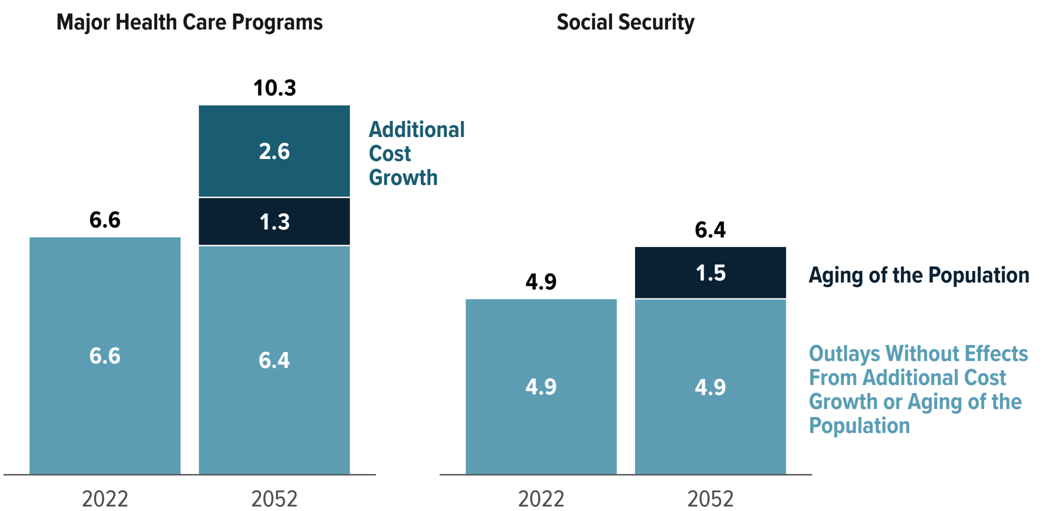
Rising Health Care Costs per Person. The growth of health care costs per person has recently slowed. However, in CBO's extended baseline projections, such costs, adjusted for demographic changes, continue to grow faster than potential GDP per person—0.9 percent faster for Medicare and 0.9 percent faster for Medicaid, on average—over the second and third decades of the projection period. That growth in health care costs per person accounts for about two-thirds of the increase in spending, measured as a percentage of GDP, on the major health care programs between 2022 and 2052.

Aging of the Population. Over the 2022–2052 period, about one-third of the projected increase in total spending on the major health care programs, measured as a percentage of GDP, is attributable to the aging of the population and is mostly the result of increased spending on Medicare. (See Figure 3-1 on page 26 for CBO's projections of the population by age group.) That is because Medicare is the largest of the major health care programs, and most beneficiaries qualify for it at age 65. As the group of people who qualify for Medicare becomes larger and, on average, older, Medicare spending will increase, not only because the number of beneficiaries will rise but also because spending on health care tends to increase as people age.

Figure 2-5.

Composition of Growth in Outlays for the Major Health Care Programs and Social Security, 2022 to 2052

Percentage of GDP



Much of the growth in spending on the major health care programs and on Social Security results from the aging of the population. Growth in spending on the major health care programs is also driven by cost growth above and beyond that accounted for by demographic changes or the growth of potential GDP per person.

Data source: Congressional Budget Office. See www.cbo.gov/publication/57971#data.

The spending on the major health care programs examined here consists of gross spending on Medicare (which does not account for premiums or other offsetting receipts), Medicaid, and the Children's Health Insurance Program, as well as outlays to subsidize health insurance purchased through the marketplaces established under the Affordable Care Act and related spending.

Additional cost growth is the extent to which the growth rate of nominal health care spending per person (adjusted for demographic changes) exceeds the growth rate of potential GDP per person. Potential GDP is the maximum sustainable output of the economy.

GDP = gross domestic product.

From 2022 to 2052, all of the projected increase in spending on Social Security, measured as a percentage of GDP, is attributable to the aging of the population. The effects of the aging of the population, which push spending on Social Security up, are offset by scheduled increases in the full retirement age for Social Security, which reduce the lifetime benefits for affected beneficiaries and thus push spending down.[10]

Discretionary Spending

About 45 percent of all discretionary spending is dedicated to national defense, and the rest is for an array of federally funded activities and programs, including education, transportation, housing assistance, veterans' health care, health-related research and public health programs, the administration of justice, and international affairs.

In the half-century preceding the pandemic, discretionary outlays decreased significantly in relation to the size of the economy, from 11.5 percent of GDP in 1970 to 6.3 percent in 2019. In 2020 and 2021, such outlays were boosted to 7.8 percent and 7.3 percent of GDP, respectively, by policies put in place to counter the pandemic-related economic disruption. In the agency's projections, discretionary outlays generally decrease as a percentage of GDP, from 7.0 percent in 2022 to 6.0 percent in 2036. After that, CBO's extended baseline projections reflect the assumption that discretionary spending remains constant at 6.0 percent of GDP through 2052.

Net Interest Costs

Over the past 50 years, the government's net interest costs have ranged from 1.2 percent to 3.2 percent of GDP, averaging 2.0 percent of GDP. In CBO's projections, net interest costs are 1.6 percent of GDP in 2022. By 2032, those costs double, reaching 3.3 percent of GDP, as federal debt grows and interest rates rise.

10. For more details about the full retirement age for Social Security, see Zhe Li, *The Social Security Retirement Age,* Report R44670, version 14 (Congressional Research Service, July 6, 2022), https://go.usa.gov/xGnEx.

Net interest costs continue to rise thereafter, reaching 7.2 percent of GDP in 2052. They would be higher in that year than spending on Social Security, discretionary spending, or all mandatory spending other than that for the major health care programs and Social Security—and higher than at any time since at least 1940 (the first year for which the Office of Management and Budget reports such data).[11]

The increase in interest payments is the result of escalating interest rates and the rising level of debt. CBO estimates that the increase in interest rates accounts for about one-half of the projected growth in net outlays for interest over the 2022–2052 period.[12]

Revenues

In CBO's projections, revenues measured as a percentage of GDP are generally higher over the next 30 years than they have been, on average, in recent decades.[13] Revenues averaged 17.3 percent of GDP over the past 50 years, but they fluctuated between 14.5 percent and 20.0 percent of GDP over that period because of changes in tax laws and interactions between those laws and economic conditions. Over the 2022–2052 period, revenues average 18.6 percent of GDP in the agency's projections.

Projected Revenues

In CBO's projections, the strong growth in federal revenues seen in 2021 continues temporarily as revenues equal 19.6 percent of GDP in 2022, one of the highest levels ever recorded. That strong growth is largely the result of sizable increases in collections of individual income taxes. From 2023 to 2025, revenues decline as a percentage of GDP as the effects of temporary factors that boosted tax receipts in 2021 and 2022 fade. In 2026 and 2027, by contrast, revenues rise in relation to GDP because of changes to rules governing the individual income tax that are scheduled to occur at the end of calendar year 2025. In the agency's extended baseline projections, revenues grow faster than the economy after 2032, totaling 19.1 percent of GDP in 2052.

From 2022 to 2052, total revenues, measured as a percentage of GDP, fall by one-half of one percentage point in CBO's projections. Receipts from corporate income taxes and payroll taxes decline by a small amount over that period (by 0.3 percent of GDP and 0.2 percent of GDP, respectively). Receipts of individual income taxes increase slightly, on net, reflecting offsetting factors. Such receipts initially fall from their highs seen in 2022 as the effects of the temporary factors that had boosted tax receipts dissipate; but they then resume their growth, ending the 30-year projection period at 10.7 percent of GDP—one-tenth of one percentage point higher than their value in 2022 (see Figure 2-6).

Factors Affecting Revenues

The small projected decline in total revenues as a percentage of GDP over the next 30 years is the result of several factors whose effects are largely offsetting. Real bracket creep, scheduled changes to tax rules, and faster earnings growth for higher-earning people (who are taxed at higher individual income tax rates) are among the factors that cause revenues to increase. But the near-term boost to tax receipts dissipates, which, along with growing health care costs, causes revenues to decrease (see Figure 2-7).

End of the Temporary Boost to Tax Receipts. In CBO's estimation, some of the causes of the recent jump in individual income tax receipts will dissipate, reducing revenues as a percentage of GDP from 2023 to 2025. First, a pandemic-related tax provision allowed some taxes due in 2020 and 2021 to be deferred until 2022 and 2023. That provision boosts tax receipts in 2022 and 2023 but will have no effect thereafter, causing receipts to drop.

11. Since publishing *The 2021 Long-Term Budget Outlook*, CBO has refined its projections of the average interest rate on federal debt held by the public. See Appendix D for a discussion of that change.

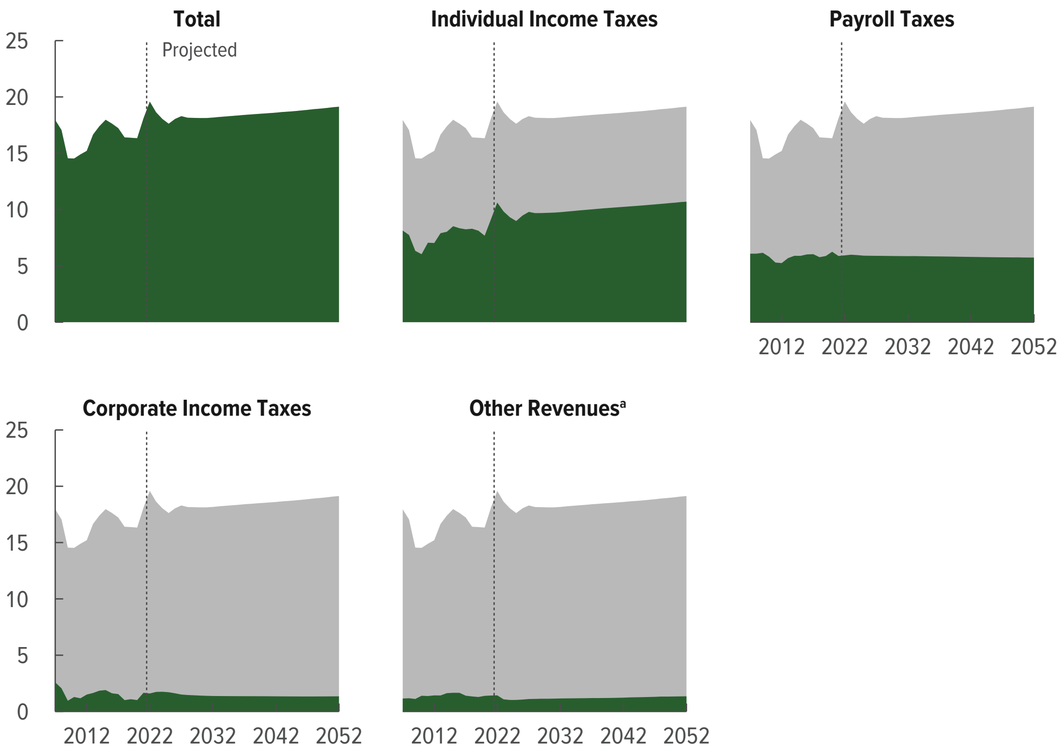
12. The agency estimated the contribution of rising interest rates to net interest costs by keeping interest rates on marketable debt held by the public at their values at the end of 2021. In that scenario, the average interest rate on federal debt gradually declines to 1.3 percent in 2052 instead of rising to 4.2 percent in 2052, as CBO currently projects. That analysis accounts only for the reduction in interest payments from lower interest rates and the reduction in federal borrowing from smaller deficits. It does not account for the economic effects that would result from lower interest rates or less federal borrowing.

13. CBO's revenue projections are based on the assumption that the rules for all tax sources (individual income taxes, corporate income taxes, payroll taxes, and other taxes) will change as scheduled under current law. The sole exception is expiring excise taxes dedicated to trust funds. The Deficit Control Act requires CBO's baseline to reflect the assumption that those taxes would be extended at their current rates. That law does not stipulate that the baseline include the extension of other expiring tax provisions, even if lawmakers have routinely extended them in the past.

Figure 2-6.

Revenues, by Source

Percentage of Gross Domestic Product



Taken together, receipts from all sources of revenues are projected to be about the same percentage of GDP in 2052 as they are today. Receipts from individual income taxes—the largest source of federal revenues—are projected to continue the strong growth observed in 2021 this year, mostly because of temporary factors whose effects quickly subside. Those receipts are projected to rise again after 2025 because of the scheduled expiration of some provisions of the 2017 tax act.

Data source: Congressional Budget Office. See www.cbo.gov/publication/57971#data.

a. Consists of excise taxes, remittances to the Treasury from the Federal Reserve System, customs duties, estate and gift taxes, and miscellaneous fees and fines.

Second, various types of taxable income are projected to decline as a percentage of GDP in the near term. The most notable declines are in the realizations of capital gains and in wages and salaries.

Third, and most significant, the strength of recent tax receipts is projected to gradually dissipate over the next few years, thus better reflecting the past relationship between tax revenues and the state of the economy. The source of that recent strength in individual income tax receipts is uncertain. Receipts in the past few years have been larger than expected given currently available data on economic activity. Those larger-than-anticipated receipts may result from several factors whose effects could persist, end, or reverse.

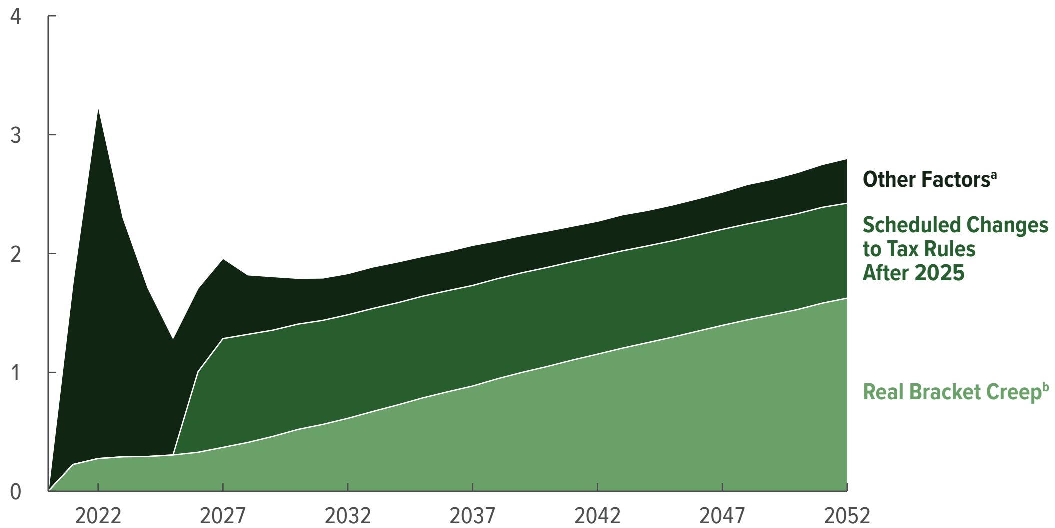
Real Bracket Creep. The income thresholds for the various tax rate brackets in the individual income tax are indexed to increase with inflation (as measured by the chained consumer price index for all urban consumers as published by the Bureau of Labor Statistics). If income grows faster than prices—as typically happens during economic expansions—more income is pushed into higher tax brackets, even when the underlying distribution of income remains unchanged. That process is known as real bracket creep and is the largest source of growth in total revenues over the next three decades. If current laws generally remained unchanged, real bracket creep would continue to gradually push up taxes in relation to income through 2052, CBO projects, thereby increasing tax receipts. From 2032 to 2052, the share of income taxed at the top rate of 39.6 percent would rise by 1 percentage point—and the share of income excluded from taxation would fall by 3 percentage points—because of real bracket creep (see Figure 2-8).[14]

14. For more details, see Congressional Budget Office, "How Income Growth Affects Tax Revenues in CBO's Long-Term Budget Projections" (June 2019), www.cbo.gov/publication/55368.

Figure 2-7.

Composition of Changes in Revenues, 2020 to 2052

Percentage of GDP



Over the long term, the largest source of growth in tax revenues is real bracket creep. Revenues as a percentage of GDP are projected to rise in 2022 as a result of temporary increases in the collections of individual income taxes. Projected revenues rise sharply after certain temporary provisions of the 2017 tax act expire at the end of 2025.

Data source: Congressional Budget Office. See www.cbo.gov/publication/57971#data.

GDP = gross domestic product.

a. Other factors include an end to the temporary boost to tax receipts as recent strength in collections dissipates, as well as factors that affect revenues over the longer term, such as changes in the distribution of wages and growth in nontaxable compensation resulting from health care costs.

b. Real bracket creep is the process in which, as income rises faster than inflation, a larger proportion of income becomes subject to higher tax rates, even when the underlying distribution of income remains unchanged.

Scheduled Changes to Tax Rules. The most significant factor pushing up taxes in relation to income is the scheduled expiration, after calendar year 2025, of nearly all provisions of the 2017 tax act (P.L. 115-97) that affect individual income taxes. The expiring provisions include lower statutory tax rates, the higher standard deduction, the repeal of personal exemptions, and the expansion of the child tax credit. The scheduled changes to tax rules after 2025 would cause tax liabilities to rise in calendar year 2026. Those changes boost revenues as a share of GDP by 0.8 percentage points, on average, after 2025.

Other Factors. Two other factors affect revenues—but to a lesser extent—in CBO's projections. The first factor is the growth in health care costs, which is projected to reduce revenues as a percentage of GDP over the next three decades. The share of employees' compensation that is paid in the form of spending on fringe benefits, such as employment-based health insurance, is projected to increase, and those benefits are not taxable. Conversely, the share of employees' compensation that is paid in the form of wages and salaries, which are subject to income and payroll taxes, is projected to decline. That shift in compensation would decrease taxable income—and thus revenues from both income and payroll taxes—in relation to GDP.

The second factor is the change in the distribution of earnings. Earnings are projected to grow faster for higher-earning people than for other people in the long term. That trend would cause a larger share of individual earnings to be taxed at higher rates. However, the resulting increase in individual income tax revenues would be largely offset by a decrease of nearly the same amount in payroll tax receipts, CBO projects, because the share of earnings above the maximum amount subject to Social Security payroll taxes would grow.[15]

15. For additional information, see Brooks Pierce, *How Changes in the Distribution of Earnings Affect the Federal Deficit*, Working Paper 2021-12 (Congressional Budget Office, October 2021), www.cbo.gov/publication/57217.

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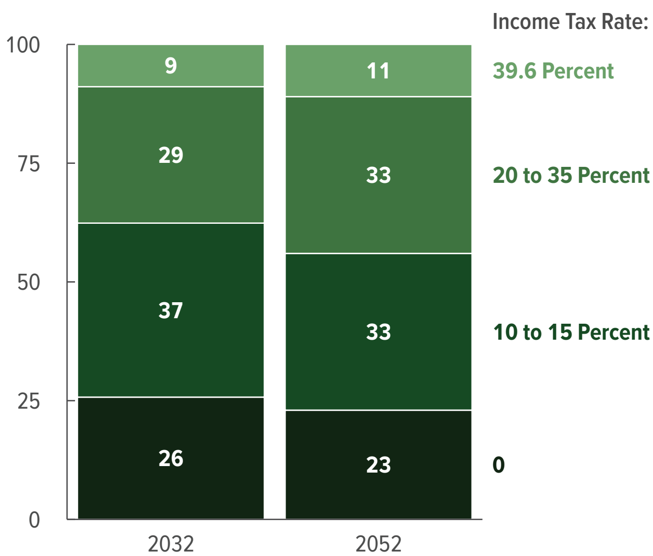
Figure 2-8.

Shares of Income Taxed at Different Rates Under the Individual Income Tax System

Percent



The largest contributor to growth in projected revenues over the long term is real bracket creep—the process in which, as income rises faster than inflation, a larger proportion of income becomes subject to higher tax rates. As the share of income taxed at higher rates grows, the share exempt from taxation shrinks.

Data source: Congressional Budget Office. See www.cbo.gov/publication/57971#data.

In this figure, income refers to adjusted gross income—that is, income from all sources not specifically excluded by the tax code, minus certain deductions. The income tax rate is the statutory rate specified under the individual income tax system. The lowest statutory tax rate is zero (because of deductions and exemptions).

Chapter 3: Long-Term Demographic and Economic Projections

Overview

Demographic and economic trends are key determinants of the long-term budget outlook. By the Congressional Budget Office's estimates, the population will grow more slowly over the next 30 years than it did over the past 30 years, and it will get older, on average. The economy is projected to grow more slowly over the next three decades than it has over the past three, and interest rates are expected to rise significantly.

Demographic Projections

The size and age profile of the U.S. population affects the nation's economy and the federal budget. For example, those two factors help determine the number of people in the labor force and thus affect both gross domestic product (GDP) and federal tax receipts. Those factors also help determine the number of beneficiaries of Social Security and other federal programs and thus federal outlays.

CBO estimates the population in future years by projecting rates of fertility, net immigration, and mortality. In the agency's projections, the population increases from 335 million people at the beginning of 2022 to 369 million people at the beginning of 2052—an average expansion of 0.3 percent per year (see Figure 3-1).[1] That rate is one-third the average annual rate of growth over the past 30 years (0.9 percent). Moreover, as fertility remains lower than necessary for a generation to replace itself, population growth is increasingly driven by immigration, which by 2043 accounts for all population growth.

The proportion of the population that is age 65 or older expands over the coming decades, continuing a long-standing historical trend. By 2052, 22 percent of the population will be 65 or older; today, that proportion is 17 percent.

Economic Projections

The state of the U.S. economy in coming decades will affect the federal government's budget deficits and debt. Key to the agency's long-term budget projections are its long-term projections of GDP, interest rates, and inflation. Among the factors incorporated into the agency's long-term economic forecast are the effects of projected deficits on private investment and the effects of marginal tax rates on the supply of labor and private saving.

Real Potential Gross Domestic Product

In CBO's extended baseline projections, the growth of real potential GDP (the maximum sustainable output of the economy, adjusted to remove the effects of inflation) over the next 30 years is slower than it has been over the past 30 years (see Figure 3-2).[2] From 2022 to 2052, real potential GDP increases at an average rate of 1.7 percent per year; from 1992 to 2021, it grew at an average annual rate of 2.4 percent.

That slower growth in real potential GDP is primarily attributable to slower growth in the potential labor force (that is, the labor force adjusted to account for fluctuations in the business cycle). Whereas the potential labor force grew by an average of 0.9 percent per year over the past 30 years, in CBO's projections it grows by an average of 0.3 percent per year through 2052. Slowing population growth and the aging of the population account for most of that slowdown.

An additional factor contributing to real potential GDP's slower growth is that potential labor force productivity (that is, potential output per member of the potential labor force) is projected to grow more slowly over the next 30 years than it did over the past 30 years. In CBO's projections, potential labor force productivity grows at an average annual rate of 1.3 percent from 2022 to 2052; over the past 30 years, it grew at an average annual rate of 1.5 percent.

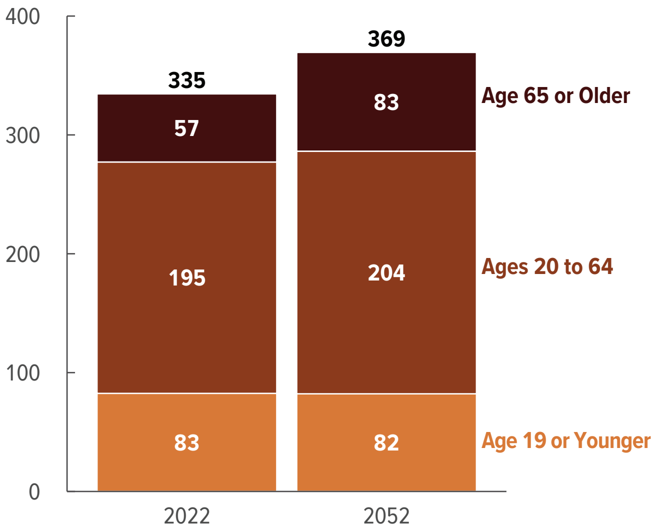
The slightly slower growth in potential labor force productivity is, in turn, driven by two key factors. First, the accumulation of capital—structures and equipment, intellectual property products (such as computer software), and residential housing, for example—per worker

1. See Congressional Budget Office, *The Demographic Outlook: 2022 to 2052* (July 2022), www.cbo.gov/publication/57975.

2. For a more detailed discussion of the economic projections, see Appendix B.

Figure 3-1.

U.S. Population, by Age Group



CBO projects that over the next three decades, the population will become older, on average, as the share of the population age 65 or older continues to grow.

Data source: Congressional Budget Office. See www.cbo.gov/publication/57971#data.

is projected to be slower over the next three decades than it has been in the past, in part because increased federal borrowing is projected to reduce private investment. (See Chapter 1 for details.)

The second reason the growth of potential labor force productivity slows is that total factor productivity (TFP)—that is, the real output per unit of combined labor and capital in the nonfarm business sector—is also expected to grow more slowly over the next 30 years than it did over the past 30 years (although the growth of TFP is projected to accelerate from its historically slow rate in recent years). That slower growth in TFP is attributable to several factors, including the following:

- A slowdown in the growth of workers' educational attainment,
- Reductions in federal investment relative to the size of the economy, and
- Climate change.[3]

Growth in real potential GDP slows over the three decades in the projection period, from an annual average of 1.8 percent over the 2022–2032 period to an average of 1.5 percent over the 2043–2052 period. That decrease is attributable primarily to falling potential labor force productivity. From 2022 to 2032, potential labor force productivity is expected to grow at an average annual rate of 1.5 percent. Over the third decade of the projection period, that growth is expected to average 1.2 percent. That slowing growth of potential labor force productivity stems primarily from increased federal borrowing, which is projected to reduce private investment below what it otherwise would be and lower the rate of capital accumulation.

Real Gross Domestic Product

In CBO's projections, real GDP grows slightly faster than real potential GDP, on average, over the next decade—at an average annual rate of 1.9 percent. The growth rate of real GDP converges with the growth rate of real potential GDP in the second half of the decade, and the level of real GDP stays about 0.5 percent below the level of real potential GDP thereafter. That gap reflects the agency's assessment that real GDP falls short of real potential GDP by a larger amount and for longer during and after economic downturns than actual output exceeds potential output during economic expansions.[4]

Nominal Gross Domestic Product

Nominal GDP grows by 9.3 percent this year in CBO's projections. After 2022, an easing of upward pressure on prices and the same factors that slow the growth of real GDP slow the growth of nominal GDP. From 2023 to 2026, the annual growth of nominal GDP averages 4.1 percent. As is the case with real GDP, the growth rate of nominal GDP converges with the growth rate of nominal potential GDP in the second half of the first decade of the projection period.

Interest Rates

CBO expects interest rates to rise throughout the projection period but to remain lower than they have been, on

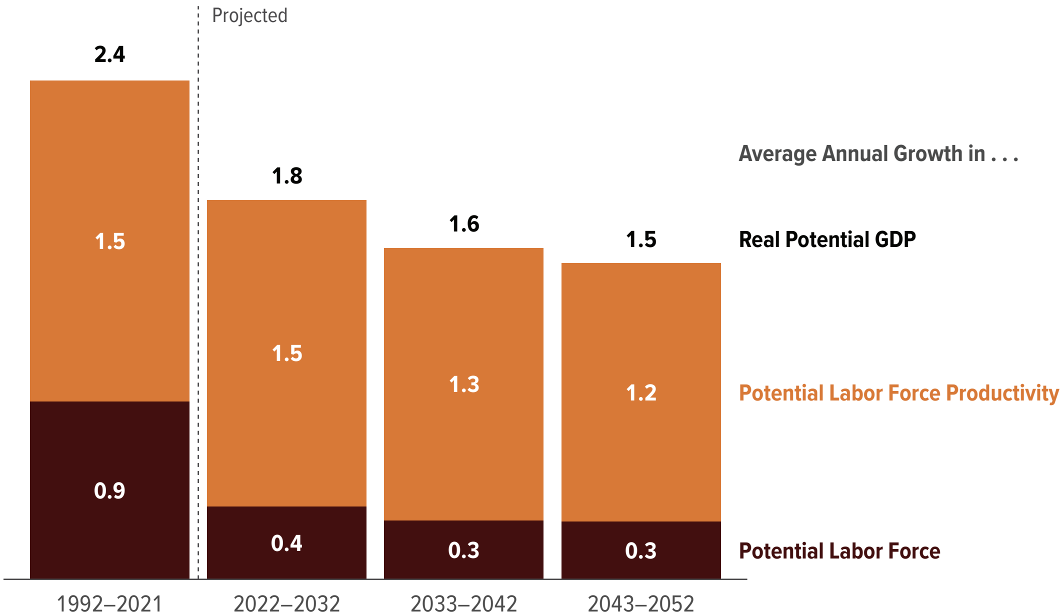
3. See Evan Herrnstadt and Terry Dinan, *CBO's Projection of the Effect of Climate Change on U.S. Economic Output*, Working Paper 2020-06 (Congressional Budget Office, September 2020), www.cbo.gov/publication/56505.

4. One recent study explains the existence of a persistent output gap by examining asymmetric fluctuations in the noncyclical rate of unemployment (that is, the rate that results from all sources except fluctuations in aggregate demand). See Stéphane Dupraz, Emi Nakamura, and Jón Steinsson, *A Plucking Model of Business Cycles*, Working Paper 748 (Banque de France, January 2020), https://tinyurl.com/1njkmzkf. CBO assessed the persistent output gap in an earlier report. See Congressional Budget Office, *Why CBO Projects That Actual Output Will Be Below Potential Output on Average* (February 2015), www.cbo.gov/publication/49890.

Figure 3-2.

Composition of the Growth of Real Potential GDP

Percent



Growth in real potential GDP is projected to be slower over the next 30 years than it was over the past 30 years. That slowdown occurs mostly because the potential labor force is projected to grow more slowly than it has in the past. Within the 2022–2052 period, the growth in real potential GDP slows primarily because the growth of potential labor force productivity slows in those years.

Data source: Congressional Budget Office. See www.cbo.gov/publication/57971#data.

Real values are nominal values that have been adjusted to remove the effects of inflation. Potential GDP is the maximum sustainable output of the economy. The potential labor force is the labor force (that is, the number of people in the civilian noninstitutionalized population who are age 16 or older and who have jobs or who are available for work and are actively seeking jobs) adjusted to remove the effects of fluctuations in the business cycle. Potential labor force productivity is the ratio of real potential GDP to the potential labor force. The sum of growth in the potential labor force and growth in potential labor force productivity is equal to growth in real potential GDP.

GDP = gross domestic product.

average, over the past three decades. In CBO's projections, the interest rate on 10-year Treasury notes rises to 3.8 percent in 2032 and to 4.6 percent in 2052—about one percentage point below the 5.4 percent average recorded over the 1995–2004 period.[5] Several factors, including slower growth of the labor force and of productivity than in the past, keep interest rates in the period below their historical averages; the effects of those factors outweigh the effects of rising federal debt and other factors that tend to push interest rates above historical rates.[6]

The average interest rate on all federal debt held by the public tends to be lower than the rate on 10-year Treasury notes. (Interest rates on shorter-term debt are generally lower than those on longer-term debt because shorter-term debt is less risky; the average term to maturity for federal debt has been less than 10 years since the 1950s.) In CBO's projections, the average interest rate on federal debt is 3.1 percent in 2032 and 4.2 percent in 2052. Over the 2022–2052 period, that rate is an average of 0.7 percentage points lower than the interest rate on 10-year Treasury notes. (Since last year, CBO has refined the methods that it uses to project the average

5. The 1995–2004 period was chosen for comparison for several reasons. In those years, expectations for inflation were stable, there were no severe economic downturns or significant financial crises, and monetary policy was, according to CBO's estimates, neutral, on average—that is, the real federal funds rate (the interest rate that financial institutions charge each other for overnight loans of their monetary reserves) was generally consistent with the economy's operating at full employment.

6. See Edward N. Gamber, *The Historical Decline in Real Interest Rates and Its Implications for CBO's Projections,* Working Paper 2020-09 (Congressional Budget Office, December 2020), www.cbo.gov/publication/56891.

interest rate on all federal debt. For a discussion of those changes, see Appendix D.)

Inflation

In CBO's extended baseline projections, inflation in the consumer price index for all urban consumers falls to its 30-year historical average of 2.3 percent in 2024. That decline is attributable to reduced disruptions in supply chains, slower growth in the prices of goods, and actions taken by the Federal Reserve to rein in inflation by reducing monetary accommodation.[7] After 2024, inflation remains roughly at its historical average through the rest of the 30-year projection period. Inflation in the GDP price index—a measure of prices in the overall economy (rather than just consumer prices) that is used to derive real GDP from nominal GDP—follows a similar path over the next few years, falling to 2.0 percent, its 30-year historical average, in 2025.

Effects of Fiscal Policy in CBO's Economic Projections

CBO's economic projections incorporate the effects of projected federal deficits under current law. In those budget projections, deficits grow, and as a result, the federal government borrows more. That increase in federal borrowing pushes up interest rates and thus reduces private investment in capital, causing output to be lower in the long term than it would be otherwise, especially in the last two decades of the projection period. Less private investment reduces the amount of capital per worker, making workers less productive and leading to lower wages, which reduces people's incentive to work and thus leads to a smaller supply of labor.

The agency's baseline projections also incorporate the economic effects of changes in federal tax policies scheduled under current law, including the effects of higher marginal tax rates. (The marginal tax rate is the percentage of an additional dollar of income from labor or capital that is paid in taxes.) Under current law, tax rates on individual income are scheduled to rise at the end of 2025. Moreover, as income rises faster than inflation and more income is pushed into higher tax brackets over the long term—a phenomenon referred to as real bracket creep—labor income and capital income are taxed at higher tax rates.[8] Higher marginal tax rates on labor income would reduce people's after-tax wages and thus weaken their incentive to work. Likewise, an increase in the marginal tax rate on capital income would lower people's incentives to save and invest, thereby reducing the stock of capital and, in turn, labor productivity; the reduction in labor productivity would put downward pressure on wages. All told, less private investment and a smaller labor supply decrease economic output and income in CBO's extended baseline projections.

7. Monetary accommodation refers to a central bank's lowering interest rates in an attempt to boost economic growth, thereby stabilizing or reducing unemployment.

8. See Congressional Budget Office, "How Income Growth Affects Tax Revenues in CBO's Long-Term Budget Projections" (June 2019), www.cbo.gov/publication/55368.

Chapter 4: The Long-Term Outlook Under Alternative Paths for the Economy and Budget

Overview

The extended baseline projections that the Congressional Budget Office describes in this report are based on the agency's economic forecast and reflect the assumption that current laws governing taxes and spending generally remain unchanged. To show how changes in economic conditions or in current law might affect budgetary outcomes, CBO analyzed four illustrative economic paths and three illustrative budgetary paths that differ from those underlying the agency's baseline projections.[1]

Illustrative Economic Paths

CBO's long-term budget projections depend on its forecasts of economic factors, including productivity growth and interest rates. If economic conditions differed from those in CBO's forecast, budgetary outcomes would diverge from those in the agency's extended baseline projections. To illustrate the effects of such differences, CBO analyzed how its budget projections would differ if productivity growth or interest rates were higher or lower than it anticipated (see Figure 4-1).

Paths for Growth of Total Factor Productivity

CBO examined the effects of changes in the growth rate of total factor productivity (TFP) in the nonfarm business sector on its projections of federal debt measured as a percentage of gross domestic product (GDP). The growth of TFP—the average real output (that is, output adjusted to remove the effects of inflation) per unit of combined labor and capital services—is a key contributor to growth in GDP.

The agency projected budgetary outcomes using rates of growth for TFP in the nonfarm business sector that were 0.5 percentage points higher and 0.5 percentage points lower than the rates underlying the extended baseline projections. That range reflects the variation of about one percentage point in average TFP growth over the 43 30-year periods between 1950 and 2021. After accounting for the effects of the alternative paths for TFP on capital and other macroeconomic factors, CBO made the following projections:

- If nonfarm business productivity grew 0.5 percentage points faster than CBO projects, federal debt held by the public would be 140 percent of GDP in 2052 rather than the 185 percent it amounts to in the extended baseline projections.
- If nonfarm business productivity grew 0.5 percentage points more slowly than projected, federal debt held by the public would be 234 percent of GDP in 2052.

Paths for Interest Rates on Federal Debt Held by the Public

CBO also examined the effects of changes in interest rates on its projections of federal debt as a percentage of GDP. The agency projected budgetary outcomes under two illustrative paths in which interest rates on federal debt were either higher or lower than the rates underlying the agency's extended baseline.

- For the first path, CBO boosted the average interest rate on federal debt above the baseline rate by a differential that starts at 5 basis points in 2022 and increases by 5 basis points each year (before macroeconomic effects, which are described below, are accounted for).[2] Under that path, federal debt held by the public equals 235 percent of GDP in 2052 rather than the 185 percent of GDP it equals in the extended baseline projections.

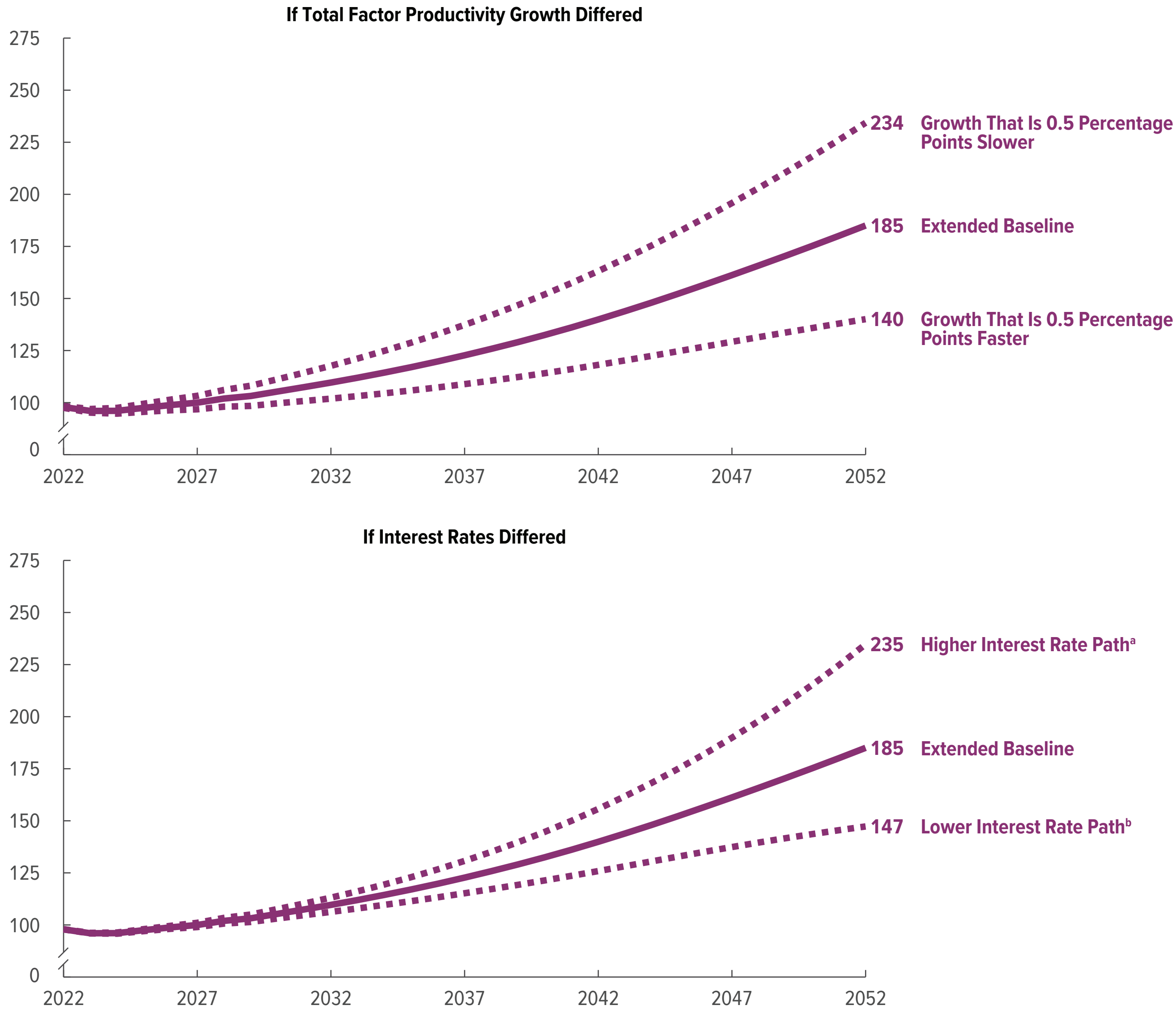
1. For detailed information about the illustrative paths, see the supplemental data for this report at www.cbo.gov/publication/57971#data.

2. That is, the interest rate was boosted above the baseline rate by 5 basis points in 2022, 10 basis points in 2023, 15 basis points in 2024, and so on. A basis point is one one-hundredth of a percentage point.

Figure 4-1.

Federal Debt If Total Factor Productivity Growth or Interest Rates Differed From the Values Underlying CBO's Extended Baseline Projections

Percentage of Gross Domestic Product



Data source: Congressional Budget Office. See www.cbo.gov/publication/57971#data.

Total factor productivity growth is the growth of real output (that is, output adjusted to remove the effects of inflation) per unit of combined labor and capital services in the nonfarm business sector. The interest rate is the average interest rate on federal debt.

The extended baseline projections, which generally reflect current law, follow CBO's 10-year baseline budget projections and then extend most of the concepts underlying those projections for an additional 20 years.

a. For this path, the average interest rate on federal debt was boosted above the rate underlying CBO's extended baseline by a differential that starts at 5 basis points in 2022 and increases by 5 basis points each year (before macroeconomic effects are accounted for)—that is, the interest rate is 5 basis points higher than the baseline rate in 2022, 10 basis points higher than the baseline rate in 2023, 15 basis points higher than the baseline rate in 2024, and so on. (A basis point is one one-hundredth of a percentage point.)

b. For this path, the average interest rate on federal debt was pushed below the rate underlying CBO's extended baseline by a differential that starts at 5 basis points in 2022 and increases by 5 basis points each year (before macroeconomic effects are accounted for)—that is, the interest rate is 5 basis points lower than the baseline rate in 2022, 10 basis points lower than the baseline rate in 2023, 15 basis points lower than the baseline rate in 2024, and so on.

- For the second path, the average interest rate on federal borrowing was pushed below the baseline rate by those same amounts each year. Under that path, federal debt held by the public equals 147 percent of GDP in 2052.

Under the first path, the boost to interest rates increases the government's interest costs and thus deficits. Larger deficits and the increased federal borrowing required to finance them decrease private investment. (For a discussion of why increased federal borrowing reduces private investment, see Chapter 1.) The decrease in private investment reduces the amount of capital and increases the return on investment because more workers make use of each unit of capital. When the return on capital grows, interest rates—including the rates that the federal government pays on debt held by the public—rise further. Thus, macroeconomic effects push interest rates above the initial boost that was built into the illustrative path.

The average interest rate on federal debt, which is 4.2 percent in 2052 in the extended baseline projections, reaches 6.0 percent that year under the path with higher interest rates. That rate reflects both the initial boost of the rate built into the path and the resulting effects of larger deficits, less investment and capital, and the additional increases in interest rates. About one-eighth of the 1.8 percentage-point difference between the rate in the illustrative path and that in the extended baseline in 2052 results from those macroeconomic effects rather than from the initial boost to borrowing rates.

The lower interest rates in the second illustrative path result in smaller interest payments and smaller deficits than those in CBO's baseline projections. Those smaller deficits increase private investment, making the amount of capital per worker grow and the return on capital—and, ultimately, interest rates—fall. The average interest rate on federal debt falls to 2.4 percent in 2052 under that path.

The budgetary effects of higher or lower interest rates are highly uncertain because those effects depend on the amount of debt that the interest rates are applied to and on the macroeconomic effects of the higher or lower rates. Also, this analysis does not explicitly account for the budgetary effects that might stem from the sources of the changes in interest rates.

Illustrative Budgetary Paths

The budget projections in this report show what federal spending, revenues, and deficits would be if current laws governing spending and taxes generally remained unchanged. Those projections are not intended to be a forecast of budgetary outcomes; rather, they are meant to provide a benchmark that policymakers can use to assess the potential effects of policy decisions.

When constructing its baseline projections of spending and revenues, CBO follows procedures specified in law as well as long-standing guidelines. For example, the Balanced Budget and Emergency Deficit Control Act of 1985 (Public Law 99–177) requires CBO to incorporate the assumption that future discretionary funding will match the amounts most recently provided, with adjustments for inflation, through the end of the 10-year baseline projection period. For later years in the projection period, CBO assumes that after a five-year transition period, discretionary spending would grow at the rate of nominal GDP. The agency's projections also reflect the assumptions that most laws governing mandatory spending will continue beyond their statutory expiration and that scheduled payments from trust funds, such as Social Security benefits, would be made even after the program's trust funds were exhausted and its annual revenues were inadequate to fund those payments. By contrast, CBO's projections of revenues reflect the assumption that certain provisions affecting the tax code—including changes in statutory tax rates—will expire as scheduled under current law.

Spending and revenues may, however, differ from the amounts in CBO's baseline projections. For example, lawmakers can—and do—set discretionary funding at amounts that differ from the projected amounts. To illustrate how changes in spending and revenues could affect the long-term budget outlook, CBO examined three illustrative budgetary paths that are more consistent with the past than are its extended baseline projections—one in which discretionary spending (measured as a percentage of GDP) deviates from the path underlying the agency's extended baseline projections and two in which both discretionary spending and revenues (measured as a percentage of GDP) differ from their baseline amounts.[3]

3. In 2019, CBO analyzed an additional illustrative scenario in which the Social Security Administration would no longer pay beneficiaries the full amount specified in law once the combined trust funds were exhausted and current revenues were insufficient to pay those amounts. CBO found that such a reduction in benefits would substantially reduce the amount of debt by the end of the projection period. See Congressional Budget Office, *The 2019 Long-Term Budget Outlook* (June 2019), pp. 41–44, www.cbo.gov/publication/55331.

Path for Discretionary Spending

For the first illustrative budgetary path, discretionary outlays were set to equal 7.0 percent of GDP—their value in 2022—over the entire projection period. That path for discretionary spending more closely resembles the past than does the path for such spending in CBO's extended baseline projections. Whereas discretionary outlays have averaged 6.9 percent of GDP over the past 10 years and 7.3 percent of GDP over the past 20 years, they average 6.2 percent of GDP over the 2022–2052 period in CBO's extended baseline projections. Discretionary spending of the amount specified in the illustrative path would exceed the amount in the extended baseline projections by 0.8 percentage points in 2032 and by 1.0 percentage point in 2052.[4]

Paths for Revenues

Following changes in tax law scheduled to take effect at the end of 2025, revenues generally increase as a share of the economy in CBO's projections; they reach 19.1 percent of GDP in 2052. That upward trend does not align with experience, however. Largely because of legislated changes, federal revenues have fluctuated around their 50-year average of 17.3 percent over the past five decades and have followed no apparent long-term trend.

In the second illustrative budgetary path, noninterest spending is about the same as it is in the illustrative path for discretionary spending throughout the projection period, and revenues are the same as they are in the agency's extended baseline projections through 2026. Thereafter, revenues remain at 18.0 percent of GDP through the rest of the projection period—much closer to their 50-year average than are the amounts in the extended baseline but still high by historical standards.

The third illustrative budgetary path is more consistent with past revenues than is the second budgetary path. Revenues in the third path are the same as they are in the extended baseline projections through 2025, and in 2026, they return to their 50-year average of 17.3 percent of GDP, where they remain through the rest of the projection period. Noninterest spending is about the same as it is in the illustrative path for discretionary spending throughout the projection period.

4. For a more detailed discussion of the budgetary effects of a similar illustrative path through 2032, see Congressional Budget Office, *The Budget and Economic Outlook: 2022 to 2032* (May 2022), pp. 101–104, www.cbo.gov/publication/57950.

Budgetary and Economic Outcomes Under the Illustrative Budgetary Paths

Different paths for spending and revenues would result in different paths for the deficit and debt and thus affect the amount of federal borrowing. That change in federal borrowing would, in turn, affect the economy, and those macroeconomic effects would feed back into the federal budget. To assess the effects of different budgetary paths on the long-term budget outlook, CBO analyzed deficits and debt under the three paths when those macroeconomic effects are taken into account (see Figure 4-2).

Path for Discretionary Spending. Under the first illustrative budgetary path, in which discretionary spending is set equal to 7.0 percent of GDP for the entire projection period, the primary deficit (which excludes interest costs) would be 1.2 percentage points higher in 2052 than it is in CBO's extended baseline projections (see Table 4-1). Once the rising costs of debt service are added, the total deficit in 2052 would be 2.8 percentage points higher than the baseline amount. Debt held by the public would reach 218 percent of GDP in 2052, 33 percentage points higher than it is in CBO's extended baseline projections.

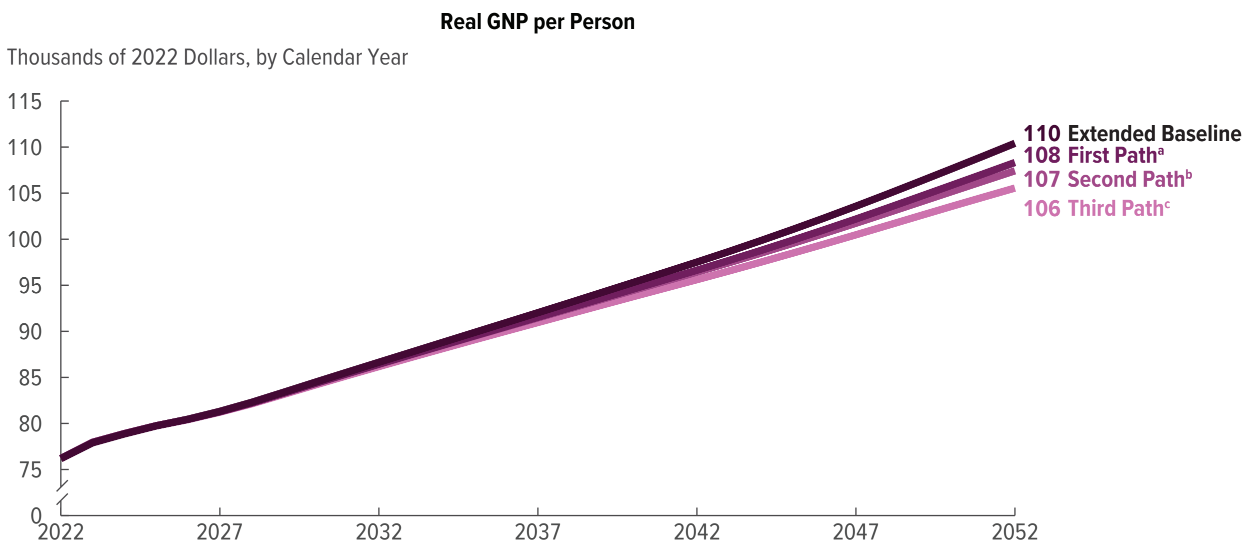
More discretionary spending and increased government borrowing would lead to a reduction in private investment and a smaller capital stock, thus causing output to be lower and interest rates to be higher in the long term than they are in the extended baseline projections. In 2052, for instance, real gross national product (GNP) under the illustrative path would be 1.9 percent lower than it is in CBO's baseline projections, and real GNP per person would be about $2,100 lower (in 2022 dollars).[5]

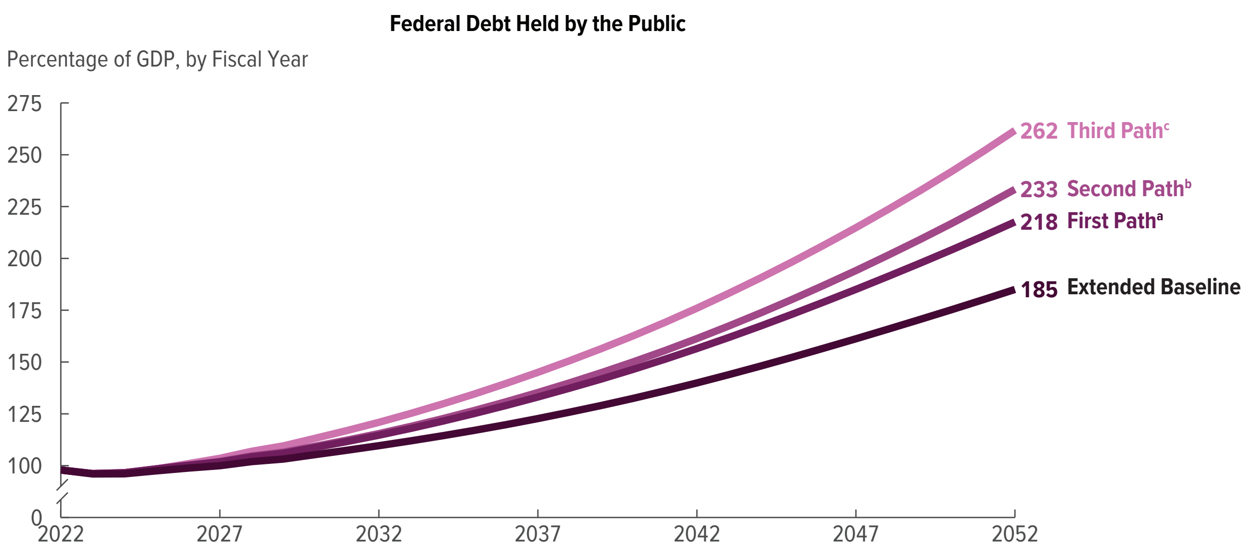
Paths for Revenues. Under the second illustrative budgetary path, in which discretionary spending is set equal to 7.0 percent of GDP for the entire projection period and revenues remain at 18.0 percent of GDP after 2026, the primary deficit in 2052 would be 2.3 percent of GDP larger than it is in CBO's extended baseline projections, and the total deficit for that year would be 4.7 percent of GDP larger than the baseline amount.

5. Whereas GDP, the more common measure of economic output, is the value of all final goods and services produced within the borders of the United States, GNP is the value of all final goods and services produced by labor and capital supplied by residents of the United States, regardless of where that labor and capital are located.

Figure 4-2.

Output per Person and Federal Debt Under Three Illustrative Budgetary Paths





Data source: Congressional Budget Office. See www.cbo.gov/publication/57971#data.

The extended baseline projections, which generally reflect current law, follow CBO's 10-year baseline budget projections and then extend most of the concepts underlying those projections for an additional 20 years.

The estimates of debt include macroeconomic feedback.

Whereas GDP, the more common measure of economic output, is the value of all final goods and services produced within the borders of the United States, GNP is the value of all final goods and services produced by labor and capital supplied by residents of the United States, regardless of where that labor and capital are located.

GDP = gross domestic product; GNP = gross national product.

a. In the first path, discretionary outlays equal 7.0 percent of GDP—their value in 2022—over the entire projection period.

b. In the second path, noninterest outlays are about the same as they are in the first path, and revenues are the same as they are in the extended baseline projections through 2026. Thereafter, revenues remain at 18.0 percent of GDP through the rest of the projection period.

c. In the third path, noninterest outlays are about the same as they are in the first path, and revenues are the same as they are in the extended baseline projections through 2025. In 2026, revenues return to their 50-year average of 17.3 percent of GDP, where they remain through the rest of the projection period.

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Table 4-1.

Budget Projections in 2052 Under Three Illustrative Paths

Percentage of Gross Domestic Product

	Extended Baseline	First Path[a]	Second Path[b]	Third Path[c]
Revenues	19.1	19.1	18.0	17.3
Outlays, Excluding Interest Payments	23.0	24.1	24.2	24.3
Primary Deficit	3.9	5.0	6.2	7.0
Total Deficit	11.1	13.9	15.8	18.2
Federal Debt Held by the Public	185	218	233	262

Data source: Congressional Budget Office. See www.cbo.gov/publication/57971#data.

The extended baseline projections, which generally reflect current law, follow CBO's 10-year baseline budget projections and then extend most of the concepts underlying those projections for an additional 20 years.

The estimates of debt include macroeconomic feedback.

a. In the first path, discretionary outlays equal 7.0 percent of GDP—their value in 2022—over the entire projection period.

b. In the second path, noninterest outlays are about the same as they are in the first path, and revenues are the same as they are in the extended baseline projections through 2026. Thereafter, revenues remain at 18.0 percent of GDP through the rest of the projection period.

c. In the third path, noninterest outlays are about the same as they are in the first path, and revenues are the same as they are in the extended baseline projections through 2025. In 2026, revenues return to their 50-year average of 17.3 percent of GDP, where they remain through the rest of the projection period.

Debt held by the public would reach 233 percent of GDP in 2052, 48 percentage points higher than it is in CBO's extended baseline projections. That year, real GNP would be 2.7 percent lower than it is in the agency's baseline projections, and real GNP per person would be about $3,000 lower (in 2022 dollars).

Under the third illustrative budgetary path, in which discretionary spending equals 7.0 percent of GDP for the entire projection period and revenues remain at 17.3 percent of GDP after 2025, the primary deficit in 2052 would be 3.2 percent of GDP larger than it is in the agency's baseline projections, and the total deficit for that year would be 7.1 percent of GDP larger than the baseline amount. Debt held by the public would reach 262 percent of GDP in 2052, 77 percentage points higher than it is in CBO's extended baseline projections. That year, real GNP would be 4.4 percent lower than the baseline projection, and real GNP per person would be about $4,900 lower (in 2022 dollars).

How CBO Analyzed Outcomes Under the Illustrative Budgetary Paths

Fiscal policy underlying the three illustrative budgetary paths would differ significantly from fiscal policy under current law. For simplicity—and to avoid presuming which fiscal policies lawmakers might implement to alter the deficit—CBO analyzed the paths without specifying the tax and spending policies underlying them. In particular, CBO assumed that under all paths, transfer payments to people would be the same as they are under current law and that spending on federal investment would make the same contribution to future productivity and output that it makes in the agency's baseline projections. Under the paths in which revenues are lower, the effective marginal tax rates on labor and capital income are assumed to move proportionally for all households as revenues change to meet the specified targets.

Those changes in fiscal policy are projected to have effects on the economy that would feed back into the budget. CBO has not analyzed every way in which those changes would affect the economy in the long term. Instead, for the simplified analysis presented in this report, CBO considered these three effects:

- Effective marginal tax rates on labor income would be lower under the two paths in which revenues are reduced than they are in the extended baseline projections. Those lower rates would encourage people to work and save more and thus increase output.[6]

6. The effective marginal tax rate on labor income is the share (averaged among all taxpayers by assigning them weights proportional to their labor income) of an additional dollar of such income that is paid in federal individual income taxes and payroll taxes.

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- Effective marginal tax rates on income from most types of capital would also be lower under the paths in which revenues are reduced. Those lower rates would encourage saving and investment and thus further increase output.[7]
- Federal debt would be greater under all three paths than it is in the extended baseline projections. The increase in federal borrowing would draw money away from investment in capital goods and services and thus reduce the stock of private capital and output.

In addition to those three effects, CBO's analysis accounts for the short-term effects that the illustrative budgetary paths would have on the economy. Policies that increased spending or reduced revenues would boost overall demand for goods and services over the next few years, thereby increasing output and employment in the short term.

Changes to fiscal policy could also alter people's incentives in other ways, possibly resulting in significant long-term changes to the economy. For example, changes to tax policy might alter businesses' choices about how they were structured, and those choices might, in turn, alter the effective marginal tax rate on capital income. Similarly, changes in the tax treatment of mortgage debt would affect households' decisions about how much to save. Because this analysis is simplified, it does not account for any changes in individuals' or businesses' incentives or activities that might result from particular policy changes.

7. The effective marginal tax rate on capital income is the share of the return on an additional dollar of investment made in a particular year that will be paid in taxes over the life of that investment.

Appendix A: Assumptions and Methods Underlying CBO's Long-Term Budget Projections

The Congressional Budget Office's long-term budget projections are consistent with the baseline budget projections and economic forecast for 2022 to 2032 that the agency published in May 2022.[1] The long-term projections extend most of the concepts underlying the 10-year projections for an additional 20 years. Together, those projections constitute the agency's *extended baseline* projections.

CBO's extended baseline projections give lawmakers a point of comparison from which to measure the effects of policy options or proposed legislation. The projections are not predictions of budgetary outcomes. Rather, they represent the agency's assessment of future spending, revenues, deficits, and debt under these assumptions:

- Current laws affecting revenues and spending generally remain unchanged;
- Some programs—for example, the Supplemental Nutrition Assistance Program—are nevertheless extended after their authorizations lapse;
- Spending on Medicare and Social Security continues as scheduled regardless of the amounts in those programs' trust funds; and
- Discretionary spending follows the agency's baseline projection through 2032, after which time it transitions (over a five-year period) to grow at the rate of nominal gross domestic product. (For a summary of the assumptions about outlays and revenues that underlie CBO's extended baseline projections, see Table A-1.)

For years beyond 2032, the agency used a model with the following four components to integrate its demographic, economic, and long-term budget projections.[2]

- A *demographic model* was used to project the size of the population by age and sex.
- A *microsimulation model* was used to project annual changes in demographic characteristics and economic outcomes for a representative sample of the population and to project Social Security outlays beyond CBO's standard 10-year budget period.
- A *long-term budget model* was used to project federal outlays (except those for Social Security), revenues, deficits, and debt beyond CBO's standard 10-year budget period.
- A *model of economic growth* was used to simulate how demographic changes, economic factors, and fiscal policy would affect the U.S. economy and, in turn, the federal budget.[3]

Those four components interact in various ways. For example, the economic projections reflect how increases in spending and revenues in the extended baseline projections would affect the economy. In turn, the budget projections in the extended baseline projections reflect those economic effects.

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1. See Congressional Budget Office, *The Budget and Economic Outlook: 2022 to 2032* (May 2022), www.cbo.gov/publication/57950.

2. See Congressional Budget Office, *An Overview of CBOLT: The Congressional Budget Office Long-Term Model* (April 2018), www.cbo.gov/publication/53667.

3. See Congressional Budget Office, "CBO's Policy Growth Model" (April 2021), www.cbo.gov/publication/57017; and Robert W. Arnold, Chief, Projections Unit, Macroeconomic Analysis Division, Congressional Budget Office, "CBO's 10-Year Economic Forecast and How It Is Produced" (presentation at a seminar of the Congressional Research Service, April 26, 2018), www.cbo.gov/publication/53792.

Table A-1.

Assumptions About Outlays and Revenues Underlying CBO's Extended Baseline Projections

	Assumption
	Outlays
Social Security	As scheduled under current law[a]
Medicare	As scheduled under current law through 2032; thereafter, projected spending depends on the estimated growth rates of the number of beneficiaries, health care costs per beneficiary, potential GDP per person, and additional cost growth for Medicare (which is projected separately for various parts of the program and, by 2052, moves smoothly up to a rate of 0.1 percent for Part A, down to a rate of 0.2 percent for Part B, and down to a rate of 0.6 percent for Part D)[a]
Medicaid	As scheduled under current law through 2032; thereafter, projected spending depends on the estimated growth rates of the number of beneficiaries, health care costs per beneficiary, potential GDP per person, and additional cost growth for Medicaid (which is projected to move smoothly down to a rate of 0.6 percent by 2052)
Children's Health Insurance Program	As projected in CBO's baseline through 2032; thereafter, projected spending remains constant as a percentage of GDP
Subsidies for Health Insurance Purchased Through the Marketplaces	As scheduled under current law through 2032; thereafter, projected spending depends on the estimated growth rates of the number of beneficiaries and potential GDP per person, an additional indexing factor for subsidies, and additional cost growth for subsidies for health insurance purchased through the marketplaces (which is projected to move smoothly down to a rate of 1.0 percent by 2052)
Other Mandatory Spending	As scheduled under current law through 2032; thereafter, refundable tax credits are estimated as part of revenue projections, and the rest of other mandatory spending is assumed to decline as a percentage of GDP at roughly the same annual rate at which it is projected to decline between 2026 and 2030 in the agency's baseline projections published in March 2020 (those projections are the most recent projections that exclude the effects of the coronavirus pandemic)
Discretionary Spending	As projected in CBO's baseline through 2032; beyond that year, after a five-year transition period, discretionary spending would grow at the rate of nominal GDP
	Revenues
Individual Income Taxes	As scheduled under current law
Payroll Taxes	As scheduled under current law
Corporate Income Taxes	As scheduled under current law
Excise Taxes	As scheduled under current law[b]
Estate and Gift Taxes	As scheduled under current law
Other Sources of Revenues	As scheduled under current law through 2032; constant as a percentage of GDP thereafter

Data source: Congressional Budget Office.

The extended baseline projections, which generally reflect current law, follow CBO's 10-year baseline budget projections and then extend most of the concepts underlying those projections for an additional 20 years.

For CBO's most recent 10-year baseline projections, see Congressional Budget Office, *The Budget and Economic Outlook: 2022 to 2032* (May 2022), www.cbo.gov/publication/57950.

Additional cost growth (which was called excess cost growth in CBO's past reports) is the amount by which the growth rate of nominal health care spending per person (adjusted to remove the effects of demographic changes) exceeds the growth rate of potential GDP per person. Potential GDP is the maximum sustainable output of the economy.

GDP = gross domestic product.

a. Assumes the payment of full benefits as scheduled under current law, regardless of the amounts in the program's trust funds.

b. The exception to the current-law assumption applies to expiring excise taxes dedicated to trust funds. The Balanced Budget and Emergency Deficit Control Act of 1985 requires CBO's baseline to reflect the assumption that those taxes would be extended at their current rates. That law does not stipulate that the baseline include the extension of other expiring tax provisions, even if they have been routinely extended in the past.

Appendix B: CBO's Projections of Economic Variables

Overview

The Congressional Budget Office develops its assessment of the long-term outlook for the federal budget on the basis of its projections of economic variables over the next three decades.[1] The projections presented in this report are consistent with the baseline budget projections and the economic forecast for the 2022–2032 period that CBO published in May 2022.[2] Those projections reflect the assumption that current laws governing federal taxes and spending generally remain unchanged. (The agency's annual projections of economic variables through 2052 are included in this report's supplemental data, which are available at www.cbo.gov/publication/57971#data.)

Projections of federal budgetary outcomes depend on many economic variables. In this appendix, CBO describes and explains the projected growth of gross domestic product (GDP); labor force participation and labor force growth; other labor market outcomes (unemployment, average weekly hours worked, total hours worked, earnings as a share of compensation, the growth of inflation-adjusted earnings per worker, and the distribution of earnings among workers); capital accumulation and productivity; inflation; and interest rates.

CBO's projections of those variables reflect the agency's assessment of various economic and demographic developments, as well as the effects of monetary and fiscal policy on economic activity.

1. In previous versions of this report, the agency discussed projections of demographic trends along with its discussion of economic trends. This year, the demographic trends are instead covered in a companion report. See Congressional Budget Office, *The Demographic Outlook: 2022 to 2052* (July 2022), www.cbo.gov/publication/57975.

2. See Congressional Budget Office, *The Budget and Economic Outlook: 2022 to 2032* (May 2022), www.cbo.gov/publication/57950.

Gross Domestic Product

In CBO's projections, the average annual growth of real GDP (that is, GDP adjusted to remove the effects of inflation) slows from 1.9 percent in the first decade of the projection period (2022 to 2032) to slightly less than 1.6 percent in the second decade (2033 to 2042) to just over 1.5 percent in the third decade (2043 to 2052); see Table B-1. Those rates of growth are 0.6 to 0.9 percentage points lower than the average growth rate of 2.5 percent that has occurred for the past three decades. In the agency's current projections, real GDP grows slightly faster over the 2021–2051 period than the agency projected last year.

Real GDP per person is expected to increase at an average annual rate of 1.4 percent over the 2022–2052 period. Over the past 30 years, that measure has increased at an average annual rate of 1.5 percent. In the agency's projections, the average annual growth of real GDP per person falls from 1.5 percent in the first decade of the projection period to 1.2 percent in the second decade. In the third decade, growth in real GDP per person rises to 1.3 percent as population growth slows more than real GDP.

Nominal GDP is projected to grow at an average annual rate of 3.9 percent over the next 30 years, which is slower than the average growth rate over the past 30 years (4.5 percent). CBO projects that average annual growth in nominal GDP will slow from 4.4 percent over the first decade to 3.7 percent in the second decade and to 3.5 percent in the third decade. In the agency's current projections, nominal GDP grows faster over the 2021–2051 period than the agency projected last year.

Real GDP

The long-term growth of real GDP in CBO's forecasts is driven by the growth rate of real potential GDP (that is, the maximum sustainable output of the economy, adjusted to remove the effects of inflation). Over the next three decades, the growth of real potential GDP is

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Table B-1.

Average Annual Growth Rates for Economic Variables That Underlie CBO's Extended Baseline Projections, by Calendar Year

Percent

	1992–2021	2022–2032	2033–2042	2043–2052	Overall, 2022–2052
GDP					
Real GDP	2.5	1.9	1.6	1.5	1.7
Real potential GDP[a]	2.4	1.8	1.6	1.5	1.7
Potential labor force	0.9	0.4	0.3	0.3	0.3
Potential labor force productivity	1.5	1.5	1.3	1.2	1.3
Nominal GDP	4.5	4.4	3.7	3.5	3.9
Real GDP per person	1.5	1.5	1.2	1.3	1.4
Labor Force Participation Rate (Average annual value)	65.1	61.8	61.0	60.7	61.2
Labor Force	0.8	0.5	0.3	0.3	0.4
Unemployment (Average annual value)					
Unemployment rate	5.9	4.2	4.4	4.2	4.2
Noncyclical rate of unemployment[b]	5.0	4.4	4.1	3.9	4.1
Average Weekly Hours Worked	*	*	*	*	*
Total Hours Worked	0.8	0.6	0.3	0.3	0.4
Earnings as a Share of Compensation (Average annual value)	81	82	81	80	81
Real Earnings per Worker	1.4	0.7	0.9	0.9	0.8
Productivity					
Total factor productivity in the nonfarm business sector	1.3	1.0	1.1	1.1	1.1
Real GDP per hour worked	1.6	1.4	1.3	1.2	1.3
Inflation					
CPI-U	2.3	2.8	2.3	2.3	2.4
GDP price index	2.0	2.4	2.0	2.0	2.2
Interest Rates (Average annual value)					
Real rates					
On 10-year Treasury notes and the OASDI trust funds	1.7	0.7	1.7	2.3	1.5
Nominal rates					
On 10-year Treasury notes and the OASDI trust funds	4.0	3.4	4.0	4.5	4.0
On all federal debt held by the public (By fiscal year)[c]	4.2	2.5	3.4	4.0	3.3

Data source: Congressional Budget Office. See www.cbo.gov/publication/57971#data.

The extended baseline projections, which generally reflect current law, follow CBO's 10-year baseline budget projections and then extend most of the concepts underlying those projections for an additional 20 years.

Real values are nominal values that have been adjusted to remove the effects of inflation.

CPI-U = consumer price index for all urban consumers; GDP = gross domestic product; OASDI = Old-Age, Survivors, and Disability Insurance; * = between -0.05 percent and zero.

a. Potential GDP is the maximum sustainable output of the economy. The potential labor force is the labor force (that is, the number of people in the civilian noninstitutionalized population who are age 16 or older and who have jobs or who are available for work and are actively seeking jobs) adjusted to remove the effects of fluctuations in the business cycle. Potential labor force productivity is the ratio of real potential GDP to the potential labor force. The sum of growth in the potential labor force and growth in potential labor force productivity is equal to growth in real potential GDP.

b. The noncyclical rate of unemployment is the rate that results from all sources except fluctuations in aggregate demand. It reflects the normal turnover of jobs and mismatches between the skills of available workers and the skills necessary to fill vacant positions.

c. The interest rate on all federal debt held by the public equals net interest payments in the current fiscal year divided by debt held by the public at the end of the previous fiscal year.

expected to decelerate. Starting from an average annual rate of growth of 1.8 percent in the first decade of the projection period, that measure declines to slightly less than 1.6 percent in the second decade and then inches down to just over 1.5 percent in the third decade.

That deceleration reflects a gradual slowing of growth in the potential labor force (the labor force adjusted for fluctuations in the business cycle) and slower growth in potential labor force productivity (potential output per member of the potential labor force). Growth in potential labor force productivity is, in turn, driven by two key factors; total factor productivity, or TFP (real output per unit of combined labor and capital inputs in the nonfarm business sector), and capital accumulation per worker. Over the 30-year projection period, capital accumulation slows, primarily owing to the effect of increased federal borrowing on private investment.

In CBO's current 10-year economic forecast, the level of real GDP exceeds that of real potential GDP for several years, but then the growth rate of real GDP slows in relation to the growth rate of real potential GDP, in part because monetary policy gradually tightens. As a result, the level of real GDP falls below that of real potential GDP in 2026. By 2028, real GDP is 0.5 percent below real potential GDP, and that gap persists through 2052 and beyond.[3] Therefore, over the second and third decades of the projection period, real GDP and real potential GDP grow at the same annual rate in the agency's projections.

Nominal GDP

In CBO's forecast, growth in nominal GDP is determined by the growth of the GDP price index and the growth of real GDP. Projected growth in the GDP price index falls from an average annual rate of 2.4 percent in the first decade to 2.0 percent in the second and third decades. Slower growth in both the GDP price index and real GDP leads to a significant decline in the average growth of nominal GDP from the first decade to the second decade. Slowing growth of GDP between the second and third decades, however, is almost entirely because of lower growth in real GDP.

Changes in Projections of GDP Since Last Year

CBO's current projections of real GDP and nominal GDP are higher than last year's projections throughout the 30-year period. Faster growth of real GDP over the first two decades results from levels of investment that are projected to be stronger than CBO previously estimated and that lead to a larger stock of productive capital. For the third decade, the agency's projections of growth in nominal GDP, real GDP, and real potential GDP are similar to last year's projections, because a slight decrease in the growth of TFP offsets the effect of the larger stock of capital. In 2031, the level of real GDP is projected to be 1.1 percent higher in this year's projections than in last year's. By 2051, the level of real GDP is projected to be 1.8 percent greater than CBO expected last year. Compared with last year's projections of real GDP per person over the next three decades, this year's projections grow faster because real GDP grows slightly faster and growth in the U.S. population is slightly slower.

The agency's projections of nominal GDP are higher this year because CBO now expects much higher inflation in the GDP price index over the next few years and slightly faster growth in real GDP and real potential GDP in the first and second decades of the projection period. (For details, see Box C-1 on page 53.) By 2051, the level of nominal GDP is projected to be 9.3 percent higher than the agency projected last year.

Factors Affecting Projections of Potential GDP

The growth of potential GDP is determined by the growth of the potential labor force and of potential labor force productivity. Projected growth in potential labor force productivity, in turn, is determined by projections of various trends. Among those economywide trends are average weekly hours worked; investment and the accumulation of capital, such as structures and equipment, intellectual property products, and residential housing; and the growth of TFP in the nonfarm business sector.

The Labor Force Participation Rate and Labor Force Growth

In CBO's projections, the size of the labor force depends on the rates at which people in different demographic

3. That output gap reflects the agency's assessment that GDP falls short of potential GDP to a greater extent and for longer periods during and after economic downturns than actual output exceeds potential output during economic expansions. A recent study explains the existence of a persistent output gap by examining asymmetric fluctuations of the unemployment rate around the noncyclical rate of unemployment (that is, the rate that results from all sources except fluctuations in aggregate demand). See Stéphane Dupraz, Emi Nakamura, and Jón Steinsson, *A Plucking Model of Business Cycles,* Working Paper 748 (Banque de France, January 2020), https://tinyurl.com/1njkmzkf. CBO assessed the persistent output gap in an earlier report; see Congressional Budget Office, *Why CBO Projects That Actual Output Will Be Below Potential Output on Average* (February 2015), www.cbo.gov/publication/49890.

groups participate in the labor market and on the number of people in those groups. Since the mid-2000s, the overall rate of labor force participation (the rate for people age 16 or older) in the United States has declined substantially, driven predominantly by the aging of the population.[4] Because that aging is likely to continue, CBO expects the decline in participation to persist during the first half of the 30-year projection period before stabilizing in the second half of the period. As a result, the labor force is expected to grow more slowly than the number of people age 16 or older for the first two decades of the period and at roughly the same pace as the number of people age 16 or older in the third decade.

The agency's projections of the labor force participation rate (LFPR) and the size of the labor force are important factors for CBO's projections of other economic outcomes. For example, faster growth of the labor force would directly boost GDP growth. It would also cause private capital to accumulate faster, which would further boost the growth of GDP.

The Labor Force Participation Rate

The labor force participation rate is generally projected to decline as the effects of the aging population become more prominent in relation to the short-term effects of the expanding economy. The LFPR falls from 61.8 percent, on average, in the first decade to 61.0 percent in the second decade. As demographic shifts slow over time, the LFPR is expected to stabilize, averaging 60.7 percent in the third decade of the projection period.

Labor Force Growth

The labor force is expected to grow from 164 million people in 2022 to 181 million people in 2052. Growth in the labor force slows in CBO's projections, from 0.5 percent per year, on average, from 2022 to 2032 to 0.3 percent per year, on average, from 2043 to 2052. That change represents a significant slowdown from the pace of growth in earlier periods: For example, the average annual growth rate of the labor force was 1.2 percent during the 1990–2006 period and 0.6 percent during the 2010–2019 period.

Changes in Projections of the Labor Force Participation Rate and Labor Force Growth Since Last Year

CBO's current projections of the labor force participation rate are higher than last year's throughout the projection period. Even though lingering health concerns and issues related to the availability of child care and other in-home care (stemming from the coronavirus pandemic) reduced the agency's labor force projections in the near term, upward revisions to the agency's projection of the size of the prime-age population (people ages 25 to 54) more than offset those factors throughout the projection period.[5]

As a result of those upward revisions to the agency's projections of the prime-age population and labor force participation rates, CBO's current projections of the size of the labor force are about 0.5 percent larger, on average, for 2023 to 2051, compared with last year's projections.

Factors Affecting Projections of the Labor Force Participation Rate and Labor Force Growth

The projected decline in the overall labor force participation rate in the coming decades stems mainly from the aging of the population: People age 65 or older tend to participate in the labor force at lower rates than younger people do. In 2019, for example, the average participation rate was 82.5 percent among the civilian noninstitutionalized population ages 25 to 54, and it was 20.1 percent among those age 65 or older.[6] As members of the baby-boom generation started to turn 65 in the early 2010s, the share of people age 65 or older in the civilian noninstitutionalized population increased rapidly, growing from 16.3 percent in 2010 to 20.4 percent in 2019. (The baby-boom generation encompasses people born between 1946 and 1964.) In CBO's projections, the percentage of people age 65 or older continues to rise (reaching 25.2 percent by 2032) and averages 27.1 percent during the third decade of the projection period.

4. The labor force participation rate is the share of the civilian noninstitutionalized population age 16 or older that is working or actively seeking work.

5. Technical adjustments made in response to recent data from the Census Bureau account for most of the revisions to the population ages 25 to 54 since last year. See Bureau of Labor Statistics, *Adjustments to Household Survey Population Estimates in January 2022* (February 2022), https://go.usa.gov/xuDH6 (PDF, 73 KB).

6. The civilian noninstitutionalized population excludes people who are younger than age 16, members of the armed forces on active duty, and people in penal or mental institutions or in homes for the elderly or infirm.

To assess the importance of aging in CBO's projections of the labor force participation rate, the agency calculated what the rate would be if the age-and-sex composition of the population remained the same in each year of the projection period as it was in 2022. That adjusted LFPR would increase from 61.9 percent in 2022 to 64.6 percent in 2052. Because the sex composition of the population is projected to change only slightly over the next three decades, the analysis implies that the effect of the aging of the population is roughly equal to the difference between the unadjusted and adjusted rates.[7] The adjusted LFPR in 2052 (64.6 percent) is 3.9 percentage points higher than the unadjusted LFPR in that year (60.7 percent). Therefore, aging accounts for more than the 1.2 percentage-point decline in the unadjusted rate that CBO projects from 2022 to 2052.

In contrast to the aging of the population, CBO expects two long-term trends to boost participation in the labor force:

- The population is becoming more educated, and people with more education tend to participate in the labor force at higher rates than do people with less education.
- Increasing longevity is expected to lead people to continue working until increasingly older ages.

CBO expects those two trends to be mostly offset by other trends that will put downward pressure on the labor force participation rate:

- Members of each generation (particularly men) that followed the baby boomers—Generation X and the Millennial Generation—tend to participate in the labor force at lower rates than their predecessors did at the same ages. (One notable exception in later generations is women age 34 or younger, who participate in the labor force at higher rates than did baby-boomer women at the same ages. However, as those later generations of women have aged, their participation rates have also fallen below those of their predecessors.)
- The marriage rate is projected to continue to fall, and unmarried men tend to participate in the labor force at lower rates than married men.

In addition to the effects of those demographic trends, as people's income rises faster than inflation, more of their income is pushed into higher tax brackets through a process known as real bracket creep, raising their effective tax rates. Scheduled increases in tax rates and real bracket creep are projected to decrease participation in the labor force because people would earn less return on their labor.

Other Labor Market Outcomes

In addition to the rate of labor force participation and the size and growth of the labor force, CBO projects the unemployment rate, the average and total number of hours that people work, and various measures of workers' earnings. CBO regularly updates those projections to reflect revisions in historical data, reassessments of economic and demographic trends, and changes to the agency's analytic methods.

Unemployment

The unemployment rate is projected to gradually rise over the next few years. By 2028, it is projected to reach 4.5 percent, surpassing the noncyclical rate of unemployment.[8] From 2029 to 2052, the unemployment rate is expected to remain roughly one-quarter of one percentage point above the noncyclical rate of unemployment, a difference that is consistent with both the average historical relationship between the two measures and the projected gap of one-half of one percent between actual and potential GDP.

In CBO's projections, the noncyclical rate of unemployment declines gradually to 4.3 percent in 2032 and to 3.9 percent in 2052. That slow decline reflects the continuing shifts in the composition of the workforce toward older workers, who tend to have lower rates of unemployment (when they participate in the labor force), and away from less-educated workers, who tend to have higher ones. As the noncyclical rate of unemployment decreases, the actual unemployment rate also declines. By 2052, the actual rate is projected to reach 4.1 percent.

Average Weekly Hours Worked

Workers tend to work a different number of hours each week depending on their industry: For example,

7. The share of men and women in the population in 2022 is 49 percent and 51 percent, respectively.

8. The noncyclical rate of unemployment is the rate that results from all sources except fluctuations in aggregate demand, including normal turnover of jobs and mismatches between the skills of available workers and the skills necessary to fill vacant positions.

workers in manufacturing put in more than 40 hours per week, on average, whereas those in service industries typically work about 32 hours per week. Over the past few decades, as the share of workers employed in manufacturing has decreased and the share employed in service industries has increased, the average number of hours worked per week has declined for the economy as a whole. During the past decade, the shares of workers in the manufacturing and service industries have been largely stable. In CBO's assessment, future changes in the employment shares of different industries are unlikely to substantially affect the economywide number of average hours worked.

Some incentives under current tax law are projected to influence the average number of hours worked. Higher tax rates on individual income are set to take effect when, under current law, certain provisions of the 2017 tax act expire at the end of 2025. In CBO's projections, those higher rates slightly reduce the average number of hours worked beginning in 2026. In addition, effective tax rates on individual income are projected to rise because of real bracket creep. Given economic trends and current laws, CBO expects the average number of hours worked to decline slightly over the next 30 years. By 2052, the average worker is projected to work roughly half an hour less per week than he or she does today.

Total Hours Worked

Total hours worked are calculated on the basis of projections of the growth of the labor force, average hours worked, and unemployment. CBO estimates that total hours worked will increase at an average annual rate of 0.4 percent between 2022 and 2052—about half the average annual increase in total hours worked over the past three decades (0.8 percent). The deceleration in the growth of total hours worked mainly occurs because the working-age population is expected to grow more slowly in the future than it has over the past 30 years.

In CBO's projections, the average growth in total hours worked is 0.6 percent in the first decade and 0.3 percent in the second and third decades.

Earnings as a Share of Compensation

Workers' total compensation consists of taxable earnings and nontaxable benefits (such as employers' contributions to health insurance and pensions). Since 1960, the share of total compensation paid in the form of wages and salaries has declined—from 91 percent in that year to 82 percent in 2021—mainly because health insurance premiums have risen more quickly than total compensation.[9] Because CBO expects that the cost of health insurance will continue to rise faster than wages and salaries, the portion of compensation that workers receive as earnings is projected to decline, on average, to 81 percent over the 2022–2052 period, reaching 80 percent in 2052.

Growth of Real Earnings per Worker

Projections of prices, capital services (that is, the flow of productive services from the stock of capital assets), TFP, the amount of nonwage compensation (such as employment-based health insurance), and the average number of hours worked imply that real earnings per worker will grow by an average of 0.8 percent annually over the 2022–2052 period. That rate is less than the 1.4 percent average annual growth of real earnings per worker over the past 30 years.

Distribution of Earnings

In CBO's projections, earnings grow faster for high earners than for low earners, but the rate of growth for high earners is projected to be slower than it was in the past. The share of earnings accruing to workers in the top 10 percent of the earnings distribution, for example, increases at an average rate of 0.1 percentage point per year from 2022 to 2052. That growth is less than it was between 1978 and 2019, when the share of earnings accruing to workers in the top 10 percent of the distribution increased by 0.2 percentage points per year.

The distribution of earnings affects revenues from income taxes and payroll taxes (particularly Social Security taxes). Income taxes are affected by the earnings distribution because of the progressive rate structure of the individual income tax: People with lower income pay a smaller share of their earnings in taxes than people with higher income.

Social Security payroll taxes are levied only on earnings up to a certain annual amount (called the taxable maximum, which is $147,000 in 2022), so they also are affected by the earnings distribution. Because earnings have grown more for higher earners than for others, the portion of covered earnings on which Social Security payroll taxes are paid has fallen from 90 percent in

9. For more details, see Congressional Budget Office, *How CBO Projects Income* (July 2013), www.cbo.gov/publication/44433.

1983 to 84 percent in 2019.[10] The portion of earnings subject to Social Security taxes is projected to be 82 percent, on average, in the first and second decades of the projection period. It falls to 81 percent, on average, in the third decade and equals 81 percent in 2052. That decline in the share of covered earnings below the taxable maximum reduces CBO's projection of Social Security payroll taxes.

Changes in Projections of Other Labor Market Outcomes Since Last Year

Some of this year's projections are close to last year's. CBO's current projections of real earnings per worker grow at roughly the same rate as last year's projections over the 2021–2051 period, for instance. Other projections differ. For the unemployment rate, for example, CBO's current projections are substantially lower over the next five years and higher over the following five years than the rates the agency projected last year.

The near-term revision to the unemployment rate is mainly because recent data on unemployment indicate a much stronger labor market recovery than the agency anticipated, driven primarily by stronger economic growth, compared with last year's projected pace of recovery. Revisions for the latter part of the first decade stem from CBO's expectation that GDP will return to its historical relationship with potential output sooner than the agency forecast last year. As a result, the unemployment rate is expected to rise toward CBO's estimate of the noncyclical rate of unemployment sooner as well. That earlier rise in the unemployment rate accounts for the slight upward revision to the average unemployment rate over the 2027–2032 period. For the second and third decades, the unemployment rate is projected to be roughly the same as CBO projected last year.

In CBO's current projections, earnings as a share of compensation are slightly higher for the 30-year period than the agency projected last year. The higher projection is because the increase in taxable earnings relative to last year's projected amount is larger than the increase in nontaxable benefits.

10. Covered earnings are those received by workers in jobs subject to Social Security payroll taxes. Most workers pay payroll taxes on their earnings, although a small number of workers—mostly in state and local government jobs or in the clergy—are exempt. Earnings above the taxable maximum are also exempt from payroll taxes, and no additional Social Security benefits accrue to people who have those excess earnings.

CBO's projections of the earnings distribution also differ from last year's. The top 10 percent of earners in 2051 are now projected to make 45.7 percent of all earnings, slightly more than last year's projected amount (45.0 percent). CBO refined its method for calculating the distribution of earnings, leading to a larger share of earnings accruing to high-wage earners over the long run.

Capital Accumulation and Productivity

In addition to the labor force, two other factors directly affect CBO's projections of output. One is the accumulation of capital, which contributes a flow of services to production over a given time period. The second factor is growth in total factor productivity. In CBO's projection method, economywide growth is driven mainly by growth in the nonfarm business sector; for that reason, the productivity measure that contributes the most to economywide growth is TFP in the nonfarm business sector.

The combined effect of capital accumulation and productivity on real GDP can be accounted for by measuring growth in real GDP that is not attributable to growth in total hours worked. Growth in real GDP per hour worked is a measure of economywide productivity that CBO uses to calculate the combined effect of growth in capital and growth in productivity on real GDP growth.

Capital Accumulation

Accumulation of private capital depends primarily on growth of the labor force, private saving, international flows of capital, and federal borrowing. Over the next 30 years, CBO projects, private saving as a percentage of GDP will rise. In the agency's projections, however, those effects are more than offset by an increase in federal borrowing, which rises as a percentage of GDP over the same period, pushing up interest rates, reducing growth in private investment, and slowing the growth of the stock of private capital. The average annual real interest rate on 10-year Treasury notes (calculated by subtracting the rate of increase in the consumer price index from the nominal yield on those notes) is projected to be 1.5 percent in 2032, rising to 2.4 percent by 2052.

Total Factor Productivity

The annual growth of TFP in the nonfarm business sector is projected to average 1.1 percent through 2052. That projected growth rate is about 0.3 percentage points slower than the average annual rate of growth since

1950 (1.4 percent) and 0.2 percentage point slower than the average rate since 1990.

Recent analysis of historical trends in TFP growth suggests that projections for the next few decades should place greater weight on recent slower growth than on faster growth in the more distant past. Thus, although CBO projects that growth in nonfarm business TFP will accelerate from its unusually slow recent rate, the agency expects the future rate of growth to be slower than its long-term historical average.

Real GDP per Hour Worked

Given the projected slowdown in growth of the capital stock and TFP, average annual growth in real GDP per hour worked is expected to fall from 1.4 percent over the first decade of the projection period to 1.3 percent over the second decade and to 1.2 percent over the third decade. Potential labor force productivity is expected to follow a similar decline over the next 30 years.

Changes in Projections of Capital Accumulation and Productivity Since Last Year

CBO's projections of capital accumulation and growth of capital services over the 2022–2051 period are higher this year than last year, reflecting the agency's upward revision, on average, to its projections of fixed investment in nearly all types of capital. That revision was the result of updates to historical data on investment made over the past year.

CBO's projections of TFP growth in the nonfarm business sector are slightly lower over the 30-year period, reflecting modest revisions to historical trends in TFP growth that influence the agency's judgment about the potential for future growth. Stronger projected growth of capital services outweighs weaker projected growth of TFP, though, so CBO's projection of real GDP per hour worked is higher over the 30-year period than it was last year.

Factors Affecting Capital Accumulation and Productivity

Over the long term, in CBO's view, growth of the nation's stock of private capital (or the flow of private investment) will be driven by the growth of the labor force, private saving, international flows of direct foreign investment and financial capital, and federal borrowing. Private saving tends to move in the same direction as growth in the labor force, and both private saving and international capital flows tend to move in tandem with the rate of return on investment—a rate that measures the extent to which investment in the stock of capital results in a flow of income. In the agency's view, increased federal borrowing reduces the amount of funds available for private investment and puts upward pressure on interest rates. CBO's projections of private investment and the rate of return on investment are consistent with its projections of federal borrowing and interest rates on 10-year Treasury notes, which increase over the 30-year period.

Several developments support CBO's projections of slower growth in nonfarm business TFP over the next 30 years (at an average annual rate of 1.1 percent) relative to its average growth rate over the past 30 years (1.3 percent). One is improvement in labor quality—an aggregate measure of workers' skills that accounts for educational attainment and work experience—which CBO expects to slow over the next three decades. That measure is implicitly included in CBO's measure of TFP. The slower improvement in labor quality is expected to be partly offset by improvements in health and increases in life expectancy that will lead people (particularly highly educated people) to continue working past the ages at which previous generations retired, thus boosting the total stock of experience in the workforce.

Another development that affects nonfarm business TFP is federal investment in physical capital (such as transportation infrastructure and water and power projects), education and training, and research and development; that investment produces income and other benefits (higher productivity and greater efficiency, for example) for private businesses. In CBO's projections, federal discretionary spending declines to a much smaller percentage of GDP over the next decade than it has constituted in past decades. If federal investment spending generally remained unchanged as a share of discretionary spending, and if discretionary spending declined as a percentage of GDP, then federal investment spending also would decrease as a share of GDP. In CBO's assessment, such a reduction in federal investment spending would dampen TFP growth.[11]

11. For more details about how CBO estimates the macroeconomic effects of federal investment, see Congressional Budget Office, *Effects of Physical Infrastructure Spending on the Economy and the Budget Under Two Illustrative Scenarios* (August 2021), www.cbo.gov/publication/57327, and *The Macroeconomic and Budgetary Effects of Federal Investment* (June 2016), www.cbo.gov/publication/51628.

A third development that underlies slower growth in CBO's projections of nonfarm business TFP is climate change. In at least two ways, climate change affects CBO's projections of economic growth in future decades. First, climate change has had an effect on recent productivity trends, in the agency's assessment. Because those recent trends are used to project future trends, CBO's projections thus account for a portion of the effects of climate change. Second, the agency explicitly estimates a certain amount of additional impact from future changes in climate, which are projected to affect the growth of nonfarm business TFP. By CBO's estimate, TFP growth over the 2022–2052 period will be lower by about 0.02 percentage points per year, on average, owing to climate change; as a result, TFP will be about 0.7 percent less and GDP about 0.5 percent less in 2052 than they would have been without those additional effects.[12]

Inflation

CBO projects rates of inflation for two categories: prices of consumer goods and services and GDP prices (the prices of all goods and services included in GDP). Those rates affect nominal interest rates and, consequently, nominal interest payments on federal debt. They also affect income and the indexation of income tax brackets, thereby influencing tax revenues and federal expenditures. In this year's projections, inflation is notably higher in the first few years of the forecast than it was in last year's projections, though inflation over the longer term is about the same.

Prices of Consumer Goods and Services

One measure of consumer price inflation is the annual rate of change in the consumer price index for all urban consumers (CPI-U). Over the 2022–2052 period, that measure of inflation averages 2.4 percent in CBO's projections. That long-term rate is roughly the same as the average rate of inflation since 1992.

Using a chained measure of CPI-U inflation, CBO projects that prices will grow at a rate that is about 0.3 percentage points less than the annual increase in the traditional CPI-U, on average. The chained consumer price index for all urban consumers tends to grow more slowly than the traditional CPI-U, for two reasons. First, it uses a formula that better accounts for households' tendency to substitute goods and services with similar but cheaper alternatives when prices go up. Second, unlike the CPI-U, the chained CPI-U is little affected by statistical bias related to the sample sizes that the Bureau of Labor Statistics uses to compute each index. Historically, inflation as measured by the chained CPI-U has been about 0.25 percentage points lower, on average, than inflation as measured by the CPI-U. CBO's projections reflect that difference between the two measures.

GDP Prices

Over the 2022–2052 period, inflation in GDP prices, as measured by the annual rate of increase in the GDP price index, is projected to average 2.2 percent. That rate is slightly higher than the average annual growth in the GDP price index over the past 30 years (2.0 percent). The increase is mainly attributable to higher projected price growth over the next few years. The GDP price index grows at a different rate than the CPI-U because it is based on the prices of a different set of goods and services and is calculated using a different method.

Changes in Projections of Inflation Since Last Year

Inflation, as measured by growth in either the CPI-U or the GDP price index, is projected to be considerably higher from 2022 to 2025 than CBO projected last year. Data show that prices have been increasing more rapidly in many sectors of the economy than the agency had expected—largely because the combination of strong demand and restrained supply has created tighter markets for goods, services, and labor than the agency anticipated—and CBO has revised its projections upward as a result. CBO did not significantly revise its projections for 2026 to 2051, though. After 2025, inflation is projected to remain close to its long-term average. From 2032 to 2051, CBO projects, the CPI-U and the GDP price index will grow at roughly the same rates as the agency projected last year.

Factors Affecting Inflation

The Federal Reserve sets an explicit goal for the long-run average rate of inflation: 2.0 percent for the personal consumption expenditures (PCE) price index. From 2025 to 2052, the PCE price index is projected to grow at rates that are consistent with that goal. In CBO's projections, other rates of inflation, such as the CPI-U

12. CBO has drawn on studies that relate differences in regional economic activity and growth to differences in regional weather patterns, as well as studies of the economic effects of more-intense storms and rising sea levels. For more information, see Evan Herrnstadt and Terry Dinan, *CBO's Projection of the Effect of Climate Change on U.S. Economic Output*, Working Paper 2020-06 (Congressional Budget Office, September 2020), www.cbo.gov/publication/56505.

and the GDP price index, maintain growth rates that are consistent with those indexes' long-run relationship with the PCE price index. Over the 2026–2052 period, in CBO's projections, inflation in the CPI-U returns to a rate of growth that is slightly higher than that of the PCE price index, and inflation in GDP prices is roughly the same as inflation in the PCE price index.

Interest Rates

CBO projects the interest rates that apply to federal borrowing, including the rates on 10-year Treasury notes and special-issue Social Security bonds. It also projects the average interest rates on federal debt held by the public and on the bonds held in the Social Security trust funds. Those rates influence the cost of the government's debt and the balances of the trust funds.

Interest Rates on Notes, Bonds, and Debt

In CBO's projections, real interest rates on federal borrowing are lower in the future than they were, on average, between 1995 and 2004.[13] That historical period was chosen for comparison because it was a time when expectations of inflation were stable, when there were no severe economic downturns or significant financial crises, and when, according to CBO's estimates, monetary policy was, on average, neutral (that is, the real federal funds rate, which is the interest rate that financial institutions charge each other for overnight loans of their monetary reserves, was, on average, consistent with the economy's operating at full employment during that period).

The agency expects several factors, including slower growth of the labor force and slower growth of TFP relative to its pace in that historical period, to continue to put downward pressure on interest rates through 2052. That downward pressure is expected to be partly mitigated by upward pressure on interest rates from other factors, such as federal debt that is rising in relation to GDP.

The nominal interest rate on 10-year Treasury notes is projected to average 4.0 percent over the 2022–2052 period and to reach 4.6 percent in 2052. The real interest rate on those notes has averaged 0.5 percent since 2009; it is projected to be 1.5 percent in 2032 and to rise thereafter, reaching 2.4 percent in 2052. That projection for 2052 is 0.6 percentage points below the average real interest rate on 10-year Treasury notes over the 1995–2004 period (3.0 percent).

For all federal debt held by the public, the nominal interest rate averages 3.3 percent over the 2022–2052 period, in CBO's projections, and reaches 4.2 percent in 2052. The rate on that debt tends to be lower than the rate on 10-year Treasury notes because many of the Treasury's other securities—which, in addition to the 10-year notes, constitute the securities used to finance federal debt—mature over a shorter period and thus often have a lower interest rate. For example, the rate on 3-month Treasury bills is projected to be 1.2 percentage points lower, on average, than the rate on 10-year Treasury notes over the next decade. The average nominal interest rate on federal debt over the 2022–2052 period is projected to be 0.7 percentage points lower, on average, than the rate on 10-year Treasury notes. That difference is smaller than the projected gap of 0.9 percentage points between the two rates over the 2022–2032 period. The difference between the rates is larger before 2032 because federal debt up to that time includes more Treasury securities that were issued in the wake of the 2020 recession, when the Federal Reserve kept interest rates low to support the economic recovery.

The Social Security trust funds hold special-issue bonds that generally earn interest at higher rates than the average rate of interest on federal debt. Because interest rates have been low for most of the past decade, CBO projects that the average interest rate earned by all bonds held by the Social Security trust funds will be lower than the interest rate on bonds issued over the next decade. The average interest rate on all bonds, which CBO uses to calculate the interest those bonds earn for the trust funds, is projected to average 2.4 percent from 2022 to 2032, which is the year before the combined Social Security trust funds are projected to be exhausted.

Changes in Projections of Interest Rates Since Last Year

CBO's projections of interest rates are higher this year than they were last year. For 10-year Treasury notes and for newly issued bonds held in the Old-Age, Survivors, and Disability Insurance trust funds, nominal interest rates are projected to average 4.0 percent over the 2022–2051 period, up from last year's projection of 3.6 percent; real interest rates are projected to average 1.5 percent over the same period, slightly higher than last

13. For further details on the factors affecting CBO's interest rate projections, see Edward N. Gamber, *The Historical Decline in Real Interest Rates and Its Implications for CBO's Projections*, Working Paper 2020-09 (Congressional Budget Office, December 2020), www.cbo.gov/publication/56891.

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year's projected rate of 1.3 percent. For federal debt, the average nominal interest rate is projected to be 3.3 percent over that period, 0.2 percentage points higher than last year's projection. (For a description of the changes in the method CBO uses to calculate the average interest rate on debt, see Appendix D.)

For the first decade of the projection period, CBO expects real interest rates to be higher than it did last year. That is because the agency now anticipates that, in response to recent inflation that was higher than expected, the Federal Reserve will raise the target range for the federal funds rate more rapidly than CBO previously projected. Short-term interest rates will rise in response to that more aggressive tightening of monetary conditions. Long-term rates, which partly reflect the expected path of short-term rates, will also be higher than CBO projected last year.

Because the agency raised its projections of inflation less than it raised its projections of the rate on 10-year Treasury notes (particularly after 2025), this year's projections of real interest rates are significantly higher over the 2022–2031 period—averaging 0.8 percent, compared with last year's projection of 0.1 percent for the same period. The upward revision to CBO's projections of real interest rates falls off sharply after 2027 and is mostly eliminated by the middle of the second decade of the projection period. For the latter two decades of the projection period, real interest rates average 2.0 percent and are roughly the same, on average, as in last year's projections.

Factors Affecting Interest Rates

Interest rates are determined by many factors. To project those rates, CBO compares how the values of factors that affect them are expected to differ in the long term from their average values over the 1995–2004 period (the period CBO uses for historical comparisons).

In CBO's projections for the 2022–2052 period, several factors tend to reduce interest rates on government securities below their average from 1995 to 2004.

- The labor force is projected to grow more slowly than it did from 1995 to 2004. Slower growth in the number of workers tends to increase the amount of capital per worker in the long term, reducing the return on capital and, therefore, decreasing the return on government bonds and other investments.[14]
- The share of total earnings received by higher-earning households is expected to be larger in the future than it was during the 1995–2004 period. Higher-income households tend to save a greater portion of their income, so the difference in the distribution of earnings is projected to increase the total amount of savings available for investment, all other things being equal. As a consequence, the amount of capital per worker is projected to rise, and interest rates are expected to be lower.
- TFP in the nonfarm business sector is projected to grow more slowly in the future than it did from 1995 to 2004. For a given rate of investment, a lower rate of productivity growth reduces the return on capital and results in lower interest rates, all else being equal.

At the same time, in CBO's projections, several factors tend to boost interest rates on government securities above their average over the 1995–2004 period—but not enough to offset the factors pushing rates downward.

- In CBO's baseline projections, federal debt is much larger as a percentage of GDP than it was before 2004, reaching 110 percent by 2032 and 185 percent by 2052. The latter figure is nearly five times the average amount of debt over the 1995–2004 period. Greater federal borrowing tends to crowd out private investment in the long term, reducing the amount of capital per worker and increasing interest rates and the return on capital over time.
- Before the onset of the pandemic in 2020, the percentage of total income that is paid to owners of capital (known as capital's share of income) had been rising for the past three decades. That share is projected to decline from its current percentage over the next decade but to remain greater than its average in decades before 2020. The factors that appear to have contributed to capital's rising share of income (such as technological change and globalization) are likely to persist, keeping it above its average from 1995 to 2004. In CBO's estimation, a larger share of income accruing to owners of capital would directly

14. For more information about the relationship between the growth of the labor force and interest rates, see Congressional Budget Office, *How Slower Growth in the Labor Force Could Affect the Return on Capital* (October 2009), www.cbo.gov/publication/41325.

boost the return on capital and thus would increase interest rates.

- The ongoing retirement of members of the baby-boom generation and slower growth in the size of the labor force mean that there will be fewer workers in their prime saving years relative to the number of older people who are drawing down their savings. As a result, CBO estimates, the total amount of savings available for investment will be less than it otherwise would be (all else being equal), and that decrease is expected to reduce the amount of capital per worker and thereby push up interest rates. (CBO estimates that the effect of that decrease will only partially offset the positive effect of the larger share of earnings received by higher-income households, leaving a net increase in savings available for investment.)
- CBO anticipates that other countries will attract a greater share of global investment in coming decades than they did in the 1995–2004 period. As those countries recover from the global economic downturn caused by the pandemic, they will become increasingly attractive destinations for foreign investment. CBO projects that the increased appeal of investing in those countries will put upward pressure on interest rates in the United States.

Some of those factors are easier to quantify than others. For instance, the effects of labor force growth and rising federal debt on interest rates can be estimated from available data by using theoretical models and the findings of existing research. The extent to which other factors affect interest rates is more difficult to estimate. For example, the effect on interest rates of changes in the distribution of earnings is difficult to quantify.

In light of those sources of uncertainty, CBO relies not only on economic models and findings from the research literature but also on information from financial markets to guide its assessments of the effects of various factors on interest rates over the long term. The current rate on 30-year Treasury bonds, for example, reflects market participants' judgments about the path that interest rates on short-term securities will take 30 years from now.

Appendix C: Changes in CBO's Long-Term Budget Projections Since March 2021

Overview

The Congressional Budget Office's current budget projections for the 2022–2051 period differ from those it published in March 2021.[1] In both cases, the 30-year *extended baseline* projections follow the agency's 10-year projections and then extend most of the concepts underlying them for an additional 20 years. CBO's extended baseline projections are not predictions of budgetary outcomes. Rather, they give lawmakers a point of comparison from which to measure the effects of policy options or proposed legislation.

In CBO's current projections:

- *Spending* as a percentage of gross domestic product (GDP) is higher through 2034 and lower thereafter than it was in last year's projections.
- *Revenues* as a percentage of GDP are higher throughout the 2022–2051 period than they were in last year's projections.
- *Total deficits* as a percentage of GDP are generally larger through 2031 and smaller thereafter, compared with deficits in last year's projections. *Primary deficits* (that is, total deficits excluding net outlays for interest) as a percentage of GDP are now smaller throughout the projection period than they were last year.
- *Federal debt held by the public* rises from 98 percent of GDP in 2022 to 180 percent in 2051 (see Figure C-1). Such debt is lower in most years than the agency projected last year: 4 percentage points lower for 2022 and 22 percentage points lower for 2051.

CBO also changed its projections of amounts in the two Social Security trust funds—the Old-Age and Survivors Insurance (OASI) Trust Fund and the Disability Insurance (DI) Trust Fund. In current projections, those trust funds are exhausted later than was estimated last year.

Changes in Projected Spending

In CBO's extended baseline projections, total spending, which includes net outlays for interest, is higher as a percentage of GDP in 2022 than it was in last year's projections; such spending remains higher through 2034 but is lower from 2035 to 2051.[2] Noninterest spending as a percentage of GDP is higher in 2022 than it was in last year's projections but is generally the same thereafter.[3]

Projected spending on the major health care programs, measured as a percentage of GDP, is now less throughout most of the projection period than was estimated last year, mainly because of changes in the agency's method of developing projections for those programs and increases in its estimates of nominal GDP. Higher estimates of inflation account for most of the increase in CBO's current projections of nominal GDP (see Box C-1). (For a discussion of changes in the method underlying the agency's projections of federal spending on Medicare, see Appendix D.)[4]

1. See Congressional Budget Office, *The 2021 Long-Term Budget Outlook* (March 2021), www.cbo.gov/publication/56977. Because most of last year's projections ended in 2051, this appendix generally makes comparisons only through that year. For changes in projections of economic factors since 2021, see Appendix B of this report. For changes in projections of demographic factors since 2021, see Congressional Budget Office, *The Demographic Outlook: 2022 to 2052* (July 2022), www.cbo.gov/publication/57975. For further information about budgetary projections for the next decade, see Congressional Budget Office, *The Budget and Economic Outlook: 2022 to 2032* (May 2022), www.cbo.gov/publication/57950.

2. For an additional discussion of recent changes in CBO's budget projections for the first decade of the projection period, see Congressional Budget Office, *The Budget and Economic Outlook: 2022 to 2032* (May 2022), pp. 109–123, www.cbo.gov/publication/57950.

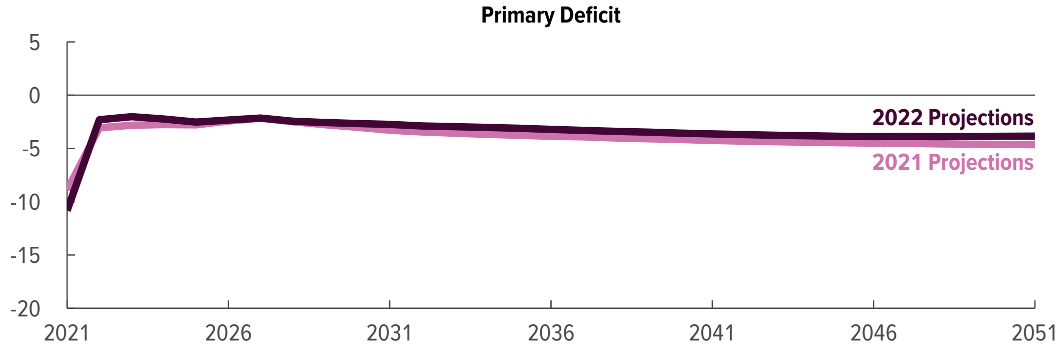
3. Noninterest spending, measured as a share of GDP, was 4 percentage points higher in 2021 than CBO projected it would be last year.

4. Spending on the federal government's major health care programs consists of spending on Medicare, Medicaid, and the Children's Health Insurance Program, as well as outlays to subsidize health insurance purchased through the marketplaces established under the Affordable Care Act and related spending.

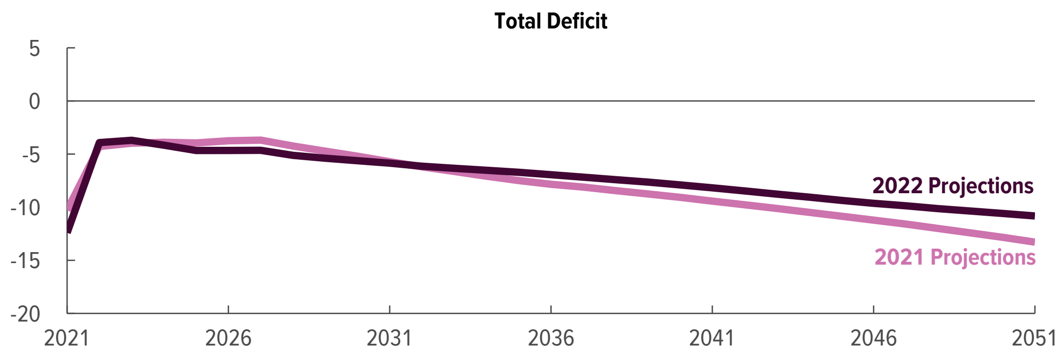
Figure C-1.

CBO's 2021 and 2022 Extended Baseline Projections of Deficits and Federal Debt Held by the Public

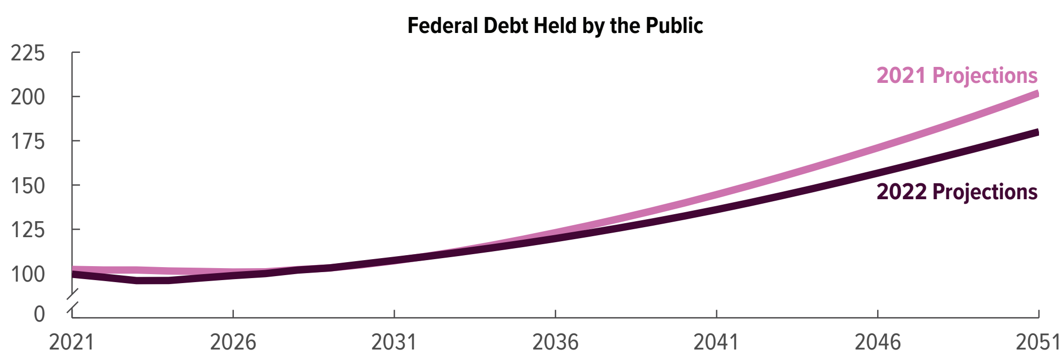
Percentage of GDP



In CBO's current projections, primary deficits as a percentage of GDP are smaller by 0.6 percentage points, on average, over the 2021–2051 period than in last year's projections.



CBO has generally increased its projections of total deficits in the near term but has decreased them over the long term.



Measured as a percentage of GDP, federal debt is now projected to be lower in most years than CBO projected last year.

Data source: Congressional Budget Office. See www.cbo.gov/publication/57971#data.

The extended baseline projections, which generally reflect current law, follow CBO's 10-year baseline budget projections and then extend most of the concepts underlying those projections for an additional 20 years.

Primary deficits exclude net outlays for interest.

GDP = gross domestic product.

Box C-1.

How Estimates of Inflation Affected CBO's Budget Projections

In the Congressional Budget Office's current projections, inflation, as measured by growth in either the consumer price index for all urban consumers or the gross domestic product (GDP) price index, is considerably higher from 2022 to 2025 than was projected last year. The agency did not significantly revise its projections of inflation for 2026 to 2051. Nevertheless, the effects of that higher projected inflation in the near term on the level of nominal GDP, revenues, and spending persist after 2025, when projected inflation falls to the rates in last year's projections. Those higher estimates of inflation also increased nominal interest rates paid on federal debt and net interest payments. (See Appendix B for an additional discussion of changes in CBO's economic forecast since last year.)

In CBO's assessment, higher projections of inflation in this year's economic forecast contributed to the decrease in current projections of federal debt held by the public, measured as a percentage of GDP, compared with last year's projections of such debt. It is, however, difficult to quantify the effects of those higher projections of inflation because inflation affects spending and revenues as well as the level of nominal GDP.

Higher estimates of inflation increased CBO's current projections of nominal GDP—which also reflect the faster growth of real GDP (that is, GDP adjusted to remove the effects of inflation)—compared with such projections last year. Nominal GDP is now 7.9 percent higher in 2022 and 9.3 percent higher in 2051 than was projected last year. For 2051, GDP prices (the prices of all goods and services included in GDP) are 7.2 percent higher, and real GDP is 1.8 percent higher, than the agency projected last year. The higher levels of nominal GDP mean that any amount of spending, revenues, deficits, or debt represents a smaller percentage of GDP than it otherwise would; thus, all else being equal, higher nominal GDP holds down the amount of debt in relation to the nation's output.

CBO did not analyze the effects of higher estimates of inflation on projections of revenues and spending for this report.[1] However, all else being equal, higher estimates of inflation led to higher estimates of taxable income, thereby increasing projections of tax revenues. Higher estimates of inflation also increased projections of noninterest spending, largely because the estimates raised cost-of-living adjustments for certain benefit programs (for example, Social Security) and increased prices for purchases of goods and services. Those changes counteract each other, but the net result is uncertain.

Higher estimates of inflation in the near term increased nominal interest rates in CBO's current projections, which elevated net interest costs in dollars. All else being equal, those higher net interest costs would result in larger budget deficits, pushing the debt that the Treasury issues to the public higher than was estimated in CBO's previous budget projections. Because higher inflation also increases nominal GDP, the effect of inflation on interest payments in relation to the size of the economy is unclear.

1. In March 2022, CBO provided an illustrative estimate of the effects of higher inflation and interest rates on its budget projections. In that example, revenue increases were roughly as large as increases in noninterest spending, so the resulting primary deficit did not differ much from the agency's projections. See Congressional Budget Office, *Budgetary Effects of Higher Inflation and Interest Rates* (March 2022), www.cbo.gov/publication/57868.

Projected discretionary spending, measured as a percentage of GDP, is now higher than estimated last year, mainly because newly enacted legislation increased the agency's projections of such spending over the first 10 years of the projection period; those projections establish the level of discretionary spending in the second and third decades of the projection period.[5]

In current projections, spending on Social Security as a percentage of GDP is slightly lower in all years than was projected last year. That lower spending is the result of offsetting factors: Although projections of nominal outlays are slightly higher than before (largely driven by the projected size of annual cost-of-living adjustments (COLAs) and increased projections of average wages), they are more than offset by higher projections of GDP. Projections of other mandatory spending are now slightly higher over the short term. Neither the projections of spending on Social Security nor the projections of other

5. Discretionary spending encompasses an array of federal activities that are funded through or controlled by appropriation acts. That category includes most defense spending, outlays for highway programs, and spending for many other nondefense activities, such as elementary and secondary education, housing assistance, international affairs, and the administration of justice.

Table C-1.

CBO's 2021 and 2022 Projections of Revenues, Outlays, Deficits, and Federal Debt Held by the Public in Selected Years

Percentage of Gross Domestic Product

	2022	2033	2043	2051
Revenues				
Individual income taxes				
2021 projections	8.8	9.4	9.9	10.3
2022 projections	10.6	9.8	10.3	10.7
Payroll taxes				
2021 projections	5.9	5.8	5.7	5.7
2022 projections	5.9	5.9	5.8	5.7
Corporate income taxes				
2021 projections	1.1	1.2	1.2	1.2
2022 projections	1.6	1.4	1.3	1.3
Other[a]				
2021 projections	1.5	1.1	1.2	1.3
2022 projections	1.4	1.2	1.3	1.3
Total Revenues				
2021 projections	**17.3**	**17.6**	**18.0**	**18.5**
2022 projections	**19.6**	**18.2**	**18.7**	**19.1**
Outlays				
Mandatory				
Social Security				
2021 projections	5.2	6.1	6.3	6.3
2022 projections	4.9	6.0	6.2	6.3
Major health care programs[b]				
2021 projections	5.7	7.3	8.6	9.4
2022 projections	5.8	7.0	8.2	8.7
Other[c]				
2021 projections	2.5	2.1	2.0	1.9
2022 projections	4.3	2.1	2.0	1.9
Subtotal, Mandatory				
2021 projections	13.4	15.6	16.9	17.6
2022 projections	14.9	15.1	16.5	17.0
Discretionary				
2021 projections	7.0	5.6	5.5	5.5
2022 projections	7.0	6.1	6.0	6.0
Net interest				
2021 projections	1.2	3.1	5.8	8.6
2022 projections	1.6	3.4	5.0	7.0
Total Outlays				
2021 projections	**21.6**	**24.2**	**28.2**	**31.8**
2022 projections	**23.5**	**24.6**	**27.4**	**29.9**

Continued

mandatory spending changed significantly over the long term since last year (see Table C-1).[6]

6. Other mandatory spending includes outlays for retirement programs for federal civilian and military employees, certain programs for veterans, certain refundable tax credits, the Supplemental Nutrition Assistance Program, and all other mandatory programs aside from Social Security and the health care programs described above.

Net outlays for interest total 1.6 percent of GDP in 2022—0.4 percentage points higher than in last year's projections because of higher interest rates. Such outlays remain higher through 2034 than was estimated last year, but for most of the second decade and for all of the third decade of the projection period, they are lower than previously estimated (see Figure C-2). That is because primary deficits are now projected to be smaller

Table C-1. Continued

CBO's 2021 and 2022 Projections of Revenues, Outlays, Deficits, and Federal Debt Held by the Public in Selected Years

Percentage of Gross Domestic Product

	2022	2033	2043	2051
Deficit				
2021 projections	**-4.3**	**-6.6**	**-10.1**	**-13.3**
2022 projections	**-3.9**	**-6.3**	**-8.8**	**-10.8**
Federal Debt Held by the Public				
2021 projections	**102**	**113**	**155**	**202**
2022 projections	**98**	**112**	**144**	**180**
Memorandum:				
Noninterest Spending				
2021 projections	20.4	21.1	22.4	23.2
2022 projections	21.9	21.2	22.4	22.9
Primary Deficit[d]				
2021 projections	-3.1	-3.6	-4.4	-4.6
2022 projections	-2.3	-3.0	-3.8	-3.8

Data source: Congressional Budget Office. See www.cbo.gov/publication/57971#data.

a. Consists of excise taxes, remittances to the Treasury from the Federal Reserve System, customs duties, estate and gift taxes, and miscellaneous fees and fines.

b. Consists of spending on Medicare (net of premiums and other offsetting receipts), Medicaid, and the Children's Health Insurance Program, as well as outlays to subsidize health insurance purchased through the marketplaces established under the Affordable Care Act and related spending.

c. Includes the refundable portions of the earned income tax credit, the child tax credit, and the American Opportunity Tax Credit.

d. Excludes net outlays for interest.

throughout the period, and the average interest rate on federal debt is now projected to be lower after 2034. (For a discussion of changes in the method underlying the agency's projections of the average interest rate on federal debt, see Appendix D.)

Changes in Projected Revenues

Compared with revenues in last year's projections, current projections of federal revenues as a percentage of GDP are higher throughout the 2022–2051 period—by 2.3 percentage points in 2022 and 0.6 percentage points in 2051 (see Figure C-3).[7] The major sources of revenues—that is, individual income taxes, payroll taxes, and corporate income taxes—are generally higher as a percentage of GDP throughout the projection period than was estimated last year.

The largest increases are in the projections of receipts of individual and corporate income taxes, whereas payroll tax receipts increased only slightly. In the near term, the increase in projected individual income tax receipts is a result of their recent unexplained strength; in the longer term, the increase is attributable to an upward revision to the agency's estimate of corporate business income taxed at the individual level. Projected receipts of individual income taxes and payroll taxes were also higher measured in nominal dollars, because of increases in estimates of factors that affect the size of the economy, including wages and salaries, proprietors' income, and corporate profits. Those changes had less of an impact on receipts as a percentage of GDP because they affected both revenues and GDP. CBO also increased its estimate of revenues from corporate income taxes as a percentage of GDP in the near term because recent receipts from such taxes have been stronger than expected. The agency has updated its modeling of corporate taxes and now estimates that a greater share of corporate profits will be taxable over the longer term.

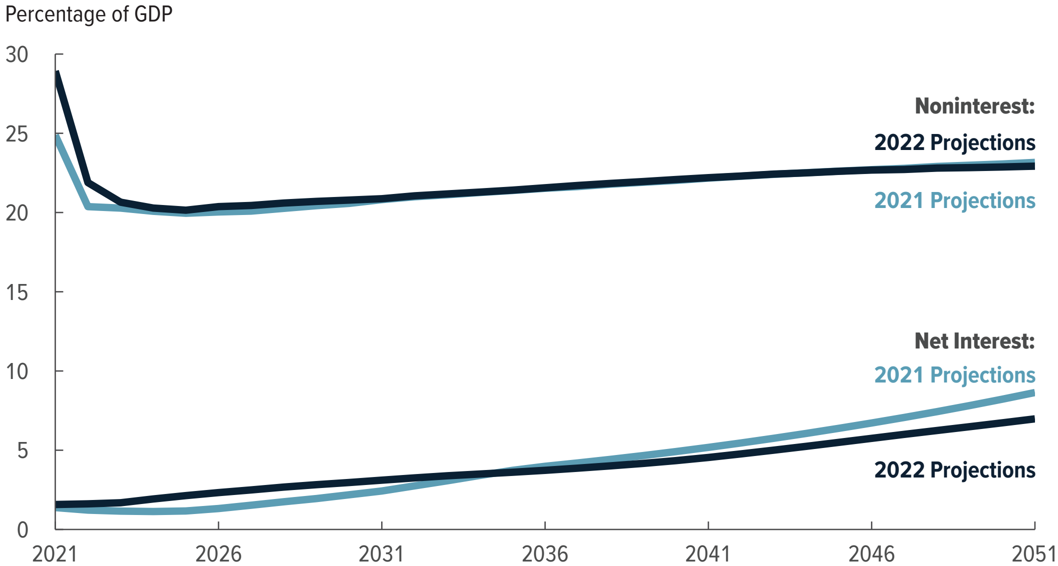
Changes in Projected Deficits and Debt

As a result of the changes to CBO's projections of spending, revenues, and GDP, projections of primary deficits as a percentage of GDP are now smaller throughout the projection period than they were last year. The current estimate of the primary deficit for 2022 is 2.3 percent of

7. Revenues, measured as a percentage of GDP, were 2.1 percentage points higher in 2021 than CBO projected they would be last year.

Figure C-2.

CBO's 2021 and 2022 Extended Baseline Projections of Outlays



In CBO's current projections, noninterest spending as a percentage of GDP is higher for 2022 than it was in last year's projections. Projections of such spending are generally the same after that year.

Net outlays for interest, measured as a percentage of GDP, are higher through 2034 than in last year's projections and lower thereafter.

Data source: Congressional Budget Office. See www.cbo.gov/publication/57971#data.

The extended baseline projections, which generally reflect current law, follow CBO's 10-year baseline budget projections and then extend most of the concepts underlying those projections for an additional 20 years.

GDP = gross domestic product.

GDP, which is 0.8 percentage points smaller than it was last year.[8] Projected primary deficits now average 2.4 percent of GDP from 2023 to 2031 and 3.5 percent from 2032 to 2051—0.3 percentage points and 0.6 percentage points smaller, respectively, than their averages over those periods in last year's projections.

However, as a result of upward revisions to net interest costs in the first decade of the projection period, projected total deficits as a percentage of GDP are now generally larger through 2031. Although the current estimate of the total deficit for 2022—3.9 percent of GDP—is 0.4 percentage points smaller than was projected last year, total deficits now average 4.9 percent of GDP from 2023 to 2031—0.5 percentage points larger than their average over that period in last year's projections.

As a percentage of GDP, total deficits are smaller in the long term than was projected last year. They average 8.4 percent of GDP over the 2032–2051 period—1.3 percentage points less than in last year's projections. The total deficit in 2051 is now estimated to be 10.8 percent of GDP—2.5 percentage points less than last year's estimate. Higher revenues, less spending on the major health care programs, and lower net outlays for interest in relation to the size of the economy pushed deficits lower as a percentage of GDP. Those changes were partially offset by higher projections of discretionary spending.

The factors that caused smaller projected deficits than CBO estimated last year also caused lower projections of federal debt held by the public. Measured as a percentage of GDP, such debt is projected to be lower in most years than the agency estimated last year. In current projections, that debt rises from 98 percent of GDP in 2022 to 180 percent in 2051; last year, CBO projected it would rise from 102 percent of GDP in 2022 to 202 percent in 2051.

Changes in Projected Amounts in the Social Security Trust Funds

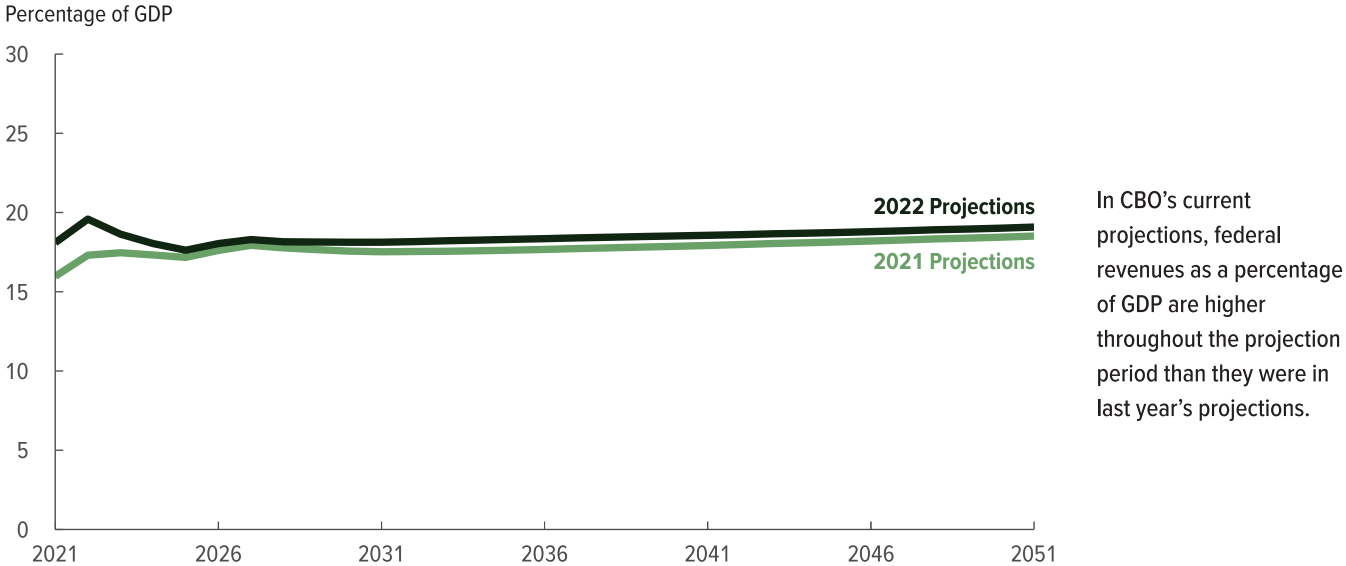
CBO projects that if current laws governing the Social Security program's taxes and benefits did not change, the OASI trust fund would be exhausted in calendar year 2033, and the DI trust fund would be exhausted in calendar year 2048.[9] Those dates are later than the

8. The primary deficit, measured as a share of GDP, was 1.9 percentage points larger in 2021 than CBO projected last year.

9. CBO expects to publish information later this year about its projections of outlays and income for Social Security over the next 75 years. For last year's long-term projections for Social Security, see Congressional Budget Office, *CBO's 2021 Long-Term Projections for Social Security: Additional Information* (July 2021), www.cbo.gov/publication/57342.

Figure C-3.

CBO's 2021 and 2022 Extended Baseline Projections of Revenues



Data source: Congressional Budget Office. See www.cbo.gov/publication/57971#data.

The extended baseline projections, which generally reflect current law, follow CBO's 10-year baseline budget projections and then extend most of the concepts underlying those projections for an additional 20 years.

GDP = gross domestic product.

agency projected last March, by 1 year and by 13 years, respectively. If the balances of the OASI and DI trust funds were combined, the funds would be exhausted in calendar year 2033, which is 1 year later than CBO projected last year.

Since last year, CBO has increased its estimates of income credited to the OASI trust fund from 2022 until the fund is exhausted in 2033 by 8.6 percent. The increase is mainly attributable to higher revenues from payroll taxes associated with the higher nominal GDP reflected in current projections. However, the agency has also increased its estimated expenditures from the fund, which are now 5.8 percent higher over that period than they were last year. Those increases stem primarily from higher estimates of COLAs through 2024 and higher projections of average wages, which offset the effect of fewer OASI beneficiaries through 2033 and slightly lower estimates of COLAs, on average, from 2025 through 2031. The projected increases in income more than offset the projected increases in expenditures from the fund, leading to the later estimate of when it would be exhausted.

In this year's projections, income credited to the DI trust fund from 2022 until it is exhausted in 2048 is higher by 12.7 percent than was estimated last year, mainly because of higher projected revenues from payroll taxes. The projected expenditures from the DI trust fund are lower from 2022 through 2035—in total, by 3.3 percent—than the agency estimated last year. CBO revised those projections of expenditures downward mainly because far fewer new beneficiaries have begun receiving benefits in recent months than was previously estimated, which led the agency to reduce its projection of the number of DI beneficiaries. Those downward revisions to the number of beneficiaries are partially offset by higher estimates of COLAs through 2024 and higher projections of average wages. The projections of increased income and (through 2035) decreased expenditures led to the later estimate of when the DI trust fund would be exhausted.

All told, CBO's projections of income credited to the combined OASDI trust funds are 8.8 percent higher over the 2022–2033 period than they were last year, and projections of expenditures are 4.6 percent higher. Because the increases in estimated income exceed the increases in estimated expenditures, CBO now anticipates that the combined trust funds would be exhausted 1 year later than the agency projected last year.

Appendix D: Changes to Methods Underlying Selected Long-Term Budget Projections

Overview

The Congressional Budget Office has changed the way it develops its long-term budget projections since publishing them last year; two of the changes have significant budgetary effects.[1] CBO refined its method of projecting the average nominal interest rate on federal debt held by the public in the second and third decades of the 30-year projection period. The agency also refined its estimate of a key parameter in the final year of the projection period (2052, in this year's projections)—specifically, the estimate of the growth in federal spending on health care above and beyond that attributable to demographic changes and to growth in potential gross domestic product (GDP) per person.[2] Refining that estimate, in turn, affects projections of federal spending on health care throughout the second and third decades of the projection period.

Projections of the Average Interest Rate on Federal Debt

In the past, to project the average nominal interest rate on federal debt beyond the standard 10-year budget period, CBO first calculated the difference between that rate and the nominal interest rate on 10-year Treasury notes as projected within that period. That difference was then held constant in the second and third decades of the projection period. (In last year's projections, the difference was calculated using rates from the 10th year of the projections underlying the agency's January 2020 forecast—the most recent forecast that excludes the effects of the coronavirus pandemic.) CBO developed that method when its only projections of nominal interest rates beyond the 10-year budget period were of rates for 10-year Treasury notes; now, the agency also projects nominal interest rates for Treasury securities of other maturities in the second and third decades of the projection period.

The method CBO now uses to project the average nominal interest rate on federal debt held by the public beyond the 10-year budget period is similar to the method it uses for projections within that period, but with some notable differences.[3] Projected interest payments *within* the 10-year budget period are generally based on the agency's projections of primary deficits (which exclude net outlays for interest), the stock of outstanding Treasury securities at the beginning of the projection period, the issuance of Treasury securities of different maturities, and interest rates on those securities of different maturities. Those projections reflect monthly calculations of interest rates. In the new method, projections of the average interest rate on federal debt *beyond* the 10-year budget period are based on those factors as well, but they reflect calculations that use quarterly data, and they do not include details about Treasury securities that mature in less than three months.

Using similar methods to project the average interest rate on federal debt for all three decades of the projection period makes the agency's projections of that rate more consistent throughout the period. Furthermore, when using the new method, debt issued in the past, which is subject to certain interest rates, is replaced with debt subject to the interest rates that CBO projects would occur in the future—a factor that the old method did not account for, because it used information from the 10th year of the projection period as the basis for the average interest rate on federal debt over the longer term.

1. For last year's projections, see Congressional Budget Office, *The 2021 Long-Term Budget Outlook* (March 2021), www.cbo.gov/publication/56977.

2. Potential GDP is the maximum sustainable output of the economy.

3. For a discussion of CBO's method of projecting interest rates in the first 10 years of the projection period, see Congressional Budget Office, *Federal Net Interest Costs: A Primer* (December 2020), www.cbo.gov/publication/56780.

Compared with the old method (all else being equal), the new one has resulted in lower projections of the average interest rate on federal debt, lower net outlays for interest as a share of GDP, and lower debt as a share of GDP in the second and third decades of the projection period. Accordingly, in CBO's current projections, the average interest rate on federal debt reaches 4.2 percent in 2052 instead of 4.6 percent using the old method. Net outlays for interest are 7.2 percent of GDP that year instead of 7.9 percent (see Figure D-1). And the current projection of federal debt held by the public in 2052 is 185 percent of GDP instead of 194 percent.

Projections of Federal Spending on Health Care

CBO's new method of projecting federal spending on health care beyond the 10-year budget period is similar to the method used last year but with two important differences. First, the agency refined its estimate of additional cost growth at the end of the 30-year projection period. (Additional cost growth is the amount by which the growth rate of nominal health care spending per person, adjusted to remove the effects of demographic changes, exceeds the growth rate of potential GDP per person.)[4] That new estimate consequently leads to changes in projections of spending on Medicare in the last two decades of the projection period. Second, the estimates of additional cost growth in Medicare Parts A and B now reflect CBO's expectation that certain provisions of current law will cause federal spending on various aspects of health care to grow more slowly than spending on health care overall.[5]

Estimate of Additional Cost Growth in Health Care Overall

In the past, CBO developed its long-term estimate of additional cost growth in the health care sector, and in Medicare more narrowly, by choosing a parameter for the end of the projection period on the basis of historical patterns. To refine that estimate in this year's projections, the agency separately assessed the effects of three factors on the growth of spending on health care in 2052.[6]

- *Growth in real national income per person* has been—and, in CBO's estimation, will continue to be—the most significant factor in the growth of spending on health care. The agency projects that in 2052, that factor would account for just over half of the rate of additional cost growth in the health care sector.
- *Increasing medical prices* have been—and, in CBO's estimation, will continue to be—another significant factor in the growth of spending on health care. The agency projects that in 2052, such increases would account for slightly less than half of the rate of additional cost growth in the health care sector.
- *Changes in out-of-pocket spending for health care* have historically been an important factor in the growth of spending on health care. However, CBO projects that, under current law, the out-of-pocket share of national health expenditures would not change over the 30-year projection period. That is, the agency does not expect changes in out-of-pocket spending to affect additional cost growth in the health care sector in 2052.

CBO reduced its estimate of additional cost growth in federal spending on health care because of its assessment of historical trends. Although the growth rate of such spending has varied over time, it has generally been declining, the agency estimates. For instance, additional cost growth in Medicare averaged 1.1 percent from 1985 to 2017 but averaged about –0.1 percent from 2005 to 2017.

CBO's estimate of additional cost growth in health care overall in 2052 is 0.6 percent. As they have in previous extended baseline projections, the rates of additional cost growth in this year's projections move linearly from their rates at the end of the 10-year budget period—as determined by the method of projecting such rates in

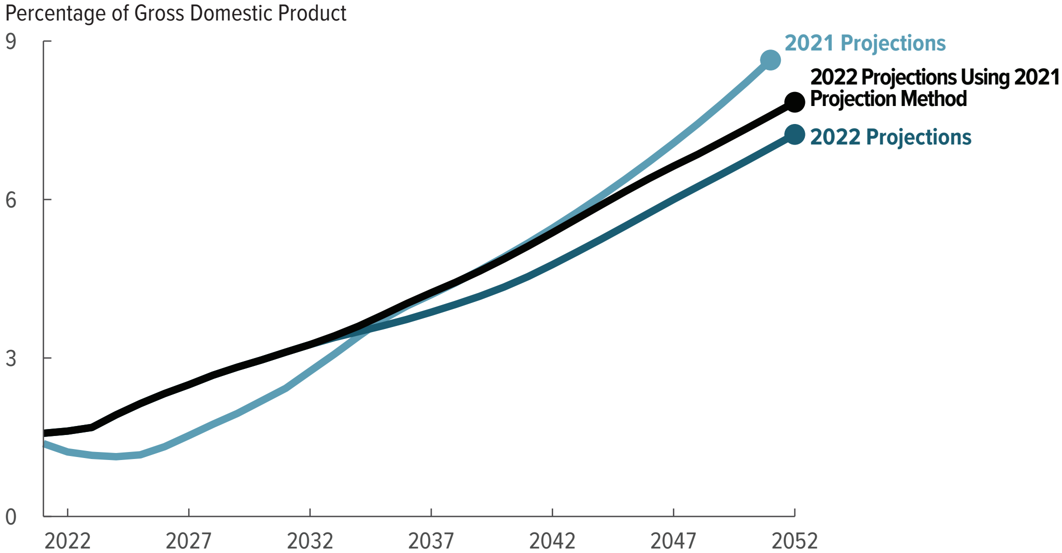
4. In CBO's past reports, the term "excess cost growth" was used instead of "additional cost growth" to describe the increase in such spending.

5. Medicare is the most significant contributor to growth in federal spending on health care over the 2032–2052 period. This appendix therefore focuses on a discussion of the agency's projections of spending on Medicare in the extended baseline. For a discussion of the agency's projections of spending on Medicare for the 2022–2032 period, see Congressional Budget Office, *The Budget and Economic Outlook: 2022 to 2032* (May 2022), www.cbo.gov/publication/57950.

6. To refine its estimate of additional cost growth in the health care sector, CBO essentially used the same method that the Centers for Medicare & Medicaid Services' Office of the Actuary uses to produce the 75-year projections of Medicare spending for its annual report to the Congress. Within that framework, CBO uses its own estimates of key parameters: an income-technology elasticity of 1.27, an insurance elasticity of –0.20, and a price elasticity of –0.55. For a discussion of the methods underlying projections by the Office of the Actuary, see Centers for Medicare & Medicaid Services, "The Long-Term Projection Assumptions for Medicare and Aggregate National Health Expenditures" (accessed May 16, 2022), https://tinyurl.com/msfjx6te (PDF, 1.3 MB).

Figure D-1.

Net Outlays for Interest Using Old and New Projection Methods, 2021 to 2052



CBO's current projection of net outlays for interest in 2052 is 0.6 percentage points lower than it would have been had the agency not refined its method of estimating the average nominal interest rate on federal debt held by the public.

Data source: Congressional Budget Office. See www.cbo.gov/publication/57971#data.

that period—to estimated rates at the end of the 30-year projection period.

Estimate of Additional Cost Growth in Medicare Part D

In CBO's current projections for 2052, additional cost growth in Medicare Part D is 0.6 percent; in last year's projections, it was 1.0 percent at the end of the 30-year projection period.[7] (CBO estimates that additional cost growth in spending on Medicaid and private health insurance premiums would also be 0.6 percent in 2052, down from 1.0 percent in last year's projections.) In the agency's view, additional cost growth in Medicare Part D at the end of the 30-year projection period would be the same as such growth in the health care sector overall. That is because the health care system in the United States will be integrated to such a degree over the long term that spending growth in most parts of the system will be affected by common factors, such as changes in physicians' practices and the development and diffusion of new medical technologies.

Estimates of Additional Cost Growth in Medicare Parts A and B

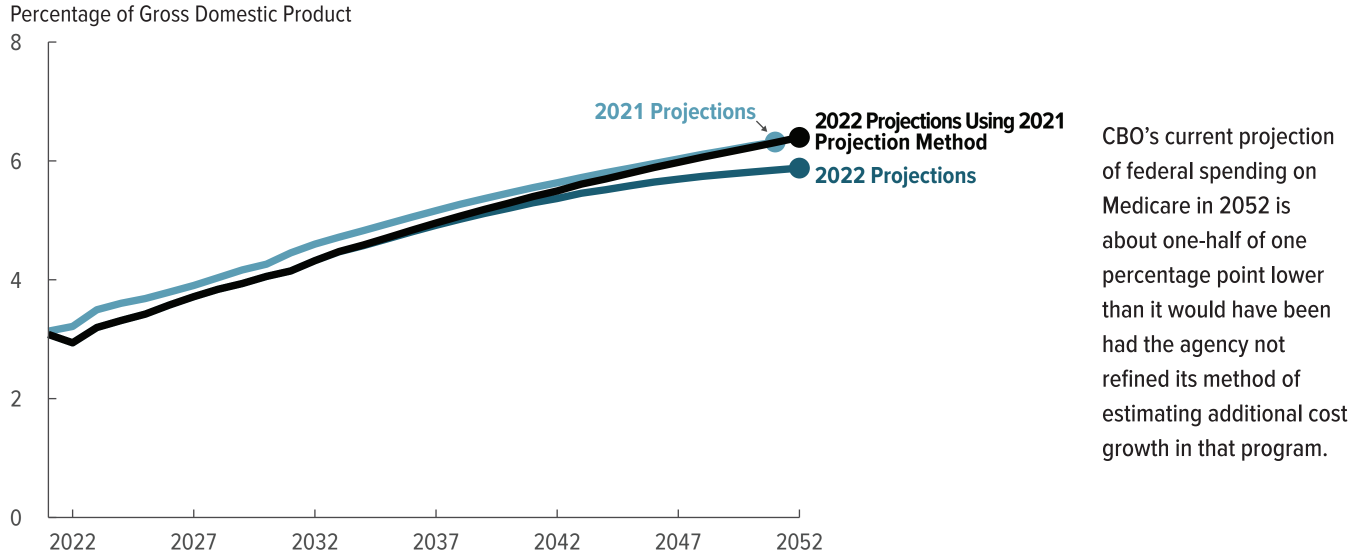
In CBO's current projections for 2052, additional cost growth is 0.1 percent in Medicare Part A and 0.2 percent in Medicare Part B. In last year's projections, both of those rates were 1.0 percent at the end of the 30-year projection period. The agency expects additional cost growth in Medicare Parts A and B to be lower than such growth in Medicare Part D (and in the health care sector overall) because of the way prices in Parts A and B are determined. Under current law, in Parts A and B, the prices of labor, goods, and services are adjusted to account for gains in private nonfarm business productivity (the ability to produce the same output using fewer inputs, such as hours of labor).[8] Because of expected gains in productivity, the increase in prices paid to providers would be less than they otherwise would be. In the agency's assessment, that would slow the growth in the use of Medicare Parts A and B by a small amount. That expectation largely stems from the agency's view that lower prices would cause some providers to decline to treat patients insured under Parts A or B and might also reduce providers' incentives to adopt innovative services and technologies.

7. Part D is Medicare's optional prescription drug benefit, which is delivered through private-sector companies. Part A primarily covers services provided by hospitals and other facilities, and Part B covers physicians' and other outpatient services. Part C of Medicare (known as Medicare Advantage) specifies the rules under which private health care plans can assume responsibility for, and be paid for, providing benefits covered under Parts A and B.

8. See Centers for Medicare & Medicaid Services, *Methodology for Projecting Total Factor Productivity for the Private Nonfarm Business Sector* (March 2022), https://tinyurl.com/36c4d654 (PDF, 144 KB).

Figure D-2.

Spending on Medicare Using Old and New Projection Methods, 2021 to 2052



Data source: Congressional Budget Office. See www.cbo.gov/publication/57971#data.

Additional cost growth is the amount by which the growth rate of nominal health care spending per person (adjusted to remove the effects of demographic changes) exceeds the growth rate of potential gross domestic product (GDP) per person. Potential GDP is the maximum sustainable output of the economy.

Changes in Projections Attributable to the New Method of Estimating Additional Cost Growth

The new method of estimating additional cost growth in Medicare results in lower projections of federal spending on that program from 2037 to 2052 (see Figure D-2). In CBO's current projections, spending on Medicare (net of offsetting receipts, which are mostly premiums paid by enrollees) reaches 5.9 percent of GDP in 2052—lower than the 6.4 percent that would have resulted from using estimates of additional cost growth derived from the agency's previous method. The current projection of federal spending on health care overall in 2052 (comprising spending on Medicare, net of premiums and other offsetting receipts, and on Medicaid, the Children's Health Insurance Program, and marketplace subsidies) is also lower than it would have been using the previous estimate of additional cost growth: 8.8 percent of GDP instead of 9.4 percent. And the current projection of federal debt held by the public in 2052 is 185 percent of GDP instead of 190 percent that would result from using the previous method.

List of Tables and Figures

Tables

Figures

About This Document

This volume is one of a series of reports on the state of the budget and the economy that the Congressional Budget Office issues each year. It builds on the 10-year budget and economic projections that CBO released on May 25, 2022. In keeping with CBO's mandate to provide objective, impartial analysis, the report makes no recommendations.

Overseen by Molly Dahl and prepared with guidance from Devrim Demirel, Edward Harris, John Kitchen (formerly of CBO), John McClelland, Julie Topoleski, and Jeffrey Werling, the report represents the work of many analysts at CBO. Jordan Trinh prepared the visual summary. Molly Dahl wrote Chapter 1 in collaboration with John Kitchen and with contributions from Daniel Crown, Sebastien Gay, Joseph Kile, Kerk Phillips, and John Seliski. Molly Dahl wrote Chapter 2 in collaboration with Kathleen Burke and with contributions from Xinzhe Cheng and Jordan Trinh. Aaron Betz wrote Chapter 3 with contributions from Edward Gamber, Chandler Lester, Jeffrey Schafer, and Robert Shackleton (formerly of CBO). Daniel Crown wrote Chapter 4 in collaboration with Kerk Phillips and with a contribution from Damir Cosic. Molly Dahl compiled Appendix A. Aaron Betz authored Appendix B with contributions from Damir Cosic, Daniel Crown, Edward Gamber, Chandler Lester, Jeffrey Schafer, and Robert Shackleton. Molly Dahl and Charles Pineles-Mark prepared Appendix C. Molly Dahl prepared Appendix D with contributions from Yiqun Gloria Chen (formerly of CBO), Michael Cohen, Grace Hwang, Kyoung Mook Lim, Michael McGrane, and Jordan Trinh.

Barry Blom, Stuart Hammond, Noah Meyerson, Eamon Molloy, Lisa Ramirez-Branum (formerly of CBO), Dan Ready, Sarah Sajewski, Emily Stern, and Robert Stewart contributed to the analysis in this report with guidance from Christina Hawley Anthony, Chad Chirico, Elizabeth Cove Delisle, Theresa Gullo, Leo Lex, Paul Masi, and Sam Papenfuss.

The long-term budget simulations were coordinated and prepared by Charles Pineles-Mark along with Xinzhe Cheng, Damir Cosic, Daniel Crown, Kyoung Mook Lim, and Jordan Trinh.

Edward Harris and Joshua Shakin coordinated the revenue simulations, which were prepared by Kathleen Burke, Paul Burnham, Madeleine Fox, Nathaniel Frentz, Shannon Mok, Omar Morales, Tess Prendergast, Kurt Seibert, Jennifer Shand, Ellen Steele, and James Williamson.

Robert Arnold coordinated the macroeconomic projections, which were prepared by Grace Berry, Aaron Betz, Yiqun Gloria Chen, Daniel Fried, Edward Gamber, Ron Gecan, Mark Lasky, Junghoon Lee, Chandler Lester, Vinay Maruri, Michael McGrane, Christine Ostrowski, Jeffrey Schafer, John Seliski, and Robert Shackleton.

Daniel Crown developed the population projections.

Jordan Trinh coordinated the fact-checking process, which he contributed to along with Nicholas Abushacra, Grace Berry, Kyoung Mook Lim, Omar Morales, and Lucy Yuan.

Mark Doms, Jeffrey Kling, and Robert Sunshine reviewed the report. Christine Bogusz, Scott Craver, and Bo Peery edited it, and Casey Labrack and R. L. Rebach prepared the text for publication and created the graphics. Nicholas Abushacra, Grace Berry, Daniel Crown, Kyoung Mook Lim, Jordan Trinh, and Lucy Yuan prepared the supplemental information files. The report is available at www.cbo.gov/publication/57971.

CBO seeks feedback to make its work as useful as possible. Please send comments to communications@cbo.gov.

Phillip L. Swagel
Director
July 2022

FAA AEROSPACE FORECAST

Fiscal Years 2022-2042

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Forecast Highlights (2022–2042)

The Russian invasion of Ukraine and ensuing war in 2022 occurred after this forecast was prepared and therefore it does not reflect impacts from those events. However, those impacts are already being felt and may worsen significantly depending on the extent, severity and duration of the war. Already, flights that normally traverse Russian and Ukrainian airspace are rerouting, resulting in longer flight times and higher fuel and crew costs. Next, fuel prices spiked as some countries halted imports of oil from Russia, a major global supplier. Higher energy costs for American consumers may combine with higher food costs as other exports such as for wheat and fertilizer from the region are also curtailed. Higher fuel costs can be passed on to consumers in the form of higher ticket prices, thus directly restraining air travel demand, but higher prices for both food and fuel also stretch consumer wallets, leaving less for discretionary travel. Finally, depending on the progression of the war, consumer confidence may weaken, increasing caution and financial conservatism.

Since its deregulation in 1978, the U.S. commercial air carrier industry has been characterized by boom-to-bust cycles. The volatility that was associated with these cycles was thought by many to be a structural feature of an industry that was capital intensive but cash poor. However, the great recession of 2007-09 marked a fundamental change in the operations and finances of U.S Airlines. Since the end of the recession in 2009, U.S. airlines revamped their business models to minimize losses by lowering operating costs, eliminating unprofitable routes, and grounding older, less fuel-efficient aircraft. To increase operating revenues, carriers initiated new services that customers were willing to purchase and started charging separately for services that were historically bundled in the price of a ticket. The industry experienced an unprecedented period of consolidation with three major mergers in five years. The results of these efforts were impressive: 2019 marked the eleventh consecutive year of profitability for the U.S. airline industry.

The outbreak of the COVID-19 pandemic in 2020, however, brought a rapid and cataclysmic end to those boom years. Airline activity and profitability tumbled almost overnight and without the financial and competitive strength built up during the boom, airlines would have faced even greater challenges. As it was, they were able to slash capacity and costs, and then, relying on their balance sheets, credit ratings and value inherent in their brands, to raise capital through borrowing and restructuring fleets allowing them to withstand the period of losses. Although several small regional carriers ceased operations in 2020, no mainline carriers did. Cargo activity was one of few bright spots as it surged, boosted by consumers purchasing goods to enhance time spent at home as necessitated by the pandemic, and by surface transportation disruptions caused by worker shortages due to COVID-19 illnesses.

By the middle of 2021, conditions and the outlook had brightened considerably. With the arrival of spring, the introduction of vaccines, and the lifting of some local restrictions, leisure travel began rebounding. Favored destinations remained concentrated in outdoor recreation spots, whether beach or mountain, and some recorded traffic levels higher than in 2019. The emergence of the

COVID-19 variants in the second half of the year paused the recovery but generally didn't reverse it. Two new low-cost carriers were formed and one regional carrier that ceased operations in 2020 was reborn. By the third quarter, industry profitability was nearing the breakeven point.

The business modifications necessitated by the downturn will shape the industry for years to come, long after the recovery is complete. Primarily, airlines will be smaller having retired aircraft and encouraged voluntary employee separations. Fleets, however, become younger and more fuel-efficient as retirements targeted the oldest and the least efficient aircraft. As airlines carry high levels of debt, capital spending and investment will be restrained which in turn holds back future growth. And even the unbundling of services took a small step backwards as carriers eliminated change fees for all but Basic Economy tickets.

In the medium-term, airlines will be focused on trying to foretell the recovery in demand and position themselves to meet it. To date, that demand recovery has been extremely uneven across markets and population segments, driven by COVID-19 case counts, vaccinations, governmental restrictions and the degree of pent-up demand experienced by consumers and businesses. While domestic leisure traffic has led the recovery, domestic business travel is expected to gain momentum in 2022. International activity generally lags domestic as individual country experience with the pandemic is varying and shifting so widely.

Long-term, the strengths and capabilities developed over the past decade will become evident again. There is confidence that U.S. airlines have finally transformed from a capital intensive, highly cyclical industry to an industry that can generate solid returns on capital and sustained profits.

Fundamentally, over the long-term, aviation demand is driven by economic activity, and a growing U.S. and world economy provides the basis for aviation to grow. The 2022 FAA forecast calls for U.S. carrier domestic passenger growth over the next 20 years to average 4.7 percent per year. This average, however, includes double-digit growth years in 2022 and 2023, as activity climbs out from a very low base. Following the recovery period, trend rates resume with average growth through the end of the forecast of 2.6 percent. Domestic passengers are forecast to return, on an annual basis, to 2019 levels in 2023. Oil prices averaged $55 per barrel over the five years ending in 2021 but are forecast to rise to $75 per barrel in 2022 (again, as forecast prior to the war in Ukraine) before rising steadily to $87 by the end of the forecast period.

Just as U.S. economic activity drives domestic demand for air transport, foreign economic activity affects international travel demand. And as virtually all countries took actions to contain COVID-19, those same actions resulted in economic patterns that are similar to those in the U.S. with sharp declines in 2020 followed by strong rebounds that began in 2021. The variation of economic performance across countries depends on their relative strength as the pandemic began but is also dependent on the severity of their experience with COVID-19 as well as the stringency of their responses. Europe saw sharp economic declines in 2020, consistent with its relatively high level of infections and numerous lockdowns that overwhelmed a tepid level of baseline economic growth. Many Asian countries, on the other hand, saw only mild downturns as they took swift and strong actions to control the virus early in the pandemic but also began the year with relatively strong economic growth. For most countries, economic growth rates settle back to their long-run trends in about 2023.

System traffic in revenue passenger miles (RPMs) is projected to increase by 5.7 percent a year between 2022 and 2042. Domestic RPMs are forecast to grow 4.8 percent a year while International RPMs are forecast to grow significantly faster at 8.8 percent a year, largely due to the steep declines in 2020 and 2021 that brought RPM to just 31 percent of 2019's level – about half that of domestic RPM. Thus, these figures are boosted by several years of high growth rates during the recovery after which the annual rates return to more moderate long-term trends. The strong growth rates return system RPM, on an annual basis, to 2019 levels in 2024, with domestic RPM returning a year earlier and international RPM also recovering in 2024. System capacity as measured by available seat miles (ASMs) is forecast to grow somewhat slower than RPM during the recovery period as airlines seek to restore load factors but, subsequently, ASM grow in line with the increases in demand.

The FAA expects U.S. carrier profitability to remain under pressure for several years due to lower demand and competitive fare pressures. As carriers return to levels of capacity consistent with their fixed costs, shed excess debt, and yields stabilize, consistent profitability should return. Over the long term, we see a competitive and profitable aviation industry characterized by increasing demand for air travel and airfares growing more slowly than overall inflation, reflecting growing U.S. and global economies.

The general aviation (GA) sector was less affected by the COVID-19 crisis than the airlines. Private aviation continues to attract those who can afford while the pandemic continues. At the lower end of the industry, new comers to private flying included student, private and commercial pilots, joining the existing GA pilot population. The long-term outlook for general aviation thus is promising, as growth at the higher-end offsets continuing retirements at the traditional low end, mostly piston-powered part of the sector. The active GA fleet is forecast to increase by just 0.1 percent between 2022 and 2042, after recording a slight increase of 0.1 percent in 2021 from the year before, and is essentially unchanged from its 2019 level. The turbine aircraft fleet, including rotorcraft, did not experience a decline between 2019 and 2020, and is estimated to have increased slightly between 2020 and 2021; while the total of piston fleet (single and multi-engine pistons, light-sport aircraft, and piston rotorcraft) declined by 3.8 percent between 2019 and 2020 and is estimated to have fallen by 0.6 percent in 2021 from the previous year. While steady growth in both GDP and corporate profits results in continued growth of the turbine and rotorcraft fleets, the largest segment of the fleet – fixed wing piston aircraft will continue to shrink over the forecast period, just to be offset by the growing turbine fleet. Despite the marginal growth of the active GA fleet between 2020 and 2042, the number of GA hours flown is projected to increase by 31.4 percent from 2020 to 2042 (an average of 1.2 percent per year), as growth in turbine, rotorcraft, and experimental hours more than offset a decline in fixed wing piston hours. When the period of 2022 to 2042 is compared, the total hours flown by the GA aircraft is forecast to increase by an average of 1.0 percent per year, after declining by 12.0 percent between

2019 and 2020, and recovering partially, with a growth of 4.0 percent in 2021 from the previous year.

With the expected robust air travel demand growth between 2022 and 2026 due to the U.S. economy recovering from the impact of COVID, we expect increased activity growth that has the potential to increase controller workload. Operations at FAA and contract towers are forecast to grow 1.5 percent a year over the forecast period (FY2022-42) with commercial activity growing at approximately five times the rate of non-commercial (general aviation and military) activity. The recovery in U.S. airline activity from the COVID downturn is the primary driver. The U.S. commercial aviation sector has been hit by the pandemic much harder than the non-commercial sector. The pent-up demand is expected to drive the commercial operations back to the pre-COVID level by 2023, hence leading to the stronger growth in the commercial sector. In particular, large and medium hubs will see much faster increases than small and non-hub airports, largely due to the commercial nature of their operations.

Review of 2021

Although conditions in 2021 remained bleak, there was definite improvement from the previous year as the turmoil and uncertainty from COVID-19 began to diminish. Businesses began to reopen, employment growth stabilized, and consumer spending rebounded, supported by fiscal and monetary stimulus. Air passenger travel picked up, air cargo surged, and tower operations rose for both the air carrier and general aviation segments. UAS activity grew solidly and commercial space launches surged in 2021, both of which had expanded in 2020.

U.S. commercial aviation began the year on the back foot but saw solid movement along the path of recovery as the year progressed, while COVID-19 remained the limiting factor. TSA checkpoint throughput had come off the bottom by the end of the previous year but only improved to about 40 percent of 2019's level at the start of 2021. With the rollout of vaccinations in the spring, however, throughput rose steadily to about 80 percent of 2019's level by mid-summer. Then, the emergence of COVID-19 variants (Delta in late summer and Omicron in the final weeks of the year) hampered further recovery and throughput ended the year about where it was in the summer. The main source of strength throughout the year was from leisure travelers, both to domestic and short-haul international destinations, primarily in the Latin region. In the business segment, activity picked up although not to the same extent as in the leisure segment as many employees remained on work-from-home status and meetings, conferences and trainings were either conducted virtually or forgone.

Airlines responded aggressively to these shifts in demand, seeking to match capacity with changes in timing, markets and segments. According to the Bureau of Transportation Statistics (BTS), airline employment rose in ten months of the year to average an increase of 3,000 jobs per month. At year end, employment was 40,000 higher than in 2020 even though it remained 19,000 lower than in 2019. Airlines increased staffing to enable them to offer more flights to more, and generally smaller, destinations as leisure travelers were eager to escape pandemic restrictions. Airlines assisted by adding capacity to outdoor locales, particularly to beaches in the south and mountains in the west. International destinations in the Latin region also saw especially heavy activity with available seat miles (ASM) in the fourth quarter exceeding those in 2019.

As reflected by the TSA throughput figures, demand for air travel in 2021 began to recover. In FY2021, system traffic as measured by revenue passenger miles (RPMs) grew 3.3 percent from the previous year while system enplanements rose 9.0 percent. Domestic RPMs were 13.1 percent higher while enplanements were up 9.7 percent. International RPMs, however, fell 28.8 percent although enplanements rose by 1.4 percent, a consequence of busy short-haul Latin markets. The system-wide load factor was 68.5 percent, down a percentage point from the FY2020 level.

System nominal yields fell again in 2021. In domestic markets, all carriers, whether they normally targeted the leisure segment or not, focused on that price-sensitive segment, adding capacity and lowering fares to attract revenue. The result was a 12.9 percent drop in nominal yields. International yield, however, declined just 4.5 percent as demand was constrained more by travel restrictions than by price.

With the pickup in activity during the year, financial results improved as well. Data for FY2021 shows that the reporting passenger carriers[1] had a combined operating loss of $26.1 billion compared to an average profit over the five years ending in FY2019 of $22.1 billion. However, this obscures improvement over the course of the year that shows quarterly losses gradually declining and ending the fiscal year with a loss of under $200 million – far better than the $10 billion average loss of the previous six quarters.

The general aviation industry partially recovered from its decline in 2020 with an increase of 7.4 percent in deliveries of U.S. manufactured aircraft in 2021, with pistons slightly up by 0.5 percent (in fact, fixed-wing single engine piston aircraft deliveries were up by 2.3 percent) and turbines up by 16.6 percent. Global billings increased by 7.7 percent to $21.6 billion (still down by 8.2 percent from its 2019 level (Statistics for the U.S. billings were not available as of the publication date of this report).

Total operations in 2021 at FAA and contract towers increased by 7.4 percent compared to 2020 (down by 10.5 percent from 2019). Air carrier activity increased by 4.1 percent, while air taxi operations were up 7.1 percent. General aviation activity increased by 9.1 percent and military activity was up by 6.8 percent. Activity at large and medium hubs rose by 2.3 percent and 5.0 percent, respectively, while small and non-hub airport activity rose by 8.8 percent in 2021 compared to the prior year.

[1] Includes network carriers (Alaska Airlines, American Airlines, Delta Air Lines, and United Air Lines) and low cost carriers (Allegiant Air, Frontier Airlines, JetBlue Airways, Southwest Airlines, Spirit Air Lines, and Sun Country Airlines).

Glossary of Acronyms

Acronym	Term
ANG	FAA Office of NextGen
ARP	FAA Office of Airports
ASMs	Available Seat Miles
AST	FAA Office of Commercial Space Transportation
ATO	FAA Air Traffic Organization
ATP	Air Transport Pilot
AUVSI	Association for Unmanned Vehicle Systems International
BVLOS	Beyond Visual Line of Sight
CAPS	COA Application Processing System
CBP	Customs and Border Patrol
CFR	Code of Federal Regulations
COAs	Certification of Authorizations
CORSIA	Carbon Offsetting and Reduction Scheme for International Aviation
CRS	Commercial Resupply Services
CY	Calendar Year
DARPA	Defense Advanced Research Projects Agency
DHS	Department of Homeland Security
DoD	Department of Defense
DoE	Department of Energy
DoI	Department of Interior
FAA	Federal Aviation Administration
FY	Fiscal Year
GA	General Aviation
GAMA	General Aviation Manufacturers Association
GC	Grand Challenge
GDP	Gross Domestic Product
ICAO	International Civil Aviation Organization
IFR	Instrument Flight Rules
IMF	International Monetary Fund
ISS	International Space Station
LAANC	Low Altitude Authorization and Notification Capability
LCC	Low Cost Carriers
LSA	Light Sport Aircraft
IUAS	Large Unmanned Aircraft System(s)
NAS	National Airspace System
NASA	National Aeronautics and Space Administration
NDAA	National Defense Authorization Act
NOTAM	Notices to Airmen
NPRM	Notice of Public Proposed Rulemaking
PCE	Personal Consumption Expenditure
PDARS	Performance Data Analysis and Reporting Systems
RAC	Refiners' Acquisition Cost
RLV	Reusable Launch Vehicle
RP	Remote Pilot
RPA	Remote Pilot Authorization
RPMs	Revenue Passenger Miles

RTMs	Revenue Ton Miles
sUAS	Small Unmanned Aircraft System(s)
SpaceX	Space Exploration Technologies Corp.
TRACON	Terminal Radar Approach Control
TRB	Transportation Research Board
TSA	Transportation Security Administration
UAM	Urban Air Mobility
UAS	Unmanned Aircraft System(s)
UASFM	UAS facility maps
USD	United States Dollar
VFR	Visual Flight Rules

Acknowledgements

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APO Websites

- Forecasts and Statistical publications — http://www.faa.gov/data_research/aviation_data_statistics/
- APO databases — http://aspm.faa.gov

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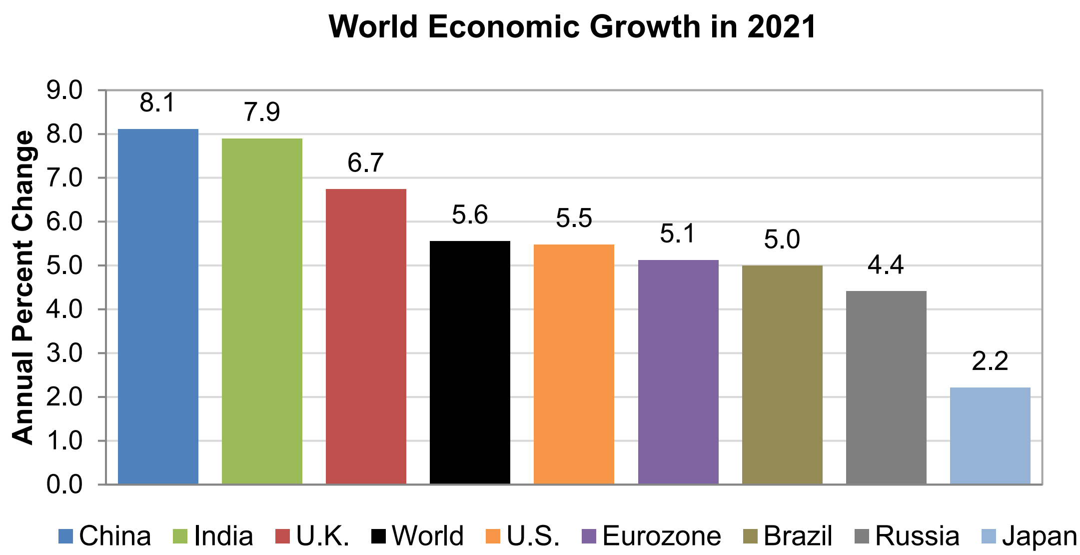
FAA Aerospace Forecasts Fiscal Years 2022-2042

Economic Environment

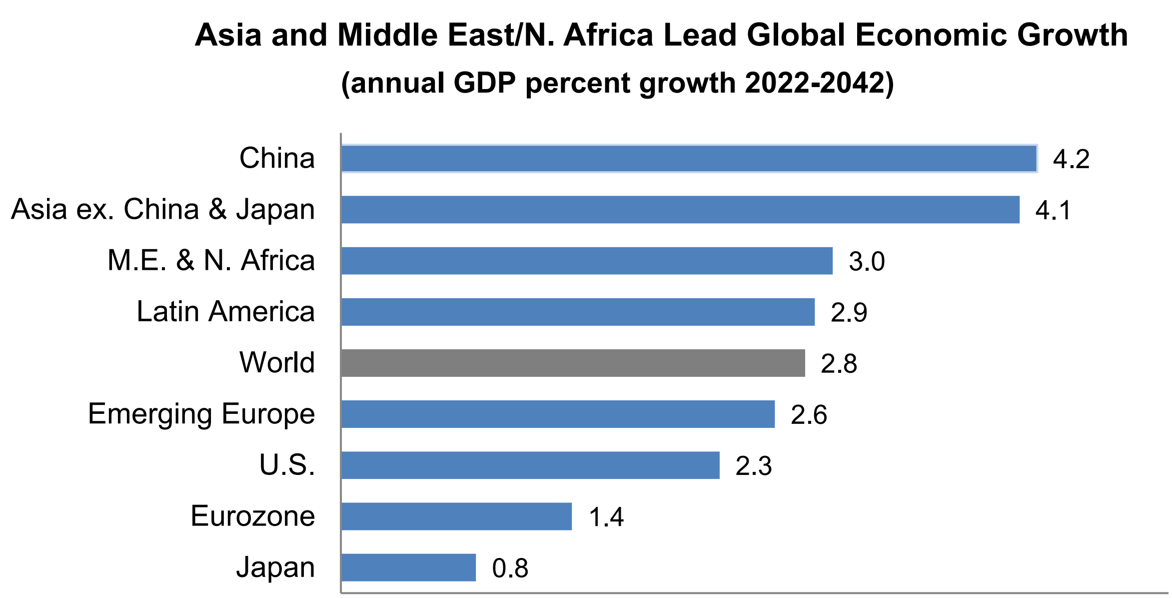
In 2021, global real GDP expanded sharply as countries began to recover from the worst of the economic effects of COVID-19. After falling 3.5 percent in 2020, GDP surged by 5.6 percent in 2021, a rate not seen since the early 1970s. Despite this high rate of growth, the level of GDP is not expected to return to its pre-pandemic path until about the middle of the decade. The recovery was supported by widespread fiscal stimulus, the availability of COVID-19 vaccines and the revival of consumer spending that had been curtailed in 2020. Moving into 2022 and 2023, countries are expected to shift their foci to dealing with COVID-19 as an endemic disease, to fiscal restraint, to rising interest rates and to reducing inflation, all of which contribute to moderating GDP growth in the coming years.

In the U.S., real GDP growth slows from 5.5 percent in 2021 to 4.3 percent in 2022 and 2.9 percent in 2023 as the effects of COVID-19 relief measures wear off, consumer spending normalizes and interest rates rise. Compared to the U.S., real GDP growth in the Eurozone will be somewhat slower in the near- and medium-term at 3.7 percent in 2022 and 2.2 percent in 2023. Aggressive deficit reduction efforts, high energy costs and supply chain disruptions all dampen growth in the near-term followed by continued slowing toward the area's trend rate. In Japan, the recovery was somewhat delayed by stringent COVID-19 control measures and increased cases in the second half of 2021, resulting in real GDP growth rates that rise in 2022 before receding in 2023. Some of the near-term strength will be due to increased exports, particularly autos, as supply chain disruptions fade. Although China's growth remained positive in 2020 and jumped to 8.1 percent in 2021, the country's zero-COVID policy tamps down growth in 2022 and 2023 to 5.5 percent, or slightly below its trend rate. Additionally, exports slow as global consumer spending shifts out of goods and back to services. In efforts to support growth, the government is easing monetary policy and boosting infrastructure investment. In other large emerging markets, Brazil provided large fiscal stimulus causing growth to surge in 2021 but then fall back sharply in 2022 as that stimulus was withdrawn. Further constraining growth, Brazil's central bank hiked interest rates sharply in an effort to rein in the country's high inflation. Russia, like Brazil, began raising interest rates in 2021 to counter inflation, thus restraining GDP growth. On the other hand, the energy sector, consumer spending and investment activity are expected to counterbalance that restraint.. While India's pandemic stimulus spending has been relatively modest, in the medium-term its growth will be supported by favorable demographics including strong consumer spending from growing middle-income households.



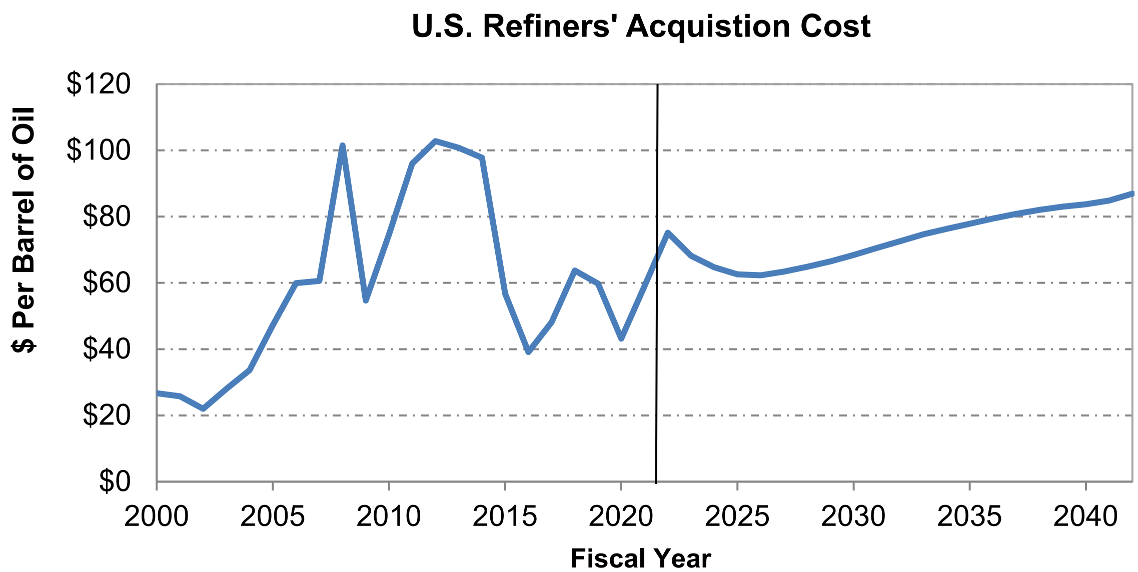
Source: IHS Markit

IHS Markit forecasts world real GDP to grow at 2.8 percent a year between 2022 and 2042. Emerging markets, at 3.9 percent a year, are forecast to grow above the global average but at lower rates than in the early 2000's. Asia (excluding Japan), led by India and China, is projected to have the fastest growth followed by Africa and Middle East, Latin America, and Eastern Europe. Growth in the more mature economies (1.8 percent a year) will be lower than the global trend with the fastest rates in the U.S. followed by Europe. Growth in Japan is forecast to be very slow at 0.8 percent a year reflecting deep structural issues associated with a shrinking and aging population.



Source: IHS Markit, Dec 2021 World Forecast

Accompanied by the rebound in global economic activity was increased demand for oil in 2021, pushing prices up. After dropping from about $60 per barrel to $43 in 2020, the price returned to $60 and is projected to continue up to $75 in 2022. Again, however, this forecast does not include the impacts of the Russian invasion of Ukraine, which will likely push prices even higher in 2022 and beyond. Over the long-run, IHS Markit expects the price of oil to increase due to growing global demand and higher costs of extraction. IHS Markit forecasts U.S. refiner's acquisition cost of crude to rise to $87 per barrel at the end of the forecast horizon.



Source: IHS Markit

U.S. Airlines

Domestic Market

Mainline and regional carriers[2] offer domestic and international passenger service between the U.S. and foreign destinations, although regional carrier international service is confined to the border markets in Canada, Mexico, and the Caribbean.

Over the coming years, the commercial air carrier industry will be focused on recovering from the devastating consequences of the COVID-19 pandemic. First, carriers will work to identify and assess demand as it returns fitfully from the lows reached in 2020. Next, and as load factors rise, the focus will shift to adding capacity back into networks in a cautious and deliberate manner. With demand beginning to approach 2019 levels, balance sheets strengthen allowing carriers to adopt the more customary longer-term strategies.

[2] Mainline carriers are defined as those providing service primarily via aircraft with 90 or more seats. Regionals are defined as those providing service primarily via aircraft with 89 or fewer seats and whose routes serve mainly as feeders to the mainline carriers.

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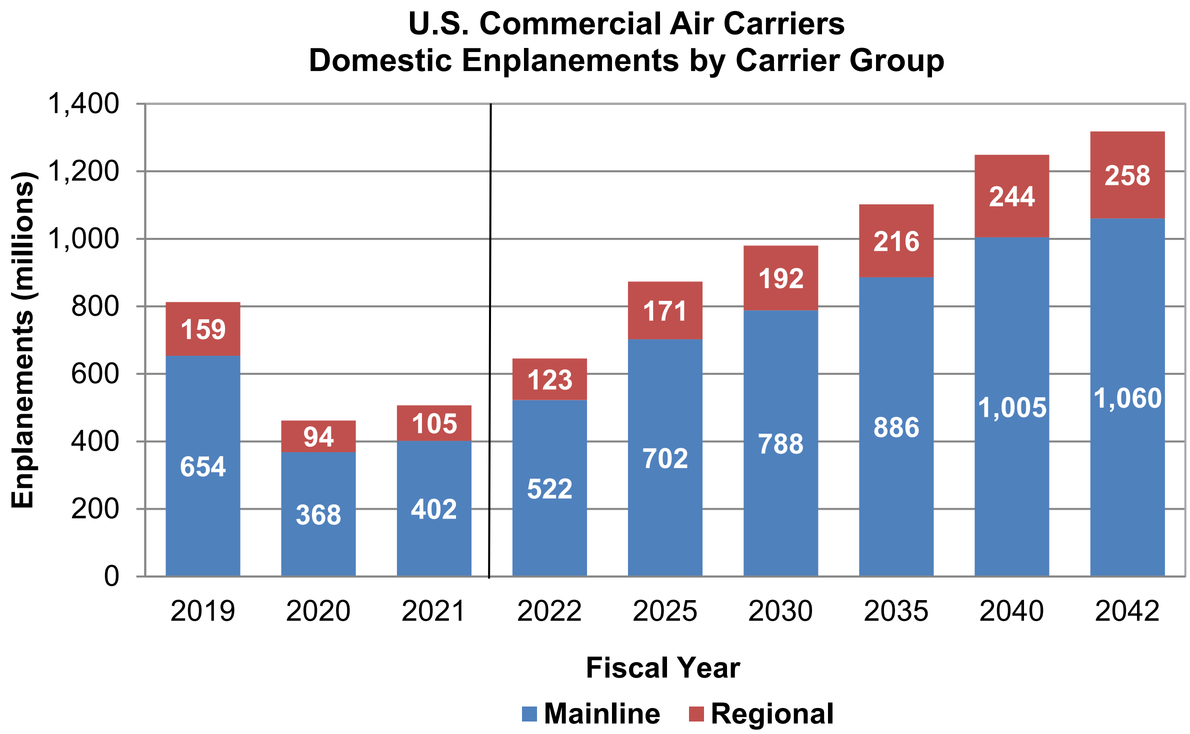
The unpredictable demand environment carriers faced in the previous two years will improve in 2022. Driving the predictability will be the continued lifting of COVID-19 precautions, the working off of pent-up demand, and employees returning to offices as they become more comfortable with travelling again and employers find ways to satisfy duty-of-care requirements. Increasingly predictable activity allows carriers to return capacity to typical markets, and reduce reliance on purely recreational destinations. Load factors and utilization rates will rise and so will fares.

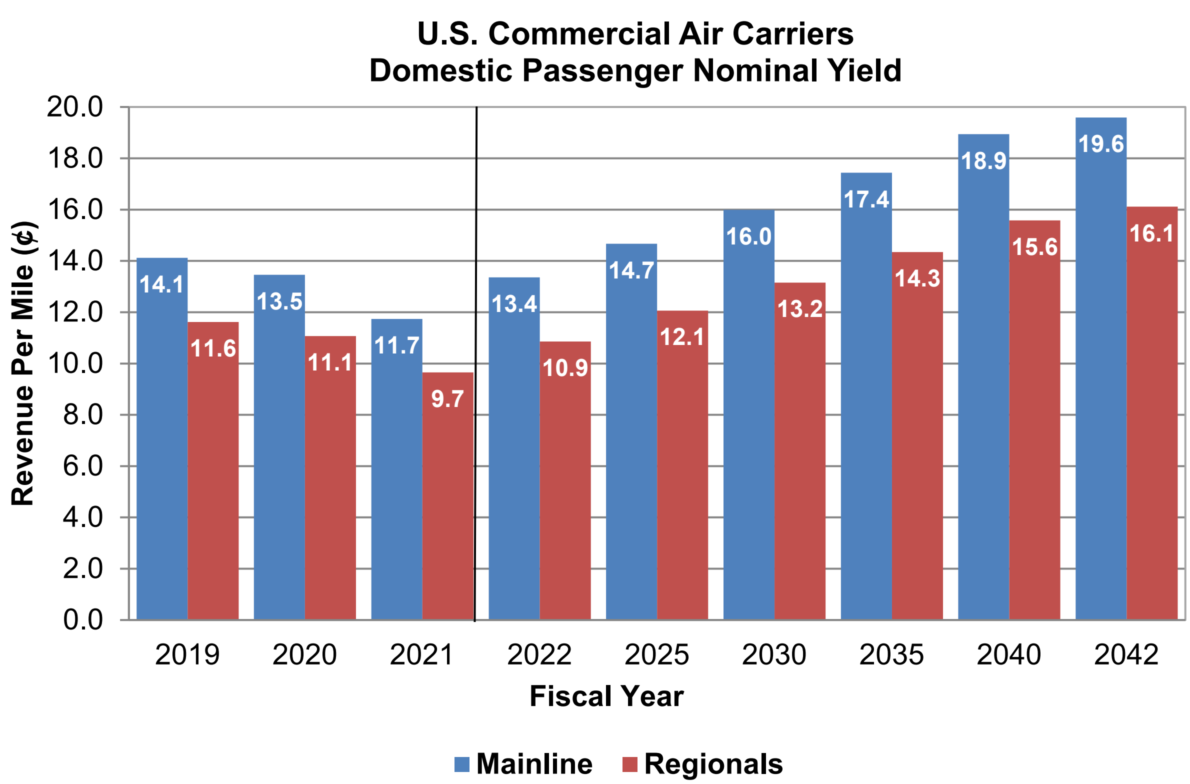
In the final recovery phase, activity approaches 2019 levels and industry conditions begin to normalize. Leisure travel has largely returned to pre-pandemic levels and business travel is steadily catching up. Carriers remain somewhat constrained by debt incurred to survive the crisis and forgo some capital investments in favor of strengthening their balance sheets.

Throughout the recovery from the pandemic, several trends emerged that subsequently will, to greater or lesser extent, be reversed. Low-cost carriers targeting leisure travelers benefitted from relative strength in this segment. The sharp curtailment of business travel, on the other hand, impacted legacy carriers and those serving key business markets. And all carriers received a boost from low fuel prices that were due in part to reduced energy demand worldwide.

Regional carriers suffered very similar consequences of COVID-19 as did the mainline group. In 2021, regionals provided 11.6 percent of domestic capacity, up just slightly from 11.1 percent in 2019. In terms of traffic, regionals saw marginally better performance than their mainline counterparts, claiming 11.3 percent of RPM in 2021 compared to 10.4 percent in 2019. The deviations in 2020 are expected to be temporary as travel patterns and airline operations begin their recovery to more normal conditions.

The regional market continues to face pressure as the regionals compete for even fewer contracts with the remaining dominant carriers; this implies paltry growth in enplanements and yields.


U.S. Commercial Air Carriers
Domestic Enplanements by Carrier Group
Enplanements (millions)
1,400
1,200
1,000
800
600
400
200
0
2019
2020
2021
2022
2025
2030
2035
2040
2042
654
159
368
94
402
105
522
123
702
171
788
192
886
216
1,005
244
1,060
258
Fiscal Year
Mainline
Regional


U.S. Commercial Air Carriers
Domestic Passenger Nominal Yield
Revenue Per Mile (¢)
20.0
18.0
16.0
14.0
12.0
10.0
8.0
6.0
4.0
2.0
0.0
2019
2020
2021
2022
2025
2030
2035
2040
2042
14.1
11.6
13.5
11.1
11.7
9.7
13.4
10.9
14.7
12.1
16.0
13.2
17.4
14.3
18.9
15.6
19.6
16.1
Fiscal Year
Mainline
Regionals

The regionals have less leverage with the mainline carriers than they have had in the past as the mainline carriers have negotiated contracts that are more favorable for their operational and financial bottom lines. And as mainline carriers cut service to smaller cities over the past two years, it was the regional partners that were most affected. Furthermore, mainline carriers successfully reduced costs by offering voluntary retirements to flight crews but as activity picked up they drew replacements from the ranks of the regionals, exacerbating their pre-pandemic pilot shortages. As regional carriers recover and activity returns to 2019 levels, service to smaller cities is expected to return. Regional pilot shortages, however, are likely to persist through next year due to the time required for training and recruitment.

A trend for regionals that was largely unaffected by the pandemic is the longstanding increase in the number of seats per aircraft. This measure rose by more than 55 percent over the decade from 1997 to 2007 and although it slowed more recently to an increase of 17 percent in the ten years ending in 2019, that same pace generally continued in 2021. A consequence of this drive to replace 50 seat regional jets with more fuel-efficient 70 seat jets is that capital costs have increased. The move to the larger aircraft will prove beneficial in the future, however, since their unit costs are lower.

Mainline carriers have also been increasing the seats per aircraft flown although, unlike that for the regionals, the trend had been accelerating. From 1997-2007, mainline seats per aircraft expanded just one-half of one percent but from 2009-2019, the measure grew 10 percent. In 2021, mainline seats per aircraft bumped up to almost 13 percent over the decade as carriers flew some of their idle long-haul international aircraft on domestic routes.

Another continuing trend is that of ancillary revenues. Carriers generate ancillary revenues by selling products and services beyond that of an airplane ticket to customers. This includes the un-bundling of services previously included in the ticket price such as checked bags, on-board meals and seat selection, and by adding new services such as boarding priority and internet access. After posting record net profits in 2015, U.S. passenger carrier profits declined subsequently on rising fuel and labor costs, and flat yields, but were supported by ancillary revenues. Even in 2020 when profits turned to staggering losses, this remained a meaningful source of revenue for carriers.

On the other hand, revenue management systems that have grown increasingly sophisticated in recent years became almost worthless in 2020. These systems enable carriers to price fares optimally for each day and time of flight, and to minimize foregone revenue. But, because they rely on historical data to make price and schedule predictions, the unprecedented nature of the collapse in 2020 meant they could provide little guidance and carriers were forced to assess market conditions without the benefit or precision of that quantitative analysis.

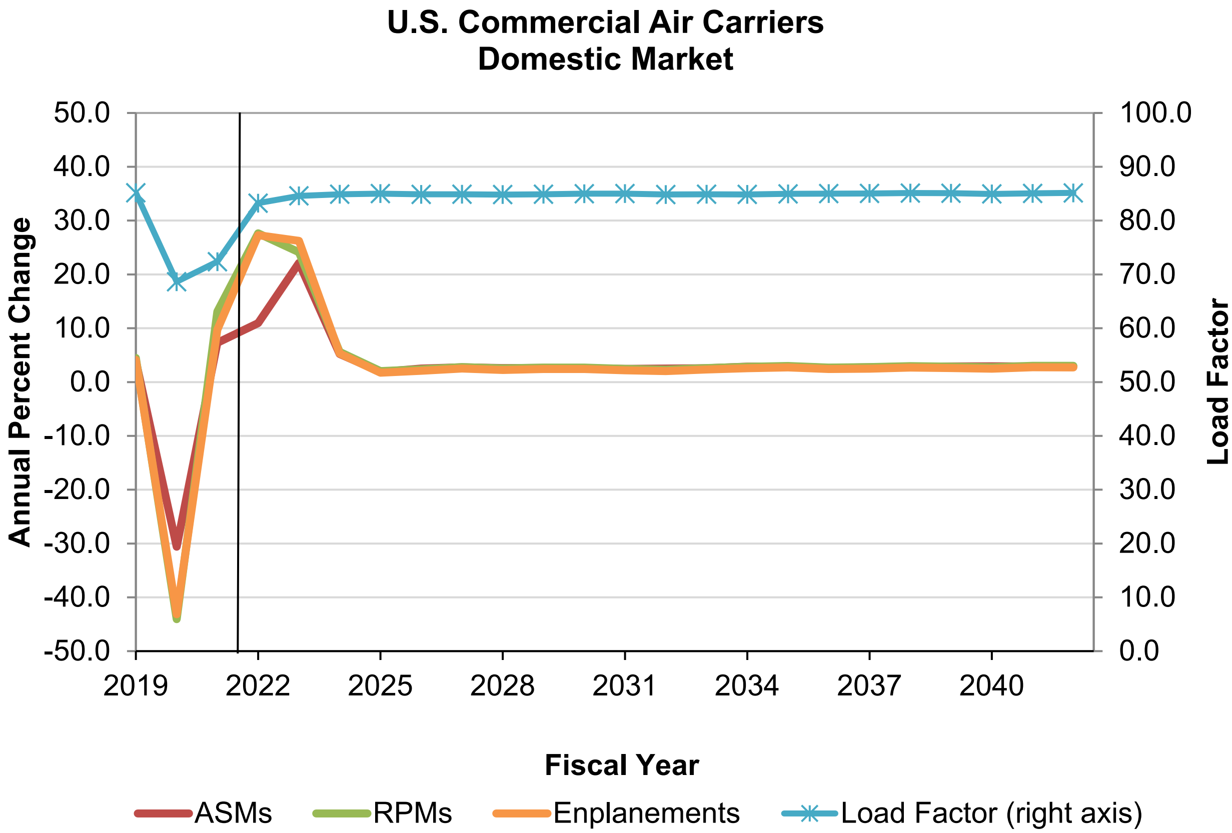
While revenue management systems will regain their important role once travel demand returns to more normal rhythms, one source of ancillary revenue, change fees, was broadly scrapped in 2020. As traveler plans were forced to change due to COVID-19-related restrictions, airlines began dropping fees for itinerary changes in many ticket classes. As a share of total passenger revenue, cancellation fees dropped from about 2 percent in FY2019 and the years prior to under

1 percent in FY2021. Some airlines have stated that the elimination of change fees is a permanent move and won't be reversed with the end of the pandemic. In contrast, baggage fees seem unlikely to be rescinded as their share rose from 4.0 percent to 6.7 percent in FY2021. And in the third quarter of 2021, revenue from baggage fees exceeded that in the same quarter of 2019 even though total passenger revenue remained down nearly a third.

Other methods of segmenting passengers into more discreet cost categories based on comfort amenities like seat pitch, leg room, and access to social media and power outlets were unaffected by the pandemic. The offering of Basic Economy fares has been part of an effort by network carriers to protect market share in response to the rapid growth low cost carriers (LCC) have achieved in recent years. In 2019, mainline enplanements had increased almost 23 percent since 2007 but low cost carrier enplanements grew by 39 percent. RPM over the same period show a similar pattern with mainline RPMs up almost 27 percent and LCC RPM fully 48 percent higher. These longer term trends were interrupted in 2020 with both enplanements and RPM dropping across both mainline and LCC carriers to about 55 percent of 2019's levels. However, by 2021 the strength of LCC's became apparent again as their enplanements and RPM had recovered to about 70 percent of 2019 levels while mainline traffic edged up to about 60 percent. In fact, 2021 saw the inaugural operations of three new small LCCs, Aha!, Avelo and Breeze, all of which are targeting smaller, underserved cities with point-to-point flights independent of mainline contracts.

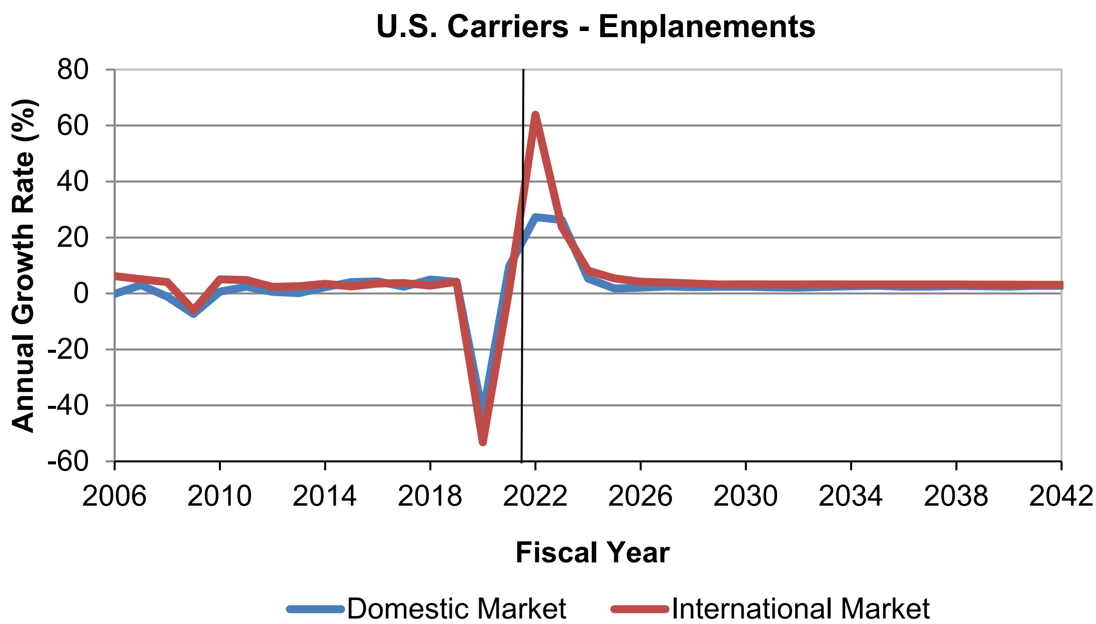
The outbreak of the pandemic in 2020 interrupted other domestic trends as well. U.S. commercial air carriers'[3] total number of domestic departures had risen for the second year in a row in 2019, and ASM had risen each of the previous nine years. But then in 2020, departures and ASM declined sharply, falling 30 percent from the prior year. On the demand side, RPM and enplanements, which had grown for ten consecutive years, saw even steeper declines of 40 percent in 2020. Because of the faster demand-side growth, load factors rose in ten of the eleven years leading up to 2020, reaching 85.2 percent, before dropping sharply in that year to 68.6 percent, as passengers stopped flying to a greater extent than carriers could match. As leisure travelers returned in 2021, load factors began to recover and reached 72.4 percent.

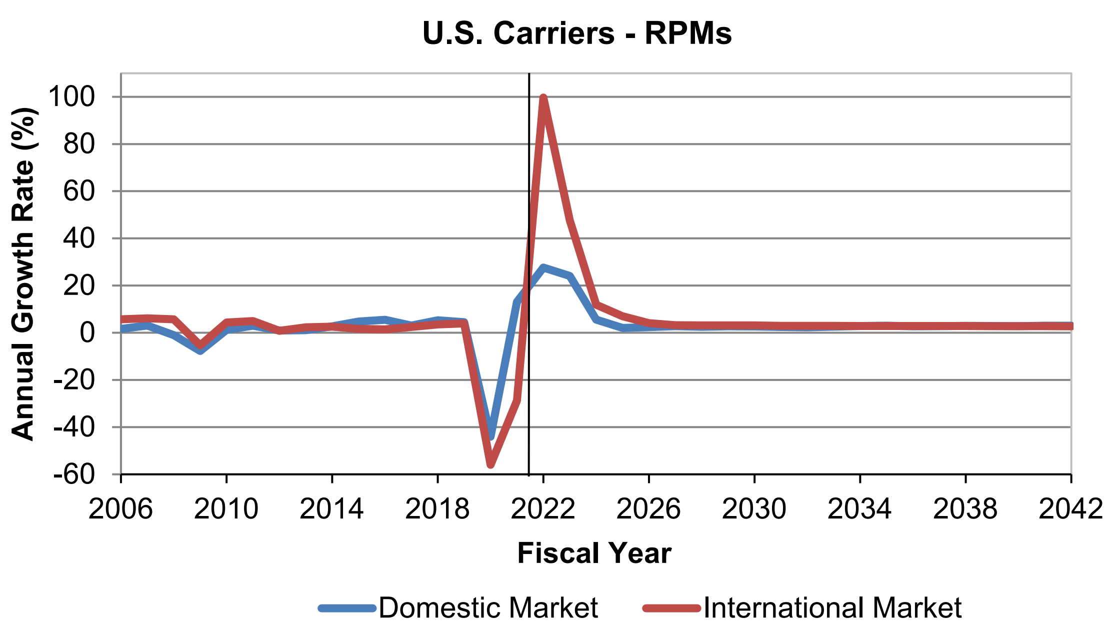
[3] Commercial air carriers encompass both mainline and regional carriers.

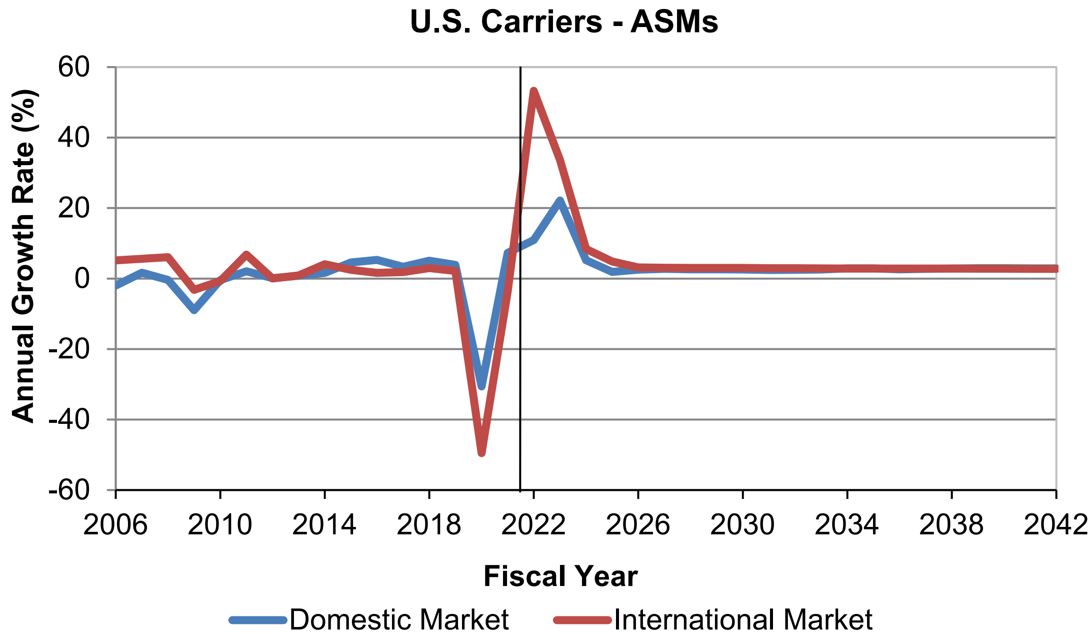


International Market

Over most of the past decade, the international market has been the growth segment for U.S. carriers when compared to the mature U.S. domestic market. In 2015 and 2016, growth in the domestic market surged, outpacing international markets. However, in 2017 enplanement growth in international markets exceeded that in domestic markets, only to be reversed again in 2018 and 2019. That relative strength of domestic activity compared to international continued during the downturn in 2020 and the start of the recovery in 2021. In 2021, domestic enplanements rose to 62 percent of 2019's level after being at 57 percent a year earlier, but international enplanements were flat at 47 percent, increasing less than a percentage point from 2020. International travel continues to be particularly impacted by border closings, quarantine requirements and other travel restrictions, as well as the uncertainty of when requirements might change. The fall off of business travel also contributed to the decline, even as leisure travel supports domestic markets. International travel is expected to continue to be constrained over the next two years by varying levels of COVID-19 infections and governmental responses across countries. Individuals will also be making personal assessments of the risks of travel and will likely be less comfortable travelling internationally than domestically due to uncertainties surrounding border closures and other restrictions.



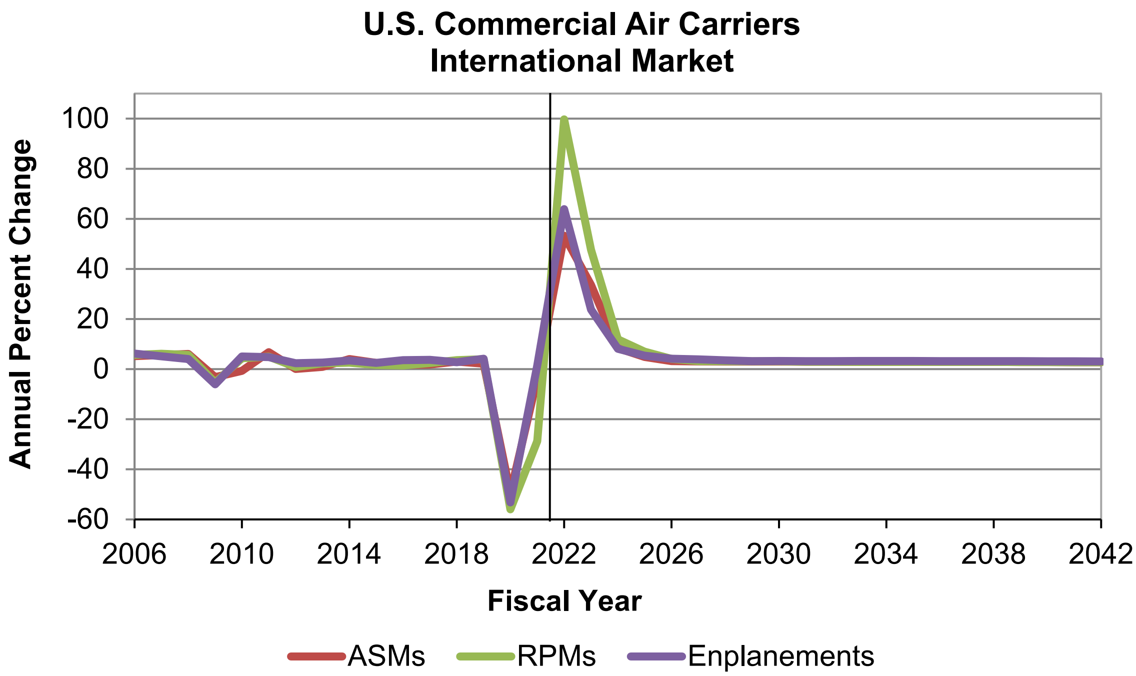




The early years of the international recovery will see some strong growth rates as activity levels come off a low base but these will return to more typical rates once levels approach 2019 values expected in 2024. From FY2022-2024, average annual growth rates for international ASM and enplanements are projected at 30 percent while RPM are forecast to grow at an annual rate of 49 percent as aggregate trip lengths grow due to increasing Atlantic and Pacific activity. From FY2024-2042, annual growth for ASM and enplanements are forecast to grow at 3.0 and 3.4 percent, respectively, while RPM will grow at a rate of 3.2 percent. Taking these two periods as a whole gives annual growth rates from FY 2022-2042 for ASM, RPM and enplanements of 6.5, 8.8, and 6.9 percent, respectively.

In the long-run, growth of major global economies will slow from the above-trend rates of recent, pre-pandemic years. Several moderating factors are at work, including dampened credit growth, reduced global trade, and political stresses. The European and Japanese economies are generally seeing slow but positive growth, in part due to weak trade with Asia. In turn, this has been driven by trade disputes as well as China's continuing gradual slowdown which has been managed by the government and is unlikely to decline sharply. Overall, global conditions appear set to return to a stable path once the pandemic has been brought under control but with growth rates that are closer to long-term trends than the higher rates of the recent pre-pandemic years. Rising oil prices, however, will create some drag on this otherwise supportive environment for air travel demand.

The past two years have been particularly difficult for carriers serving international markets because no amount of marketing, low fares or other strategizing could overcome the border closures and other restrictions related to COVID-19 that were constraining demand. For countries with few restrictions or that have lifted restrictions, activity has already been strong and, in some cases, at or above 2019 levels. As other countries lift restrictions this year and next and uncertainties surrounding travel diminishes, activity is expected to resume smartly. In 2022, ASM are forecast to grow 53 percent. RPM will double from its low level in 2021 (just 30 percent of 2019's level) and enplanements will grow 64 percent. Load factors fell further in 2021, reaching 54 percent, almost 30 percentage points below where they were in 2019 because carriers retained some capacity to protect market share. As RPM recovers in 2022, load factors also rise sharply, to 70 percent and are nearly fully recovered by 2024.



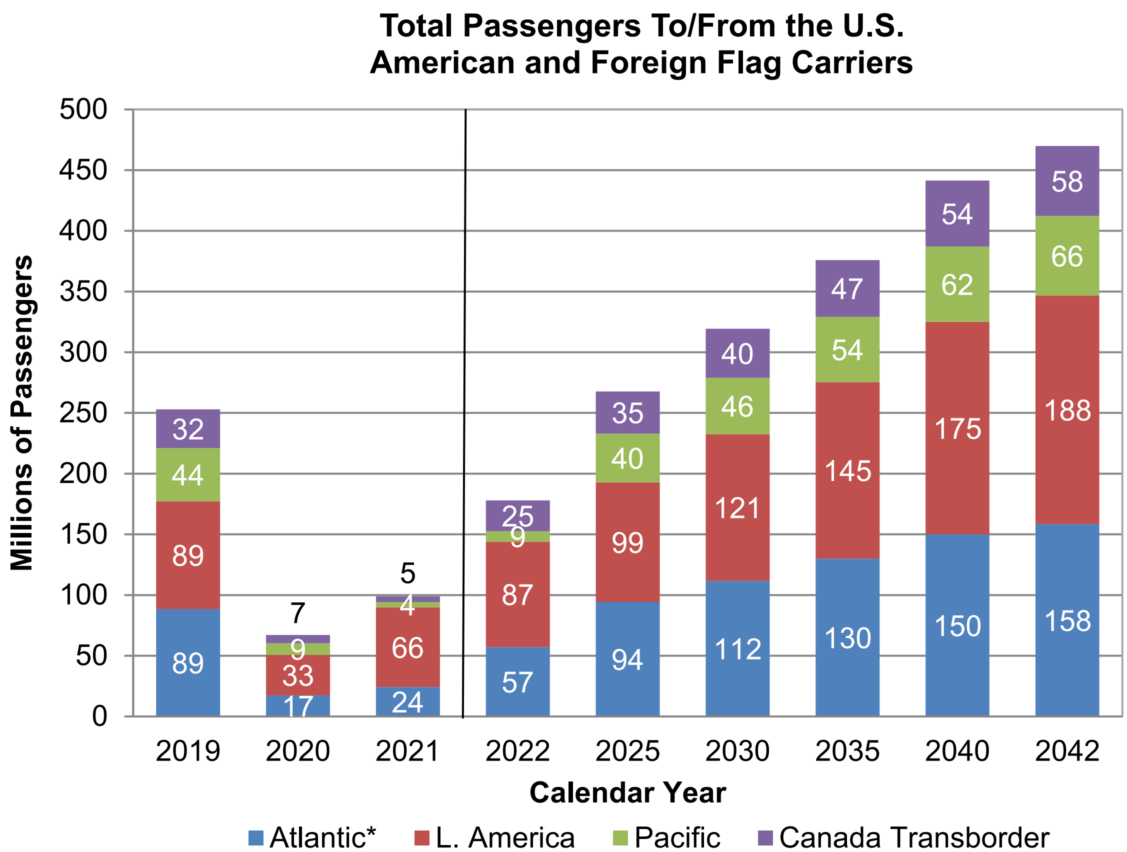
The impact of COVID-19 on travel by region has varied considerably, as will the recovery paths. Factors affecting the responses by market are similar to those affecting travel as a whole: COVID-19 case counts, governmental restrictions, predominant traveler segments, and macroeconomic conditions. As a result, by 2021, enplanements to Latin America had recovered the most followed by the Atlantic region and, in a distant third, the Pacific region.

For U.S. carriers, Latin America remains the largest international destination with more than twice the enplanements of Atlantic, the next largest in a typical year, due to its proximity to the U.S., strong trade ties, and popular visitor destinations. In contrast to the other two regions that saw declines in 2021, Latin enplanements rose by 34.9 percent while RPMs rose 22.6 percent. Much of the strength was fueled by leisure traffic heading to warm weather destinations and by the relatively low number of COVID-19 cases and travel restrictions in some countries. Enplanements and RPMs are forecast to increase 41.6 and 46.3 percent, respectively, in 2022, before resuming single-digit growth and gradually slowing to a long-term trend rate of around 4 percent. Both enplanements and RPM are expected to recover to

2019 levels in 2023. Over the twenty-year period 2022-2042, Latin America enplanements are forecast to increase at an average rate of 5.8 percent a year while RPMs grow 6.2 percent a year.

Switching to the Pacific region, it is the smallest in terms of enplanements despite the economic growth and potential of air travel to the region's emerging markets. After falling in 2020 to 42.1 percent of 2019's level, enplanements fell further in 2021 to just 5.8 percent as many countries enforced stringent travel restrictions, especially China, a very large market in the region. RPM also collapsed by similar amounts. In 2022, enplanements and RPM are expected to come off the bottom and recover to about 20 percent of 2019 levels. Because many countries in the Pacific region have had relative success in controlling COVID-19 transmission, travel restrictions have been slow to lift, leading to the slow recovery in 2022 and in the medium term. Although initial growth is strong in percentage terms due to the low base, trend growth is comparatively slow. Consequently, enplanements take 7 years to fully recover to 2019's level and RPM reach that milestone in 2025. From FY2022-2025, Pacific enplanements and RPM are forecast to double each year on average, and in the long-term from FY2025-2042, grow at rates of 2.4 percent and 2.8 percent, respectively. Although the region is forecast to have the strongest economic growth of any region over the next 20 years, led by China and India, enplanements and RPMs over the period are restrained in part because U.S. carriers continue to provide a majority of their service in the region to Japan as opposed to faster growing countries.

The Atlantic region ranks in the middle between the other two, with pre-pandemic enplanements roughly twice those in the Pacific region and half those in the Latin region. After contracting in 2015 and 2016, Atlantic enplanements began rising to reach 7.0 percent growth in 2019. This growth was supported by U.S. demand as well as growth of Middle East and African markets, even as the European economies slowed in 2019. In 2020, like the other regions, Atlantic enplanements tumbled by 61.1 percent and then a further 47.1 percent in 2021 to bottom out at 21 percent of 2019's level. Subsequent percentage gains are large, returning enplanements to 2019 levels in 2024. The historical and forecast path for RPM is quite similar and for the medium-term from FY2022-2024, RPM grows at an average annual rate of 67 percent while enplanements grow at a rate of 71 percent. Although Western Europe is a mature area with moderate economic growth, the economically smaller Middle East and Africa areas are expanding rapidly with GDP growth rates more than twice that of Europe. As a result, a larger share of the forecast aviation demand in the Atlantic region is linked to those two areas, particularly in the second half of the forecast period. Over the forecast horizon from 2022 to 2042, enplanements and RPM in the Atlantic region are forecast to grow at an average annual rate of 10 percent.



Source: US Customs & Border Protection data processed and released by Department of Commerce; data also received from Transport Canada
* Per past practice, the Mid-East region and Africa are included in the Atlantic category.

Total passengers (including Foreign Flag carriers) between the United States and the rest of the world fell even more in 2020, and recovered less in 2021, than did U.S. carriers alone. Foreign carriers, without the relative strength of domestic markets for support, were forced to reduce capacity more and thereby sacrificed passenger traffic. Total passengers collapsed by an estimated 73.4 percent to 67 million in 2020 as all regions posted losses led by an 80.4 percent reduction in the Atlantic region. In 2021, the Latin American and Atlantic regions saw sizable growth from the previous year, while the Pacific and Canada Transborder regions saw further declines, and all regions remained well below 2019 levels.

FAA projects total international passenger growth of 79.7 percent in 2022 as global economic growth stabilizes and COVID-19 restrictions abate. The strongest passenger growth is expected in the Latin region and the slowest in the Pacific. Similar to growth rates of enplanements on U.S. carriers, total passenger growth rates in the early years of the forecast are high, returning passenger numbers to 2019 levels in 2024. Moderate global economic growth averaging 2.8 percent a year over the next 20 years (2022-2042) is the foundation for the forecast growth of international passengers of 7.7 percent a year, as levels increase almost five fold from 99 million in 2021 to 470 million in 2042.

The Atlantic and Latin American regions were of comparable size in 2019 but by the end of the forecast period the Latin American region counts about 20 percent more passengers and their growth paths differ. Atlantic growth is faster early on and slows relative to Latin American in later years, consistent with GDP forecasts. Over the 20-year forecast period (2022-2042), the Atlantic region grows at an average annual rate of 9.4 percent while Latin America grows at a rate of 5.1 percent. Although European markets in the Atlantic region are mature and relatively slow growing, other markets such as the Middle East and Africa boost overall growth in the region.

In the Pacific region, passenger levels in 2021 were just 10 percent of those in 2019 and combined with stringent COVID-19 travel restrictions and sluggish Japanese GDP growth that offsets some of the strong economic growth and rising incomes in China, India and South Korea, the outcome is a relatively slow return to 2019 passenger levels in 2028. From 2022 to 2042, passengers between the United States and the Pacific region are forecast to grow 13.8 percent a year.

Like the Atlantic region, Canada transborder is another mature market but is considerably smaller. It is projected to grow at an average rate of 12.6 percent over the forecast period, slightly faster than the Atlantic region. Total passenger counts return to 2019 levels in 2023, about the same as in the Latin America region.

System

System (the sum of domestic plus international) capacity contracted 35.9 percent to 791 billion ASMs in 2020 while RPMs plummeted 47.4 percent to 549 billion. During the same period, system-wide enplanements fell 44.3 percent to 511 million. Supported by domestic and Latin markets, activity began to recover in 2021 as ASM, RPM and enplanements expanded by 4.8 percent, 3.3 percent and 9.0 percent, respectively. In prior years, U.S. carriers had prioritized the domestic over the international market in terms of allocating capacity as the U.S. saw stronger economic growth than many regions around the world. And in 2020 and 2021, travel restrictions associated with COVID-19 caused this split to largely continue as domestic capacity was curtailed less than international: down 25.5 percent in 2021 from 2019 for domestic compared to down 51.4 percent for international. However, as U.S. carriers shift their focus to recovery, international capacity growth will outpace domestic, mainly because the international reductions in 2020 and 2021 were much more severe. Subsequent years through 2042 see carriers continue to expand capacity in international markets faster than domestic as the international markets see stronger income growth and the corresponding demand for travel.

U.S. mainline carrier enplanement growth in the combined domestic and international market was 8.2 percent in 2021 while regional carriers carried 12.1 percent more passengers – a difference explained by the greater reliance of mainline carriers on lagging international markets.

In the domestic market in 2019, mainline enplanements marked their ninth consecutive year of increases, a trend that was abruptly halted in 2020 with a decline of 43.7 percent, but followed by a 9.1 percent increase in

2021. Similarly, international mainline passengers had posted a tenth consecutive year of growth in 2019, a trend that was broken in 2020 with a 53.4 percent decline but, in contrast to the domestic side, was followed by a small 1.4 percent increase. Domestic mainline enplanement growth is forecast to accelerate in 2022, rising 30.0 percent as the recovery proceeds. Another year of strong growth in 2023 returns domestic enplanements to 2019 levels in that year. With the recovery complete, domestic enplanements resume growth driven by economic fundamentals and average 2.5 percent over the remainder of the forecast. International mainline enplanements follow a similar path with strong growth early in the recovery that slows as enplanements return to 2019 levels in 2024. From then through the end of the forecast in 2042, international enplanements are expected to grow at an average of 3.5 percent.

Although carriers cut capacity aggressively in 2020, the drop in traffic was even greater and system load factor fell from 84.5 percent in 2019 to 69.5 in 2020 and further to 68.5 in 2021 – a combined drop that far exceeded those following both 9/11 and the Great Recession. Load factor gradually recovers, returning close to its 2019 level in 2025.

Cargo

Air cargo traffic includes both domestic and international freight/express and mail. The demand for air cargo is a derived demand resulting from economic activity. Cargo moves in the bellies of passenger aircraft and in dedicated all-cargo aircraft on both scheduled and nonscheduled service. Cargo carriers face price competition from alternative shipping modes such as trucks, container ships, and rail cars, as well as from other air carriers.

U.S. air carriers flew 51.3 billion revenue ton miles (RTMs) in 2021, a large 16.9 percent increase from the previous year that raised RTM 19.7 above 2019's level. Domestic cargo RTMs increased 11.7 percent to 19.9 billion in 2021 while international RTMs expanded 20.4 percent to 31.4 billion. In comparison, for the decade ending in 2019, domestic RTM increased at an average rate of 3.2 percent and international grew at a 3.8 percent rate. The surge in 2020 and 2021 RTM was supported by consumers purchasing goods to enhance time spent at home as necessitated by the pandemic, and by surface transportation disruptions caused by worker shortages due to COVID-19 illnesses. Air cargo RTMs flown by all-cargo carriers averaged 78.7 percent of the total in the years leading up to 2020 but then spiked to 88.0 percent of total RTMs in 2020 and 2021, with passenger carriers flying the remainder. Total RTMs flown by the all-cargo carriers increased 12.3 percent in 2020 while total RTMs flown by passenger carriers fell by 37.8 percent but in 2021, both all-cargo and passenger carriers saw increases of about 17 percent. Although many passenger carriers reconfigured aircraft to accommodate more cargo, the sheer drop in passenger flights in 2020 outweighed that increase, resulting in the steep drop of passenger carrier RTM. As passenger flights return, the share of cargo on all-cargo carriers will ease, dropping from 88 percent in 2021 to about 82 percent in 2025.

U.S. carrier international air cargo traffic spans four regions consisting of Atlantic, Latin, Pacific, and 'Other International.'

Historically, air cargo activity tracks with GDP. Other factors that affect air cargo growth are fuel price volatility, movement of real yields, globalization and trade.

The forecasts of revenue ton miles rely on several assumptions specific to the cargo industry. First, security restrictions on air cargo transportation will remain in place. Second, most of the shift from air to ground transportation has occurred. Finally, long-term cargo activity depends heavily on economic growth.

The forecasts of RTMs derive from models that link cargo activity to GDP. Forecasts of domestic cargo RTMs use real U.S. GDP as the primary driver of activity. Projections of international cargo RTMs depend on growth in world and regional GDP, adjusted for inflation. FAA forecasts the distribution of RTMs between passenger and all-cargo carriers based on an analysis of historic trends in shares, changes in industry structure, and market assumptions.

After increasing by 16.9 percent in 2021, total RTMs are expected to grow 2.5 percent in 2022. Because of steady U.S. and world economic growth in the long term, FAA projects total RTMs to increase at an average annual rate of 3.2 percent over the forecast period (from 2022 to 2042).

Following the surge in 2021, domestic cargo RTMs are projected to moderate in subsequent years as the boost from the pandemic fades. Between 2022 and 2042, domestic cargo RTMs are forecast to increase at an average annual rate of 2.6 percent. In 2021, all-cargo carriers carried 93.4 percent of domestic cargo RTMs. The all-cargo share is forecast to decline modestly to about 92 percent in the medium-term as passenger flights return to the system. In the long-term, the all-cargo share rises only slightly to 92.7 percent by 2042 based on increases in capacity for all-cargo carriers.

International cargo RTMs 20.4 percent surge in 2021 dissipates in 2022 as surface transportation snarls are resolved. As with domestic markets, RTM carried by all-cargo carriers grew strongly in 2020 while that transported by passenger carriers fell even more sharply, but by 2021 both types grew again. With the post-pandemic return of passenger flights, RTM on passenger aircraft is expected to grow rapidly, increasing about 18 percent per year from 2022 to 2024. Over the same period, all-cargo RTM is roughly flat as some tonnage is lost to passenger carriers in 2022. Following the period of recovery, growth for both types of carriers returns to long-run trend rates. For the forecast period (2022-2042), international cargo RTMs are expected to increase an average of 3.6 percent a year based on projected growth in world GDP with the Pacific International region having the fastest RTM growth (4.0 percent), followed by Other (3.5 percent), Atlantic (3.3 percent), and Latin America region (2.1 percent).

The share of international cargo RTMs flown by all-cargo carriers was 84.6 percent in 2021 and is forecast to decline steadily during the recovery period before gradually increasing in line with historical trends and ending at 80.3 percent in 2042.

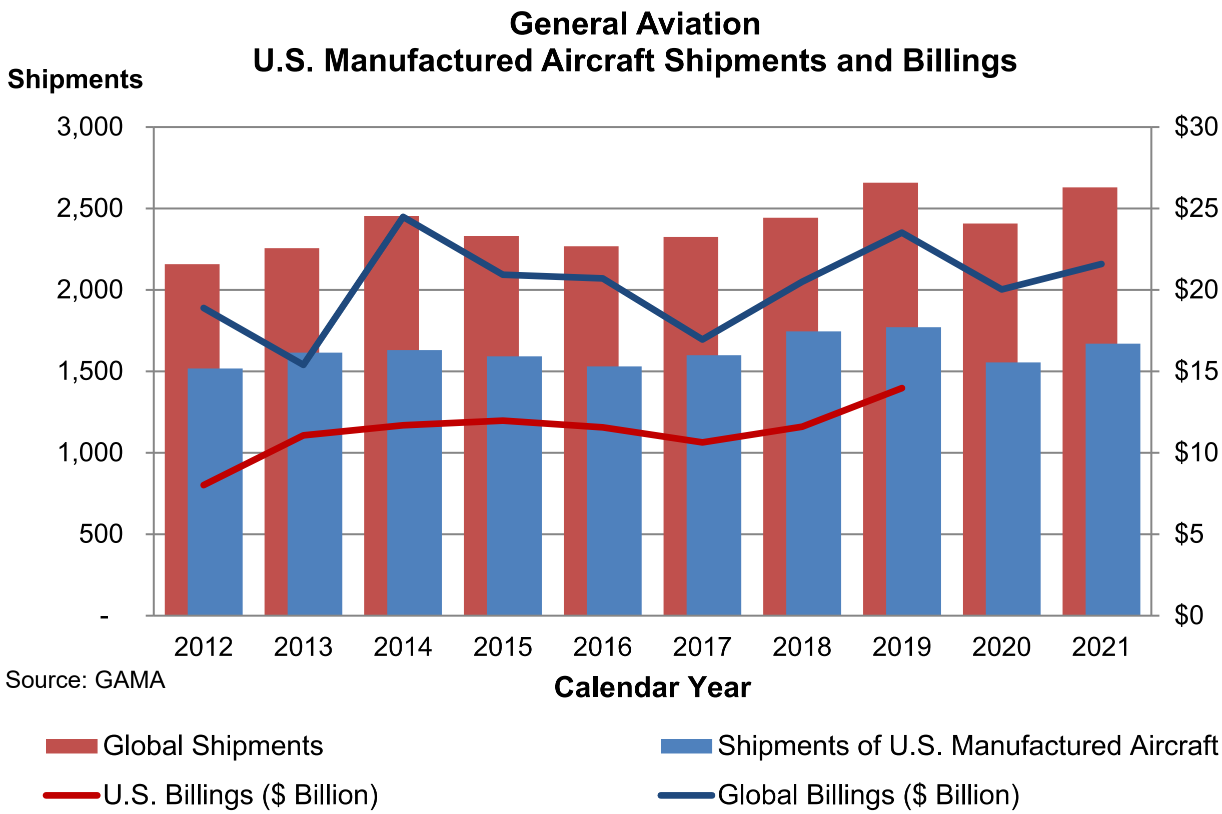
General Aviation

The FAA uses estimates of fleet size, hours flown, and utilization rates from the General Aviation and Part 135 Activity Survey (GA Survey) as baseline figures to forecast the GA fleet and activity. Since the survey is conducted on a calendar year (CY) base and the records are collected by CY, the GA forecast is done by CY. Forecasts of new aircraft deliveries, which use the data from General Aviation Manufacturers Association (GAMA), together with assumptions of retirement rates, generate growth rates of the fleet by aircraft categories, which are applied to the GA Survey fleet estimates. The forecasts are carried out for "active aircraft,"[4] not total aircraft. The FAA's general aviation forecasts also rely on discussions with the industry experts conducted at industry meetings, including Transportation Research Board (TRB) meetings of Business Aviation and Civil Helicopter Subcommittees conducted twice a year in January and June.

The results of the 2020 GA Survey, the latest available, were consistent with the results of surveys conducted since 2004 improvements to the survey methodology. The active GA fleet was estimated to be 204,140 aircraft in 2020 (3.2 percent decline from 2019), as increases in fixed wing turbine were more than offset by decreases in pistons, rotorcraft, lighter-than-air and light sport aircraft (LSA), and experimental aircraft. Total hours flown were estimated to be 22.5 million in 2020, down 12.0 percent from 2019. Decreases were across the board, with the highest absolute decline in fixed wing piston hours (10.3 percent), and highest percentage decline in lighter than air aircraft (44.6 percent) and glider activity (28.7 percent), followed by rotorcraft hours (19.6 percent).

In 2021, deliveries of the general aviation aircraft manufactured in the U.S. increased to 1,670, 7.4 percent higher than in CY 2020 (still 5.7 percent lower than the 2019 level, but has been improving). Deliveries of single-engine piston aircraft were up 2.3 percent, while the much smaller segment of multi-engine piston deliveries were down by 51.6 percent (summing to a 0.5 percent increase in the fixed engine piston deliveries). Business jet deliveries increased by 14.7 percent and turboprop deliveries were up 18.6 percent, amounting for a 16.6 percent increase in fixed wing turbine shipments. While the GAMA statistics for factory net billings were not available yet for the U.S. manufactured GA aircraft, global billings increased in 2021 by 7.7 percent to $21.6 billion.

[4] An active aircraft is one that flies at least one hour during the year.



Source: GAMA

GAMA also reported the rotorcraft deliveries increased at a global level in 2021 in both piston and turbine segments by 27.5 percent and 13.8 percent, respectively.

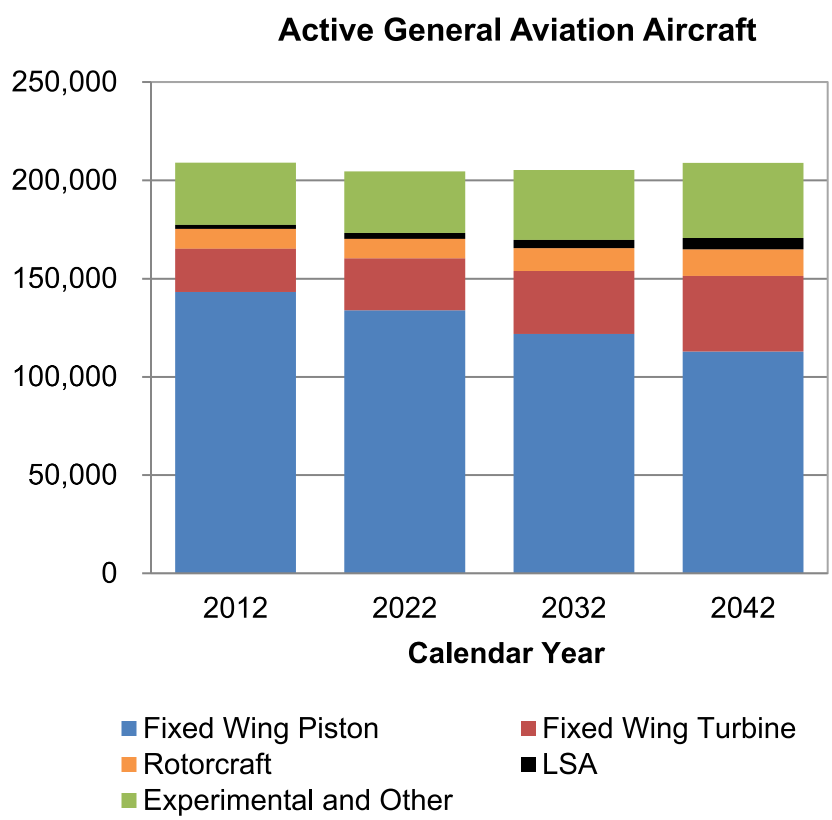
Against these current conditions, we expect the GA sector, which was not as severely affected by the pandemic as the airlines, to recover sooner to its 2019 levels by aircraft type than the other sectors. Then, the long-term outlook for general aviation, driven by turbine aircraft activity, remains stable. The active general aviation fleet, which showed a decline of 3.2 percent between 2019 and 2020, is projected to increase from its 2021 level of 204,405 aircraft to 208,905 by 2042, as the declines in the fixed-wing piston fleet were offset by increases in turbine, rotorcraft, experimental, and light sport fleets. The total active general aviation fleet grows by a small increase of 0.1 percent annually. When measured from pre-COVID-19 levels in 2019, the active GA fleet of 210,981 experiences an annual decline of 0.04 percent on average.

The more expensive and sophisticated turbine-powered fleet (including rotorcraft) is projected to grow by 15,750 aircraft between 2021 and 2042 to total 46,060 in 2042, an average rate of 1.9 percent a year during this period, with the turbojet fleet increasing 2.6 percent a year. When measured from the 2019 levels, the growth rate for the turbine-powered fleet is 1.8 percent. The growth in U.S. GDP and corporate profits are catalysts for the growth in the turbine fleet.

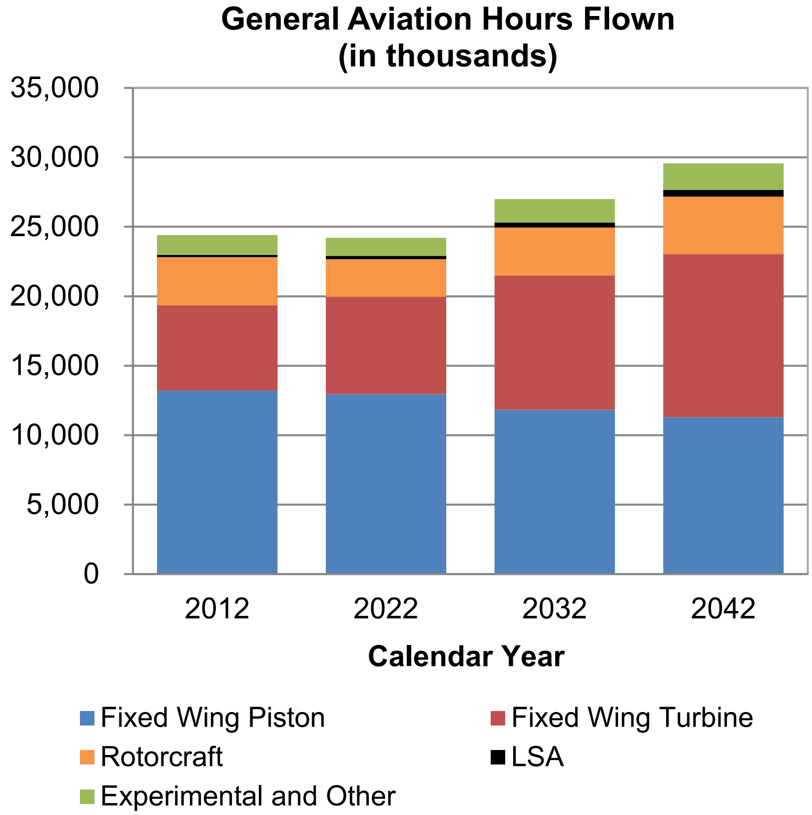
The largest segment of the fleet, fixed wing piston aircraft, is predicted to shrink over the by 22,055 aircraft between 2021 and 2042, an average annual rate of -0.8 percent.

When measured from the 2019 fleet of 141,396 in 2019, the annual decline averages 1.0 percent. Unfavorable pilot demographics, overall increasing cost of aircraft ownership, availability of much lower cost alternatives for recreational usage, coupled with new aircraft deliveries not keeping pace with retirements of the aging fleet are the drivers of the decline.

On the other hand, the smallest category, light-sport-aircraft (created in 2005), is forecast to grow by 3.5 percent annually, adding about 2,890 new aircraft by 2042, doubling its 2019 fleet size of 2,675.



Although the total active general aviation fleet is projected to marginally increase, the number of general aviation hours flown is forecast to increase an average of 1.1 percent per year through 2042, from 22.5 million in 2020 to 29.6 million, as the newer aircraft fly more hours each year. Fixed wing piston hours are forecast to decrease by 0.6 percent, at a slightly lower rate than that of the fleet decline. Countering this trend, hours flown by turbine aircraft (including rotorcraft) are forecast to increase 3.2 percent yearly between 2020 and 2042. Jet aircraft are expected to account for most of the increase, with hours flown increasing at an average annual rate of 3.8 percent between 2021 and 2042. The large increases in jet hours result mainly from the increasing size of the business jet fleet.



Rotorcraft activity, which was not as heavily impacted by the pandemic conditions as most of the other aircraft categories, had been facing the challenges brought by lower oil prices, a trend currently moving in the opposing direction. By the time this forecast was completed, it was too early to include the most recent changes. The low oil prices impacted utilization rates and new aircraft orders both directly through decreasing activity in oil exploration, and also through a slowdown in related economic activity. The active fleet of rotorcraft is projected to grow at a faster rate than the previous year's forecast, driven by higher growth in the turbine segment, going from a total of (piston and turbine together) 9,746 in 2020 to 13,530 in 2042. Rotorcraft hours are projected to grow by 2.2 percent annually between 2021 and 2042.

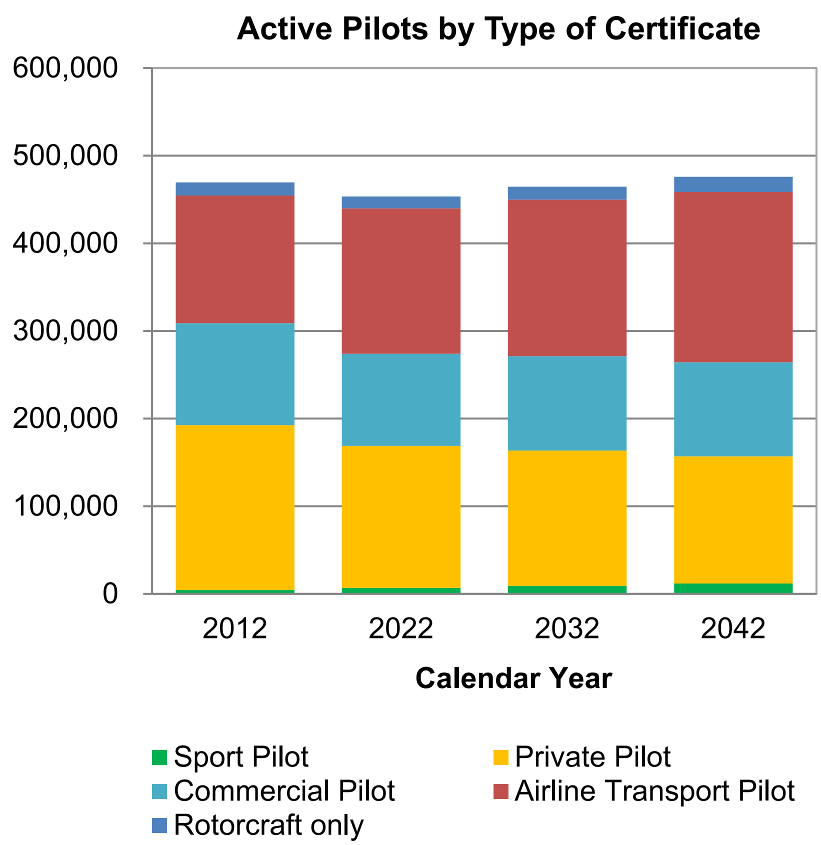
Lastly, the light sport aircraft category is forecasted to see an increase of 3.9 percent a year in hours flown, primarily driven by growth in the fleet.

The FAA also conducts a forecast of pilots by certification categories, using the data compiled by the Administration's Mike Monroney Aeronautical Center. There were 720,605 active pilots certificated by FAA at the end of 2021. The number of certificates in some pilot categories continued to increase, while there were different rates of declines in the rotorcraft only, ATP, and recreational certificates. The FAA suspended the student pilot forecast since 2018. The number of student pilot certificates has been affected by a regulatory change that went into effect in April 2016 and removed the expiration date on the new student pilot certificates. The number of student pilots jumped from 128,501 at the end of 2016 to 149,121 by the end of 2017, and to 250,197 at the end of 2021. The 2016 rule change generates a cumulative increase in the certificate numbers and breaks the link between student pilot and advanced certificate levels of private pilot or higher. There is no sufficient data yet to perform a reliable forecast for the student pilots.

Commercial and air transport pilot (ATP) certificates have been impacted by a legislative change as well. The Airline Safety and Federal Aviation Administration Extension Act of 2010 mandated that all part 121 (scheduled airline) flight crew members would hold an ATP certificate by August 2013. Airline pilots holding a commercial pilot certificate and mostly serving at Second in Command positions at the regional airlines could no longer operate with only a commercial pilot certificate after that date, and the FAA data initially showed a faster decline in commercial pilot numbers, accompanied by a higher rate of increase in ATP certificates. The number of both commercial pilot and ATP certificates had increased until 2012 for three years. Commercial pilot certificate holders continued to increase in 2021 to 104,610. Significantly reduced number of flights and a large number of parked aircraft due to the pandemic generated an overcapacity for the ATPs employed by the airlines, despite government support to the aviation sector. Consequently, the number of pilots holding an ATP certificate declined in 2021 for the second year in a row, to 163,934 (still higher than the 2018 level), after growing every year since 2011.

Private pilots increased in 2021, from 160,860 to 161,459, to a level higher than where they were in 2019, after a slight decline in 2020. Sport pilot certificates, created in 2005, kept their steady increase since their inception to reach 6,801 by December 31, 2021. Rotorcraft pilots continued their decline since 2016 to end up with 13,191 by the end of 2021.

The number of active general aviation pilots (excluding students and ATPs) is projected to remain flat between 2021 and 2042 at around 306,400. The ATP category is forecast to increase by 30,360 (up 0.8 percent annually). The much smaller category of sport pilots are predicted to increase by 2.7 percent annually over the forecast period. Commercial pilot certificates, which has been on an increase for five consecutive years, are projected to increase at an average annual rate of 0.1 percent between 2021 and 2042. On the other hand, private pilot certificates are projected to decrease at an average annual rate of 0.6 percent over the forecast horizon.


Active Pilots by Type of Certificate
600,000
500,000
400,000
300,000
200,000
100,000
0
2012
2022
2032
2042
Calendar Year
Sport Pilot
Private Pilot
Commercial Pilot
Airline Transport Pilot
Rotorcraft only

FAA Operations

The traffic at FAA facilities underwent drastic changes during the period of 2019 and 2020 from the COVID-19 impact. Activity recovered a modest 7.4percent from 44.4 million in 2020 to 47.7 million in 2021, following the 16.7 percent decline from 53.3 million in 2019 to 44.4 million in 2020. The limited recovery was partially due to the fact that FY 2020 includes 5 months of pre-pandemic data. Going forward, the pace of recovery accelerated starting in early spring of CY 2021, and continued in the winter months of CY 2021 and CY 2022 despite the fourth wave of COVID-19 driven by the Delta variant. Elevated growth is predicted to last until around 2023 and 2024 as the unemployment rate is forecast to reach the pre-pandemic level around that time.

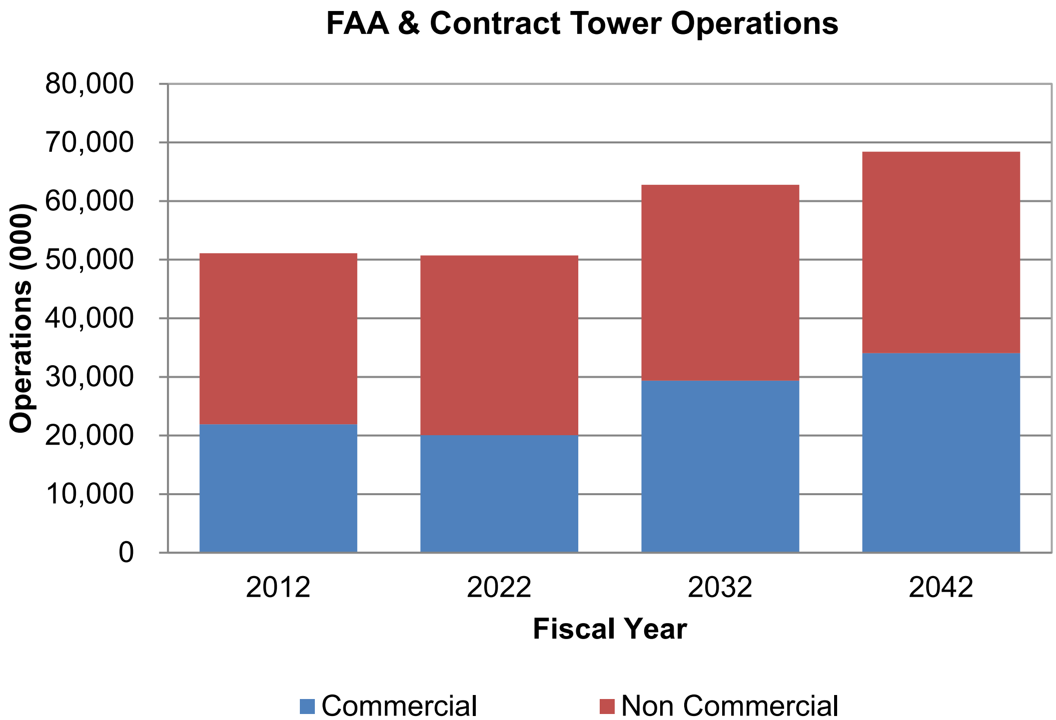
After operations return to pre-pandemic levels, the longer term economic health along with the growth in air travel demand and the business aviation fleet will drive the long term growth in operations at FAA facilities over the rest of the forecast period. Activity at FAA towers and contract towers is forecast to increase at an average rate of 1.5 percent a year through 2042 from 50.7 million in 2022 to close to 68.4 million in 2042. The 1.5 percent annual growth forecast is lower than the 1.9 percent forecast for 2021-2041 last year mainly due to the shorter recovery time from COVID-19. Commercial operations[5] at these facilities are forecast to increase 2.7 percent a year, approximately five times faster than non-commercial operations. The growth in commercial operations is less than the growth in U.S. airline passengers (2.7 percent versus 3.8 percent) over the forecast period due primarily to larger aircraft (seats per aircraft mile) and higher load factors. Both of these trends allow U.S. airlines to accommodate more passengers without increasing the number of flights.

General aviation operations are forecast to increase an average of 0.6 percent a year as increases in turbine powered activity more than offset declines in piston activity. General aviation operations accounted for 57 percent of operations in 2021. The share has been increasing since the pandemic, from 51 percent in 2019 to 56 percent in 2020, and 57 percent in 2021. This occurs because the decline of general aviation traffic was relatively mild during the pandemic and the recovery speed has been very swift.

The growth in operations at towered airports is not uniform. Most of the activity at large and medium hubs[6] is commercial in nature, given that these are the airports where most of the passenger enplanements in the U.S., about 87 percent in 2021, are reported.

[5] Commercial operations include air carrier and commuter/air taxi operations.

[6] A large hub is defined to have 1 percent or more of total U.S. revenue passenger enplanements in FY 2021. A medium hub is defined to have at least 0.25 percent but less than 1 percent of total U.S. revenue passenger enplanements. In the 2021 TAF there were 29 large hub airports and 34 medium hub airports.



Given the growth in airline demand and most of that demand is at large and medium hubs, activity at the large and medium hubs is forecast to grow substantially faster than small towered airports including small FAA towers[7] and FAA contract towers[8]. The forecasted annual growth is 3.0 percent at large hubs, 2.4 percent at medium hubs, 0.9 percent at small FAA towers, and 0.7 percent at FAA contract towers between 2022 and 2042.

Among the 29 large hubs, the airports with the fastest long term annual growth forecast are those located along the coastal sections of the country where most large cities are located. Large cities have historically shown to generate robust economic activity, which in turn drives up the airline demand. On the other hand, the airports forecast to have slower long term annual growth tend to be located in the middle of the country. In terms of COVID-19 recovery, the airports with mostly domestic traffic and the ones located at popular leisure destinations are forecast to have shorter recovery timeline.

FAA Tracon (Terminal Radar Approach Control) Operations[9] are forecast to grow slightly

[7] Small FAA towers are defined as towered airports that are neither large or medium hubs nor FAA contract towers.

[8] FAA contract towers are air traffic control towers providing air traffic control services under contract with FAA, staffed by contracted air traffic control specialists.

[9] Tracon operations consist of itinerant Instrument Flight Rules (IFR) and Visual Flight Rules (VFR) arrivals and departures at all airports in the domain of the Tracon as well as IFR and VFR overflights.

faster than at towered facilities. This is in part a reflection of the different mix of activity at Tracons. Tracon operations are forecast to increase an average of 1.9 percent a year between 2022 and 2042. Commercial operations accounted for approximately 52 percent of Tracon operations in 2021 and are projected to grow 2.6 percent a year over the forecast period. General aviation activity at these facilities is projected to grow only 0.5 percent a year over the forecast.

The number of IFR aircraft handled is the measure of FAA En-Route Center activity. Growth in airline traffic and domestic leisure aviation is expected to lead to increases in activity at En-Route centers until the business aviation sector recovers. Over the forecast period, aircraft handled at En-Route centers are forecast to increase at an average rate of 2.7 percent a year from 2022 to 2042, with commercial activity growing at the rate of 3.1 percent annually. Activity at En-Route centers is forecast to grow faster than activity at towered airports and FAA Tracons because more of the activity at En-Route centers is from the faster growing commercial sector and high-end (mainly turbine) general aviation flying.[10] In 2021, the share of commercial IFR aircraft handled at FAA En-Route centers is about 78 percent, which is greater than the 52 percent share at Tracons or the 38 percent share at FAA and Contract Towers.

[10] Much of the general aviation activity at towered airports, which is growing more slowly, is local in nature, and does not impact the centers.

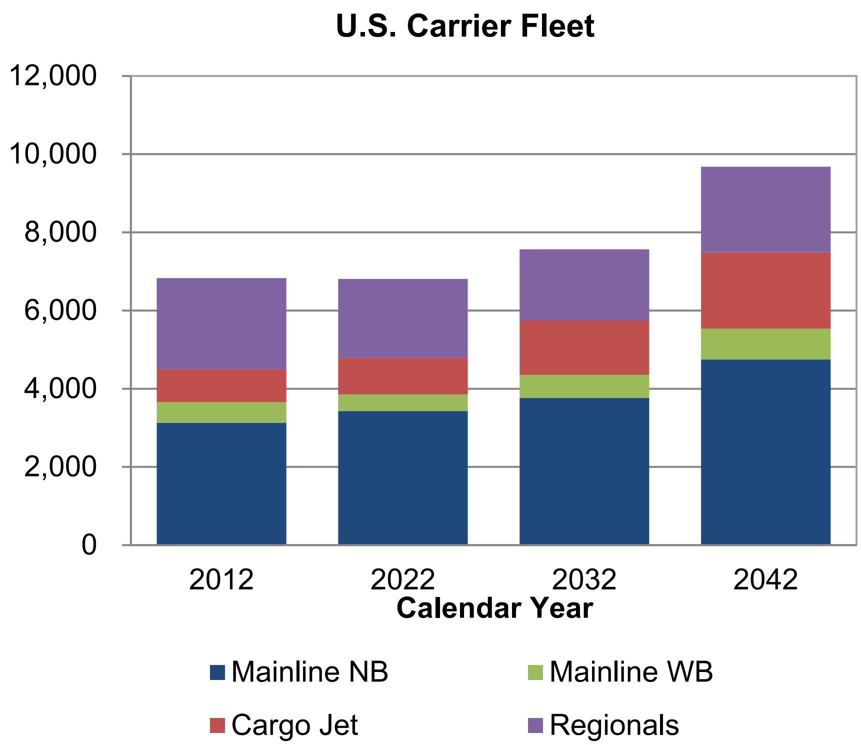
U.S. Commercial Aircraft Fleet

After arresting the Pandemic shrinkage and posting a very moderate -1.2% in 2020-21 (a decrease of 69 aircraft), the number of aircraft in the U.S. commercial fleet is forecast to increase from 5,815 in 2021 to 8,894 in 2042, an average annual growth rate of 2.0 percent a year. The continued recovery in demand from the COVID-19 downturn along with long-term post-COVID increases in demand for air travel and growth in air cargo is expected to fuel increases in both the passenger and cargo fleets.

Between 2021 and 2042 the number of jets in the U.S. mainline carrier fleet is forecast to grow from 3,132 to 5,532, a net average of 114 aircraft a year as carriers continue to remove older, less fuel efficient narrow body aircraft. As the industry recovers from the COVID-19 downturn, many aircraft that were temporarily parked are returning to the fleet, resulting in a large increase in the fleet (approximately 152 aircraft per year) out to 2026 and then slower rates thereafter. The narrow-body fleet (including E-series aircraft as well as A220-series at JetBlue and A220-series at Delta) is projected to grow 91 aircraft a year as carriers replace current technology 737 and A320 family aircraft with the next generation MAX and Neo families. The wide-body fleet grows by an average of 24 aircraft a year as carriers add 777-8/9, 787's, A350's to the fleet while retiring 767-300/400 and 777-200 aircraft. In total the U.S. passenger carrier wide-body fleet increases by 5.0 percent a year over the forecast period.

The regional carrier fleet is forecast to increase from 1,807 aircraft in 2021 to 2,187 in 2042 as the fleet expands by 0.9 percent a year (18 aircraft) between 2021 and 2042. Carriers remove 50 seat regional jets and retire older small turboprop and piston aircraft, while adding 70-90 seat jets, especially the E-2 family after 2021. By 2030 only a handful of 50 seat regional jets remain in the fleet. By 2042, the number of jets in the regional carrier fleet totals 1,979, up from 1,406 in 2021. The turboprop/piston fleet is forecast to shrink by 48% from 401 in 2021 to 208 by 2042. These aircraft account for 9.5 percent of the fleet in 2042, down from 22.2 percent in 2021.

The cargo carrier large jet aircraft fleet is forecast to increase from 876 aircraft in 2021 to 1,959 aircraft in 2042 driven by the growth in freight RTMs. The narrow-body cargo jet fleet is projected to increase by 19 aircraft a year as 737-800/900MAX's are converted from passenger use to cargo service. The wide body cargo fleet is forecast to increase 32 aircraft a year as new 777-8/10 and converted 767-300 aircraft are added to the fleet, replacing older MD-11, A300/310, and 767-200 freighters.


U.S. Carrier Fleet
12,000
10,000
8,000
6,000
4,000
2,000
0
2012
2022
2032
2042
Calendar Year
Mainline NB
Mainline WB
Cargo Jet
Regionals

Commercial Space

The FAA's Office of Commercial Space Transportation (AST) licenses and regulates U.S. commercial space launch activities including launch and reentry of vehicles and operation of non-federal launch and reentry sites authorized by Executive Order 12465 and Title 51 U.S. Code, Subtitle V, Chapter 509 (formerly the Commercial Space Launch Act). Title 51 and the Executive Order also direct the U.S. Department of Transportation to encourage, facilitate, and promote U.S. commercial launches. The FAA's mission is to license and regulate commercial launch and reentry operations and non-federal launch sites to protect public health and safety, the safety of property, and the national security and foreign policy interests of the United States.

The FAA licenses launches or reentries carried out inside the U.S. and by U.S. persons (which includes U.S. corporations) inside or outside the United States. The FAA does not license launches or reentries the U.S. Government carries out for the Government (such as those owned and operated by National Aeronautics and Space Administration (NASA) or the Department of Defense). Amateur-class rockets do not require a FAA license or permit[11].

To accomplish its mission, the FAA performs the following major functions:

- Maintains an effective regulatory framework for commercial space transportation activities,
- Provides guidance to prospective commercial operators on how to comply with regulatory requirements for obtaining an authorization and operating safely,
- Evaluates applications for licenses, experimental permits, and safety approvals for launch and reentry operations and related commercial space transportation activities,
- Evaluates applications for licenses for launch and reentry site operations,
- Monitors and enforces regulatory compliance through safety inspections of launches, reentries, sites, and other regulated commercial space activities,
- Provides U.S. Government oversight of investigations associated with the mishap of an FAA authorized launch or reentry,
- Facilitates the integration of commercial space launch and reentry operations into other modes of transportation including the National Airspace System (NAS) by establishing appropriate hazard areas and limits to ensure the protection of the public,
- Coordinates research into the safety, environmental, and operational implications of new technologies and the evolving commercial space transportation industry,

[11] Per 14 CFR Chapter 1, Part 1, section 1.1: Amateur rocket means an unmanned rocket that is propelled by a motor or motors having a combined total impulse of 889,600 Newton-seconds (200,000 pound-seconds) or less; and cannot reach an altitude greater than 150 kilometers above the earth's surface.

- Conducts outreach to the commercial space industry by hosting working groups and conferences,
- Collaborates with Government partners, such as the Department of Defense and NASA to assure consistent approaches to regulations, policy, and standards, and
- Conducts outreach to international counterparts to promote the U.S. regulatory framework across the world.

In addition to AST headquarters offices in Washington, D.C., AST maintains staff with assigned duty locations near active launch ranges to facilitate communication with space launch operators and to implement FAA's regulatory responsibilities more efficiently. AST personnel are currently assigned to duty locations in close proximity to: Kennedy Space Center and Cape Canaveral Space Force Station in Florida; Johnson Space Center in Texas; and, Vandenberg Air Force Base and the Mojave Air and Space Port in California. FAA also directly supports NASA's commercial space initiatives by providing on-site staff at both the Johnson Space Center and Kennedy Space Center to coordinate the FAA's regulatory and compliance activities with NASA's development and operational requirements for commercial space.

Regulatory Safety Oversight Activities of FAA

The business cycle from the time a firm first contacts FAA until the last launch of a licensed operation can be several years. There are many activities performed by FAA during this cycle. The most notable activities are described here.

Pre-Application Consultation for Licenses, Experimental Permits, and Safety Element Approvals

Prospective applicants seeking commercial space transportation licenses, experimental permits, or safety approvals are required by regulation to consult with FAA before submitting their applications. During this period, FAA assists them in identifying potential obstacles to authorization issuance and determining potential approaches to regulatory compliance. In addition, many new operators are seeking to incorporate new technologies, vehicle types, or operational models creating opportunities for FAA to assist in determining the applicable regulations or approach to regulatory compliance.

Licenses, Permits, and Safety Element Approvals

FAA authorizes commercial space transportation activities via the issuance of licenses, permits, and safety element approval. Though many licenses authorize multiple launches (for mature launch systems), the need remains for FAA to also issue individual launch licenses for systems that are still maturing towards a high level of reliability. Furthermore, with the dynamic commercial space industry, FAA often evaluates launch and reentry systems and operations that are evolving and changing, which may ultimately require license modifications or issuance of new licenses.

Inherent in the review process is the requirement to conduct policy reviews and payload reviews. When conducting a policy review, FAA determines whether the proposed launch, reentry, or site operation presents any issues that would jeopardize public health and safety or the safety of property, adversely affect U.S. national security or foreign policy interests, or be inconsistent with international obligations of the United States. If not otherwise exempt from review, FAA reviews a payload proposed for launch or reentry to determine whether the payload would jeopardize public health and safety, the safety of property, U.S. national security or foreign policy interests, or the international obligations of the United States. The policy and/or payload determination becomes part of the licensing record on which FAA's licensing determination is based.

FAA reviews and issues launch and reentry site operator licenses and license renewals. FAA also reviews and evaluates launch site license applications for launch sites located in foreign countries but operating with U.S.-licensed launch or reentry systems. FAA coordinates planning among Federal, state, and local governments and with the commercial range operators or users. As part of the evaluation of applications for launch licenses, reentry licenses, and site operator licenses, FAA also conducts environmental reviews consistent with its responsibilities under the National Environmental Policy Act.

FAA anticipates issuing a growing number of safety element approvals for space launch systems equipment, processes, technicians, training and other supporting activities. FAA reviews, evaluates, and issues safety approvals to support the continued introduction of new safety systems, safety operations applications, and safety approval renewal applications.

Safety Analyses

FAA conducts flight safety, system safety, maximum probable loss, and explosive safety analyses to support the evaluation and issuance of licenses and permits. FAA also evaluates and analyzes the performance of safety-critical space flight personnel to determine how they affect public safety risk. In the near future, as commercial firms become more involved with human space flight activity, AST and the FAA's Office of Aerospace Medicine may evaluate, analyze, and determine the health risks to the space flight participants (crew and space flight participants) due to natural and flight-induced launch and reentry environments, as well as any hazardous ground operations directly associated with the flight.

Inspections and Enforcement

FAA currently conducts as many as 330 preflight/ reentry, flight/ reentry, and post-flight/ reentry safety inspections per year. Inspections often occur simultaneously at any of the 12 licensed U.S. and international commercial space launch sites, as well as at 4 Federal launch ranges and 3 exclusive-use launch sites. The establishment of non-federal launch sites requires additional inspections in areas such as ground safety that have traditionally been overseen by the U.S. Air Force (now the U.S. Space Force) at Federal ranges. At spaceports and launch sites with high launch rates (e.g., Cape Canaveral Space Force Station, Vandenberg Air Force Base, the Mid-Atlantic Regional Spaceport, and Spaceport America), at least 80 percent of inspections are typically conducted by locally-based field inspectors. Additionally, as a result of the COVID-19 pandemic, many inspections in fiscal year (FY) 2020 were handled remotely. FAA will leverage this approach in the upcoming years in order to respond to a dynamic operational tempo, minimize cost, and increase efficiency.

Mishap Investigations

Mishap events have demonstrated that FAA needs to have the capacity to oversee the investigation of at least two space launch or reentry mishaps or accidents simultaneously anywhere in the world, and to lead/oversee as many as nine investigations during a single year. FAA anticipates an increase in mishaps with new operators coming online. FAA reviews all applicant mishap plans and accident investigation procedures as part of the license and permit evaluation process.

NAS Integration

AST works in partnership with all FAA lines-of-business, notably the Air Traffic Organization (ATO) and Office of Airports (ARP) to support the safe and efficient integration of commercial launch and reentry operations through the NAS and its system of airports and air traffic managed by the ATO. AST expects an increased level of interaction with the ATO, ARP, and the FAA Office of NextGen (ANG). Further, AST works with the ATO as FAA develops technologies to facilitate safe and efficient integration of commercial launch and reentry operations through the NAS, including technologies to improve the integration of launch and reentry data into FAA air traffic control systems and technologies to improve the timely and accurate development and distribution of notices of aircraft hazard areas.

FAA's Launch and Reentry Operations Forecast

FAA's 5-year launch and reentry operations forecast relies on data collected from operators and prospective applicants as the starting point for its launch and reentry forecasts, tying launch and reentry forecasts directly to anticipated operations by commercial space transportation firms known to FAA. As commercial space activity is still a highly dynamic and rapidly evolving industry, FAA's forecasting methodology continues to take a conservative view of industry growth by using historical launch activity data to establish better forecasting parameters for both new applicants and existing operators.

There are several factors that magnify the challenges associated with predicting the number of launches and reentries to expect in a given year. They include:

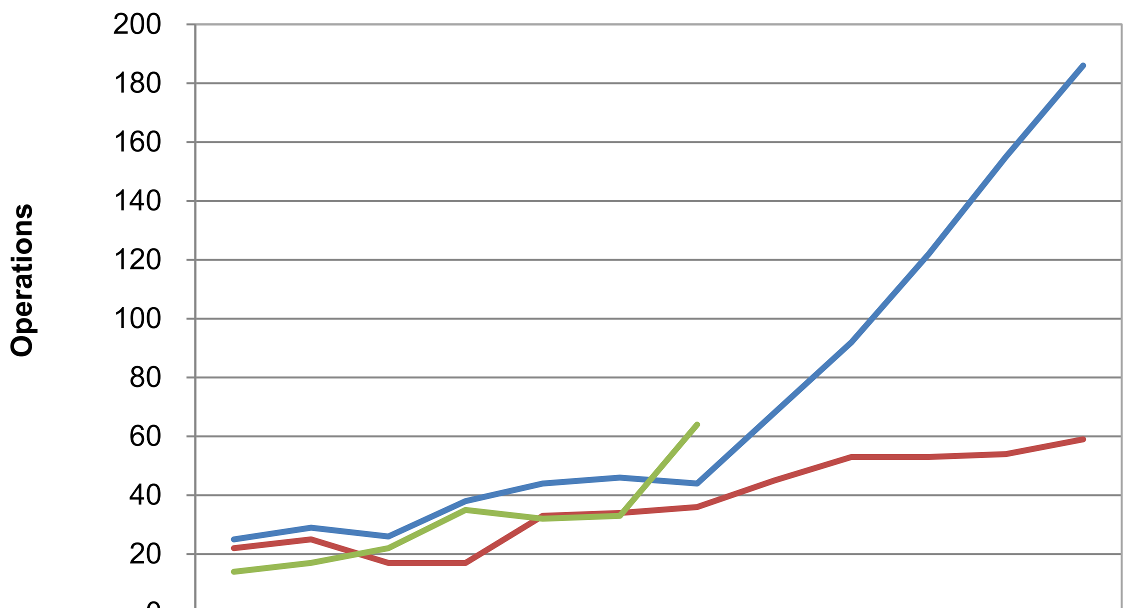
- list of firms intending to launch or actually launch is dynamic,
- continued development of new technologies,
- launch rates for reusable launch vehicles,
- commercial human spaceflight by both government astronauts and private citizens,
- dynamic nature of flight test programs, and
- mishaps.

New technologies [e.g., reusable launch vehicles (RLVs)] allow a faster operational tempo, and at the same time, early use of these technologies can increase the probability of a mishap. A mishap can drastically impact launch plans for one or more firms. Investigations and subsequent "return to flight" for firms impacted by a mishap can take months. FY2022 forecast data was collected in January 2022 and finalized in March 2022. The forecast can be considered a first quarter correction to previous forecast numbers.

However, there are reasons for optimism around the future of space activity moving forward. Space data, products, and services provide tangible benefits and economic opportunity to the American people as well as people all over the world. Firms are motivated towards new technology that is expected to increase launch cadences year over year. Interest and demand for space tourism as well as demands for placement of satellites and other equipment is anticipated to grow with each successful space mission. Likewise, as launch/reentry activities increase investment opportunities are also expected to grow. FAA has licensed approximately 525 launch/reentries since 1989, with 24% or 127 launch/reentries occurring in just the past three years (FY2018-2021). FY2021 actuals were the highest in U.S. history at 64, accounting for 12% of the activity since 1989.

FAA is forecasting launch and re-entry activity to increase from a low-high range of 45-68 in FY2022 to a low-high range of 59-186 by FY2026. Much of this increase is attributable to the lineup of reusable vehicles and the expectation for increased human space exploration. Taking these factors into account, the following table and graph provide FAA's forecasts through 2026, as well as historical activity.

Number of FAA Licensed and Permitted Operations by Fiscal Year, World-wide



	FY2015	FY2016	FY2017	FY2018	FY2019	FY2020	FY2021	FY2022	FY2023	FY2024	FY2025	FY2026
Forecast High	25	29	26	38	44	46	44	68	92	122	155	186
Forecast Low	22	25	17	17	33	34	36	45	53	53	54	59
Actual	14	17	22	35	32	33	64					

It is important to note all FAA-authorized commercial space operations are included in this forecast, regardless of where they occurred in the world. That is, not all launch and reentry activity occurs at one location, for example, at Cape Canaveral, Florida. In the past year, FAA licensed launches and reentries throughout the world, including multiple reentries in the Pacific and Atlantic Oceans and six licensed launches from New Zealand. This forecast, however, does not include launch activity not authorized by the FAA (e.g. U.S. Department of Defense or non-commercial NASA launches), launch activity for other nations, and this forecast is not tied exclusively to satellite demand.

Additional Factors Affecting Forecast Accuracy

Commercial space transportation is a rapidly evolving industry. The industry's growth through technological innovation and the development of new markets increases the challenges associated with forecasting commercial space transportation operations.

New Commercial Launch Technologies and Operations are Emerging Rapidly

The commercial space transportation industry is exploring a variety of new technologies and new approaches to space launch and reentry. In late 2015, both Blue Origin and Space Exploration Technologies Corp. (SpaceX) successfully demonstrated the reusability of their vertically launched rockets. Both companies are now developing a new generation of much larger orbital vehicles that will launch and land in a vertical configuration. By May 2021, SpaceX had successfully recovered 10 flown boosters, and planned to continue this trend in 2022. While these new orbital-class vehicles are expected to lead to increases in the number of annual launch and reentry operations over the next four years, if the trend is realized, greater increases may continue in the future, as the upper end of the forecast shows in fiscal years 2023 through 2026. Other U.S. commercial entities are also pursuing the development of reusable launch vehicles (RLVs). At the same time, state and local governments are joining with commercial firms to promote additional launch and reentry sites, and some firms are seeking to establish launch sites for their exclusive use. This added launch capacity sets the stage for simultaneous operations and an increase in the number operations per year.

New Markets for Commercial Space Transportation Continue to Emerge

The continuing development of commercial space transportation technology has spurred new markets for commercial space transportation services. As the commercialization of space flight demand increases on suborbital and orbital launches, new and reusable vehicles are emerging. With SpaceX and Blue Origin leading the way for reusable rocket development, there are a number of other private companies following suit. The introduction of reusable rockets is a significant cost reducer and thereby encourages more exploration into space.

States and municipalities have sought to open new spaceports to attract commercial space transportation and associated high-tech firms and create technology hubs for research and development. In 2021, Blue Origin flew its first crewed mission into space. Since 2008, NASA has managed the Commercial Resupply Services (CRS) program, which acquires transportation services from commercial providers to deliver cargo to and from the International Space Station (ISS). In 2020 and 2021, SpaceX successfully transported NASA astronauts to the International Space Station. Boeing continues to work on its vehicle for NASA's crewed mission. The commercial vehicles used by NASA for cargo and crew transportation will have other commercial applications that increase the capabilities of the commercial space transportation industry as a whole.

Looking further afield, there are several companies in the regulatory pipeline seeking authority to land commercial vehicles on the Moon, establish private-sector space stations, service satellites on-orbit, and establish launch sites using non-traditional technologies like railguns and tube launchers. Additional FAA resources may be needed to determine how these unprecedented commercial space ventures will impact public safety and U.S. national interests.

Unmanned Aircraft System

Unmanned Aircraft Systems or Drones

Drones have been experiencing healthy growth in the United States and around the world over the past few years. The last two years have been no exception, despite the profound impact of COVID-19 on the overall economy.[12] A drone consists of a remotely-piloted aircraft and its associated elements—including the control station and the associated communication links—that are required for safe and efficient operation in the national airspace system (NAS). The introduction of drones in the NAS has opened up numerous possibilities, especially from a commercial perspective. That introduction has also brought operational challenges including drones' safe and secure integration into the NAS. Despite these challenges, the drone sector holds enormous promise; potential uses range from individuals flying solely for recreational purposes to large companies delivering commercial packages and delivering medical supplies. Public service uses, such as conducting search and rescue support missions following natural disasters, are proving promising as well.

This section provides a broad overview covering recreational and commercial (or part 107) unmanned aircraft and their recent trends, as gathered from trends in registration, surveys, overall market, and operational information.[13] Using these trends and insights from industry, the FAA produces a number of forecasts. Forecasts reported in the following sections are driven primarily by the assumptions of the continuing evolution of the regulatory environment, the commercial ingenuity of manufacturers and operators, persistent recreational uses, and underlying demand for drone services.

Trends in Recreational/Model Aircraft New Registration

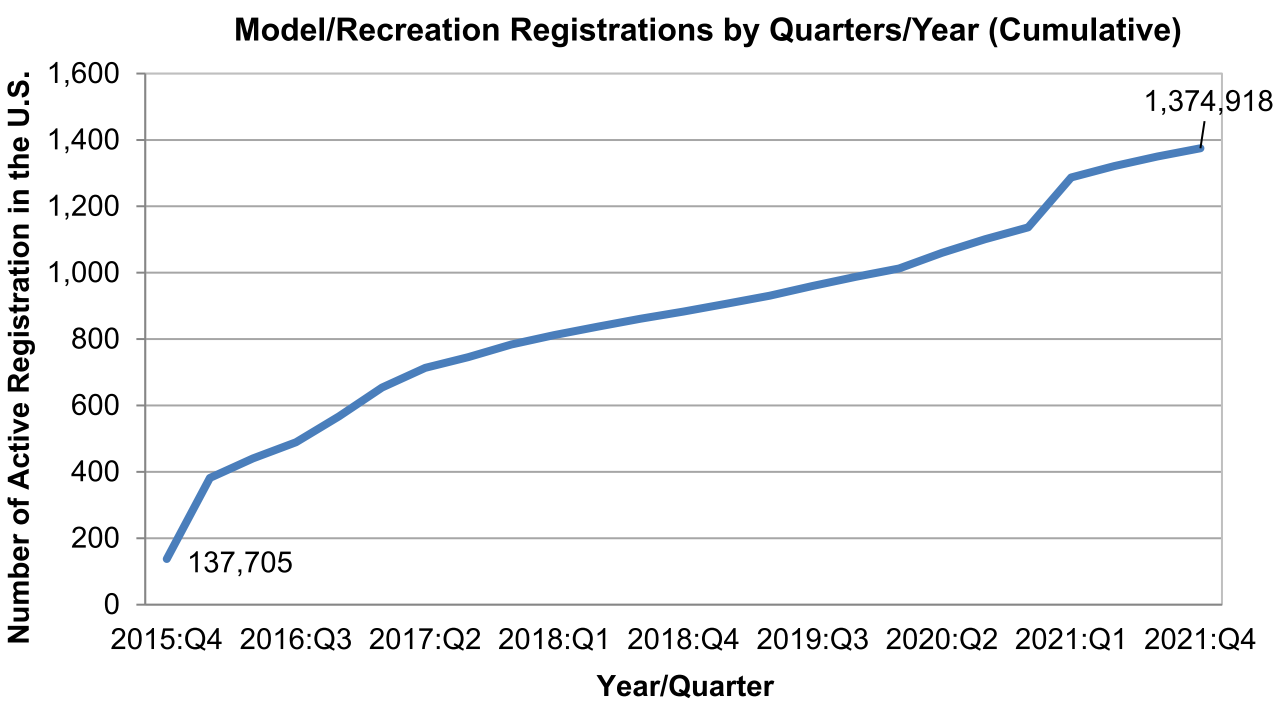
The FAA's online registration system for recreational/model small drones went into effect on December 21, 2015. This required all drones weighing more than 0.55 pounds (or 250 grams) and fewer than 55 pounds (or 25 kilograms) to be registered using the on-line system [www.faa.gov/uas/getting_started/register_drone/] or the existing

[12] Drone, model aircraft, and unmanned aircraft systems are often used interchangeably, both in common and legal terms. Although some communities differentiate between these terms, the three terms are used interchangeably in this document.

[13] Recreational and commercial drones are also called, interchangeably, hobby and non-hobby UAS, respectively. On October 5, 2018, the President signed the FAA Reauthorization Act of 2018 (Pub. L. 115-254). Section 349 of that Act repealed the Special Rule for Model Aircraft (section 336 of Pub. L. 112-95; Feb. 14, 2012) and replaced it with new conditions to operate recreational sUAS without requirements for FAA certification or operating authority. The Exception for Limited Recreational Operations of Unmanned Aircraft established by section 349 is codified at 49 U.S.C. 44809 [see www.federalregister.gov/documents/2019/05/17/2019-10169/exception-for-limited-recreational-operations-of-unmanned-aircraft for more details]. Recreational fliers, under Section 349, are referred to as "recreational fliers or modeler community-based organizations" [see www.faa.gov/uas/recreational_fliers/]. In previous notes including other documents of the Agency, these terms are often interchanged.

(paper-driven) aircraft registry. Registration was free for the first 30 days, and $5 thereafter. Following a temporary halt in registration due to an order from the US Appeals Court in Washington, DC in May, 2017 (*Taylor v. Huerta*), the registration requirement for all model aircraft was reinstated in December, 2017 with the National Defense Authorization Act (NDAA) [Pub. L. 115-91, Sec. 1092]. The NDAA extended the registration for three years for those registered prior to December, 2017. New registration resumed after the temporary halt was removed. On October 5, 2018, the President signed the FAA Reauthorization Act of 2018, which formalized new conditions for recreational use of drones. [See www.faa.gov/news/updates/?newsId=91844 for more details].

With the continuing registration, over 1.37 million (new) recreational drone owners had already registered with the FAA by end of December, 2021.[14] On average, new owner registration stood at around 10,300 per month during January – December 2021 with some expected peaks during the holiday seasons and summer.



The current pace of new registration has decreased compared to last year in the same period; average new monthly owner registration during 2021 stood at 2,500 less than the level observed in 2020.

[14] For our estimate and projections using the registration database, applying to recreational, commercial/part 107 and remote pilots, we use only those who are registered in the US and the territories for the period January – December, 2021. Furthermore, we draw a clear distinction between new registrations, cancellations, and renewals in this document.

Forecasts Using New Registrations vs. Effective/Active Fleet

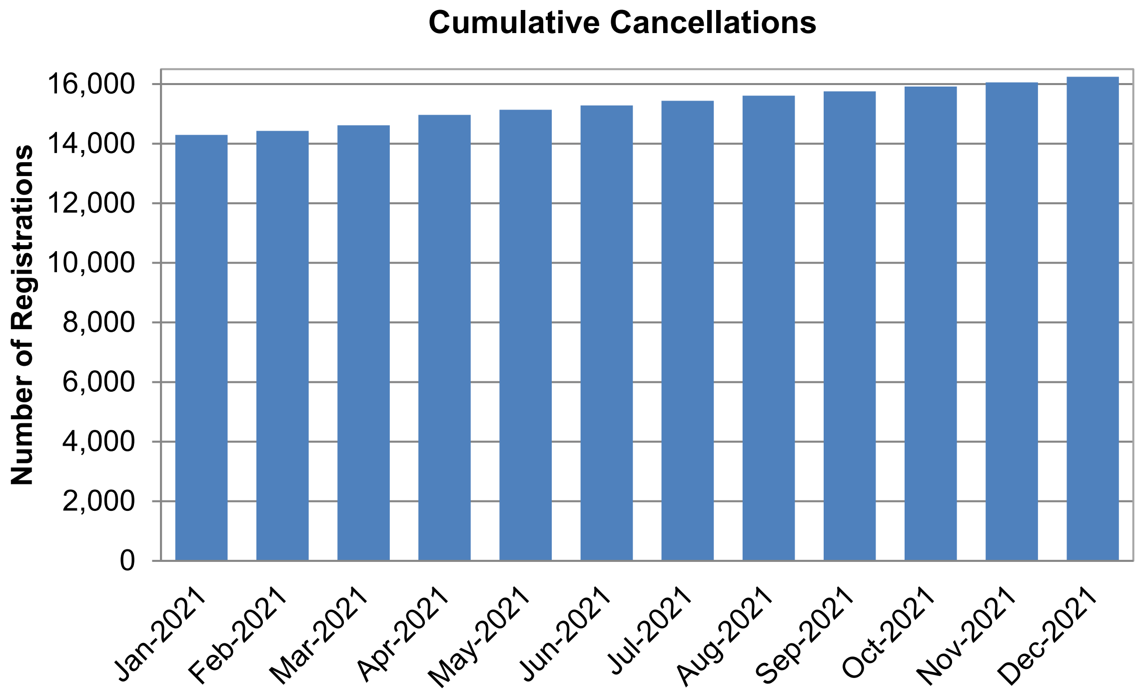
As noted in last year's Aerospace Forecast, small drones are registered for 3 years while remote pilot (RP) certifications are valid for 2 years. [See www.faa.gov/uas/getting_started/register_drone/ and

www.faa.gov/uas/commercial_operators/become_a_drone_pilot/.] Following the *Taylor vs. Huerta* ruling and the FAA's authority over registration via NDAA, the Agency elected to extend the registration period, for all drones registered prior to December 12, 2017, for three years. Thus, December 12, 2020 marked the first effective renewal date. As a result of this sequence of events, as noted in last year's report, approximately 800,000 small drone registrations were due for renewal in December 2020.

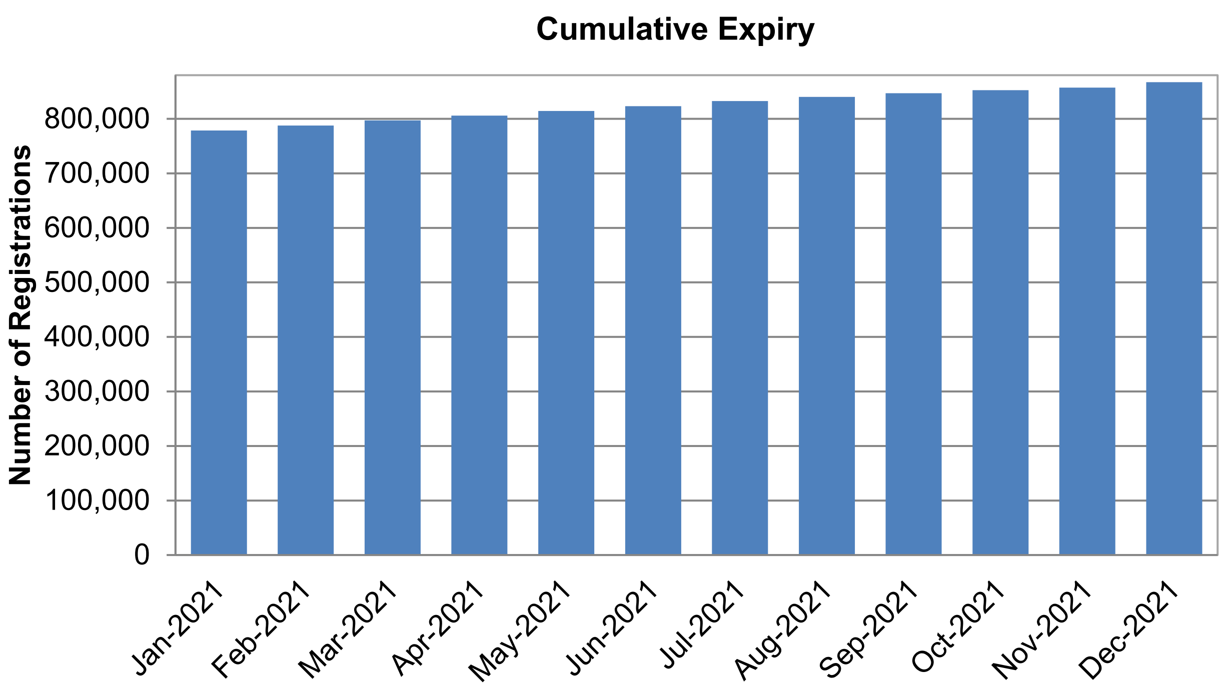
The beginning of the registration renewal afforded the FAA an opportunity to analyze the data, including duplicate and spurious registrations. Following this process, an examination of the data provided an opportunity for the FAA to discern the effective/active fleet more succinctly using the following five elements: *Cancellations*, defined as number of registrations canceled by user; *Expiry,* defined as the number of registrations expired; *New*, defined as the number of brand new registrations (i.e. new registration number) that are reported in the preceding section; *Renew*, defined as the number of registrations renewed prior to expiration; and *Renew+,* defined as the number of registrations renewed after expiration.

Cumulative cancellations were, on average, 15,313/month for the time period of January 2021 – December 2021 (or averaging around 179 new cancellations, or the average gaps between the two bars, for each month during the January – December 2021 timeframe):[15]

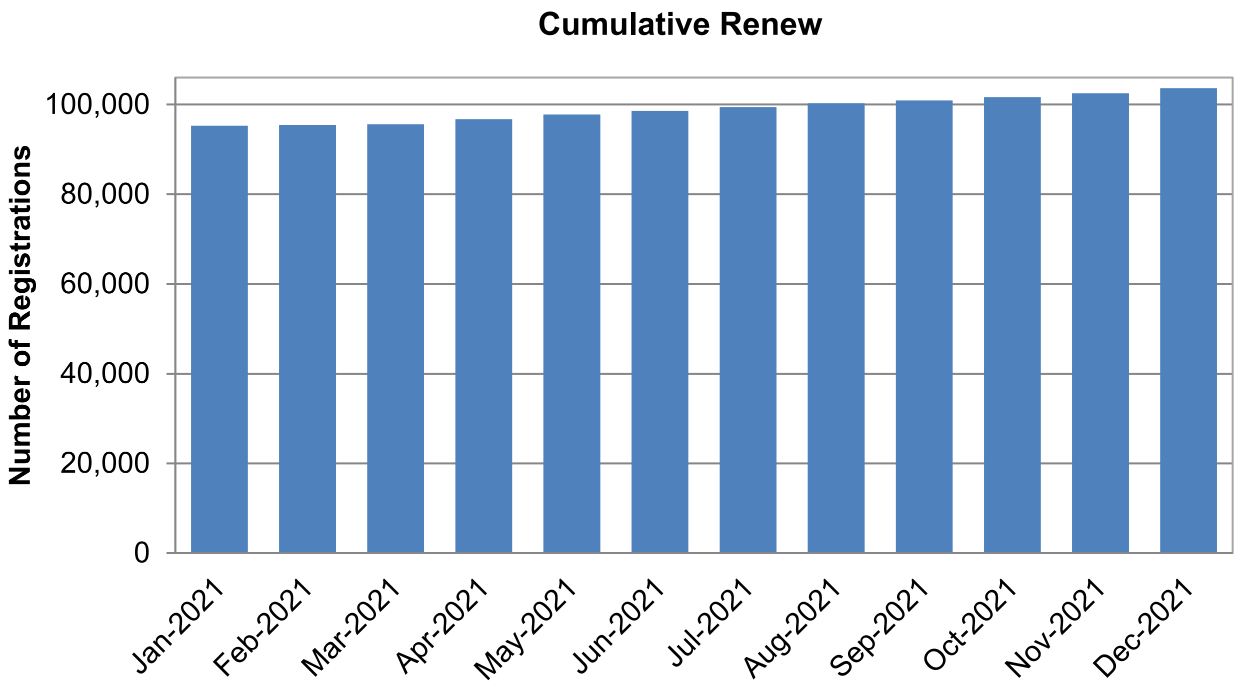
[15] We report cumulative numbers throughout this document for two reasons: first, cumulative numbers reflect the stability of the trend over time, taking into account past changes; and second, differences between the two numbers (i.e., bars) capture the changes between two particular time periods.



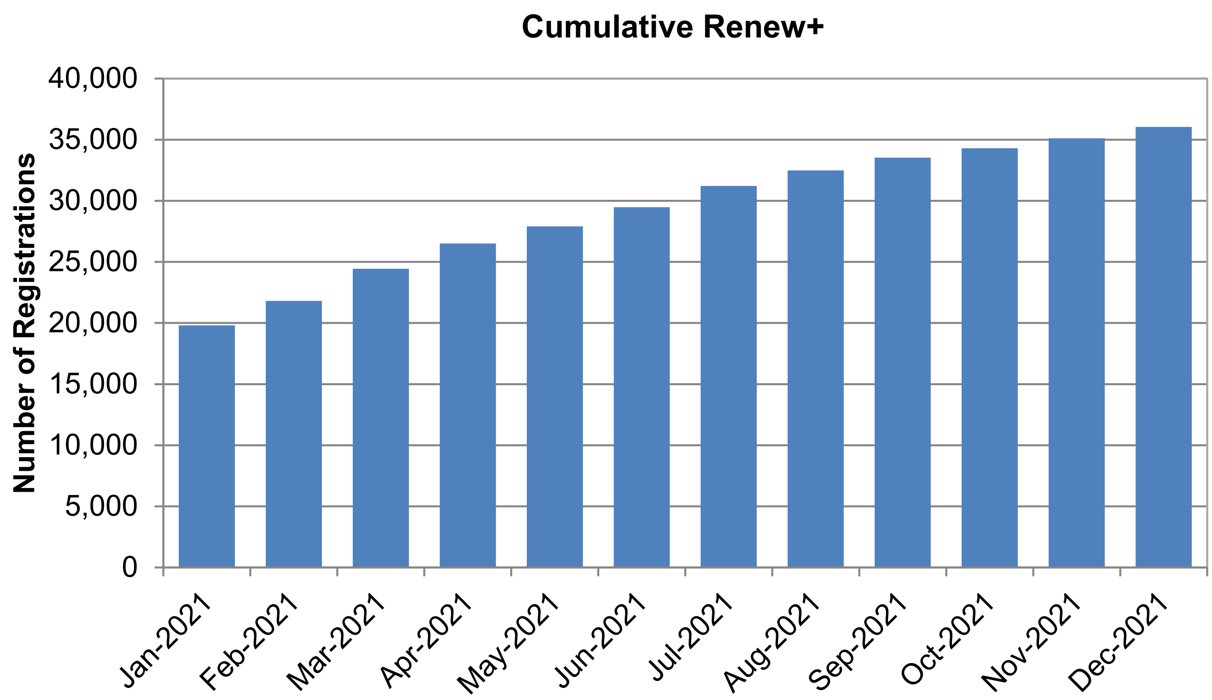
On average, cumulative registrations expired at a rate of more than 825,000/month following the substantial adjustment in December 2020, as noted above and as shown below. (This is equal to slightly more than 8,480 new average expiries for each month during January – December 2021):



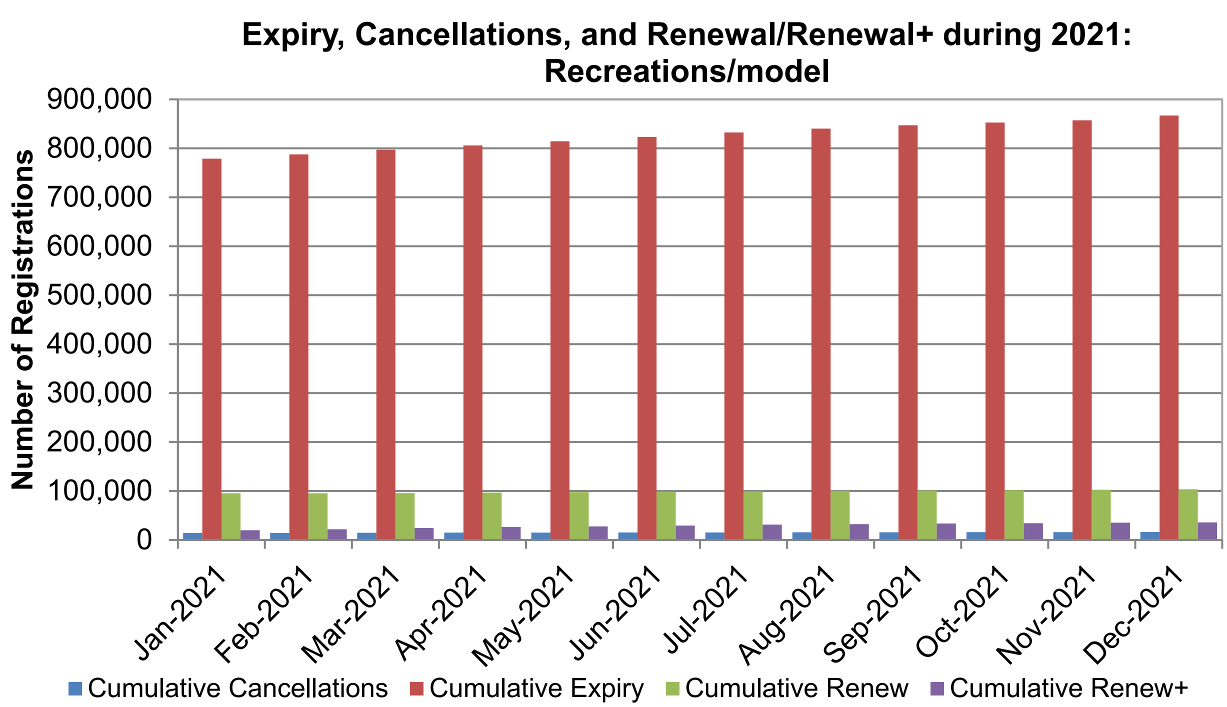
Renew or re-registrations prior to expiry date logged, on average, more than 98,984/month on a cumulative basis (or 712 new average renewals for each month during January – December 2021). This was almost four times higher than Renew+ on a cumulative basis, as reported below:



Renew+ are re-registrations after expiry date logged, on cumulative average, at 28,254/month. This is equivalent to approximately 1,780 new average Renew+ registrations for each month during January – December 2021 and are reported in below:



A summary of the above 4 charts is provided in below to narrate the relative contributions of cancellations, expiry, renew and renew+:



Calculating active/effective registrations for a particular day requires calculating the "net gain/loss" of registrations for each preceding day and adding them together with the particular day (i.e. calculating the running sum).

The following are the contributions of each element to the day's net gain/loss:[16]

- Cancel: (-1 for each registration);
- Expire: (-1 for each registration);
- New: (+1 for each registration)
- Renew: (0); and
- Renew+: (+1 for each registration)[17]

An example of this calculation may be constructed as follows: calculating the net gain/loss for recreational registration for August 9, 2021, where Cancel = 11; Expiry = 263; New = 276; Renew = 20; and Renew+ = 46 had been reported for recreational operators/modelers.

Thus, Net Gain/Loss for August 9, 2021 =

11 X (-1) + 263 X (-1) +

276 X (1) + 20 X (0) +

46 X (+1) = 48

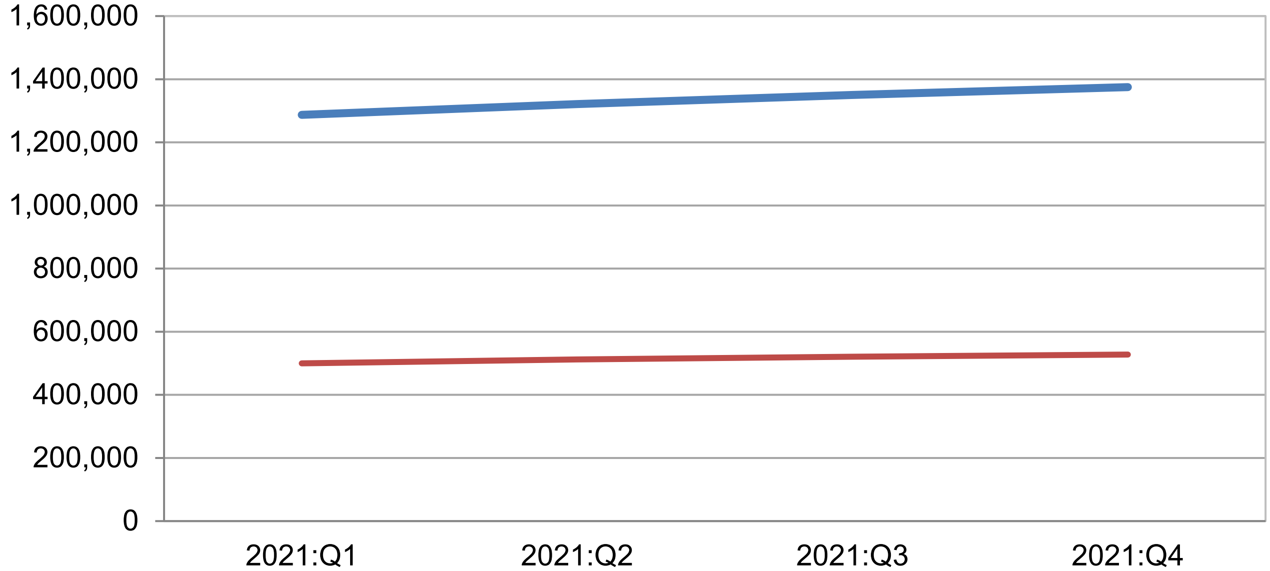
Finally, a comparison chart capturing the difference between cumulative new registrations and. effective/active registrations, using cumulative net gain/loss for recreational registrations, is provided below:[18]

[16] We attribute this methodology of calculations to the UAS Integration Office (AUS), provided internally to facilitate this year's forecasts. For cumulative new registration trends, see the final graph preceding this section.

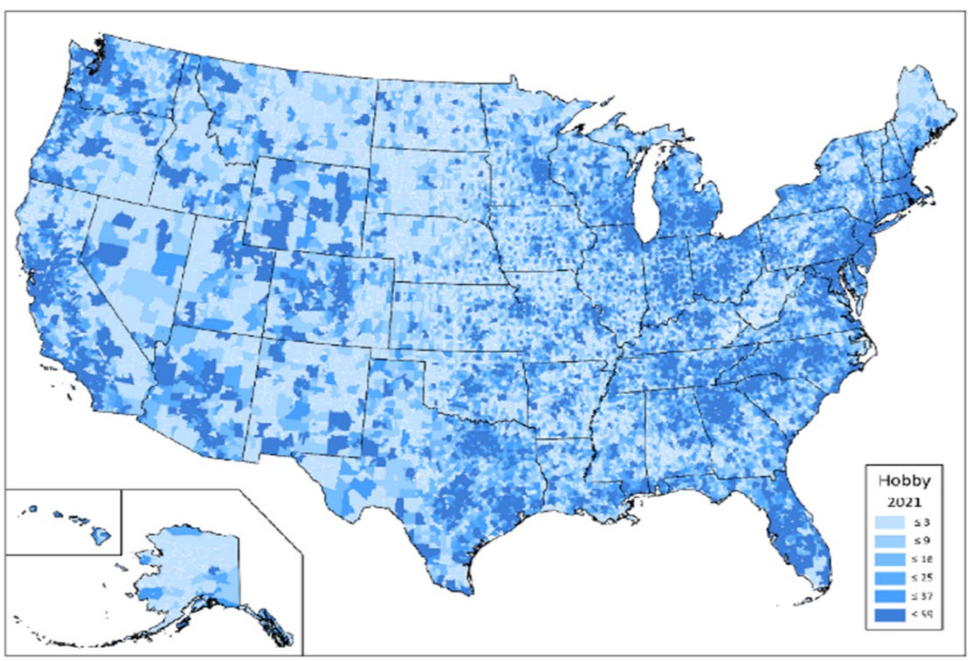
[17] It is important to note here that renew+ is a replacement for cancellation on a one-on-one basis.

[18] There are two important aspects making the difference: (a) the base; and (b) the rate of change in two lines. For cumulative net gain/loss, the base is highly influenced by substantial expiry and cancellations implemented in December 2020, as discussed above; the rates of change (or slope) of the cumulative net gain/loss line is influenced by these two elements plus new registrations and Renew+ re-registrations. In comparison, new registration counted cumulatively has a substantial base thus making the difference between the two lines while new monthly registrations is the primary factor driving the rate of change for cumulative new registrations line.

New Registrations versus Effective/Active Fleet: Model Recreation



Recreational registration, and thus ownership of small drones, is distributed throughout the country. Using the data available in December 2021, the spatial distribution of ownership by zip codes (shown below) demonstrates that small drones continue to be distributed throughout the US, with denser ownership mapping closely to the population centers of the zip codes, as expected.



At present, recreational ownership registration does not correspond one-to-one with aircraft. Unlike their commercial non-model counterparts, the registration rules for recreational operators do not require owners of recreational small drones to register each individual aircraft; only operators are registered. For each registration, therefore, one or more aircraft may be owned. In some instances, there is no equipment associated with registration. Free registration at the initial phase may have incentivized some to create a registration without any equipment to report. Notwithstanding these challenges, there is information available, both from industry and academia, allowing us to understand aircraft ownership. Furthermore, as a result of robust strategic drone research planning, the FAA has launched various research activities to understand the possible magnitude of the sector as well as implications for likely aircraft that may be used for recreational flying, as well as the safety impacts on the small drone fleet from gradual integration into the NAS. Finally, the Agency has incorporated outside analysis to aid forecasting efforts.

As noted in earlier annual reports, forecasts of small drones were based primarily on new registrations without considering the effective/active fleet for reasons described in the beginning of the section (e.g., lack of renewals required). However, now that data on elements for net gain/loss are available, more granular forecasts can be made, particularly the lower bound, using the effective or active fleet. With over 1.37 million new recreational operators cumulatively registered as of December 2021, the FAA estimates that there are approximately 1.58 million sUAS in the fleet distinctly identified as recreational aircraft. Comparing with industry sales and other data noted earlier, we conclude that the number of recreational aircraft is almost 15% higher than ownership registration.[19] Applying cumulative net gain/loss calculations from above, the effective/active fleet is estimated to be around 607,177 as of December 2021. This provides us the lower bound of effective/active fleet of recreational small drones in the NAS.

A comparison of last year's data (2020) with this year's (2021) shows the annual growth rate for new registration to be approximately 10.2%. This was possible due to the continuation of drones playing a dominant role in recreation, a continuation facilitated by decreasing equipment prices (e.g., average price of $750 or less), improved technology such as built-in cameras and higher capability sensors, and relatively easy maneuvering. Furthermore, it appears that COVID-19 had a positive impact on recreational registration during 2020, but a negative impact during 2021. (See below for more details.) Nevertheless, similar to all technologies fueling growth of hobby items, (e.g., cell phone and video game consoles, and prior to that, video cameras and video players), the trend in recreational small drone ownership registration has been slowing. It is likely to slow down further as the pace of falling prices diminishes

[19] This calculation involves taking into account retirement, redundancy, and loss of aircraft corresponding to ownership registration. As aircraft become sturdier and operators more situationally aware, this rate has been changing and we expect it to change dynamically over time. Assumptions tying ownership to aircraft holding and issues related to compliance have been discussed elsewhere. [See napawash.org/academy-studies/federal-aviation-administration-assessment-of-compliance-with-and-effective for a recent study by the National Academy of Public Administration on these issues.]

and the early adopters begin to experience limits in their experiments, or simply because recreational eagerness plateaus.

Given trends in registration and market developments, the FAA forecasts that the recreational small drone market will saturate at around 1.81 million units over the next five years.[20] However, there is still some upside uncertainty due to further changes in technology, including battery life, faster integration from a regulatory standpoint, and the likely event of continued decreasing prices. This leads to upside possibilities in the forecast of as many as 1.84 million units by 2026. In contrast, there are some low-side uncertainties; the primary among them is the lack of renewal (i.e., before and after expiry dates), followed by expiry and cancellations. The inertia, loss of interests, or lack of recreational opportunities may be key factors leading to the observed trends in renewal. Nevertheless, if renewals were kept up over time, effective/active fleet would likely converge to base forecasts, i.e., derived from cumulative new registrations combined with multiplicity of craft ownership. In the presence of slower renewal tendency, as data presently indicates, it is likely that the effective/active fleet will be lower than that derived from base forecasts. This provides the FAA with an opportunity to derive low-side forecasts using effective/active fleet calculations. Nevertheless, low-side uncertainty growth trajectory (i.e., annual growth rates) tracks closer to the base forecast. A forecast base (i.e., likely), together with high and low scenarios, is provided in the table below:[21]

Total Recreation/Model Fleet (Million sUAS Units)

Fiscal Year	Low*	Base**	High**
Historical			
2021	0.6072	1.5822	1.5822
Forecast			
2022	0.6509	1.6965	1.6981
2023	0.6848	1.7576	1.7645
2024	0.7096	1.7965	1.8182
2025	0.7262	1.8039	1.8272
2026	0.7378	1.8075	1.8360

*: Effective/Active fleet counts combined with multiplicity of craft ownership.

**: New registration counts combined with multiplicity of craft ownership.

[20] These forecasts have two dimensions worth emphasizing. When looked at from the cumulative base, "total" captures the number of drones that *are reported* to be in the system (i.e., base and high); while "effective/active fleet" refers to how many aircraft are *presently operating* in the system (i.e., low).

[21] As noted earlier, low scenario reports effective/active fleet using a net gain/loss calculation. By definition, low scenario differs from base and high scenarios, which are based on new registrations. Hence, a low scenario for the year 2021 is markedly different than the baseline and high scenario for the same year.

Last year, the FAA forecasted that the recreational small drone sector would have slightly more than 1.50 million drones in 2021, a growth rate exceeding 4.6% from the year before (2020). Actual data using new registration overshot the projection by a little over 80,000 registrations, with over 1.58 million small drones already accounted for by the end of 2021. Thus, our forecast of recreational small drones last year undershot by 5.06% for 2021, (or 1.5822 million actual aircraft vs 1.5022 million aircraft that were projected last year).

The FAA uses the trends observed in registrations, particularly over the past year; calculation of net gain/loss (described above) this year; information from the survey conducted in 2018; expert opinions distilled from Transportation Research Board annual workshops; review of available industry forecasts; market/industry research; and time-series models fitted on monthly data. These apply to all three elements reported above: low, base, and high forecasts. Using these, the FAA forecasts that the recreational small drone fleet will likely (i.e., base scenario) attain its peak over the next 5 years, from the present 1.58 million units to approximately 1.81 million units by 2026.

Following a similar growth trajectory as the base, there will be approximately 738,000 active/effective small drones over the next five years in 2026, which is now the low forecast for recreational/model small drones. Active/effective fleet count is derived and projected based on the net gain/loss calculation discussed above. The high scenario, on the other hand, may reach as high as 1.84 million units. High scenario projection is based on the base forecast.

Notice that eventual saturation at somewhat higher levels, in comparison to last year's projections, reflects relatively higher new registration by recreational flyers observed during 2021. The increased new registration trend, in part driven by COVID-19, may or may not continue in the longer run.[22] In comparison, low side forecasts assume the present trend in renewals followed by similar expiry and cancellations. Nevertheless, the growth rates underlying these numbers are fairly steady in the initial years, but fade faster in the last two to three years. The gradual saturation that is projected in five years and beyond in the recreational small drone fleet parallels other consumer technology products and the Agency's projections from last year, particularly with respect to base and high forecasts. However, both the numbers and the growth trajectory for the low scenario (i.e., effective/active fleet) are fundamentally different than the last year for reasons described above. Nevertheless, it provides a lower bound that is likely to be closer to reality in terms of small drones that are in use and effective in the NAS.

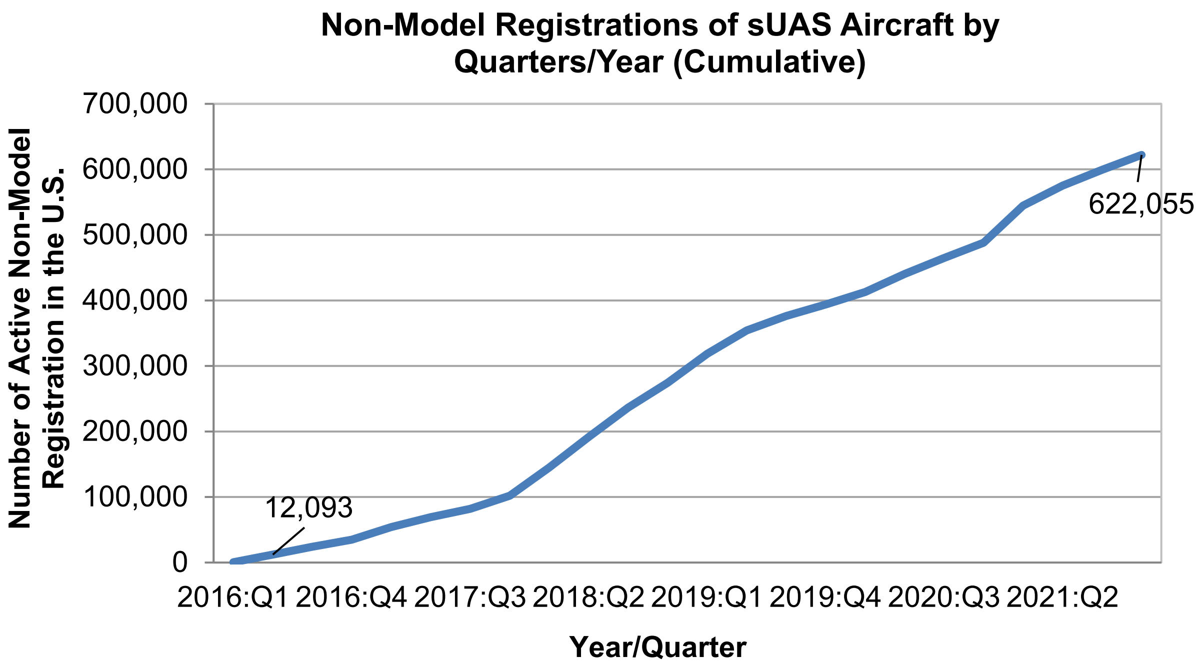
[22] It is quite likely that many users are buying and experimenting with recreational small drones given the COVID-19 public health emergency and the substantial portion of the workers presently working from home. This trend may or may not continue once regular work patterns are resumed.

The Recreational UAS Safety Test (TRUST)

Under the most recent (2018) reauthorization bill [see www.congress.gov/115/bills/hr302/BILLS-115hr302enr.pdf], new requirements for recreational pilots have been introduced. (See P.L. 115-254 – exception for limited recreational operations of unmanned aircraft.). TRUST is the safety test for recreational/model small drones. It provides education and testing for recreational flyers on important safety and regulatory information. All recreational flyers must pass an aeronautical knowledge and safety test and provide proof of test passage – the TRUST completion certificate — to the FAA or law enforcement upon request. [See www.faa.gov/uas/recreational_fliers/knowledge_test_updates/ for more details.] By December 2021, more than 175,000 recreational flyers completed TRUST certification subsequent to its inception in June 2021.

Trends in Commercial/Non-Model Aircraft and Forecasts Using Registrations vs. Effective/Active Fleet

Online registration for commercial/non-model small drones went into effect on April 1, 2016. Unlike recreational/model ownership, rules for commercial registration require owners to register each small drone, thus creating a one-to-one correspondence between registration and aircraft. During the period of January – December 2021, more than 100,000 commercial operators registered their new equipment. The pace of monthly registration, around 8,500, is higher than the same period in 2020, which was approximately 7,870. It appears that the pace of new registrations is picking up speed slightly in comparison with 2020 and prior years. (From April 2016 – December 2020 there were roughly 9,100 new registrations per month.) As the pace of recreational registration has increased somewhat, particularly last year, the pace of new registration for the commercial counterparts has followed suit, with more than 620,000 commercial drones registered since April 2016.



For each month the registration has been available, over 4,600 new aircraft per month were registered until December 2017. This pace accelerated to 14,600 new registrations per month during 2018. During 2019, average monthly new registrations stood at approximately 10,100. In the past year, 2020, average monthly registration dropped to 7,850, while during 2021, average monthly registrations jumped by 650 to around 8,500. The commercial small drone sector is dynamic and appears to be at an inflection point, demonstrating powerful stages of growth. Unlike the recreational small drone sector, the FAA anticipates that the growth rate in this sector will remain high over the next few years. This is primarily driven by the regulatory clarity that part 107 continues to provide to industry. In particular, the Operations Over People final rule, published on December 28, 2020, is the latest incremental step towards further integration of small drones into the NAS. This final rule allows routine operations over people and routine operations at night under certain circumstances, and eliminates the need for individual part 107 waivers. [See www.faa.gov/news/media/attachments/OOP_Executive_Summary.pdf for more details.]

The Remote ID rule was announced on December 28, 2020 as well. [See www.faa.gov/news/media/attachments/RemoteID_Final_Rule.pdf] Upon adjudicating numerous comments from stakeholders, the final rule [See www.faa.gov/sites/faa.gov/files/2021-08/RemoteID_Final_Rule.pdf for more details] was published in the Federal Register on January 15, 2021 with an original effective date of March 16, 2021. Corrections made to the rule and published in the Federal Register on March 10, 2021 delayed the effective date to April 21, 2021. Remote ID (i.e., digital license-plate) of remotely piloted aircraft is necessary to ensure public safety and efficiency of US airspace. The rule applies to all operators of small drones that require FAA registration (i.e., both recreational and part 107). Remote ID provides airspace awareness to the FAA, national security agencies, law enforcement entities, and other government officials. In accordance with the requirements of the present rule, remotely piloted aircraft in flight are to provide, via broadcast, certain identification, location, and performance information that can be received by interested parties on the ground and by other airspace users.

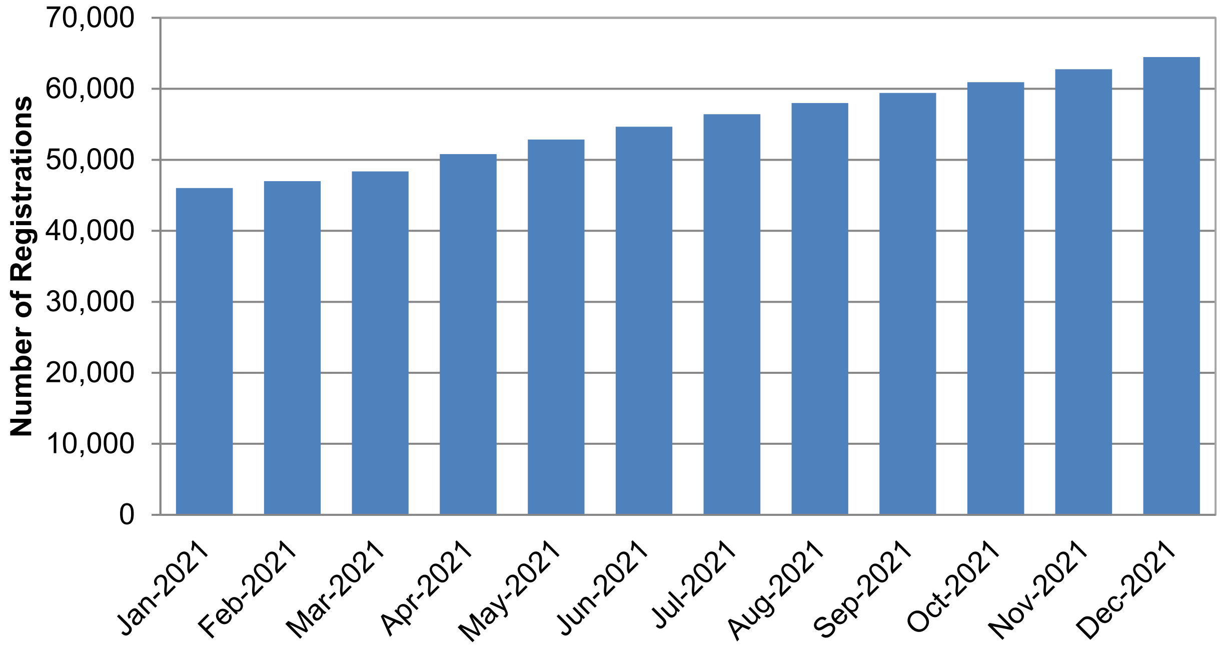
There are three ways to comply with the remote ID rule: (a) operate a standard remote ID small drone broadcasting identification and location information of both the aircraft and control station; (b) operate a small drone with a remote ID broadcast module attached to it that broadcasts identification, location and take-off information; and (c) operate a small drone without remote ID at specific FAA-recognized identification areas (or FRIAs). As noted, almost all of the final rule on remote ID became effective on April 21, 2021. The subpart covering the process for FRIA applications from community-based organizations and educational institutions becomes effective September 16, 2022. Drone manufacturer compliance with the final rule's requirements becomes effective on September 16, 2022 as well. Finally, operator compliance with the remote ID rule and/or in an FAA designated FRIA is required by September 16, 2023. [See www.faa.gov/uas/getting_started/remote_id/ for more details]

These two rules together provide much-needed regulatory clarity and reduce the need for waivers under part 107. With enhancement of operational efficiencies under increasingly well-defined concepts of operations (CONOPS)—which ensures safety and transparent information flow across the community—more and more commercial uses will become likely, fueling even further growth. Notably, as a central location for receiving all operational information, including registration, authorization, and accident report logs the DroneZone has helped further facilitate this growth. [faadronezone.faa.gov/#/].

As noted in the preceding section, the beginning of the registration renewal afforded the FAA an opportunity to review part 107 data; duplicates and unnecessary registrations were removed, and the registration database was made cleaner and more compact. As in the case of recreational/model aircraft, an examination of the data provides an opportunity to discern the effective/active fleet more accurately using the following five elements introduced earlier: Cancellations; Expiry; New; Renew; and Renew+. It is worth mentioning here that, prior to having access to these five elements, forecasts in the past were based only on new registration trends.

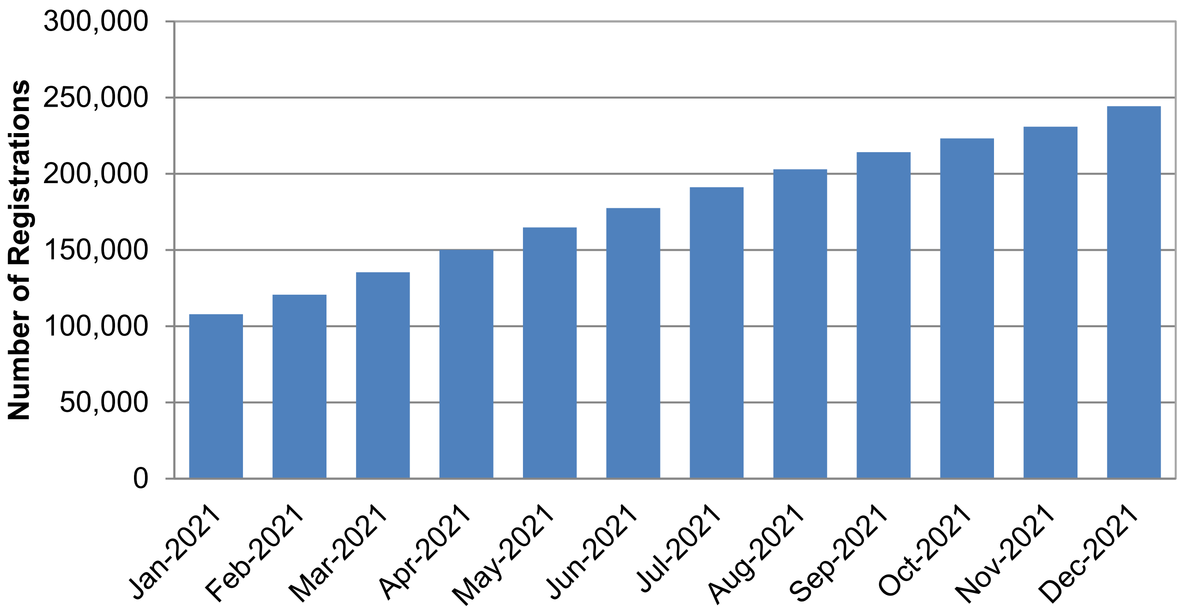
An average of 55,140 cancellations per month, on a cumulative basis, were reported between January – December 2021, as shown below. This is an average of approximately 1,650 new cancellations for each month of 2021.

Cumulative Cancellations

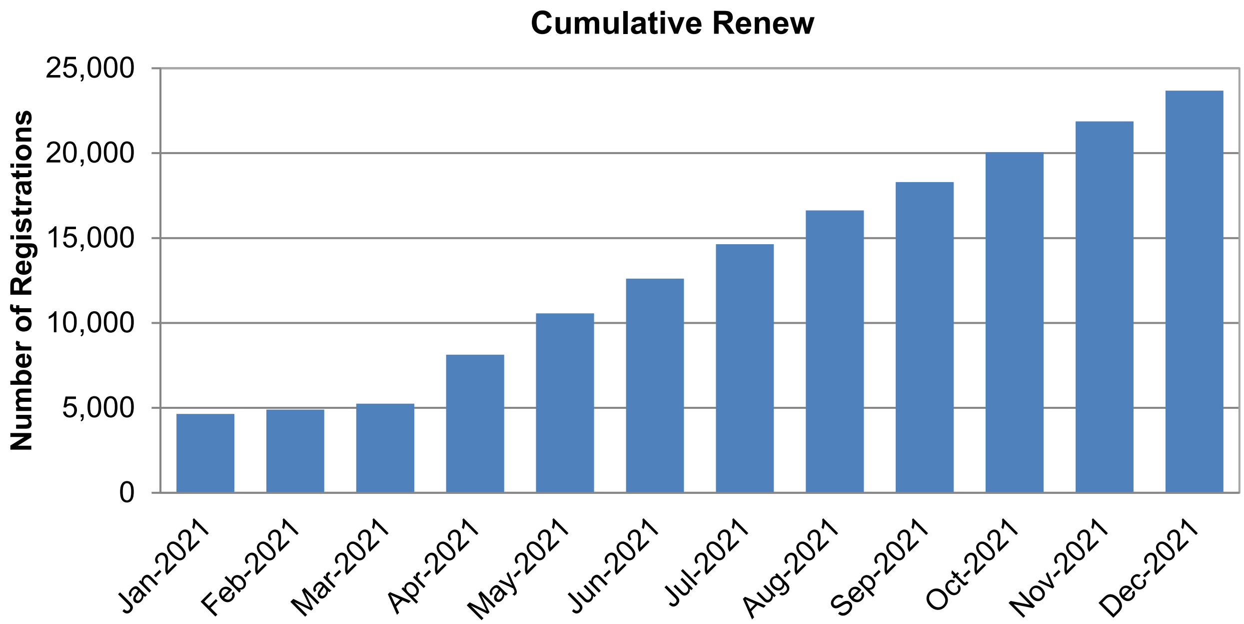


An average of 180,306 expirations per month was reported on a cumulative basis between January 2021 – December 2021 following the substantial adjustment noted above and as shown below. (This equals approximately 12,610 new average expiries for each month during January 2021 – December 2021):

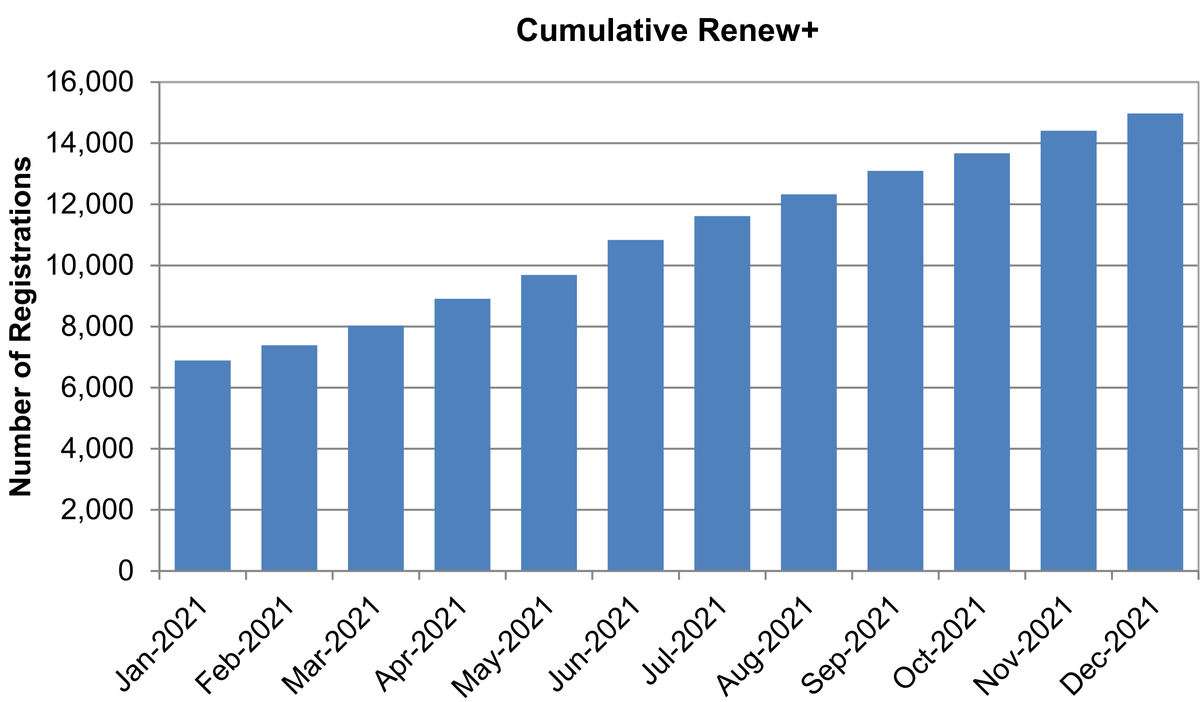
Cumulative Expiry



Renew or re-registration prior to expiry date logged, on average, more than 13,440/month on a cumulative basis during January 2021 – December 2021 (or 1,610 new average renewals for each month during January – December 2021):



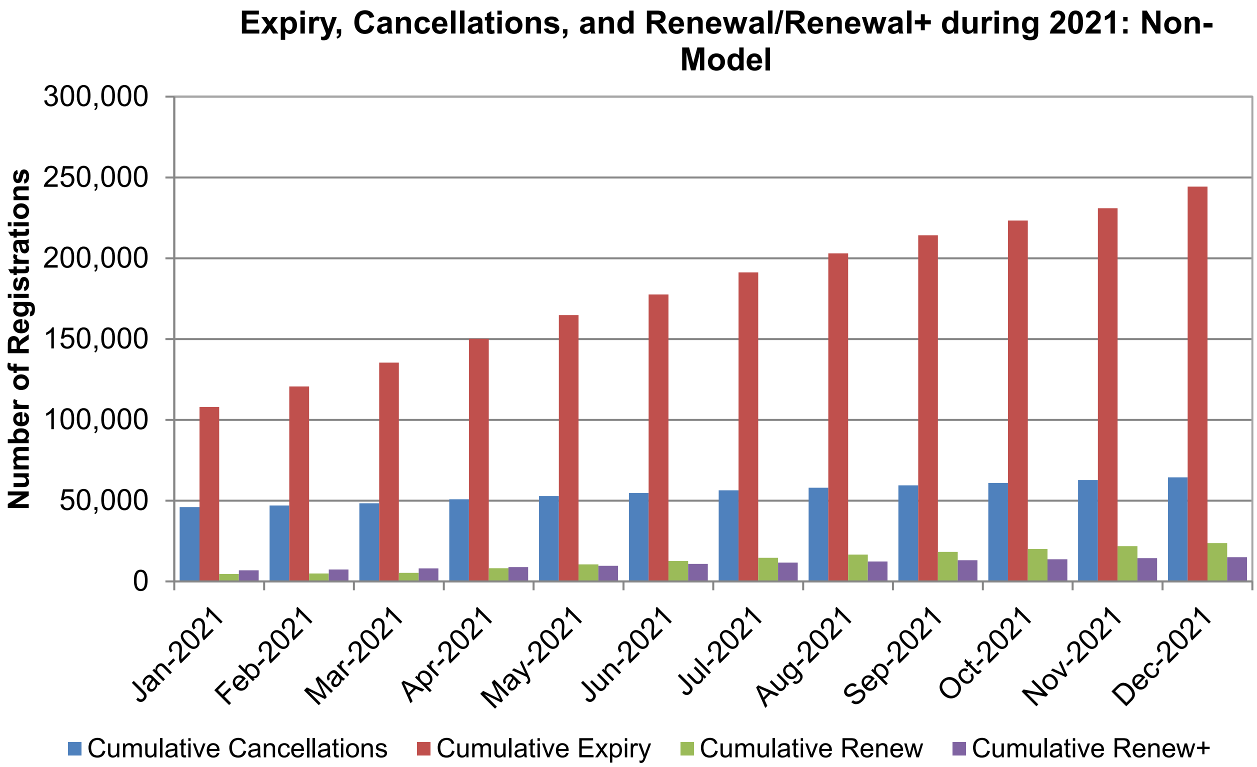
"Renew+" are re-registrations after expiry, and logged, on average, 10,986/month on a cumulative basis. This is an average of 718 new Renew+ each month between January 2021 – December 2021, as reported below:



As in the case of recreational/model registrations, calculating active/effective registrations for a particular day requires calculating the "net gain/loss" of registrations for each preceding day and adding them with the particular day (i.e. calculating the running sum).

Using the formulation described in the example in the preceding section, we can derive the net gain/loss for part 107 data as well.

A summary of the above 4 charts is provided in below to relate the relative contributions of cancellations, expiry, renew and renew+:



A comparison chart capturing the difference between cumulative new registrations vs. effective/active registrations using net gain/loss for part 107 registration is provided below:

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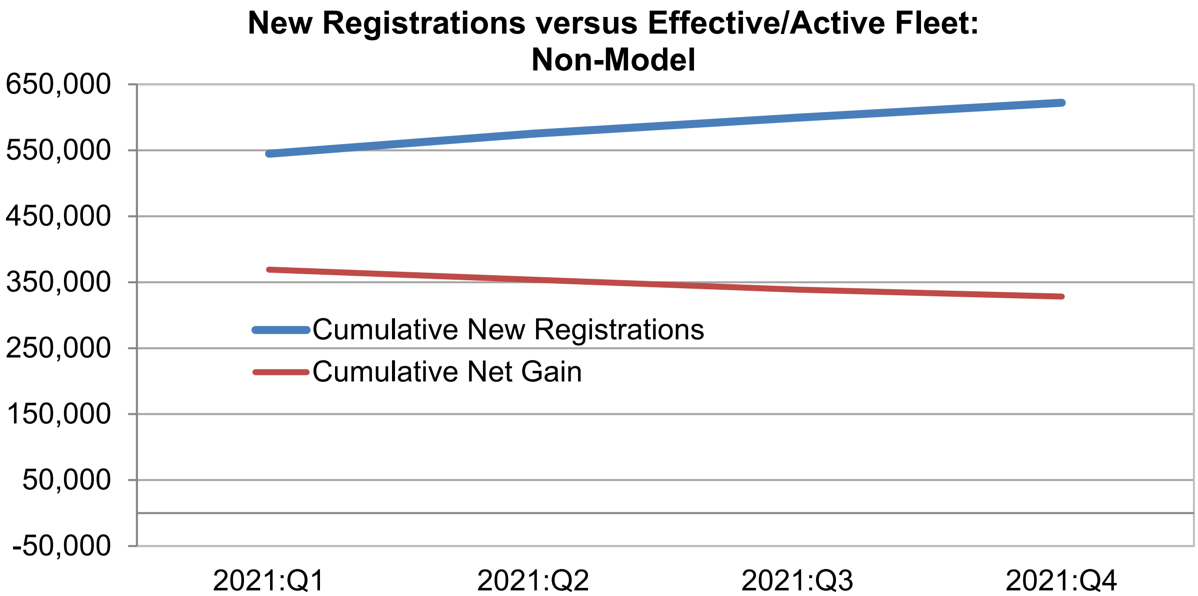
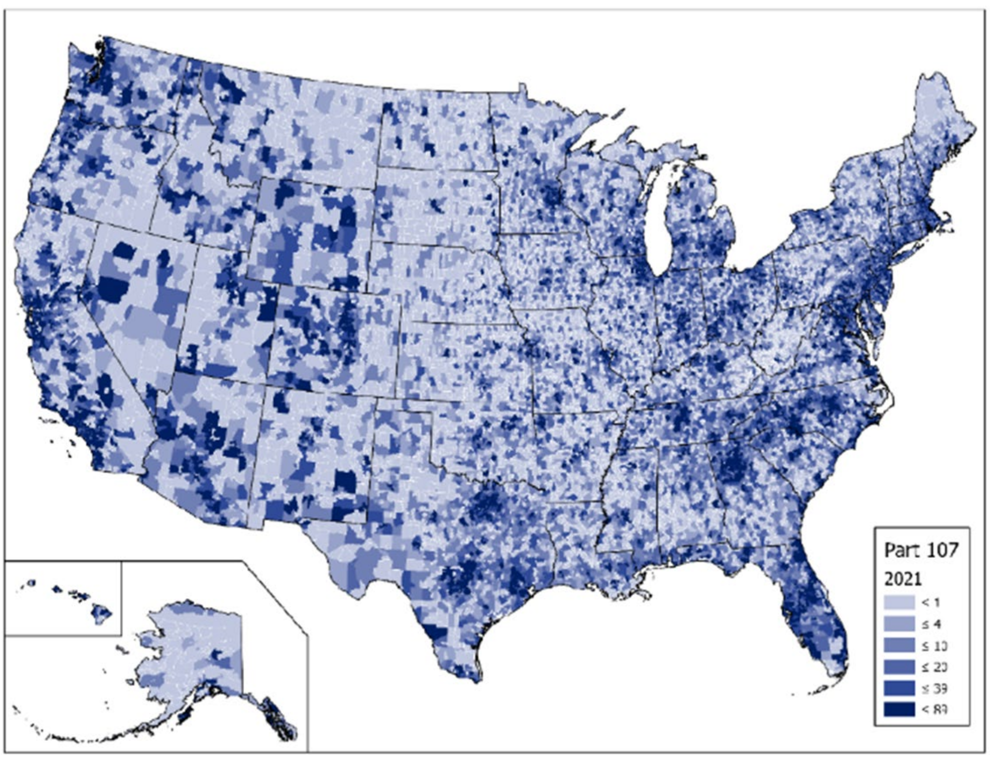




As in the case of recreational drone ownership, commercial small drones are distributed across the country. A spatial distribution of equipment registration by zip codes (using data for December 2021) demonstrates that commercial small drones are distributed throughout the country, with denser activity mapping closely against the economic or commercial activities of the geographical areas.

Last year, the FAA forecasted that the commercial drone sector would include approximately 589,000 small drones in 2021, a growth rate exceeding 21% over the year before (2020). Actual data came in slightly over 622,000 aircraft by the end of 2021. Our forecast of commercial small drones last year thus undershot by 5% for 2021 (or 622,055 actual aircraft vs 589,463 projected aircraft).

Forecasting in a time of tremendous uncertainty is indeed challenging, especially given the economic slowdown during COVID-19 and its impact on the drone sector. The commercial small drone sector's fast growth and adjustments during the pandemic demonstrate that fact. Nevertheless, our forecast errors for both recreation and commercial small drones appear to be within the bounds of reasonableness.

Total Commercial/Non-Model Fleet (Thousand sUAS Units)

Fiscal Year	Low*	Base**	High**
Historical			
2021	328	622	622
Forecast			
2022	292	699	729
2023	301	757	809
2024	320	801	869
2025	339	834	918
2026	355	858	968

*: Effective/Active fleet counts;

**: New registration counts based on fleet counts;

The FAA uses the trends observed in registration during previous years, calculation of net gain/loss, information from the survey conducted in 2018, a review of available industry forecasts/workshops and past FAA Drone Symposiums, and internal research together with market/industry research. Using these, the FAA forecasts that the commercial drone fleet will likely (i.e., base scenario) be at around 858,000 by 2026. This is 1.38 times larger than the current number of new commercial small drones.[23]

Using low or effective/active fleet, the FAA forecasts an expansion of the small drone fleet by 26,000, 1.08 times larger than the currently calculated effective/active fleet of

[23] Last year, the ratio of end-year forecast to base-year forecast was 1.7-times. (That is the FAA forecasted end-year to be 1.7 time base year's (2020) numbers in 5-year (2025)). Higher forecasts are often the result of improved regulatory environments, as noted below, and environments that are in the process of rule-making evaluation (See fn. #17-19).

328,000 units.[24] As the present base (i.e., the cumulative total) increases, the FAA anticipates the growth rate of the sector will slow down over time, and the effective/active fleet will likely catch up with the growth trajectory of new registrations. Nevertheless, the sector will be much larger than what was understood only a few years earlier.

In order to understand the growth trajectory of the sector better, this report divides the commercial drone sector into two types of small drone aircraft: consumer grade and professional grade. Consumer-grade, commercial drones have a wide range of prices, below US $10,000 with an average unit price of approximately $2,500. The professional grade, on the other hand, is typically priced above US $10,000 with an average unit price assumed to be around $25,000.[25] For both consumer-grade and professional-grade drones, the average price has fallen over time, particularly over the last few years. Currently, the consumer grade dominates the commercial drone sector, with a market share approaching 91%. However, as the sector matures and the industry begins to consolidate, the share of consumer grade commercial drones is likely to decline, though it will still be dominant. By 2026, the FAA projects this sub-sector will have approximately 86% of the overall commercial small drone sector.

Starting from a lower base of approximately 59,000 aircraft registered in 2021, the professional-grade commercial small drone sub-sector stands to expand rapidly over time, reaching 115,000 in 2026—especially as newer and more sophisticated uses are identified, designed, and operationally planned and flown. If, for example, professional-grade small drones meet criteria of operations, safety, and regulations, and if they satisfy economic and business principles and enter into the logistics chain via small package delivery, the growth in this sector will likely be phenomenal. On the other hand, starting from a registration base (and not active/effective fleet) of 563,000 in 2021, consumer grade small drones are likely to grow over 744,000 by 2026. These numbers will be somewhat smaller if we use the effective/active number of drones as the basis for calculation instead of new registration.

These growth trajectories could be even further enhanced by expanding operations in controlled airspaces, e.g., the LAANC system, which began authorization in May 2017.[26] LAANC is designed to facilitate small drone use of controlled airspace (i.e., Class B terminal airspace) in the NAS. While most of the near-term growth in commercial small drones will continue to come from consumer-grade units (over 90%), the FAA anticipates a significant part will come from professional-grade small drones as well.

[24] This is driven completely by the combined effects of projected underlying growth rates of cancellations, expiry, new registrations, and renewals.

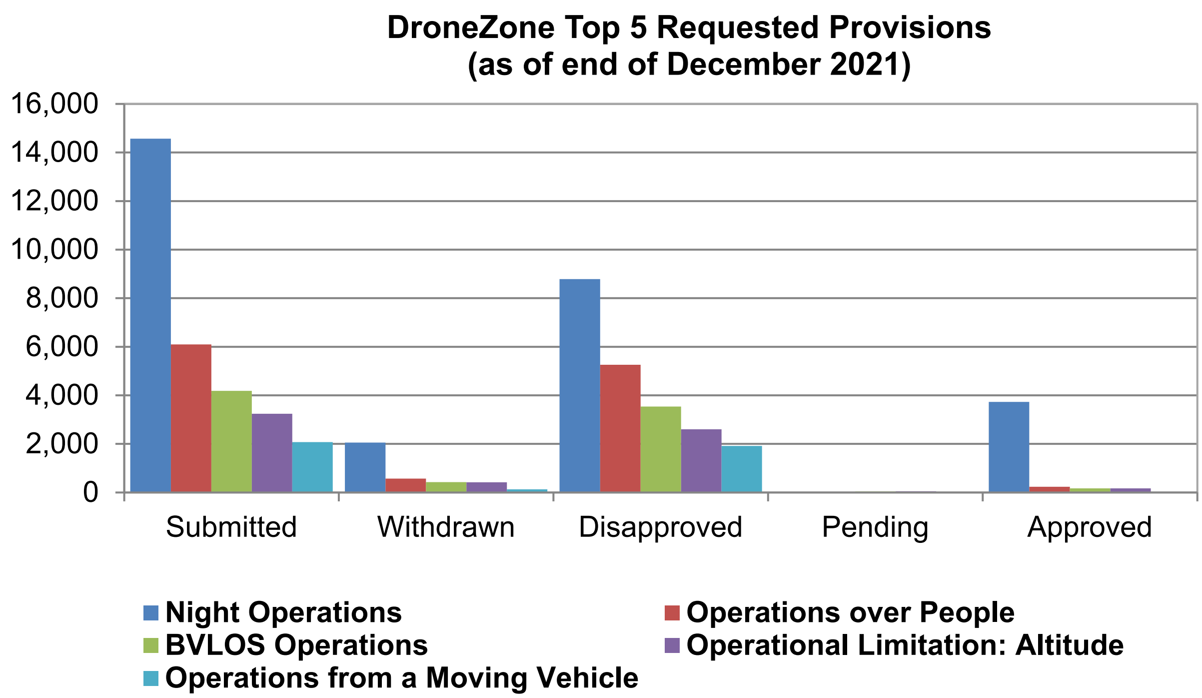
[25] Because of this wide range in prices between types of small drones in commercial activities, start-up costs for a business may vary between $2,500 and $25,000.

[26] Low Altitude Authorization and Notification Capability (LAANC) [https://www.faa.gov/uas/programs_partnerships/uas_data_exchange/] automated the application/approval process for airspace authorizations. Requests submitted via FAA-approved UAS Service Suppliers (USS) are checked against airspace data in the FAA UAS Data Exchange, such as temporary flight restrictions (TFRs), Notice to Airmen (NOTAMS), and the UAS Facility Maps (UASFM). Approved requests thus provide the FAA/ATO visibility into where and when planned drone operations will take place.

Unlike its recreational small drone counterpart, it is extremely difficult to put a floor on the growth of the commercial small drone sector due to its composition (i.e., consumer vs. professional grades) and the varying business opportunities and growth paths. As commercial small drones become operationally more efficient and safe, battery life expands, and integration continues (e.g., recent final rule involving operations over people; and remote ID), new business models will begin to develop, thus enhancing robust supply-side responses. These responses, in turn, will pull demand forces (e.g., consumer responses to receiving commercial packages, routine blood delivery to hospitals, and search-and-rescue operations) that are somewhat latent and in the experimental stage at present. Unlike a developed sector such as passenger air transportation, it is impossible to put a marker on "intrinsic demand" (or core demand) primarily driven by economic and demographic factors underlying this sector. Nevertheless, in this year's forecast the FAA makes a provisional attempt to provide a "low" side for now, essentially capturing the intrinsic demand and making use of the calculation of effective/active fleet. In addition, we provide the likely or base scenario, together with the enormous potential embodied in the "high" scenarios, representing cumulative annual growth rates of 7% and 9%, respectively. As noted earlier, low scenarios are driven by two positive factors (i.e., new registration and renew+) and two negative factors (i.e., cancellations and expiry). Average annual growth rate corresponding to the low scenario is determined by the combined effect of both positive and negative factors, and at present is calculated to be approximately 1.6%. This is much smaller than both base and high scenarios and this is because effective/active count is driven to catch up with the new registrations trend. [See fn. #7 for further explanation pertaining to effective/active count for recreational registration].

Commercial small drones are currently used for numerous purposes. As the sector grows, the FAA anticipates there will be many more uses for, and much more use of, commercial small drones. This is increasingly evident, for example, from the successful implementation of the UAS Integration Pilot Program (IPP). [See www.faa.gov/uas/programs_partnerships/integration_pilot_program/ for more details] and continuation in BEYOND [see Section later on].

One way of identifying early trends in commercial small drone use is to analyze the waiver applications granted to small drone operators. Both the magnitude and relative composition of waiver types may indicate the direction of the commercial small drone sector as a whole. A breakdown of the waiver requests granted in December 2021 is shown in the chart below:



Beyond the daytime operation that is presently allowed under existing part 107 rules, expanding applications further requires waivers, to a large extent, for night operations as distinct from daylight operations (around 9 of every 10 granted waivers), and operations over people (around 1 of every 20 granted waivers). As noted earlier, approved rules will now allow night operations and some operations over people as part of routine operations no longer requiring waivers. There are also beyond visual line-of-sight (BVLOS) waiver requests (around 14% of total requests) and limitations on altitude (around 11% of total requests), for which waiver approvals are granted at a rate of 3.9% in both cases. Many of these waivers are combined, and thus total waiver approvals (i.e., full + partial) granted (over 4,321 by December, 2021) exceed 100%.

Waivers are issued to facilitate business activities by small drones while preparing for the next round of regulations that will enable routine, more complex drone operations. Now that night operations and operations over people have been finalized,[27] amending Title 14 of the Code of Federal Regulations part 107 (14 CFR part 107) by permitting the routine operation of small drones at night[28] or over people under certain conditions,[29] the

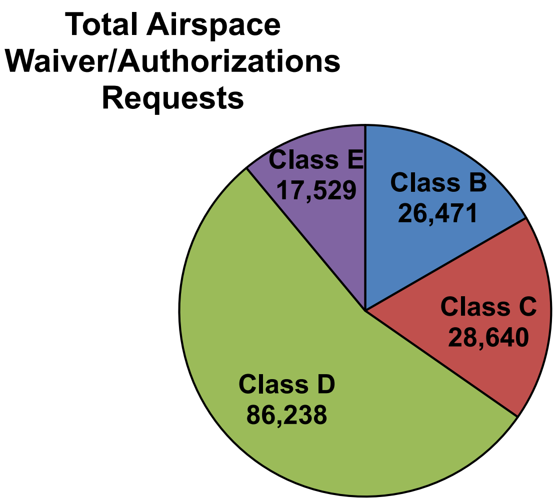
[27] The rule was published in the Federal Register on January 15, 2021. Corrections to the final rule were published in the Federal Register on March 10, 2021, delaying the effective date from March 16, 2021 to April 21, 2021 [See: www.faa.gov/uas/commercial_operators/operations_over_people/.].

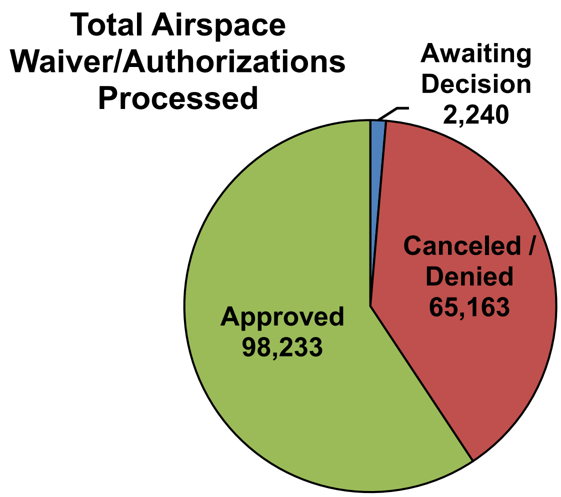
[28] *See* § 107.29. An operation at night was defined as an operation conducted between the end of evening civil twilight and the beginning of morning civil twilight, as published in the Air Almanac, converted to local time (*ibid*).

[29] *See* § 107.39. An operation over people was established as one in which a small remotely piloted aircraft passes over any part of any person

Agency is turning its focus to long term solutions that will eventually enable routine BVLOS fights without waivers.[30] Analysis of the waiver applications allows the FAA to understand industry trends, one of many metrics essential for understanding and projecting the growth trajectory, course corrections, and growth trends of the sector.

Nearly 60% of airspace authorizations and waiver requests were approved for controlled airspace at the end of December 2021. While over half were for Class D airspace (i.e., smaller airports with control towers), other classes were also requested and regularly flown.





Finally, LAANC has been routinely providing auto-approval since its inception in May 2017, and now covers 732 airports. It has provided over 1 million approvals: 545,074 auto-approvals for airspace access requests from part 107 users, and 352,775 requests from recreational operators as defined by 49 U.S.C. §44809[31] and sending 102,837 for further coordination. Approvals thus total more than 1 million, 570,000 more since this time last year. (See below.) LAANC authorizations are facilitated by the use of UAS Facility Maps (UASFM) that provide maximum allowed altitudes around airports where the FAA may authorize Part 107 UAS operations without additional safety analysis. [See faa.maps.arcgis.com/apps/webappviewer/index.html?id=9c2e4406710048e19806ebf6a06754ad.] The UAS facility maps are used to

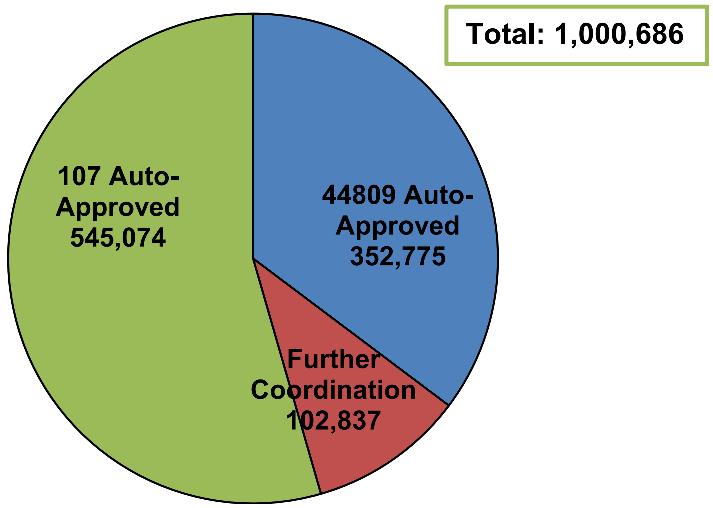
who is not directly participating in the operation and who is not located under a covered structure or inside a stationary vehicle.

[30] On June 9, 2021, the FAA initiated an Aviation Rulemaking Committee (ARC) to facilitate BVLOS in the NAS. [See www.faa.gov/regulations_policies/rulemaking/committees/documents/index.cfm/committee/browse/committeeID/837 for details.] Recently, UAS BVLOS ARC has provided recommendations to the FAA for performance-based regulatory requirements to normalize safe, scalable, economically viable, and environmentally advantageous BVLOS drone operations that are not under positive air traffic control (ATC) [see www.faa.gov/regulations_policies/rulemaking/committees/documents/media/UAS_BVLOS_ARC_FINAL_REPORT_03102022.pdf for the final report]

[31] §44809 is strictly for recreational uses. [See www.faa.gov/uas/recreational_fliers/new_changes_recreational_uas/media/44809_authorization.pdf.]

inform requests for part 107 airspace authorizations and waivers in controlled airspace.

LAANC Airspace Requests



Status of Survey

The FAA has initiated a comprehensive survey of drones, the "Survey of UAS Operators."[32] The survey targets commercial, public safety, and recreational small drone operators within the United States.[33] Recreational, commercial, and public safety UAS operators are identified via the aircraft registry and are randomly sent invitations to complete a questionnaire specific to their geographic location and operating type. Utilizing the part 107 (commercial and public safety) and section 44809 (recreational) registries, Survey of UAS Operators invites small UAS operator to participate in the survey by completing a questionnaire.[34] These invitation are randomly sent to operators within the two registries controlling for the U.S. County or the equivalent in which the registrant is registered and the type of operating: recreational, commercial, and public safety.[35] This

[32] The FAA has received OMB approval for a new information collection (OMB# 2120-0797). For additional information, see www.reginfo.gov/public/do/PRAViewDocument?ref_nbr=202008-2120-005.

[33] Survey respondents are all individuals or organizations who own and operate small drones within the United States. This does not include licensed remote pilots who pilot drones for other individuals or organizations.

[34] The section 44807 registry is used as the sample frame for sampling recreational operators. The part 107 (or Section 44809) registry is divided into two sample frames, commercial and public safety operators, by applying an algorithm to a registrant's data within the part 107 registry. These three frames serve as the bases for random sampling stratified by operator type. See following footnote for additional details in the survey design.

[35] The survey is designed as a stratified random sample with two strata: operator type and US county or the equivalent (such as parish or borough). Each cell, operator, and county pair is randomly sampled 30 times. If the cell has 30 or fewer registrants within it, the entire cell is sampled. See Supporting Statement B in the Information Collection Request (ICR) supporting doc-

survey method ensures a geographical representation of the operators and their behavior.

The survey aims to collect drone flight behavior, fleet characteristics, commercial activities, and features of public safety programs. To accomplish this, the questionnaire asks all operator types about typical flight activity such as average time of flight, operation over a week, and activity in specific months; and the composition of their fleet, such as number of aircraft, propulsion type, and operability.[36] Commercial and public safety operators who operate under part 107 are asked additional questions. Commercial operators are asked where they are operating, the industries in which they operate, and whether they intend to apply for a part 107 waiver. Public safety operators are asked about their drone program, if they share their program with other agencies or hire a commercial operator, and types of missions conducted.

The FAA is currently conducting pilot studies for the Survey of UAS Operators, and anticipates completion by summer 2022. These pilot studies are used to improve the survey design, clarify the questionnaire, and increase statistical validity.[37] The pilot studies are designed to reveal respondent activities during 2021. In late summer of 2022, the FAA plans to conduct a standardized survey regarding 2022 behavior. The FAA plans to publish the results of the 2022 standardized survey in the following year's Aerospace Forecast.[38] The Survey of UAS Operators is expected to be conducted annually, with the results published in the following year's Aerospace Forecast.

The FAA plans to use the information from the survey to paint a comprehensive picture of small drone activity throughout the NAS and how this activity is expected to change over time. This includes developing a geographical density estimate of small drone activity across the United States, and the change in activity over the course of a year. The annual survey is expected to become an additional data source for developing the small drone forecasts after multiple years of

uments at www.reginfo.gov/public/do/PRAViewDocument?ref_nbr=202008-2120-005 for additional information regarding the survey design.

[36] The survey questionnaire is administered through Survey Monkey, and invitations are sent to selected participants through an FAA email. Questionnaire completion time ranged from 5 to 10 minutes, depending on operator type. All three types were asked identical questions regarding flight behavior and fleet. Only commercial and public safety operators have additional question following the flight behavior and fleet questions.

[37] Pilot studies include several studies of sampling and nonresponse bias as well as testing several aspects of the questionnaire.

[38] The data from the 2022 Survey of UAS Operators is expected to appear in a supplement to the Aerospace Forecast 2023-2043.

survey data have been collected.[39] Moreover, the fleet data collected from the survey should support forecasting at the county level and thus increase the granularity of the small drone forecast. Overall, the Survey of UAS Operators is expected to increase the data available to FAA forecasters and the drone industry as it becomes a standard product of the FAA.

Remote Pilot Forecast

An important final metric in commercial small drones is the trend in remote pilot (RP) certifications. RPs are used primarily to facilitate commercial and public use small drone flights. As of December 2021, 254,850 RP certifications had been issued, an increase of approximately 52,000 from the same time last year (2020) and slightly higher than the year before (2019).[40]

Part 107 certifications require completing a multi-step process, beginning with obtaining an FAA tracking number via the creation of an Integrated Airman Certification and Rating Application (IACRA) profile prior to registering for a knowledge test. Following this initial step, scheduling and passing the initial aeronautical knowledge test at a Knowledge Testing Center is required. Provided that one has passed this test, the applicant is required to fill out FAA Form 8710-13 in IACRA. A confirmation email is sent when an applicant has completed the necessary Transportation Security Administration (TSA) security background check. This email contains instructions for printing a copy of the temporary remote pilot certificate from IACRA. A permanent remote pilot certificate is sent via mail once all other FAA-internal processing is complete. An RP certificate is valid for two years, and certificate holders must pass a recurrent knowledge test every two years at a Knowledge Testing Center. It is required that RPs carry their certificate whenever flying a small drone.

Certifications for part 61 operators, on the other hand, require an applicant to hold a pilot certificate issued under 14 CFR part 61, and to have completed a flight review within the previous 24 months. Since part 61 operators already have IACRA profiles established, they are required to complete, like part 107 operators, FAA Form 8710-13 in IACRA. Upon completion of this form, submission of proof of current flight review, and submission of proof of online course completion, part 61 operators are required to meet with FAA representatives at the FAA Flight Standards District Office (FSDO), or with an FAA-designated pilot examiner (DPE), or an airman certification representative (ACR) or an FAA-certificated flight instructor (CFI), who issues the RP certificate to the part 61 operator. Like their part 107 counterparts, certificates for part 61 operators are valid for 2 years and require renewal. [See

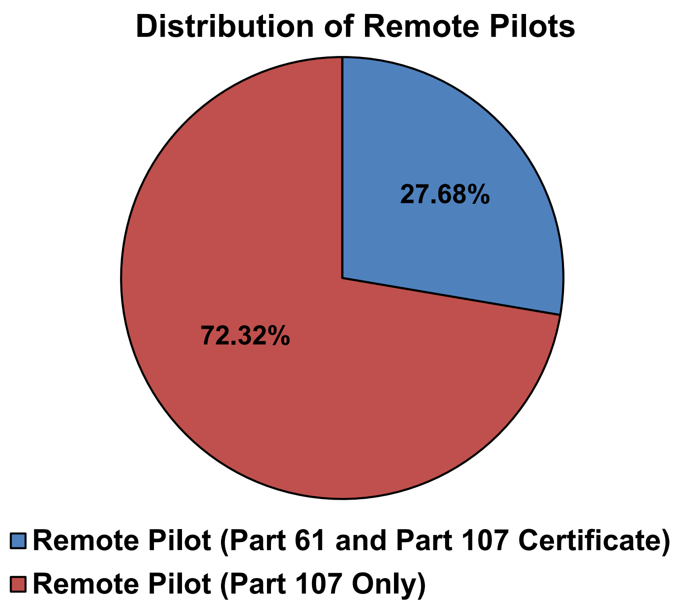
[39] The FAA has authorization to conduct the Survey of UAS Operators through 2023 under the current information collection authorization from OMB. The FAA anticipates the renewal of the survey in 2024 and to continue the survey annually in perpetuity.

[40] In our accounting of RPs, we take pilots who passed the initial knowledge test (or part 107), plus current traditional pilots who took online training in lieu of the knowledge test (or part 61).

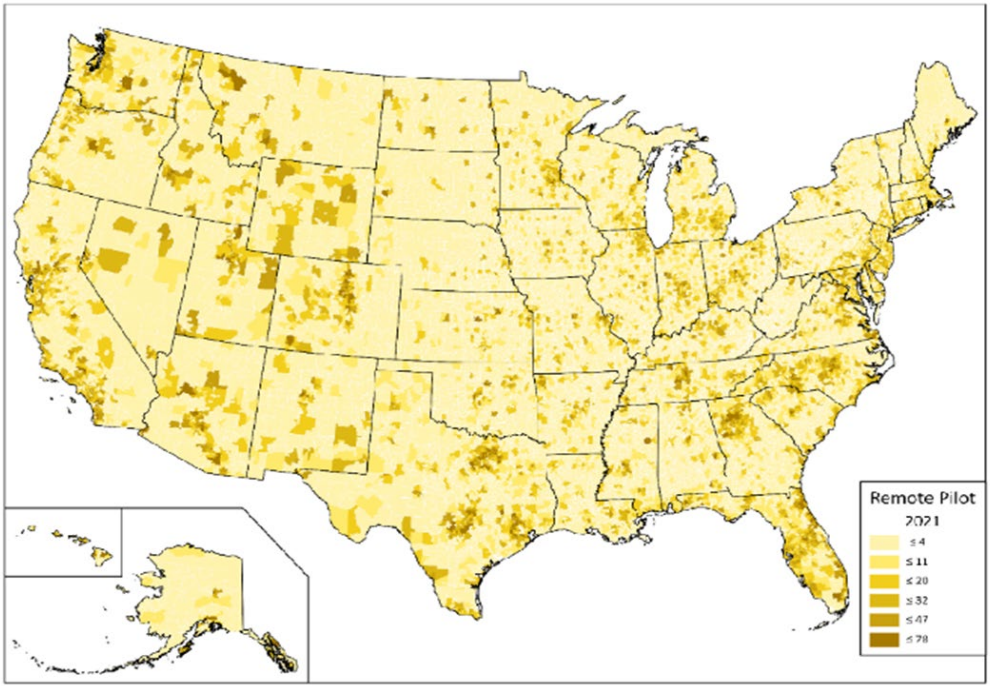
www.faa.gov/uas/commercial_operators/become_a_drone_pilot/ for more details.]

Following the process above, the FAA classifies RPs into two categories:

- those who do not hold any pilot certificate other than the part 107, or Remote Pilot Only; and
- those who hold a part 61 certificate and a part 107 certificate, or Part 61 and Remote Pilot.

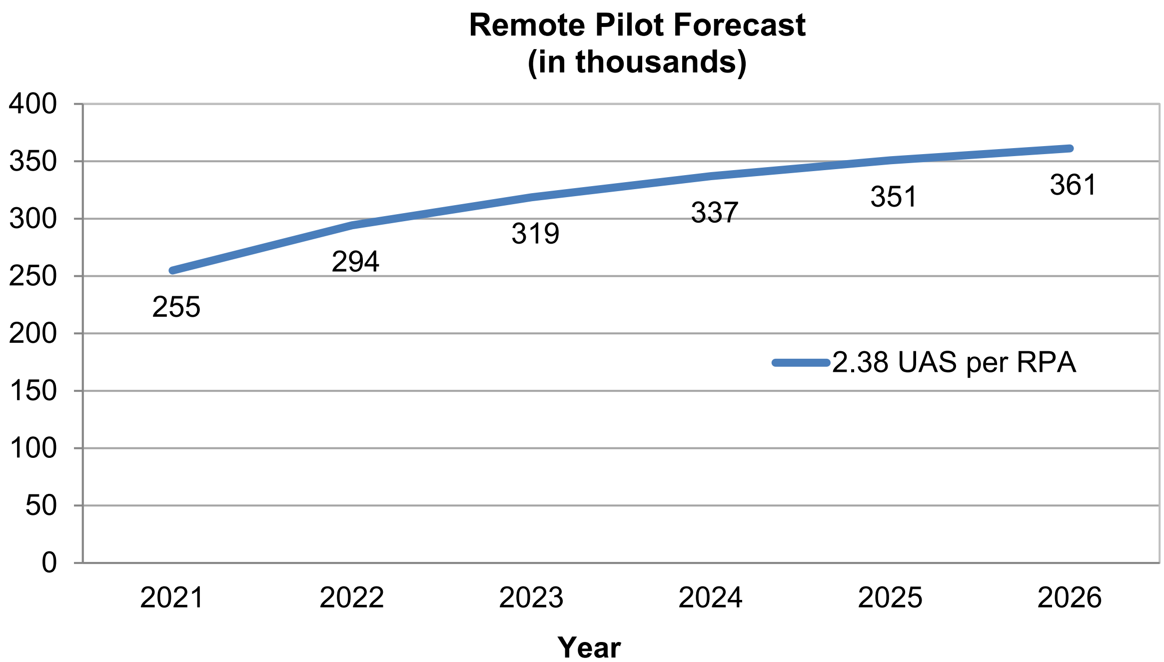


Over 70% of the RPs are part 107 RPs only. Over 90% of those who took the exam passed and obtained RP certification. A cumulative density distribution of remote pilots by zip codes in 2021 is provided in the map below.



The RP forecasts presented below are based on three primary data sources: (a) trends in total RPs; (b) renewal trends; and (c) trends in commercial small drone registration and forecasts of fleet. In this context, it is important to note that the empirical relationship between trends in RP and commercial/part 107 small drone registration, particularly new registration, appear to hold despite expiry, cancellations and renewal. Given the trends in registration and our forecast of the commercial small drone fleet (i.e., base forecasts), the FAA assumes that one pilot is likely to handle 2.38 units of commercial small drone aircraft, the same as the previous two years.

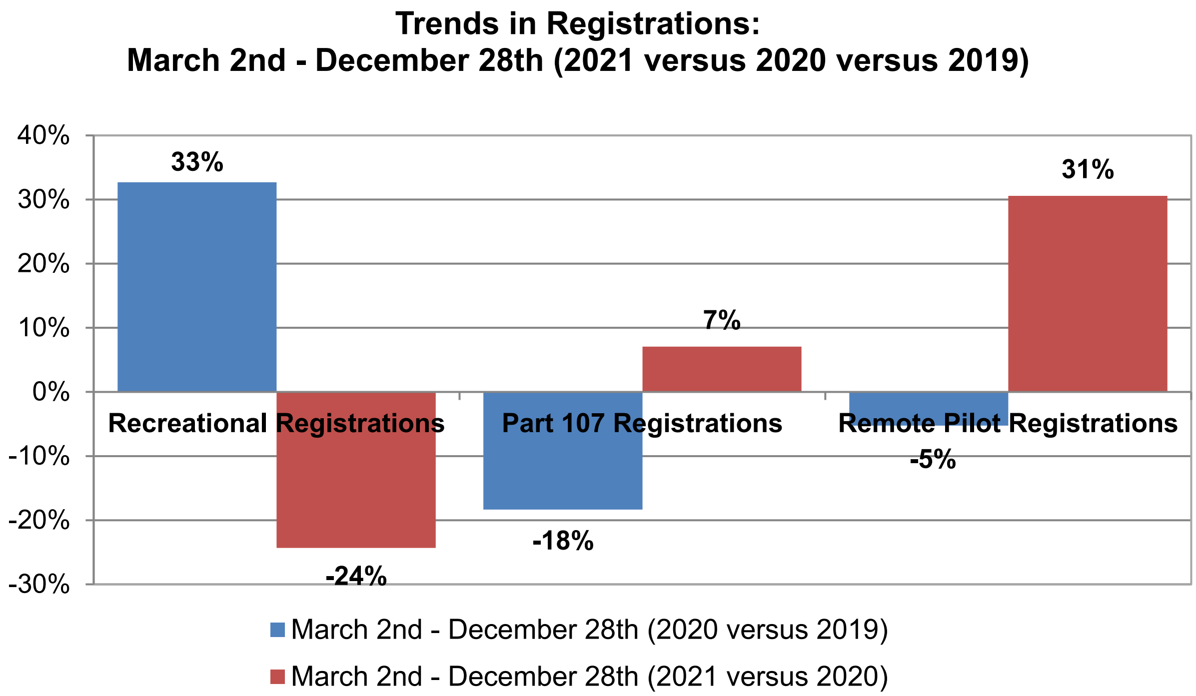
Using these assumptions and combined with the base scenario of the commercial small drone forecast, we project RPs in the graph below. Last year, the FAA projected RPs to be approximately 248,200 by the end of 2021. Actual registrations by the end of 2021 totaled 254,850 (or more than 6,800 from last year's projection) thus actual exceeding last year's projection by 2.68%.



Given the actual numbers at the end of 2021, RPs are set to experience tremendous growth following the growth trends of the commercial small drone sector. Starting from the base of 254,850 RPs in 2021, commercial activities may require over 361,000 RPs in five years, a 1.4-fold increase that may provide tremendous opportunities for growth in employment—over 100,000 new RP opportunities—associated with commercial and public use activities of small drones. Potential for RPs may enhance even more if larger drones are used in commercial activities and advanced air mobility (AAM) becomes a reality in the near future.

COVID-19 and Its Impact on sUAS

The chart below summarizes how COVID-19 may have impacted three areas of registration. During the prolonged and partial economic shut-downs during March – December 2020 and January – December 2021, respectively, it is clear that commercial facets of small drone operations, i.e., part 107 and RP registrations, were impacted negatively during 2020.



Part 107 registrations dropped by over 18% in 2020 compared to the prior year, but recovered in 2021 with an increase of 7%. RP registrations dropped by 5% in 2020, followed by a 31% increase in 2021. Interestingly, the registration of recreational users increased by almost 33% during the past year (2020) in comparison to the year before; however, recreational user registration went down by 24% in the second year of the pandemic, in comparison with the first year. While it is quite possible that these drops/increases were led by developments within the Part 107 community, we believe that at least some of the observed drops/increases were caused primarily by COVID-19. As the economy slowed down considerably, the use of commercial small drones (and, correspondingly, the use of RPs), may have decreased in the first year, followed by economic adjustments in the following year that allowed for increased commercial use. On the other hand, the economic slowdown may have afforded more time to people working from home to experiment with recreational use of small drones; this may have caused higher recreational registration in the first year of the pandemic in comparison to the prior year. The situation seems to have reversed during 2021, where recreational registrations dropped by 24%, while part 107 and RP registrations bounced back by 7% and 31%, respectively, in comparison to the prior year. The changing nature of registrations, and subsequently forecasts, offers challenges and opportunities for integration of small drones into the NAS.

IPP to BEYOND and PSP

One such integration challenge was addressed under the UAS Integration Pilot Program (IPP). Beginning in 2017, the IPP brought state, local, and tribal governments together with private sector entities, such as UAS operators or manufacturers, to test and evaluate the integration of civil and public drone operations into the NAS. The IPP program concluded on October 25, 2020 [See www.faa.gov/uas/programs_partnerships/integration_pilot_program/ for more details.] The FAA launched a new program called BEYOND to continue working on specific challenges of drone integration by:

- identifying ways to balance local and national interests related to drone integration;
- improving communications with local, state and tribal jurisdictions;
- addressing security and privacy risks; and
- accelerating the approval of operations that currently require special authorizations.

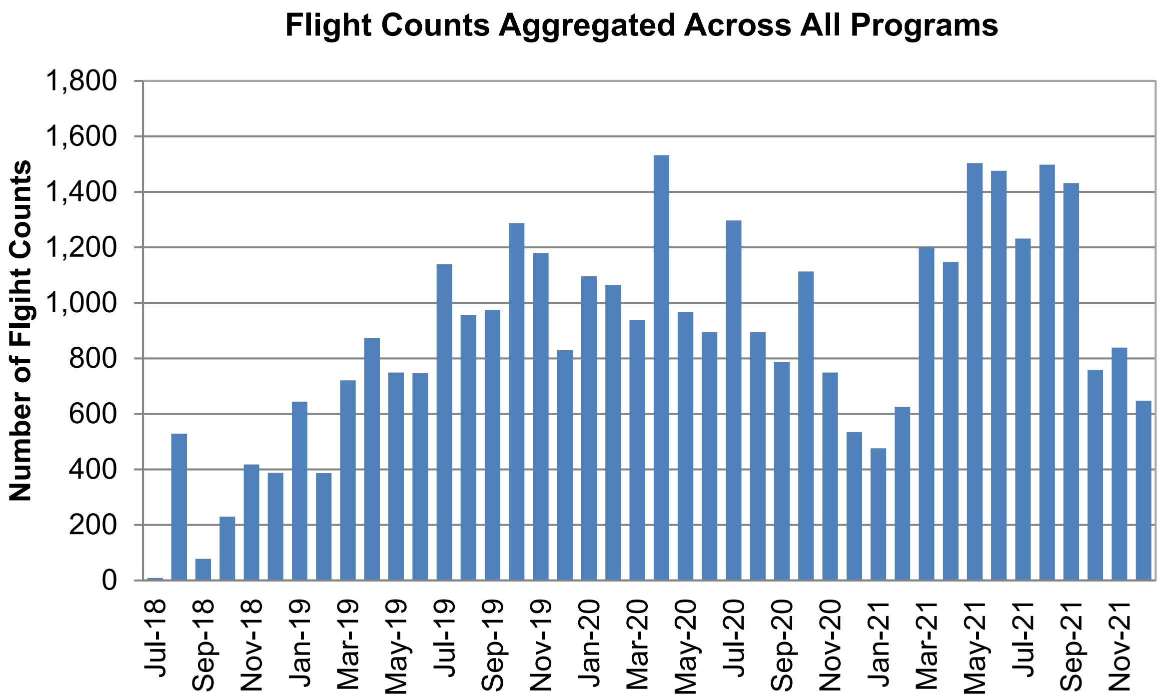
BEYOND started on October 26, 2020 to continue the partnership activities with eight of the nine IPP participants. [See www.faa.gov/uas/programs_partnerships/beyond/.]

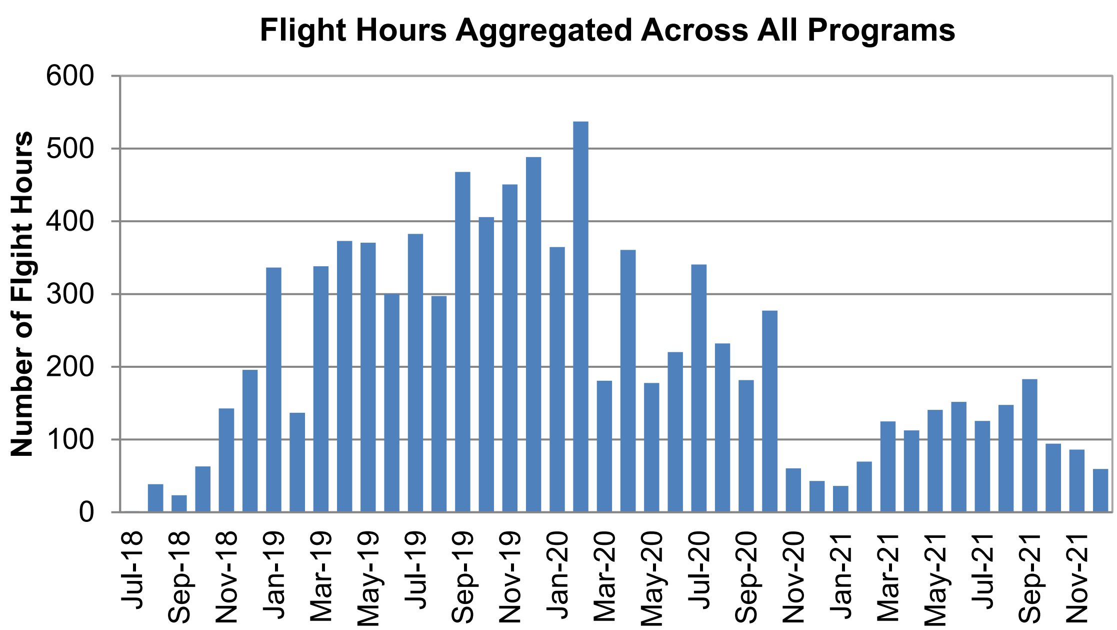
In addition to these programs, the FAA launched the UAS Partnership for Safety Plan (PSP) initiative in December 2016 to address and advance complex drone operational capabilities. The program establishes a working relationship between the FAA and industry to help facilitate the full integration of drones into the NAS. [See www.faa.gov/uas/programs_partnerships/psp/ for more details.][41]

Since their beginning, these programs have facilitated numerous activities by the participants. For example, under the programs, participants have logged over 36,800 flights using over 2,300 small drones, accumulating over 9,100 hours of flight time. Activities under both BEYOND and the PSP continue.

Distribution of the combined flight counts and corresponding total flight hours over time are given, respectively, in the following charts:

[41] In order to assist and accommodate other members outside these programs, the FAA has created a category called "voluntary reporting." Under this program, members outside BEYOND and PSP can volunteer their information which is then aggregated with IPP, BEYOND, and PSP information and presented in this section.

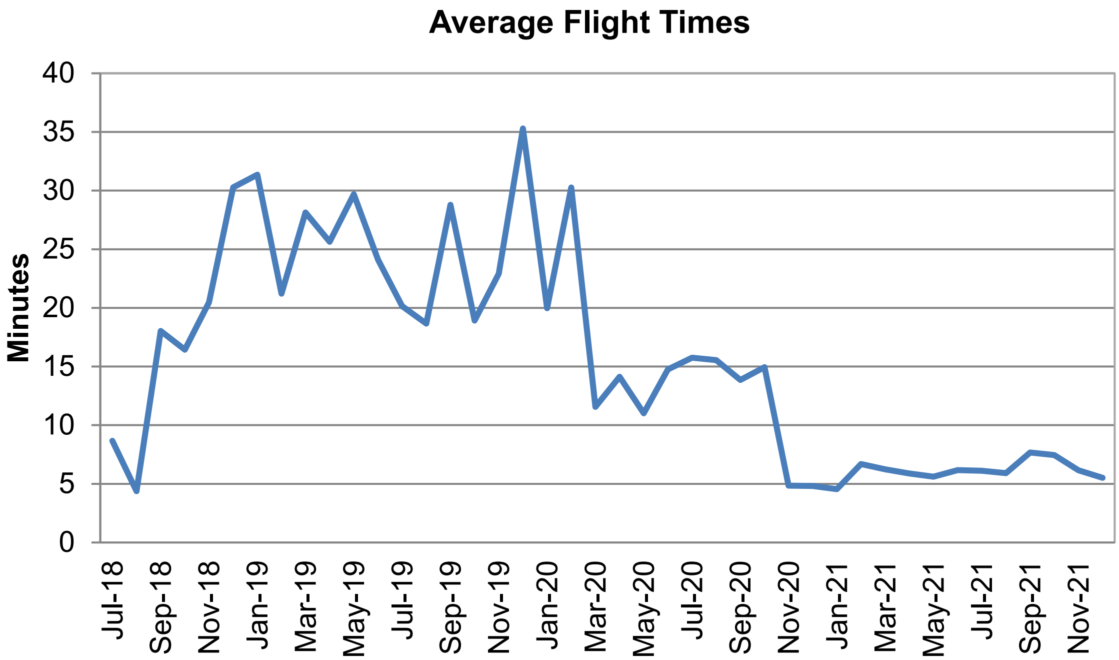




Based on the above information, average flight time over the years across all programs has stood at approximately 15 minutes.[42] Distribution of flight times during the period is provided in the graph below. Given that BE-

[42] This is an important metric to understand the scope of operational activities of drones across the NAS. When widely operational, i.e., outside BEYOND and PSP, this will have implications in terms of capital investment in infrastructure, planning for personnel, and unmanned traffic management (or UTM) in the future.

YOND and PSP programs are presently operational and active, average flight times are expected to increase over time.



Of around 36,850 total flights over the lives of these programs, a large majority of the flights have been geared towards package delivery (73%), thus signifying the commercial importance of this mission. Package delivery flights are followed by infrastructure inspection, both linear and non-linear, accounting together for over 14%; and other activities such as public safety (7.7%) and research/testing (4.4%). This composition provides some guidance in terms of likely forecasts and growth trajectory of the drone sector in the near future. The table below summarizes the types of missions and corresponding flight counts aggregated under all three programs.

Flight Counts by Mission Type

Mission Type	Flight Count
Agricultural Operations	125
Infrastructure Inspection (Linear)	2,047
Infrastructure Inspection (Non-Linear)	3,176
Media	11
Package Delivery	26,859
Public Safety	2,835
Research/Testing	1,613
Surveillance	183
Grand Total	**36,849**

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All these activities take place in different types of airspace classes, thus signifying the importance of drone integration into the NAS. Furthermore, these classes of airspace intersect with different types of geographic locations, broadly captured under assembly, rural, suburban and urban.[43] The table below summarizes airspace usage by aggregated location within the NAS.

Total Flight Counts by Geographic Locations and Use of Airspaces

Airspace Classes	Assembly	Rural	Suburban	Urban	Grand Total
Class B	50	65		1,233	1,348
Class B, Class G		50			50
Class C, Class G		1		1	2
Class D	3	534	1,816	2	2,355
Class D, Class G				486	486
Class G	28	11,618	10,102	5,463	27,211
Class G, SUA				1	1
NA		1,867	3,529		5,396
Grand Total	**81**	**14,135**	**15,447**	**7,186**	**36,849**

*NA: Not Available or Reported

Clearly, the most used airspace is Class G (74%), and it is distributed primarily in rural (43%) and suburban (37%) areas, followed by urban areas (20%). Class D and B are increasingly used while intersections of other classes, (e.g., Class D/G, and Class B/G), are also observed.

Finally, participants under all three programs undertake the above activities using different operating rules. The table below summarizes flight counts under these rules:

[43] "Assembly" is short for "open-air assembly". An open-air assembly is generally understood as a dense gathering of people in the open, usually associated with concert venues, sporting events, parks, and beaches during certain events. Such assemblies are usually associated with public spaces. [See www.faa.gov/documentLibrary/media/Advisory_Circular/AC_107-2A.pdf for more details.]

Flight Counts by Operating Rules

Operating Rules	Flight Count
Airspace	931
BVLOS w/o VO	110
BVLOS w/VO	25,373
Multiple UA	57
Night Operations	101
OOP	3,365
OOP; OOMV	187
VLOS	2,223
UNK*	4,502
Grand Total	**36,849**

*UNK: Not documented/Not reported

As noted earlier, one of the primary focuses of the BEYOND program is to accelerate the approval of operations that currently require special authorizations (or waivers). On the other hand, advancing complex operations has been the key focus of the PSP program. Given these, it is quite natural that BVLOS is the predominant operating rule under all three programs, accounting for almost 70% of total flight counts. The previous table shows that the majority of flights are conducted with a visual observer (VO), while only 0.2% of flights are conducted without a VO. [44] For operations requiring waivers, i.e., multiple UA, night operations, operations over people (OOP), operations over moving vehicles (OOMV)), airspace and altitude are facilitated and observed across programs. Thus the table above demonstrates the underlying focus of these programs in facilitating different operating rules proposed and performed by the participating members. Finally, "UNK" (unknown) stands for flights that had not reported and/or where there was very little documentation to report.

Large UAS

Drones weighing 55 pounds or greater cannot be operated under part 107 or as recreational remotely piloted aircraft. These large drones must be registered using the existing aircraft registration process and operated under a section 49 U.S.C. § 44807 exemption or public aircraft operator (PAO) certification. [See www.faa.gov/uas/advanced_operations/certification/section_44807/ for more

[44] BVLOS with VO has numerous classifications within it; e.g., BVLOS w/VO for airspace; BVLOS for operating multiple drones; BVLOS w/VO for night operations; BVLOS w/VO for operations over people, moving vehicles, and visibility. These are combined under the broad category of "BVLOS w/VO" in the table. Following on BVLOS Final Report (see fn. #19) from the ARC, it is anticipated that regulatory environment will evolve in the near future.

details.][45] At present, many of these large drones are flown within the NAS by government entities, but commercial operators have steadily increased in 2021, with the majority of new large drone operators active in agricultural spraying markets. In order to calculate active large drones in the NAS, we employ a multitude of data from various sources:

- COA Online system and its successor CAPS or COA Application Processing System [see www.faa.gov/about/office_org/headquarters_offices/ato/service_units/systemops/aaim/organizations/uas/coa];
- MITRE's Threaded Track infusing data from different sources [see www.mitre.org/publications/technical-papers/threaded-track-geospatial-data-fusion-for-aircraft-flight-trajectories];
- FAA's Performance Data Analysis and Reporting Systems (PDARS) [see www.faa.gov/about/office_org/headquarters_offices/ato/service_units/systemops/perf_analysis/perf_tools];
- FAA's Aircraft Registry [see www.faa.gov/licenses_certificates/aircraft_certification/aircraft_registry/];
- Published decisions on 44807 exemption applications; and
- Notices to Airmen (NOTAM).

Combining these data sources, the FAA estimates that 285 lUAS or large drones were operating in 2021. However, these estimates are likely the lower bound since a growing number of agricultural large drones are operating in close proximity to the ground (i.e., likely below 400 feet above ground level (AGL)) and are not captured by this data. The exemptions and registration of these agricultural spraying large drones have increased significantly in 2021 and are likely to grow rapidly over the next five years. However, these agricultural spraying large drones will have little effect on air traffic in the NAS given their location away from busy traditionally-piloted air traffic and low altitude traffic.

Large drones operated by military and civilian agencies in the NAS are expected to grow at a steady pace over the next five years. Currently, military aircraft and military contractors constitute the majority of large drone activity in airspace above 400 feet AGL and are likely to remain the predominant operators over the forecast time horizon.

In 2021, 51 companies were granted FAA 49 U.S.C. § 44807 exemptions for commercial drones with weights above 55lbs, more than double the exemptions granted in 2020. Some of these companies were granted multiple exemptions. Over 92 percent of the new 44807 exemptions for large drones were granted for use in agricultural spraying.[46] This sharp increase in the number of new exemptions granted in 2021, as well as the vast majority granted to agricultural spraying

[45] Large drones operated by the military or a military contractor are operated under authority of the Department of Defense. Military large drones are not required to be registered in the public aircraft registry.

[46] Although 92 percent of the 44807 exemptions are for agricultural spraying, only 9 percent of the public aircraft registrations were linked to agricultural large drones in 2021. However, registered agricultural large drones more than doubled between 2020 and 2021, a trend that started in 2019. This suggests that registration of large drones could lag behind grants of 44807 exemptions.

companies, signals regulatory standardization around the use of large drones operating close to ground level and outside of populated areas, such as in the case of agricultural spraying.

The registration, in the public aircraft registry, of heavier-than-air, remotely piloted aircraft over 55lbs has increased by 56 percent, from 510 at the end of 2020 to 784 at the end of 2021. Three hundred and twenty-one (321) large drones were registered or renewed in 2021, up 52 percent from 2020, while the delisted and expired registrations fell by 39 percent from 128 in 2020 to 78 in 2021. This has led to a 50 percent increase in large drones registered in the public aircraft registry.

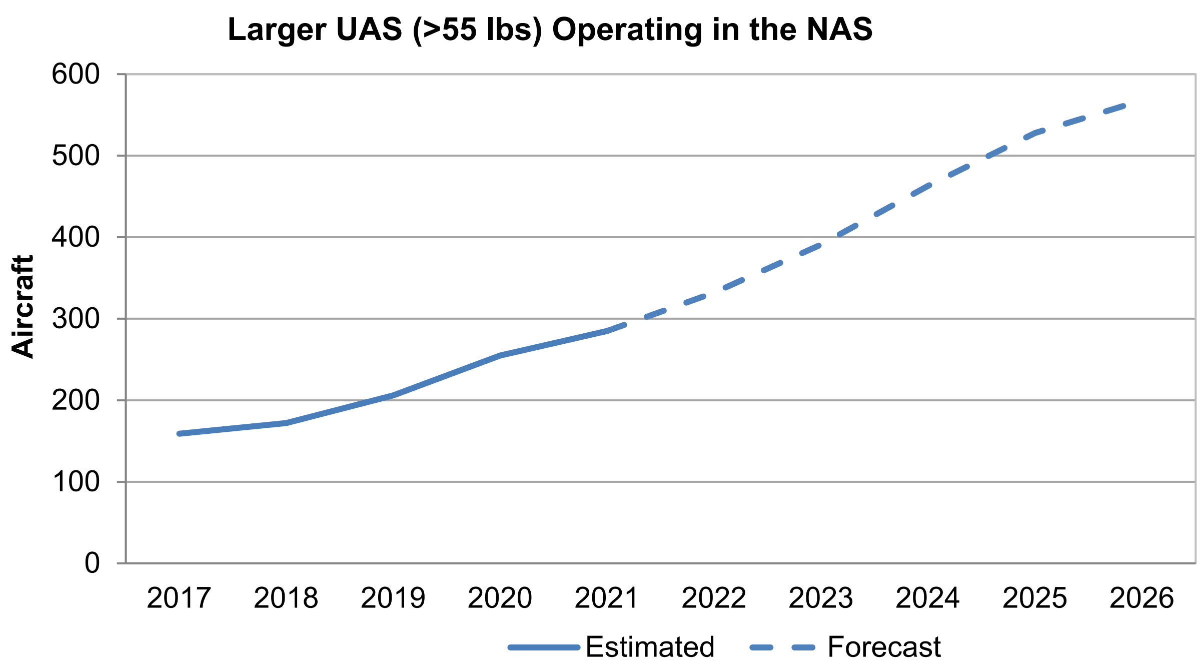
Although 784 large drones are registered in the public aircraft registry, only 12 percent of those registered large drones have been observed in flight.[47] As such, a sizable portion of large drone operators are not active in the NAS due to safety or regulatory concerns or because they only operate close to the ground or in private airfields. Thus, the vast majority of registered large drones are unlikely to come in contact with air traffic control (ATC). For the purposes of this forecast, the FAA limits the projected large drone activity to aircraft operating in airspace where contact with other large drones or traditionally-piloted aircraft is likely.

Larger UAS (>55 lbs) Forecast - 5 Years

Year	Active L-UAS	Number of Flights
Historical		
2017	159	7,066
2018	172	7,223
2019	206	7,360
2020	255	7,144
2021	285	7,519
Forecast		
2022	332	8,757
2023	391	10,325
2024	463	12,223
2025	528	13,930
2026	568	14,981

[47] The statistic is based on tail numbers from MITRE's thread tracking data and manufacturer/model characteristics from the public aircraft registry.

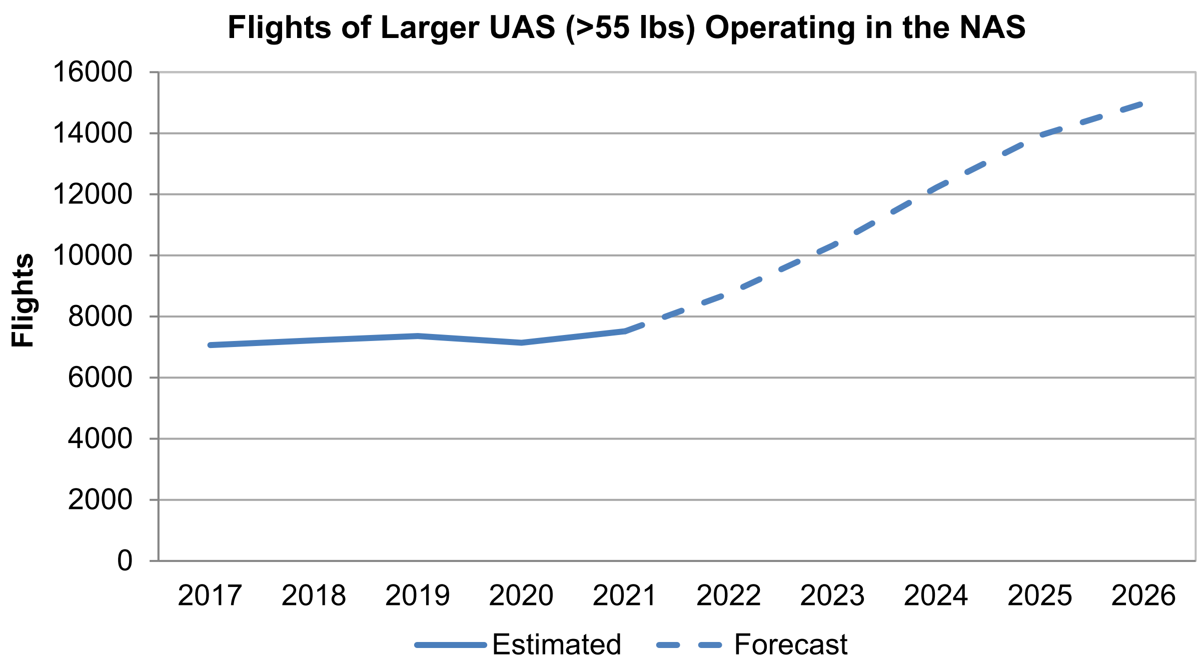
Combining the baseline from military and civilian agencies and projections of commercial exemptions from the FAA, large drones are estimated to have increased from 255 in 2020 to 285 in 2021; they are expected to continue increasing at a steady pace, through 2026, to 568 aircraft. This is due to an increase in the commercial and research applications of large drones. However, the sunset of drone exemptions under section 44807 in September of 2023 could create headwinds for further deployment of large drones. Operators are likely to scale back investment in new large drones as their ability to operate these aircraft beyond 2025, assuming they receive renewals in 2023, becomes uncertain. Extending or replacing the 44807 exemptions before 2025 would likely remove these obstacles to continued fleet expansion.



Corresponding to the active large drone fleet, the number of large drone flights increased from an estimated 7,144 in 2020 to 7,519 in 2021.[48] This indicates that the utilization of large drones is falling compared to previous years.[49] The increase in IUAS or the large drone fleet and decreasing aircraft utilization suggests that IUAS or large drones are still at an early stage of development. However, the sharp increase in 44807 exemptions granted, and the healthy increase in registered large drones in the public aircraft registry suggest that large drone operators have shrugged off the uncertainty of the 2020 – 2021 recession, which should increase investment in new aircraft over the next five years. As such, the forecast has been adjusted upward to reflect the growth

[48] Estimates of 2021 large drone flights are based on new methodology. The new algorithm decreases the misidentification of traditionally-piloted aviation as large drones. . Over 70% of the observed flights are conducted by registered large drones operating under a variety of authorities: 44807 exemptions, public aircraft operators (PAO), or the Department of Defense.
[49] Utilization is calculated as IUAS flights divided by active IUAS or large drones.

path from before the pandemic-related recession, which is likely a more accurate reflection of future outcomes, barring an economic downturn in the near future.



Advanced Air Mobility

In September 2017, NASA launched a market study for a segment crossing over some functions of drones discussed above. This segment of piloted and autonomous vehicles, broadly called AAM, is defined as "a safe and efficient system for air passenger and cargo transportation, inclusive of small package delivery and other urban drone services, which supports a mix of onboard/ground-piloted and increasingly-autonomous operations."[50] [See www.nasa.gov/aero/nasa-embraces-urban-air-mobility.] Building on the UAM concept by incorporating use cases not specific to operations in an urban environment, the FAA defines the scope of AAM as follows [See www.faa.gov/uas/advanced_operations/urban_air_mobility/):

- Commercial Inter-city (Longer Range/Thin Haul);
- Cargo Delivery;
- Public Services; and
- Private / Recreational Vehicles

[50] The community is in the process of establishing nomenclature. Only recently, the community-at-large has moved on to coining earlier-used "urban air mobility" (UAM) as "advanced air mobility" (AAM) to broaden its operational scope, technical characteristics, economic opportunities, and regulatory framework. Under this broad characterization, UAM is considered a subset of AAM.

AAM technology presents considerable opportunities for economic growth over the coming decades. Markets for AAM services, such as package delivery by drone or larger autonomous or remotely piloted cargo delivery, airport shuttling (or services along the fixed routes between urban routes to airports), or traditionally-piloted, remotely-piloted, or autonomous passenger shuttles or air taxis (i.e., on-demand point-to-point services) have significant potential both in the United States and globally. For example, package or larger cargo delivery is the AAM service that is most likely to experience economic growth in the next decade. By 2030, package delivery is likely to be profitable at a price point of $4.20 per delivery, with a fleet of 40,000 vehicles completing 500 million deliveries per year.[51]

Passenger services, on the other hand, promise larger markets for AAM services, but safety challenges, infrastructure, public acceptance, and evolving technology leading to market uncertainties may slow the pace of AAM's penetration into this segment of the market. Nevertheless, flight testing continues to elucidate the performance dynamics of electric vertical take-off and landing (eVTOL). For example, Joby Aviation announced in July 2021 that it has completed a test flight which surpassed 150 miles on a single charge with its eVTOL aircraft. The flight was remotely piloted and completed 11 laps of a predefined circuit, covering a total distance of 154.6 statute miles with a total air time of 1 hour and 17 minutes.[52] Additionally, in fall 2021, under NASA's AAM National Campaign, Joby Aviation conducted further flight tests which produced data on its eVTOL aircraft performance and acoustic characteristics.[53] The data was shared with NASA to support its modeling and simulation and AAM research efforts. The flight tests also helped evaluate NASA's flight safety and airworthiness processes to approve flight testing participants and establish a baseline and protocols for future testing.

The increasing number of flight tests and data collection are paving the way for type certification of eVTOL aircraft. In 2020, Joby became the first eVTOL company to sign a G-1 issue paper to define a certification basis with the FAA, and in February 2022 Joby announced it started certification testing observed by an on-site FAA Designated Engineering Representative (DER). The test will evaluate the material strength of its eVTOL components, and is an important step in obtaining FAA aircraft type certification.[54] It is also worth noting that Joby has begun the process to obtain an FAA part 135 air carrier certificate, which it expects to receive in 2022, to formalize its status as an eVTOL airline.

There is also eVTOL type certification progress globally. In February 2022, Eve Urban Air Mobility, which plans to operate eVTOL flights in Brazil and in Latin America, formalized the process for obtaining type certification from the National Civil Aviation Agency – Brazil for its eVTOL aircraft (with deliveries

[51] Urban Air Mobility (UAM) Market Study, Nov. 2018, NASA. (See www.nasa.gov/uamgc)

[52] www.jobyaviation.com/news/joby-completes-flight-of-more-than-150-miles/

[53] NASA launched a National Campaign in March 2020 to promote public confidence and accelerate the realization of emerging aviation markets for passenger and cargo transportation in urban, suburban, rural, and regional environments. [See www.nasa.gov/aamnationalcampaign for more details.]

[54] www.jobyaviation.com/news/joby-begins-first-conformity-testing-enters-next-phase-certification-process/

expected to start in 2026).[55] German air taxi manufacturer, Volocopter, obtained a production organization approval (POA) from the European Union Aviation Safety Agency (EASA).[56] Recently, Volocopter laid out an urban transportation and mobility roadmap enabling tourist routes within the Marina Bay area and to nearby regional economic centers from Singapore in just 30 minutes.[57] In a similar vein, Joby Aviation, in collaboration with ST Telecom, signed a partnership on February 6, 2022 to introduce aerial ridesharing services to cities and communities in South Korea.[58] Airbus expects its UAM aircraft to meet EASA certification standards (EASA SC-VTOL Enhanced Category) and receive type certification around 2025.[59]

One of the major challenges of eVTOL entering into the marketplace is infrastructure. In order to increase accessibility of vertiports for AAM services, air taxi operators have been evaluating different approaches to expand the potential network of vertiports or takeoff and landing areas (TOLAs). In 2021, both Joby and Archer entered into partnerships with parking garage operator REEF Technology with the goal of running air taxi operations from the rooftops of redesigned parking garages.[60]

The infrastructure constraint—the availability of desirable TOLAs—will be a challenge for scaling AAM operations, as they require community acceptance and affect issues relating to social equity and noise and environmental impacts. NASA is leading research in these areas, and in 2021 it released a report with NUAIR (Northeast UAS Airspace Integration Research Alliance, Inc.) and industry describing a concept of operations for high density vertiport operations.[61] Recently, the FAA issued an engineering brief providing interim guidance to airport owner/operators and their support staff for the design of vertiports for vertical takeoff and landing operations [see www.faa.gov/airports/engineering/engineering_briefs/drafts/ for more details].

Other than eVTOL operators, some companies are focusing on developing the infrastructure needs which require partnering with local governments and property owners to locate and acquire sites for future vertiports. For example, Urban-Air Port, a UK-based startup, announced in January 2022 that it plans to develop 200 vertiports for eVTOL flights in 65 cities to accommodate the anticipated AAM demand.[62]

Due to uncertainties associated with numerous issues such as type certification and infrastructure, market estimation for the overall sector has been quite wide. The total available market for passenger services is estimated to be $500 billion in the United States, but AAM is unlikely to garner more than $2.5

[55] Eve Urban Air Mobility is an Embraer company planning to become public through a merger with a special purpose acquisition company (SPAC), as predecessors Joby, Archer, Lilium, and Vertical Aerospace have.

[56] www.aerospace-technology.com/news/volocopter-poa-easa-evtol/

[57] volocopter-statics.azureedge.net/content/uploads/220209_Volocopter_Singapore-Roadmap.pdf for more details.

[58] See ransportup.com/category/headlines-breaking-news/vehicles-manufactures/

[59] www.airbus.com/en/newsroom/press-releases/2021-09-airbus-reveals-the-next-generation-of-cityairbus

[60] www.jobyaviation.com/news/joby-aviation-announces-infrastructure-partnership/

[61] ntrs.nasa.gov/api/citations/20210016168/downloads/20210016168_MJohnson_VertiportAtmtnConOpsRprt_final_corrected.pdf

[62] dronedj.com/2022/01/26/urban-air-ports-to-create-200-evtol-vertiports-for-aam-service/

billion of this market in the near term, as one study estimates.[63] On the upside of the estimation, a recent study conducted by Deloitte and the Aerospace Industries Association (AIA) estimates the AAM market in the US to reach approximately US $115 billion by 2035, equivalent to 30% of the present US commercial air transportation market.[64] Of that total, US $57 billion is expected to originate in passenger air mobility, while an equivalent amount is expected to come from the cargo market.

Market dynamics underlying AAM are complex, numerous, and quickly evolving. Although COVID-19 has led to an increased adoption of virtual work versus commuting and business travel, persistence of this trend in the long-run is mired in uncertainty.[65] Socioeconomic changes such as population shifts from urban to suburban or rural areas (i.e., de-urbanization) could also affect the various AAM use cases differently. AAM services, both cargo and passenger, may appear to be unprofitable in the near future, like many other services in the beginning. The AAM passenger industry is likely to expand due to an inflow of venture capital and experimental services exploring market opportunities. For example, following the numerous SPAC mergers for AAM companies last year, which injected significant capital to further their development and commercialization efforts, Wisk Aero secured an additional $450 million investment from Boeing in January 2022. Volocopter has also recently entered into an agreement that may provide up to $1 billion in financing.[66] Furthermore, eVTOL operators like Joby are expanding partnerships to operate air taxis in international markets[67] and many companies are experiencing rising interest and increased orders of their eVTOL aircraft, both in the US and globally.[68]

Airport shuttles and other fixed-route passenger services are the AAM passenger services most likely to gain economic traction in the coming decade. Optimistic reports project the AAM passenger industry to have 23,000 aircraft with 740 million enplanements per year at a price of around $30 per trip by 2030.[69] However, several other studies have reported more conservative estimates, arguing that market penetration is likely to be limited to a handful of major metropolitan areas where geography and economic conditions are conducive to AAM market development. As such, estimates by KMPG predict 60.4 million enplanements by

[63] UAM Market Study – Technical Out Brief, Oct. 2018, Booz-Allen-Hamilton and NASA. [See ntrs.nasa.gov/archive/nasa/casi.ntrs.nasa.gov/20190001472.pdf.]

[64] www2.deloitte.com/us/en/insights/industry/aerospace-defense/advanced-air mobility.html?id=us:2el:3pr:4diER6839:5awa:012621:&pkid=1007244

[65] Road congestion and associated opportunity cost in commuting around metro areas provided the most powerful boon for economic and financial justifications for AAM passenger services. However, changed working pattern and working from home (WFH) location due to COVID19 put a damper on that earlier economic trade-off, at least in the near-term.

[66] www.flyingmag.com/volocopter-partners-with-acg-to-provide-1-billion-in-financing-solutions/

[67] www.forbes.com/sites/catherinewang/2022/02/09/heads-up-sk-telecom-joins-forces-with-joby-aviation-to-launch-flying-taxis-in-south-korea/?sh=41b6642615c8

[68] dronedj.com/2022/01/20/japanese-helicopter-service-provider-orders-50-air-taxis-from-ehang/ and https://eveairmobility.com/eve-and-bristow-enter-partnership-to-develop-uam-capabilities-with-an-order-of-up-to-100-evtols/

[69] Urban Air Mobility (UAM) Market Study, Nov. 2018, NASA. [See www.nasa.gov/uamgc.]

2030 and a much smaller industry size.[70] Similarly, Roland Berger estimates a fleet of only 12,000 passenger drones by 2030.[71] However, given the current safety and technology challenges, even these projections may be optimistic. Using airport shuttle and air taxi as the scope, a recent study concluded that AAM passenger services could have a daily demand of 82,000 passengers served by approximately 4,000 four to five-seater aircraft in the US. Baselining in the most conservative scenario, these services may yield an annual market valuation of $2.5 billion[72].

Given the enormous economic potential underlying the AAM sector, coordination led by the FAA, including collaborations with NASA and industry, is allowing numerous integration activities to take place presently. For example, under NASA's National Campaign (NC), working groups drawn from the FAA, NASA, and numerous stakeholders are focusing on understanding the four areas of AAM integration: aircraft, airspace, community integration, and cross-cutting areas. Complimenting this effort, the FAA created an internal AAM Integration Executive Council, and is actively working with internal and external stakeholders to understand the nature, scope, and likely evolutions of AAM. [See www.faa.gov/uas/advanced_operations/urban_air_mobility/.] The FAA also issued a concept of operations (CONOPS) in June 2020, and is likely to publish a strategic implementation framework in the near future.

All these activities are facilitating an operational framework for gradual integration of AAM into the NAS; e.g., flight testing of AAM vehicles [see www.nasa.gov/centers/armstrong/features/nasa-begins-air-mobility-campaign.html], regulatory coordination for safety, traffic management, and international harmonization with other agencies, e.g., European Union Aviation Safety Agency (EASA) leading to type certifications [e.g., www.faa.gov/uas/advanced_operations/certification/].

These proactive steps are positioning the AAM industry positively towards realizing market opportunities. In December 2020, for example, Joby Aviation received the first airworthiness approval by the US Air Force (USAF) for an eVTOL aircraft under Agility Prime, and it recently reached an agreement with the FAA to certify its aircraft using the FAA's part 23 requirements along with special conditions for eVTOL aircraft.[73] Joby Aviation plans to launch air taxi services in the US by 2023. Lilium GMBH, a German company, is developing an eVTOL transport network centered on Lake Nona in Orlando, Florida. It has partnered with the City of Or-

[70] Getting Mobility Off the Ground, 2019, KPMG (see institutes.kpmg.us/manufacturing-institute/articles/2019/getting-mobility-off-the-ground.html).

[71] Urban Air Mobility: The rise of a new mode of transportation, Nov. 2018, Roland Berger. (See www.rolandberger.com/en/Publications/Passenger-drones-ready-for-take-off.html.)

[72] Advanced Air Mobility: Demand Analysis and Market Potential of the Airport Shuttle and Air Taxi Markets. [See escholarship.org/uc/item/4b3998tw for more details.]

[73] www.aviationtoday.com/2021/02/09/joby-agrees-evtol-certification-requirements-faa/

lando and a real estate development company to establish a vertiport hub in Lake Nona by 2025. It will be used for regional, inter-city air mobility services, with travel distances of up to 186 miles in 60 minutes by Lilium Jet aircraft currently under development.[74]

The trend is somewhat similar at the international level as well. For example, EHang, a Chinese manufacturer of autonomous aerial vehicles (AAVs), established a strategic partnership with UAM pilot cities in Spain, Austria, and China in 2020.[75] It also conducted demonstration flights in South Korea with its two-passenger autonomous aerial vehicle, the EHang 216. German AAM companies, Lilium and Volocopter, are also working to launch passenger air transport services within the next few years. Volocopter completed demonstration air taxi flights in Singapore in 2019 and began to sell tickets for commercial service, expected to start in Singapore by 2023.[76] Volocopter has also announced plans to introduce air taxi services in the US.

AAM services are likely to face stiff competition from technological advances in industries with close substitutes, such as ground transportation (i.e., emerging automated solutions on increasingly electric-powered vehicles). Furthermore, economic and financial tradeoffs underlying the emergence of AAM may have changed following COVID-19, changing travel patterns and perhaps long-term living arrangements. Finally, the high costs of urban infrastructure and potential community concerns pose challenges for AAM adoption. Future AAM operators must also prepare to comply with new operating requirements and other regulations yet to come.

Despite these challenges, state, local, and regional governments are aligning themselves with the manufacturers and likely operators. For example, the city of Los Angeles announced the creation of its Urban Air Mobility Partnership in December 2020. It is a public-private partnership, called Urban Movement Labs that will evaluate barriers and solutions now towards facilitating air taxi services in Los Angeles by 2023.[77] Other entities, including the Canadian AAM Consortium (CAAM,) have also studied the impacts of AAM on regional economies.[78]

In order to facilitate AAM entry into local transportation networks, numerous local and state entities have begun the process of preparing and self-identifying as early adopters. [See www.nasa.gov/aeroresearch/programs/iasp/aam/nasa-to-help-local-governments-plan-for-advanced-air-mobility.] Furthermore, targeting investments in regional air mobility (RAM) by utilizing the country's vast underutilized airport infrastructure may compliment and accelerate local and state initiatives on emerging markets, including those targeted by AAM, likely transforming the entire NAS in the future. [See sacd.larc.nasa.gov/ram/ for more details.]

As the sector grows and new initiatives are undertaken, the FAA, together with numerous stakeholders including NASA, is keeping

[74] lilium.com/newsroom-detail/lilium-partners-with-tavistock-and-orlando

[75] www.ehang.com/news/617.html

[76] www.bloomberg.com/news/articles/2020-12-09/first-electric-air-taxis-set-to-fly-in-singapore-by-2023

[77] www.lamayor.org/mayor-garcetti-announces-first-nation-urban-air-mobility-partnership; see also https://www.urbanmovementlabs.com/programs-projects/

[78] www.pnwer.org/uploads/2/3/2/9/23295822/economic_impact_assesment_-_caam_-_v1.0.pdf

a keen eye on understanding overall trends in AAM. It is likely that AAM services will become a reality in the US by 2025-2026 and will initially become incrementally available in certain urban and suburban areas. As more information becomes available, the FAA will likely provide emerging trends and forecasts for AAM in the near future.

Forecast Uncertainties

The forecasts in this document are forecasts of aviation demand, driven by models built on forecasts of economic activity. There are many assumptions in both the economic forecasts and in the FAA models that could affect the degree to which these forecasts are realized. This year's forecast is driven, at least in the near-term, by the pace of recovery from the impacts to the U.S. and global economies and the aviation industry resulting from the novel coronavirus (COVID-19). It does go without saying that terrorism remains among the greatest world-wide risks to aviation growth. Any terrorist incident aimed at aviation could have an immediate and significant impact on the demand for aviation services that could be greater than its impact on overall economic activity.

In addition, changes in the geo-political landscape could lead to outcomes very different than the forecasts provided in this document. The crisis in Ukraine represents a very large uncertainty to this year's forecast. The impacts as of the writing of this document are still evolving and dependent in large part on the outcome of the armed conflict in Ukraine. Already we have seen negative impacts on airline bookings to areas close to the fighting as well as a surge in oil prices. The impact of the economic sanctions on Russia is unknown with any specificity at this time but it is clear that the Russian economy (the world's 12th largest as of 2021) will suffer a sharp recession that may have broad spillover effects to the global economy. Many forecasters have lowered their expectations for European economic growth in 2022 as well due to the impacts of the conflict. In the longer run, most analysts are seeing a return to higher tensions between Russia and the West resulting in higher expenditures on defense that may push taxes higher, and leave consumers with less money to spend on items like air travel.

The rapid spread of the novel coronavirus (COVID-19) that began in early 2020 resulted in the largest decline in aviation activity since the jet era began in the late 1950's. Although the FAA forecast is a long-term trend forecast and it has been almost two years since a global pandemic was declared, there is still a good deal of uncertainty about the path of aviation's recovery from the 2020 downturn. This uncertainty arises from a variety of factors including the willingness of consumers to resume air travel as infection rates are reduced, the success of the strategies U.S. and foreign carriers are employing to recover from the downturn in demand, the stability of consumer attitudes and behaviors towards aviation in a post-COVID environment, as well as the breadth and depth of the and the speed and nature of the economic recovery, all of which apply both domestically and globally.

The future direction of oil prices presents another considerable uncertainty in producing the forecast. At the end of 2020, the average price of West Texas Intermediate crude (WTI) for 2021 was projected to be $44 per barrel but the actual price was 57 percent higher at $69 per barrel. Similarly, the FAA's baseline forecast (derived from economic assumptions in IHS Global Insight's November 2021 U.S. macro forecast and 30-Year Focus released during August 2021) called for oil prices to rise slightly to $74 per barrel in 2022. Instead, according to the March 2022 forecast and with the war in Ukraine only days old, the projected average for 2022 had spiked to $101 per barrel. Longer term, the forecasts are generally aligned, projecting a price of about $72 per barrel in 2030 and about $88 per barrel by the end of the forecast period in 2042. However, there are other oil price forecasts that are considerably more aggressive than the FAA base forecast such as the latest Energy Information Administration (EIA) Annual Energy Outlook released in March 2022. By 2030, it anticipates the spot price of oil will reach $88 per barrel and by 2042, $132 per barrel, considerably above the FAA base forecast of $88. Over the long run, lower oil prices give consumers an impetus for additional spending, including air travel, and should enhance industry profitability. In the case where oil prices turn out to be higher than the FAA forecast, we would expect lower spending on air travel by consumers, higher costs for fuel to airlines and reduced industry profitability.

The baseline forecast incorporates additional infrastructure spending in 2021 and beyond. However, there is considerable uncertainty as to the magnitude, timing, and nature of these programs that ultimately determines the impact on the future growth of the U.S. economy. In addition, how the U.S. will engage with the rest of the global economy over the next several years continues to evolve. Under the right conditions, a period of sustained high and more inclusive growth along with increased financial stability could occur. However, in light of the recent Russia-Ukraine conflict there is an increased possibility of an outcome that leads to greater global economic fragmentation due to rising tensions resulting in slower growth, and increased financial instability.

The baseline forecast assumes that the global economic recovery that began at the end of 2020 will continue with global GDP back to pre-COVID (2019) levels led by China and the United States by the end of 2021. Thereafter, the baseline forecast assumes that China and India will be growth engines for emerging economies as China successfully transitions the economy from heavy reliance on manufacturing and resource industries to one more oriented towards the services and technology sectors and India continues to implement reforms to make its economy more competitive. Many analysts are concerned that in light of the Russia-Ukraine conflict, China moves closer to Russia, limiting opportunities to further transition its economy away from manufacturing and resource intensive industries. In the case of India, the impact of the Russia-Ukraine conflict on energy prices and food prices may put pressure on trade and fiscal deficits resulting in a slowdown of reforms.

In the United States, economic growth will slow from the strong growth observed in 2021 as the impacts from the latest round of COVID-19 stimulus finish flowing through the economy. The combination of direct payments, extension of unemployment benefits, and direct federal spending provided money into consumer’s wallets and boosted their spending in 2021. However later on in the decade, the forecast assumes some measure of fiscal restraint will be implemented as the impact of the huge increase in federal spending to combat the economic impacts of COVID-19 has pushed the government debt as percent of GDP to levels that were last seen at the end of World War 2. In Japan, the United Kingdom, and the European Union economic growth over the next few years will be well above rates seen over the past decade as these regions recover from the COVID-19 recession. However, over the forecast horizon, demand growth will remain slow in these regions as they continue to be constrained by structural economic problems (high debt, slow population growth, weak public finances, for example) and political instability. In most of the major advanced economies, governments need to shore up their finances after the increases in government spending to offset the impacts of COVID-19. There exists a non-trivial possibility that authorities will either act prematurely or be excessively timid and late in taking necessary steps to maintain a healthy global economy. The current forecasts call for strong passenger growth for travel between the United States and other world regions, especially over the next five years. An unexpected slowing of worldwide economic activity could push the return of international passenger demand to pre-COVID levels beyond our current forecast of 2024.

Although U.S. airline finances have been decimated as a result of COVID-19 and the fall in demand, the outlook for further consolidation either through mergers and acquisitions (M&A) or bankruptcy appears to be rather limited, with one exception: a planned merger between Frontier Airlines and Spirit Airlines, pending regulatory approval. Ultra low-cost carriers which focus on domestic leisure traffic have been fastest to recover during the pandemic, putting them in relatively strong positions in recent quarters, and creating the opportunity for a merger. Based on FY 2021 data, the top 6 (American, Delta, United, Southwest, Alaska and JetBlue) accounted for about 78 percent of the U.S. airline industry capacity and traffic, and a combined Frontier and Spirit would make up about 8 percent. For the large network carriers, the steps they have taken to increase their liquidity have reduced the risk of bankruptcy in the next few years. However, if the demand recovery is slower than expected, the increase in debt that these carriers are servicing may be a burden and increase the possibility of a bankruptcy or liquidation. While the announced merger of Frontier and Spirit shows that in the right circumstances, consolidation among ultra-low cost carriers can happen, in general, the risk associated with a merger today compared to pre-COVID has increased due to the poorer financial condition of carriers.

The forecast assumes the addition of sizable numbers of large regional jets (70 to 90 seats) into the fleets of regional carriers. While the recovery in air travel demand from the COVID downturn is projected to be robust, we are not projecting a uniform recovery across all segments. As network carriers continue to adjust the size and breadth of their networks in anticipation of the post-COVID environment, they are continuing to move forward with plans to significantly reduce the numbers of small regional jets they will need. Prior to the COVID downturn in 2020, strong air travel demand has not ensured financial stability for regional carriers, as the bankruptcy filings of Republic Airways in 2016, Great Lakes Airlines in 2018 and Trans States Airlines in 2020 have shown. Financially strong and well positioned regional carriers may see increased opportunities for regional flying as a result of the network carrier actions, but the overall impact will most likely reduce opportunities for many regional carriers. In addition to managing changing relationships with network carriers, regional carriers have struggled with pilot shortages that were exacerbated during the pandemic recovery. The downturn prompted mainline carriers to reduce costs by, among other measures, offering voluntary retirements to flight crews but, as activity picked up, they drew replacements from the ranks of regionals, causing additional shortages for those carriers. To attract and recruit crews, some carriers have raised salaries and offered bonuses, further increasing financial pressures and possibly leading to new consolidation in the regional airline industry.

The general aviation sector did suffer a downturn in activity in 2020 due to the impacts of COVID-19, but the magnitude of the decline was much less than the decline in commercial aviation. By the end of 2021 most sectors, including corporate and business aviation, were at or exceeding pre-COVID activity levels. We project a return to pre-COVID levels of activity in the GA segment by 2022. Once returning to pre-COVID levels of activity, future growth in business and corporate aviation is based largely upon the prospects for economic growth and corporate profits. Uncertainty in these leading indicators poses a risk to the forecast, but the risk is not limited to these factors. Other influences, such as potential environmental regulations and taxes do not seem to be as much of a concern in the short term, but over the long term, uncertainties about the direction of these influences may place downward pressure on the forecast.

Overall activity at FAA and contract towers rose 7.1 percent in 2021, while activity at large and medium hub airports (62 in total) increased 2.3 percent and 5.0 percent, respectively, in 2021. While FAA's baseline forecast calls for operations at FAA and contract towers to return to pre-COVID levels of activity by 2023, in the long run, operations at large and medium hub airports grow faster than the overall national trend and congestion and delays could become critical limits to growth over the forecast period. FAA's forecasts of both demand and operations are unconstrained in that they assume that there will be sufficient infrastructure to handle the projected levels of activity. Should the infrastructure be inadequate and result in even more congestion and delays, it is likely that the forecasts of both demand and operations would not be achieved.

Not only is the volume of aircraft operating at most large hubs expected to increase over the next 20 years, but the mix of aircraft is changing for this same period. The expected increases in the numbers of larger regional jets and business jets as well as the anticipated widespread deployment of UAS and Advanced Air Mobility (AAM) vehicles into the national airspace system will make the FAA's job more challenging. For example, in adding these new vehicles to the system, they could replace existing traditional aircraft. This change in the mix of aircraft will most likely add to workload above and beyond the increasing demand for aviation services resulting from the growth in operations over the forecast period.

Increasing concerns about aviation's environmental impacts could potentially limit or delay the ability of the aviation sector to grow to meet national economic and mobility needs. Airspace modernization and airport expansion or new construction are often contentious because of concerns over noise, air quality, and water quality. Climate change is also of concern and could limit aviation growth. In Europe, concerns about climate change are leading to restrictions on airport expansion activities and proposals to limit short-haul domestic flights. Community concerns across the U.S. about aviation noise have led to increasing levels of public debate, political interest, and even litigation. Without effective measures to mitigate and abate aviation noise, the infrastructure projects and airspace redesign efforts needed to achieve aviation growth may be delayed. Similarly, community concerns about environmental and/or other considerations (e.g., privacy concerns) associated with UAS, AAM, and commercial space launch activity could impact growth in these aviation areas.

In addition to providing economic benefits, technologies to improve aircraft fuel efficiency and reduce fuel consumption provide benefits in terms of reduced emissions that impact air quality and climate change; many technologies that improve fuel efficiency also result in reduced noise. Airlines are increasing their use of sustainable aviation fuels, which provides benefits in terms of reduced impacts of aviation on climate change and air quality. The implementation of the Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA), a global market-based measure for international carbon dioxide emissions, will help ensure an approach that is economically preferable to a patchwork of State or Regional-level regulations around the world is used, and will help to further address the impacts of aviation on climate change. Continued advancements and fleetwide uptake of sustainable aviation fuels and new aircraft and engine technologies that result in improved fuel efficiency, reduced fuel consumption, noise reduction and reduced emissions are required to ensure that access restrictions or operating limitations are not imposed on the in-service fleet, which in turn may depress growth.

Widespread deployment of UAS and AAM vehicles is another potential tool for reducing aviation emissions if they replace traditional aircraft in the movement of people and goods. However, if they do not replace existing air vehicles, then they would result in a net life-cycle increase in environmental impacts. The expansion of commercial space launch activity could also change the mix of aircraft in service, with associated impacts on aviation emissions. The emissions from commercial space operations could have a negative impact on both climate change and the ozone layer; however, the magnitude of the impacts is unknown with the fuel type in particular having considerable impact on this magnitude.

Appendix A: Alternative Forecast Scenarios

Uncertainty exists in all industries, but especially in the commercial air travel industry. As volatility in the global environment has increased, the importance of scenarios for planning purposes has increased. In order to help stakeholders better prepare for the future, the FAA provides alternative scenarios to our baseline forecasts of airline traffic and capacity.

To create the baseline domestic forecast, economic assumptions from IHS Markit's 10-year and 30-year U.S. Macro Baselines were used. To develop the alternative scenarios, assumptions from IHS Markit's 30-year optimistic and pessimistic forecasts from their August 2021 *US Economy: The 30-Year Focus* were utilized. Inputs from these alternative scenarios were used to create "high" and "low" traffic, capacity, and yield forecasts.

International passengers and traffic are primarily driven by country specific Gross Domestic Product (GDP) forecasts provided by IHS Markit. Thus, the alternative scenarios use inputs based on ratios derived from IHS Markit's Major Trading Partner and Other Important Trading Partners optimistic and pessimistic forecasts in order to create high and low cases.

Scenario Assumptions

The FAA's domestic baseline forecast assumes that economic growth rebounds solidly in 2022 and then remains slightly above trend through the remainder of the decade, supported by consumer and government spending. The unemployment rate continues its retreat, falling below its pre-pandemic rate in 2023. Oil prices surge in 2022 but, as previously mentioned, the forecast now appears conservative due to the war in Ukraine. No external shocks are assumed in the forecast.

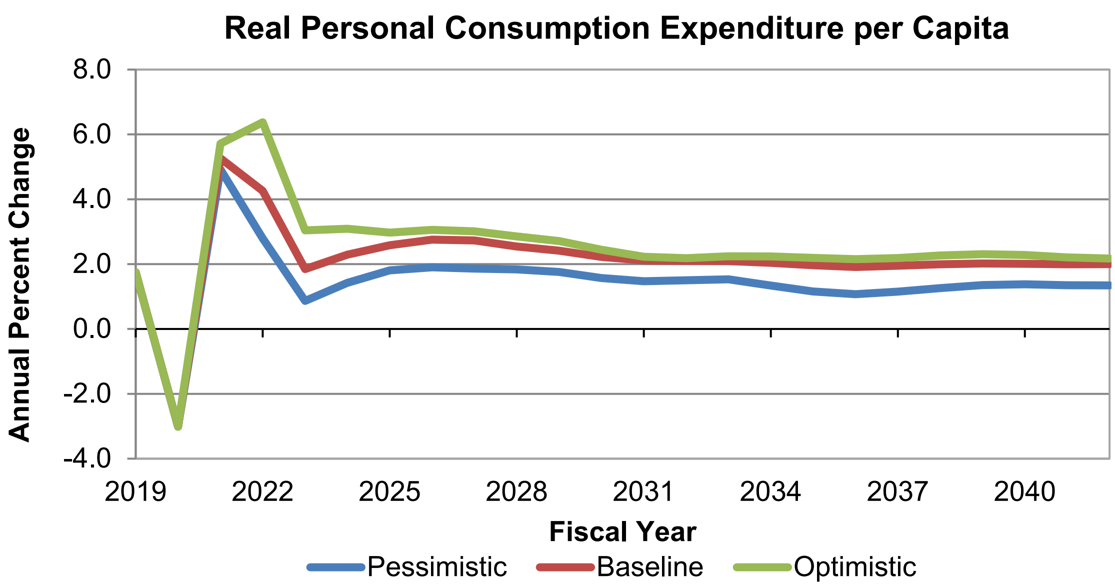
The FAA's high case forecast uses IHS Markit's optimistic forecast. The optimistic scenario is characterized by a quicker recovery in the near term than in the baseline followed by slightly stronger growth over the balance of the forecast. Near-term differences include surging GDP growth of 7.0 percent in 2022 compared to 4.5 percent in the baseline, driven mainly by stronger consumer spending. This spending results from a more robust response by consumers to the Infrastructure Investment and Jobs Act and a willingness to tap into some of their excess savings, buttressed by stronger confidence from declining COVID-19 cases. The unemployment rate falls a bit more sharply than in the baseline though it also reaches the pre-pandemic rate in 2023. And the price of oil is about 10 percent below the baseline as OPEC+ raises output quotas and US inventories rise faster than normal.

In this scenario, real personal consumption expenditure (PCE) per capita growth is about 3 tenths of a percentage point stronger than the baseline in the medium- and long-term. Unemployment averages 0.25 percentage points lower on a fiscal year basis than the baseline.[79]

Conversely, FAA's low case forecast uses IHS Markit's pessimistic scenario. In this forecast, an upturn in new COVID-19 cases, hospitalizations, and deaths, lead to more caution on the part of consumers, slowing their spending which falls below the baseline path. The economy sees a recovery in 2022 that is more modest than in the baseline and optimistic scenarios, and medium- and long-term growth is also slower. GDP growth averages 0.5 percentage points lower than in the baseline over the forecast horizon.

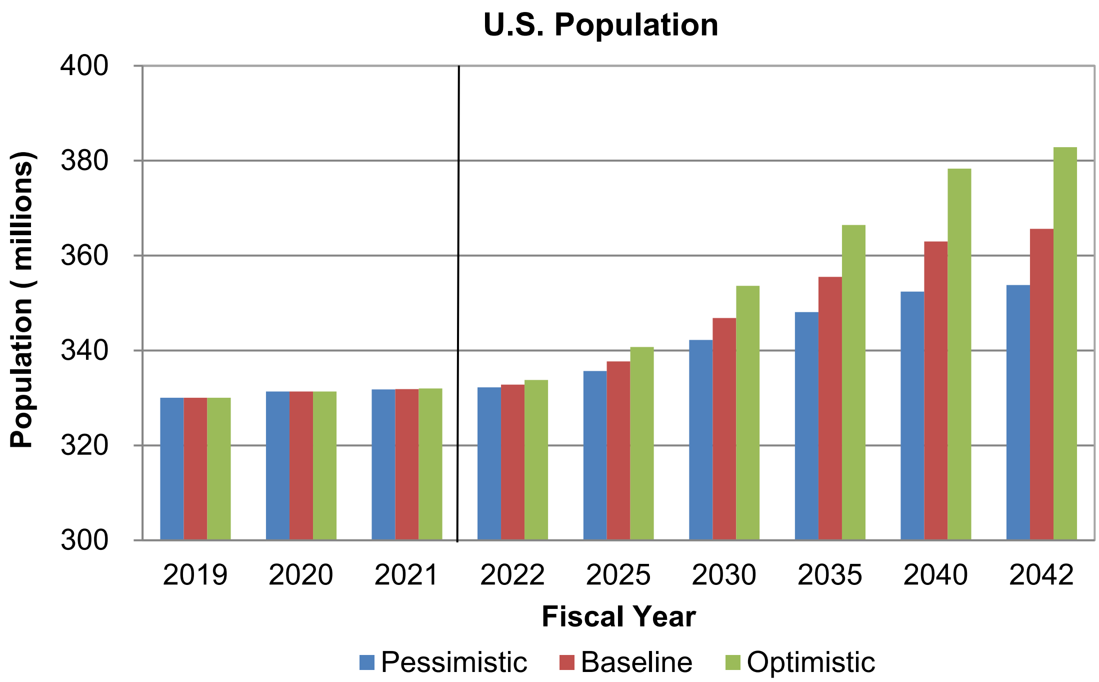
Contributing to slower GDP growth in this scenario, business capital investments and residential housing investments both grow more slowly than in the baseline, resulting in lower overall productivity growth. Supply chain issues continue and consumer hesitancy combine, causing businesses to scale back investments. Financial conditions are tight and household wealth is impacted by declining stock markets.

Oil prices rise faster than the baseline throughout the forecast and are $52 per barrel higher by 2042. Real PCE per capita in this scenario grows 0.8 percentage points slower per year than in the baseline; and unemployment, on average, is 0.6 points higher on an annual basis than in the baseline.

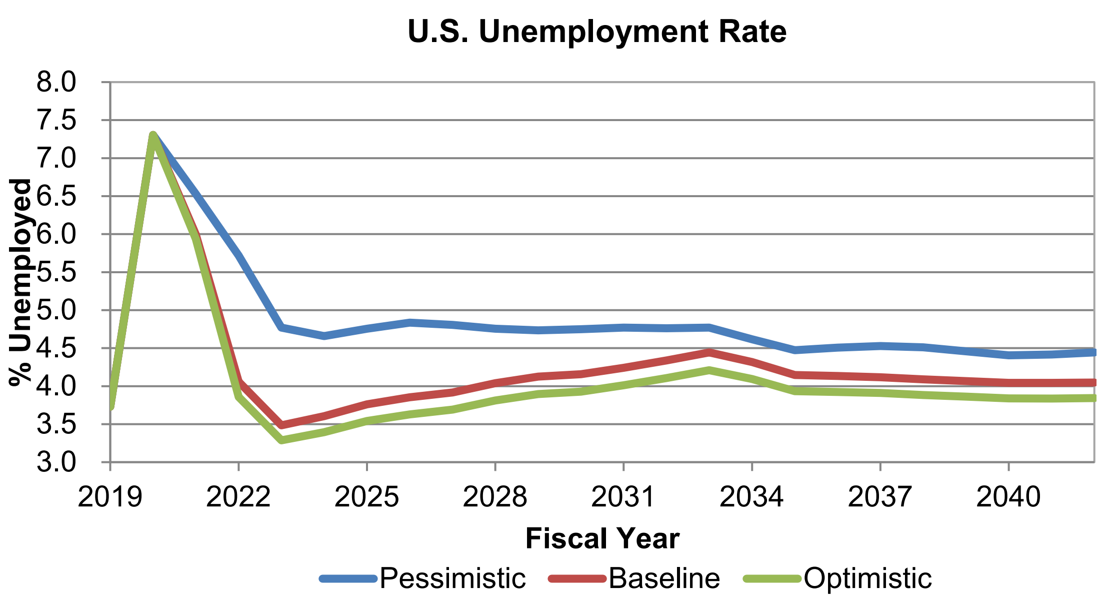


Source: IHS Markit

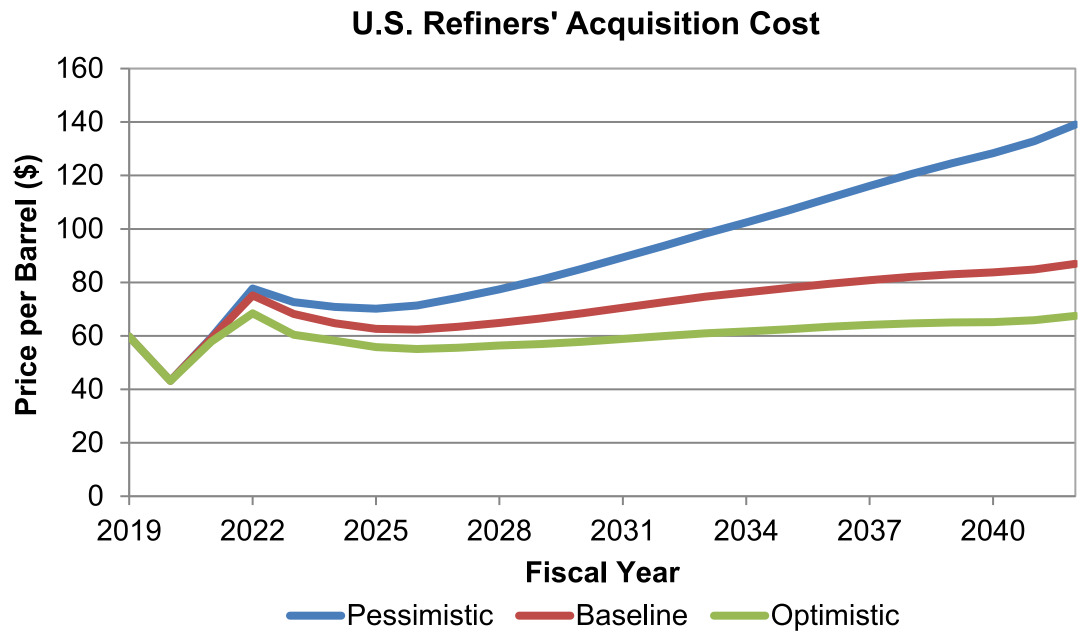
[79] Real personal consumption expenditure per capita and unemployment are used as input variables to the FAA's base, high and low forecasts of enplanements.



Source: IHS Markit

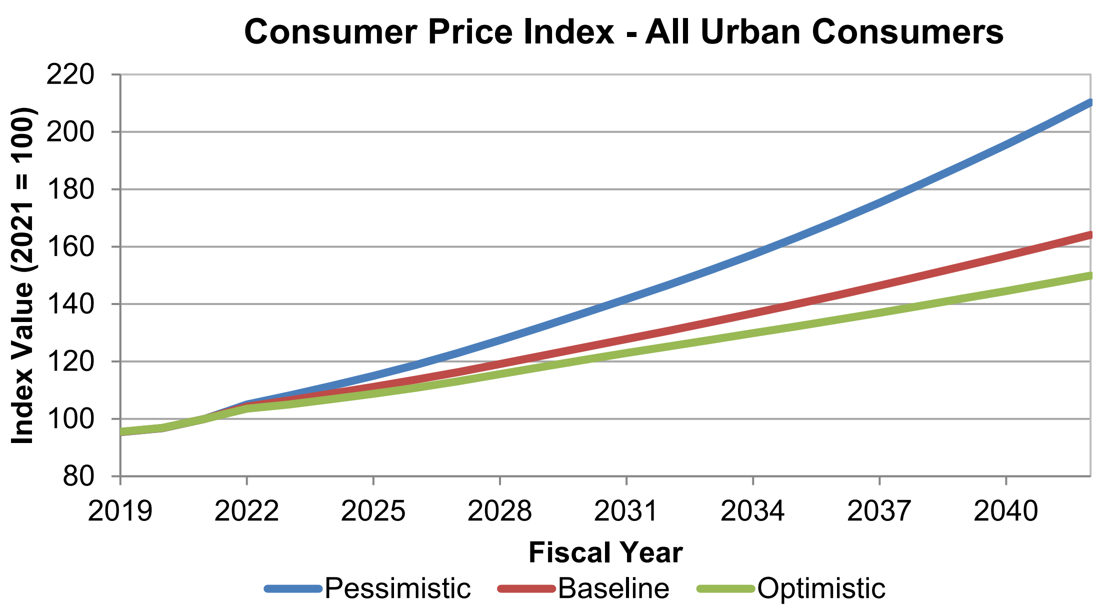


Source: IHS Markit



Source: IHS Markit

The price of energy is one of the drivers in the growth of consumer prices over the forecast period. In the optimistic case, slow growth of energy prices and import prices counteracts faster growth of other consumer goods prices causing the optimistic CPI to rise somewhat slower than the baseline. In the pessimistic case, energy prices, wages and import prices all rise more rapidly compared to the baseline.



Source: IHS Markit

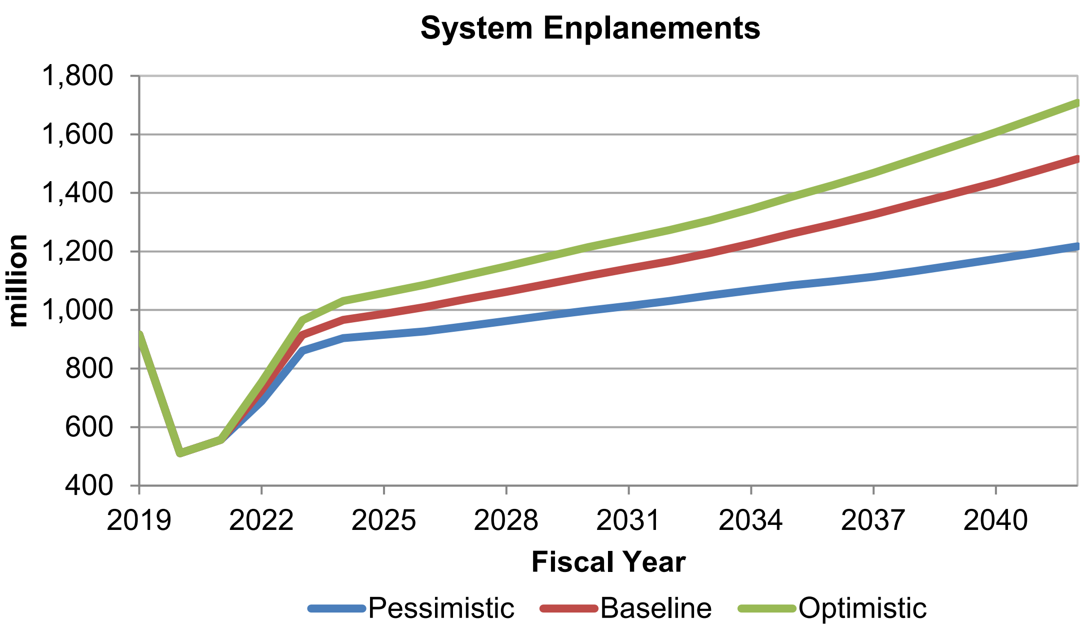
Alternative Forecasts

Enplanements

In the baseline forecast, system enplanements are forecast to grow at an average annual rate of 4.9 percent a year over the forecast horizon of 2022-2042 (with domestic and international passengers increasing at rates of 4.7 and 6.9 percent, respectively).

In the optimistic case, enplanements grow at a slightly quicker pace, averaging 5.5 percent per year (up 5.3 percent domestically and 7.1 percent internationally). This scenario is marked by a more favorable business environment and lower fuel prices which make the price of flying more affordable to business and leisure travelers. By the end of the forecast period in 2042, system passengers in the optimistic case are 12.6 percent above the baseline, totaling 1.7 billion, 191 million greater than in the baseline.

The pessimistic case is characterized by a period of weakened personal income growth and consumer confidence combined with a contraction in financial asset markets, leading to higher interest rates, and curtailed investment and consumer spending. In this scenario, enplanements grow an average of 3.8 percent per year (domestic up 3.5 percent and international up 6.3 percent). In the pessimistic case, system passengers in 2042 are 19.7 percent below the baseline case, totaling 1.2 billion, or 299 million fewer than in the baseline.

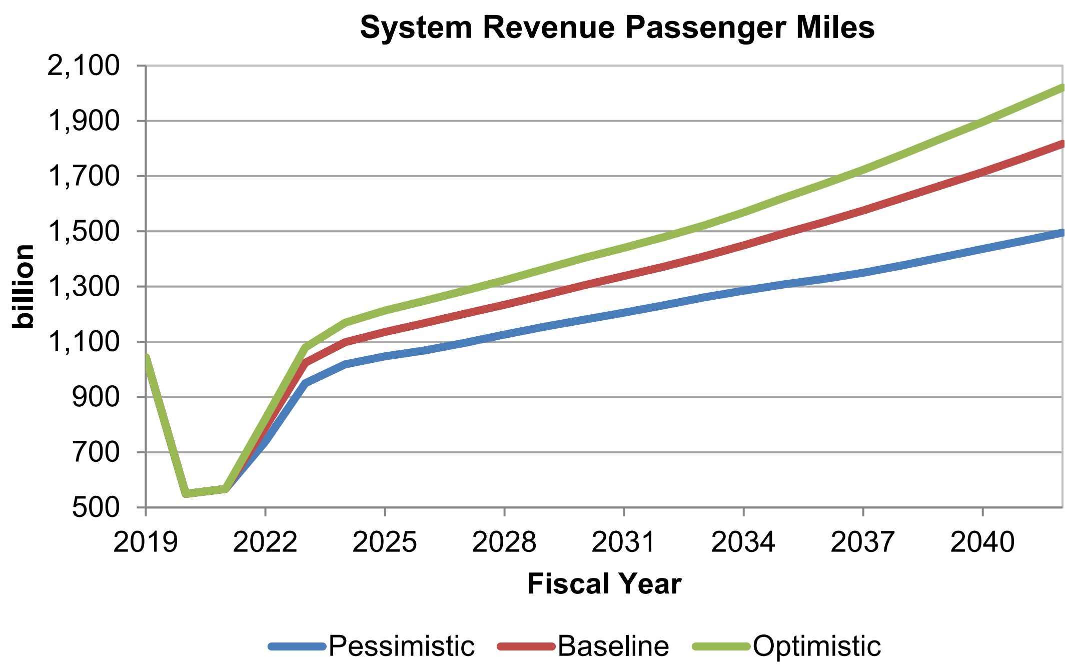


Revenue Passenger Miles

In the baseline forecast, system RPMs grow at an average annual rate of 5.7 percent a year over the forecast horizon (2022-2042), with domestic RPMs increasing 4.8 percent annually and international RPMs growing 8.8 percent annually.

In the optimistic case, the faster growing economy coupled with lower energy prices drives RPMs higher than the baseline, with growth averaging 6.2 percent per year (domestic and international RPMs up 5.5 and 9.0 percent, respectively).

In the pessimistic case, the combination of a slower growing economy and higher energy prices result in RPM growth averaging 4.7 percent annually with domestic markets growing 3.7 percent a year while international traffic grows 8.2 percent annually.



Available Seat Miles

In the base case, system capacity is forecast to increase an average of 4.7 percent annually over the forecast horizon with growth averaging 4.0 percent annually in domestic markets and 6.5 percent a year in international markets.

In the optimistic case, capacity grows somewhat faster than in the baseline forecast, averaging 5.2 percent annually system-wide (4.7 and 6.8 percent for domestic and international markets, respectively). Carriers increase capacity compared to the baseline forecast to accommodate increased travel

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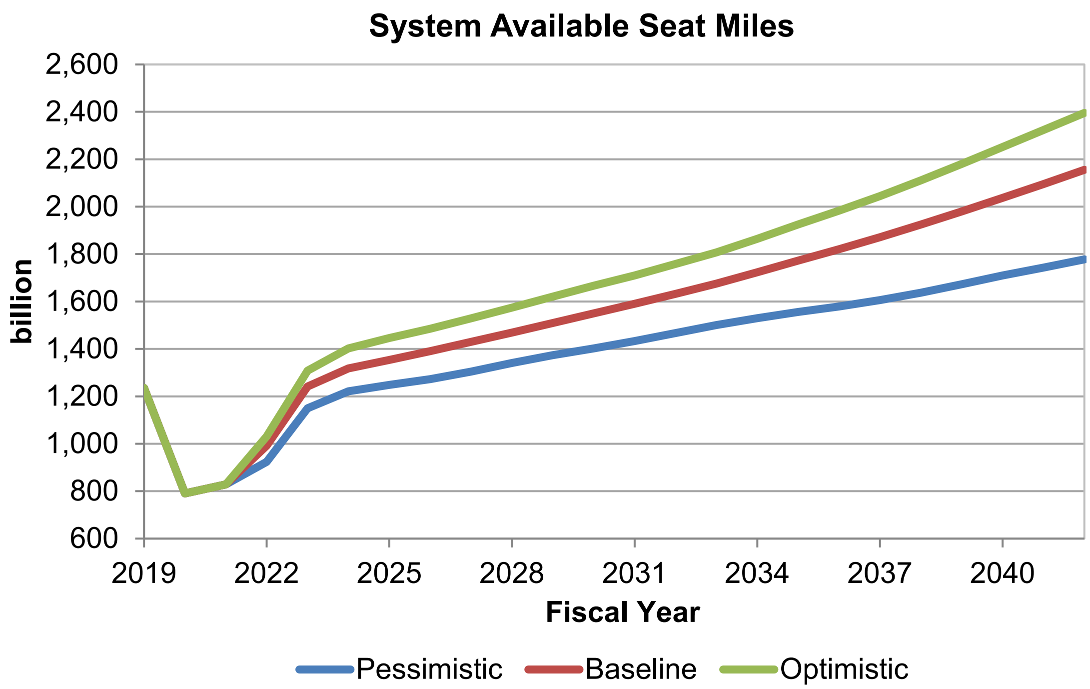
demand brought about by a more favorable economic environment.

In the pessimistic case, demand for air travel is lower than in the baseline, thus system capacity grows at a slower pace of 3.7 percent annually (domestic growth of 2.9 percent annually and international up 6.1 percent annually).



Load Factor

System load factors over the 20-year forecast period are similar for all three forecast scenarios. System load factor rises from 68.5 percent in 2021 to 84.4 (optimistic), 84.1 (pessimistic), and 84.3 (baseline) percent in 2042.

In all three scenarios it is assumed that carriers will keep load factors on the high side by actively managing capacity (seats) to more precisely meet demand (passengers).

The domestic load factor increases over the forecast horizon from 72.4 percent to 85.1 percent in the baseline, and to 85.2 percent in the optimistic and pessimistic scenarios.

The international load factor rises in the baseline from 53.5 percent to 82.3 percent; in the optimistic to 82.3 percent; and in the pessimistic to 82.0 percent. This reflects in part the relative growth in demand and capacity in the three (Atlantic, Latin, and Pacific) international regions under each scenario.

Yield

In the baseline forecast, nominal system yield increases 2.3 percent annually, rising from 11.71 cents in 2021 to 18.89 cents in 2042. In domestic markets, yield in the baseline forecast rises from 11.50 cents in 2021 to 19.23 cents in 2042. International yield rises from 12.80 cents in 2021 to 18.09 cents in 2042.

System yield rises in the optimistic case at a slower rate than in the baseline, up 1.9 percent annually to 17.35 cents in 2042. Domestic yield increases to 17.33 cents while international yield increases to 17.40 cents. The moderate growth in yield in both cases is due to advancements in technology, gains in productivity, and modestly rising fuel prices.

In the pessimistic case, nominal yields rise more rapidly than in the baseline, growing an average of 3.4 percent annually, reaching 23.49 cents by 2042 (25.10 cents domestically and 20.11 cents internationally). This scenario reflects higher general domestic inflation and markedly higher energy prices than in the baseline, forcing carriers to increase fares in order to cover the higher costs of fuel, labor, and capital.

TABLE A-1

FAA FORECAST ECONOMIC ASSUMPTIONS

FISCAL YEARS 2021-2042

Variable	Scenario	Historical 2021E	FORECAST 2022	2027	2032	2037	2042	PERCENT AVERAGE ANNUAL GROWTH 2021-22	2022-27	2022-32	2022-37	2022-42
Economic Assumptions												
Real Personal Consumption	Pessimistic	40,244	41,368	44,722	48,484	51,591	55,134	2.8%	1.6%	1.6%	1.5%	1.4%
Expenditure per Capita	Baseline	40,376	42,095	47,491	53,157	58,666	64,785	4.3%	2.4%	2.4%	2.2%	2.2%
(2012 $)	Optimistic	40,550	43,134	50,089	56,626	63,140	70,562	6.4%	3.0%	2.8%	2.6%	2.5%
Refiners Acquisition Cost -	Pessimistic	59.4	77.7	74.2	93.7	116.1	139.0	30.8%	-0.9%	1.9%	2.7%	3.0%
Average - $ Per Barrel	Baseline	59.1	75.1	63.4	72.6	80.8	86.9	27.2%	-3.3%	-0.3%	0.5%	0.7%
	Optimistic	57.9	68.4	55.6	59.9	64.1	67.5	18.2%	-4.1%	-1.3%	-0.4%	-0.1%
Consumer Price Index	Pessimistic	2.67	2.80	3.28	3.91	4.67	5.61	5.0%	3.2%	3.4%	3.5%	3.5%
All Urban, 1982-84 = 1.0	Baseline	2.67	2.78	3.10	3.48	3.90	4.37	4.3%	2.2%	2.3%	2.3%	2.3%
	Optimistic	2.67	2.76	3.01	3.34	3.65	4.00	3.5%	1.8%	1.9%	1.9%	1.9%
Civilian Unemployment Rate	Pessimistic	6.5	5.7	4.8	4.8	4.5	4.4	-12.4%	-3.4%	-1.8%	-1.5%	-1.3%
(%)	Baseline	6.0	4.1	3.9	4.3	4.1	4.0	-32.3%	-0.7%	0.7%	0.1%	0.0%
	Optimistic	5.9	3.9	3.7	4.1	3.9	3.8	-35.0%	-0.9%	0.6%	0.1%	0.0%

Source: IHS Markit

TABLE A-2

FAA FORECAST OF AVIATION ACTIVITY*

FISCAL YEARS 2021-2042

Variable	Scenario	Historical 2021E	FORECAST 2022	2027	2032	2037	2042	PERCENT AVERAGE ANNUAL GROWTH 2021-22	2022-27	2022-32	2022-37	2022-42
System Aviation Activity												
Available Seat Miles	Pessimistic	828.7	923.4	1,304.5	1,467.1	1,605.7	1,777.7	11.4%	7.2%	4.7%	3.8%	3.3%
(BIL)	Baseline	828.7	991.9	1,430.1	1,632.0	1,871.3	2,155.5	19.7%	7.6%	5.1%	4.3%	4.0%
	Optimistic	828.7	1,031.2	1,528.8	1,758.6	2,044.9	2,395.5	24.4%	8.2%	5.5%	4.7%	4.3%
Revenue Passenger Miles	Pessimistic	567.4	738.6	1,096.2	1,232.5	1,350.1	1,495.2	30.2%	8.2%	5.3%	4.1%	3.6%
(BIL)	Baseline	567.4	790.2	1,201.7	1,372.1	1,575.7	1,816.8	39.3%	8.7%	5.7%	4.7%	4.3%
	Optimistic	567.4	821.1	1,285.3	1,479.4	1,723.2	2,020.7	44.7%	9.4%	6.1%	5.1%	4.6%
Enplanements	Pessimistic	556.4	688.6	944.3	1,030.7	1,113.5	1,217.5	23.8%	6.5%	4.1%	3.3%	2.9%
(MIL)	Baseline	556.4	726.2	1,037.0	1,166.7	1,326.3	1,516.2	30.5%	7.4%	4.9%	4.1%	3.7%
	Optimistic	556.4	753.4	1,118.0	1,273.0	1,468.3	1,707.7	35.4%	8.2%	5.4%	4.5%	4.2%
Psgr Carrier Miles Flown	Pessimistic	5,391.1	5,830.1	7,993.3	8,784.3	9,456.2	10,300.9	8.1%	6.5%	4.2%	3.3%	2.9%
(MIL)	Baseline	5,391.1	6,216.0	8,772.4	9,851.3	11,133.5	12,646.6	15.3%	7.1%	4.7%	4.0%	3.6%
	Optimistic	5,391.1	6,457.2	9,415.4	10,677.6	12,240.5	14,142.9	19.8%	7.8%	5.2%	4.4%	4.0%
Psgr Carrier Departures	Pessimistic	6,553.0	6,919.2	9,124.4	9,695.7	10,195.6	10,844.6	5.6%	5.7%	3.4%	2.6%	2.3%
(000s)	Baseline	6,553.0	7,274.8	10,006.0	10,983.8	12,154.8	13,518.4	11.0%	6.6%	4.2%	3.5%	3.1%
	Optimistic	6,553.0	7,534.2	10,786.1	11,981.7	13,450.4	15,222.8	15.0%	7.4%	4.7%	3.9%	3.6%
Nominal Passenger Yield	Pessimistic	11.71	13.28	15.19	17.36	20.18	23.49	13.5%	2.7%	2.7%	2.8%	2.9%
(cents)	Baseline	11.71	13.19	14.63	15.99	17.39	18.89	12.7%	2.1%	1.9%	1.9%	1.8%
	Optimistic	11.71	13.06	14.28	15.41	16.36	17.35	11.6%	1.8%	1.7%	1.5%	1.4%

* Includes domestic and international activity.

TABLE A-3

FAA FORECAST OF DOMESTIC AVIATION ACTIVITY

FISCAL YEARS 2021-2042

		Historical	FORECAST					PERCENT AVERAGE ANNUAL GROWTH				
Variable	Scenario	2021E	2022	2027	2032	2037	2042	2021-22	2022-27	2022-32	2022-37	2022-42
Domestic Aviation Activity												
Available Seat Miles	Pessimistic	657.5	700.9	915.3	996.5	1,080.8	1,188.0	6.6%	5.5%	3.6%	2.9%	2.7%
(BIL)	Baseline	657.5	729.6	1,006.5	1,141.3	1,306.3	1,507.0	11.0%	6.6%	4.6%	4.0%	3.7%
	Optimistic	657.5	755.7	1,090.7	1,255.8	1,459.5	1,714.2	14.9%	7.6%	5.2%	4.5%	4.2%
Revenue Passenger Miles	Pessimistic	475.8	583.5	777.0	845.7	919.2	1,011.6	22.6%	5.9%	3.8%	3.1%	2.8%
(BIL)	Baseline	475.8	607.3	854.5	968.5	1,111.0	1,283.1	27.6%	7.1%	4.8%	4.1%	3.8%
	Optimistic	475.8	629.1	926.1	1,065.7	1,241.3	1,459.7	32.2%	8.0%	5.4%	4.6%	4.3%
Enplanements	Pessimistic	507.1	620.1	831.0	892.3	957.0	1,039.2	22.3%	6.0%	3.7%	2.9%	2.6%
(MIL)	Baseline	507.1	645.5	913.9	1,021.9	1,156.7	1,318.2	27.3%	7.2%	4.7%	4.0%	3.6%
	Optimistic	507.1	668.7	990.4	1,124.5	1292.4	1,499.5	31.9%	8.2%	5.3%	4.5%	4.1%
Psgr Carrier Miles Flown	Pessimistic	4,529.3	4,765.6	6,245.3	6,685.9	7,131.8	7,707.8	5.2%	5.6%	3.4%	2.7%	2.4%
(MIL)	Baseline	4,529.3	4,961.1	6,870.2	7,661.4	8,626.5	9,785.7	9.5%	6.7%	4.4%	3.8%	3.5%
	Optimistic	4,529.3	5,139.8	7,447.4	8,432.6	9,641.5	11,136.4	13.5%	7.7%	5.1%	4.3%	3.9%
Psgr Carrier Departures	Pessimistic	6,081.2	6,373.1	8,346.1	8,757.6	9,146.1	9,661.7	4.8%	5.5%	3.2%	2.4%	2.1%
(000s)	Baseline	6,081.2	6,631.0	9,160.0	10,002.7	11,015.8	12,201.9	9.0%	6.7%	4.2%	3.4%	3.1%
	Optimistic	6,081.2	6,858.4	9,909.3	10,974.9	12,268.4	13,838.0	12.8%	7.6%	4.8%	4.0%	3.6%
Nominal Passenger Yield	Pessimistic	11.50	13.25	15.87	18.49	21.53	25.10	15.2%	3.7%	3.4%	3.3%	3.2%
(cents)	Baseline	11.50	13.11	14.86	16.26	17.70	19.23	14.0%	2.5%	2.2%	2.0%	1.9%
	Optimistic	11.50	12.93	14.32	15.39	16.34	17.33	12.5%	2.1%	1.8%	1.6%	1.5%

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TABLE A-4

FAA FORECAST OF INTERNATIONAL AVIATION ACTIVITY*

FISCAL YEARS 2021-2042

		Historical	FORECAST					PERCENT AVERAGE ANNUAL GROWTH				
Variable	Scenario	2021E	2022	2027	2032	2037	2042	2021-22	2022-27	2022-32	2022-37	2022-42
International Aviation Activity												
Available Seat Miles (BIL)	Pessimistic	171.2	222.5	389.2	470.5	525.0	589.7	30.0%	11.8%	7.8%	5.9%	5.0%
	Baseline	171.2	262.3	423.7	490.7	564.9	648.5	53.3%	10.1%	6.5%	5.2%	4.6%
	Optimistic	171.2	275.4	438.0	502.8	585.5	681.3	60.9%	9.7%	6.2%	5.2%	4.6%
Revenue Passenger Miles (BIL)	Pessimistic	91.6	155.1	319.2	386.8	430.9	483.5	69.4%	15.5%	9.6%	7.0%	5.8%
	Baseline	91.6	182.9	347.3	403.6	464.8	533.6	99.7%	13.7%	8.2%	6.4%	5.5%
	Optimistic	91.6	192.0	359.3	413.7	481.9	561.0	109.7%	13.3%	8.0%	6.3%	5.5%
Enplanements (MIL)	Pessimistic	49.2	68.5	113.3	138.4	156.5	178.3	39.0%	10.6%	7.3%	5.7%	4.9%
	Baseline	49.2	80.7	123.1	144.7	169.6	198.0	63.9%	8.8%	6.0%	5.1%	4.6%
	Optimistic	49.2	84.7	127.6	148.5	176.0	208.1	72.0%	8.5%	5.8%	5.0%	4.6%
Psgr Carrier Miles Flown (MIL)	Pessimistic	861.8	1,064.5	1,748.0	2,098.3	2,324.4	2,593.1	23.5%	10.4%	7.0%	5.3%	4.6%
	Baseline	861.8	1,254.9	1,902.2	2,189.9	2,507.0	2,860.9	45.6%	8.7%	5.7%	4.7%	4.2%
	Optimistic	861.8	1,317.5	1,968.0	2,244.9	2,599.0	3,006.6	52.9%	8.4%	5.5%	4.6%	4.2%
Psgr Carrier Departures (000s)	Pessimistic	471.8	546.0	778.2	938.1	1,049.5	1,183.0	15.7%	7.3%	5.6%	4.5%	3.9%
	Baseline	471.8	643.7	846.0	981.1	1,139.0	1,316.6	36.4%	5.6%	4.3%	3.9%	3.6%
	Optimistic	471.8	675.8	876.8	1,006.8	1,182.0	1,384.8	43.2%	5.3%	4.1%	3.8%	3.7%
Nominal Passenger Yield (cents)	Pessimistic	12.80	13.43	13.53	14.90	17.30	20.11	4.9%	0.2%	1.1%	1.7%	2.0%
	Baseline	12.80	13.47	14.05	15.32	16.65	18.09	5.3%	0.8%	1.3%	1.4%	1.5%
	Optimistic	12.80	13.50	14.17	15.45	16.41	17.40	5.5%	1.0%	1.4%	1.3%	1.3%

*Includes mainline and regional carriers.

Appendix B: Forecast Tables

TABLE 1

U.S. SHORT-TERM ECONOMIC FORECASTS

	FISCAL YEAR 2021				FISCAL YEAR 2022				FISCAL YEAR 2023			
ECONOMIC VARIABLE	1ST. QTR.	2ND. QTR.	3RD QTR.	4TH. QTR.	1ST. QTR.	2ND. QTR.	3RD QTR.	4TH. QTR.	1ST. QTR.	2ND. QTR.	3RD QTR.	4TH. QTR.
Real Personal Consumption												
Expenditure per Capita												
(2012 $)	38,973	40,035	41,177	41,316	41,738	41,998	42,218	42,425	42,581	42,758	42,962	43,192
Year over year change	-2.6%	1.9%	16.1%	6.9%	7.1%	4.9%	2.5%	2.7%	2.0%	1.8%	1.8%	1.8%
Refiners' Acquisition Cost - Average												
(Dollars per barrel)	42.03	57.24	66.03	71.04	80.35	74.61	71.95	73.59	71.86	66.91	68.23	65.77
Year over year change	-27.5%	21.1%	148.6%	74.2%	91.2%	30.4%	9.0%	3.6%	-10.6%	-10.3%	-5.2%	-10.6%
Consumer Price Index												
(1982-84 equals 1)	2.61	2.63	2.69	2.73	2.76	2.77	2.79	2.80	2.82	2.83	2.85	2.86
Year over year change	1.2%	1.9%	4.8%	5.3%	5.8%	5.2%	3.7%	2.6%	1.9%	2.1%	2.1%	2.1%

Source: IHS Markit

TABLE 2

U.S. LONG-TERM ECONOMIC FORECASTS

FISCAL YEAR	REAL GROSS DOMESTIC PRODUCT (Billions 2012 $)	REAL PERSONAL CONSUMPTION EXPENDITURE PER CAPITA (2012 $)	CONSUMER PRICE INDEX (1982-84=1.00)	REFINERS' ACQUISITION COST AVERAGE (Dollars per barrel)
Historical				
2010	15,542	34,429	2.17	74.61
2015	17,310	36,750	2.37	56.69
2018	18,501	38,869	2.50	63.72
2019	18,912	39,548	2.54	59.77
2020	18,493	38,357	2.58	43.15
2021E	19,164	40,376	2.67	59.08
Forecast				
2022	20,024	42,095	2.78	75.13
2027	22,881	47,491	3.10	63.42
2032	25,475	53,157	3.48	72.60
2037	28,032	58,666	3.90	80.84
2042	30,919	64,785	4.37	86.94
Avg Annual Growth				
2010-21	1.9%	1.5%	1.9%	-2.1%
2021-22	4.5%	4.3%	4.3%	27.2%
2022-32	2.4%	2.4%	2.3%	-0.3%
2022-42	2.2%	2.2%	2.3%	0.7%

Source: IHS Markit

TABLE 3

INTERNATIONAL GDP FORECASTS BY TRAVEL REGION

	GROSS DOMESTIC PRODUCT (In Billions of 2015 U.S. Dollars)				
CALENDAR YEAR	CANADA	EUROPE / AFRICA / MIDDLE EAST	LATIN AMERICA / CARIBBEAN / MEXICO	JAPAN / PACIFIC BASIN / CHINA / OTHER ASIA / AUSTRALIA / NEW ZEALAND	WORLD
Historical					
2010	1,400	22,197	5,126	19,240	64,618
2015	1,557	23,992	5,691	24,785	74,550
2018	1,659	25,634	5,638	28,710	81,810
2019	1,690	26,122	5,584	29,862	84,007
2020	1,600	24,635	5,144	29,577	81,146
2021E	1,677	25,843	5,444	31,346	85,643
Forecast					
2022	1,747	26,849	5,563	32,880	89,280
2027	1,942	29,795	6,386	40,503	104,206
2032	2,112	32,636	7,367	48,802	119,651
2037	2,299	35,588	8,484	57,705	136,041
2042	2,503	38,661	9,758	67,262	153,843
Avg Annual Growth					
2010-21	1.7%	1.4%	0.5%	4.5%	2.6%
2021-22	4.2%	3.9%	2.2%	4.9%	4.2%
2022-32	1.9%	2.0%	2.8%	4.0%	3.0%
2022-42	1.8%	1.8%	2.8%	3.6%	2.8%

Source: IHS Markit website, GDP Components Tables (Interim Forecast, Monthly)

TABLE 4

INTERNATIONAL GDP FORECASTS – SELECTED AREAS/COUNTRIES

	GROSS DOMESTIC PRODUCT (In Billions of 2015 U.S. Dollars)				
CALENDAR YEAR	NORTH AMERICA (USMCA)	EUROZONE	UNITED KINGDOM	JAPAN	CHINA
Historical					
2010	18,794	11,192	2,668	4,220	7,490
2015	20,933	11,665	2,958	4,446	10,961
2018	22,392	12,429	3,140	4,580	13,366
2019	22,867	12,624	3,193	4,581	14,166
2020	21,992	11,803	2,883	4,367	14,493
2021E	23,192	12,407	3,078	4,464	15,669
Forecast					
2022	24,166	12,866	3,197	4,584	16,531
2027	27,445	13,880	3,442	4,788	21,239
2032	30,533	14,759	3,709	4,952	26,306
2037	33,750	15,663	3,981	5,124	31,702
2042	37,196	16,599	4,266	5,295	37,229
Avg Annual Growth					
2010-21	1.9%	0.9%	1.3%	0.5%	6.9%
2021-22	4.2%	3.7%	3.9%	2.7%	5.5%
2022-32	2.4%	1.4%	1.5%	0.8%	4.8%
2022-42	2.2%	1.3%	1.5%	0.7%	4.1%

Source: IHS Markit website, GDP Components Tables (Interim Forecast, Monthly)

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TABLE 5

U.S. COMMERCIAL AIR CARRIERS[1]

TOTAL SCHEDULED U.S. PASSENGER TRAFFIC

	REVENUE PASSENGER ENPLANEMENTS (Millions)			REVENUE PASSENGER MILES (Billions)		
FISCAL YEAR	DOMESTIC	INTERNATIONAL	TOTAL	DOMESTIC	INTERNATIONAL	TOTAL
Historical						
2010	635	77	712	555	231	786
2015	696	90	786	629	261	889
2018	781	100	880	720	281	1,001
2019	813	104	917	752	292	1,044
2020	462	49	511	421	129	549
2021E	507	49	556	476	92	567
Forecast						
2022	645	81	726	607	183	790
2027	914	123	1,037	854	347	1,202
2032	1,022	145	1,167	969	404	1,372
2037	1,157	170	1,326	1,111	465	1,576
2042	1,318	198	1,516	1,283	534	1,817
Avg Annual Growth						
2010-21	-2.0%	-4.0%	-2.2%	-1.4%	-8.1%	-2.9%
2021-22	27.3%	63.9%	30.5%	27.6%	99.7%	39.3%
2022-32	4.7%	6.0%	4.9%	4.8%	8.2%	5.7%
2022-42	3.6%	4.6%	3.7%	3.8%	5.5%	4.3%

Source: Forms 41 and 298-C, U.S. Department of Transportation.

[1]Sum of U.S. Mainline and Regional Air Carriers.

TABLE 6

U.S. COMMERCIAL AIR CARRIERS[1]

SCHEDULED PASSENGER CAPACITY, TRAFFIC, AND LOAD FACTORS

	DOMESTIC			INTERNATIONAL			SYSTEM		
FISCAL YEAR	ASMs (BIL)	RPMs (BIL)	% LOAD FACTOR	ASMs (BIL)	RPMs (BIL)	% LOAD FACTOR	ASMs (BIL)	RPMs (BIL)	% LOAD FACTOR
Historical									
2010	679	555	81.7	281	231	82.1	961	786	81.8
2015	744	629	84.5	323	261	80.7	1,067	889	83.4
2018	850	720	84.7	345	281	81.5	1,195	1,001	83.8
2019	883	752	85.2	352	292	82.9	1,235	1,044	84.5
2020	613	421	68.6	178	129	72.3	791	549	69.5
2021E	658	476	72.4	171	92	53.5	829	567	68.5
Forecast									
2022	730	607	83.2	262	183	69.7	992	790	79.7
2027	1,006	854	84.9	424	347	82.0	1,430	1,202	84.0
2032	1,141	969	84.9	491	404	82.3	1,632	1,372	84.1
2037	1,306	1,111	85.0	565	465	82.3	1,871	1,576	84.2
2042	1,507	1,283	85.1	648	534	82.3	2,155	1,817	84.3
Avg Annual Growth									
2010-21	-0.3%	-1.4%		-4.4%	-8.1%		-1.3%	-2.9%	
2021-22	11.0%	27.6%		53.3%	99.7%		19.7%	39.3%	
2022-32	4.6%	4.8%		6.5%	8.2%		5.1%	5.7%	
2022-42	3.7%	3.8%		4.6%	5.5%		4.0%	4.3%	

Source: Forms 41 and 298-C, U.S. Department of Transportation.

[1]Sum of U.S. Mainline and Regional Air Carriers.

TABLE 7

U.S. COMMERCIAL AIR CARRIERS[1]

TOTAL SCHEDULED U.S. INTERNATIONAL PASSENGER TRAFFIC

	REVENUE PASSENGER ENPLANEMENTS				REVENUE PASSENGER MILES			
FISCAL YEAR	ATLANTIC (Mil)	LATIN AMERICA (Mil)	PACIFIC (Mil)	TOTAL INTERNATIONAL (Mil)	ATLANTIC (Bil)	LATIN AMERICA (Bil)	PACIFIC (Bil)	TOTAL INTERNATIONAL (Bil)
Historical								
2010	25	40	13	77	109	63	59	231
2015	25	52	14	90	107	83	71	261
2018	26	60	13	100	112	94	75	281
2019	28	63	13	104	121	96	75	292
2020	11	32	6	49	48	49	31	129
2021E	6	43	1	49	27	60	4	92
Forecast								
2022	18	60	3	81	80	87	16	183
2027	32	79	13	123	144	119	84	347
2032	35	95	14	145	162	145	97	404
2037	39	115	16	170	180	176	109	465
2042	43	137	18	198	200	211	122	534
Avg Annual Growth								
2010-21	-12.4%	0.6%	-22.7%	-4.0%	-11.8%	-0.5%	-21.0%	-8.1%
2021-22	213.7%	40.7%	236.4%	63.9%	193.4%	45.7%	251.2%	99.7%
2022-32	6.9%	4.7%	18.8%	6.0%	7.3%	5.2%	20.0%	8.2%
2022-42	4.5%	4.2%	10.2%	4.6%	4.7%	4.5%	10.8%	5.5%

Source: Forms 41 and 298-C, U.S. Department of Transportation.

[1]Sum of U.S. Mainline and Regional Air Carriers.

TABLE 8

U.S. AND FOREIGN FLAG CARRIERS

TOTAL PASSENGER TRAFFIC TO/FROM THE UNITED STATES

	TOTAL PASSENGERS BY WORLD TRAVEL AREA (Millions)				
CALENDAR YEAR	ATLANTIC	LATIN AMERICA	PACIFIC	U.S./CANADA TRANSBORDER	TOTAL
Historical					
2010	56	53	27	22	158
2015	70	75	36	27	207
2018	85	86	42	31	244
2019	89	89	44	32	253
2020	17	33	9	7	67
2021E	24	66	4	5	99
Forecast					
2022	57	87	9	25	178
2027	101	107	42	37	288
2032	119	130	49	43	341
2037	138	156	57	50	401
2042	158	188	66	58	470
Avg Annual Growth					
2010-21	-7.4%	2.0%	-15.3%	-12.9%	-4.1%
2021-22	137.0%	32.1%	95.5%	430.3%	79.7%
2022-32	7.6%	4.1%	19.1%	5.4%	6.7%
2022-42	5.2%	3.9%	10.7%	4.2%	5.0%

Source: US Customs & Border Protection data processed and released by Department of Commerce; data also received from Transport Canada.

TABLE 9

U.S. COMMERCIAL AIR CARRIERS' FORECAST ASSUMPTIONS[1]

SEATS PER AIRCRAFT MILE AND PASSENGER TRIP LENGTH

	AVERAGE SEATS PER AIRCRAFT MILE			AVERAGE PASSENGER TRIP LENGTH		
FISCAL YEAR	DOMESTIC (Seats/Mile)	INTERNATIONAL (Seats/Mile)	SYSTEM (Seats/Mile)	DOMESTIC (Miles)	INTERNATIONAL (Miles)	SYSTEM (Miles)
Historical						
2010	121.9	216.4	139.7	874.8	2,988.0	1,104.2
2015	131.6	214.8	149.1	902.8	2,892.6	1,131.1
2018	140.0	219.1	156.3	922.1	2,820.1	1,136.9
2019	141.3	221.3	157.6	925.2	2,813.9	1,139.0
2020	141.4	216.8	153.4	910.4	2,648.1	1,075.6
2021E	145.2	198.6	153.7	938.3	1,859.6	1,019.8
Forecast						
2022	147.1	209.1	159.6	940.9	2,266.2	1,088.2
2027	146.5	222.7	163.0	935.0	2,820.1	1,158.9
2032	149.0	224.1	165.7	947.7	2,789.0	1,176.1
2037	151.4	225.3	168.1	960.5	2,739.6	1,188.0
2042	154.0	226.7	170.4	973.4	2,695.0	1,198.3
Avg Annual Growth						
2010-21	1.6%	-0.8%	0.9%	0.6%	-4.2%	-0.7%
2021-22	1.3%	5.3%	3.8%	0.3%	21.9%	6.7%
2022-32	0.1%	0.7%	0.4%	0.1%	2.1%	0.8%
2022-42	0.2%	0.4%	0.3%	0.2%	0.9%	0.5%

Source: Forms 41 and 298-C, U.S. Department of Transportation.

[1]Sum of U.S. Mainline and Regional Air Carriers.

TABLE 10

U. S. MAINLINE AIR CARRIERS

SCHEDULED PASSENGER TRAFFIC

	REVENUE PASSENGER ENPLANEMENTS (Millions)			REVENUE PASSENGER MILES (Billions)		
FISCAL YEAR	DOMESTIC	INTERNATIONAL	SYSTEM	DOMESTIC	INTERNATIONAL	SYSTEM
Historical						
2010	473	75	548	480	230	710
2015	543	87	630	556	259	815
2018	627	96	723	645	279	924
2019	654	100	754	674	290	963
2020	368	47	415	374	127	502
2021E	402	47	449	422	90	512
Forecast						
2022	522	78	601	547	181	729
2027	735	120	855	766	345	1,111
2032	822	141	963	868	401	1,269
2037	930	166	1,096	995	462	1,457
2042	1,060	193	1,254	1,150	531	1,680
Avg Annual Growth						
2010-21	-1.5%	-4.0%	-1.8%	-1.2%	-8.1%	-2.9%
2021-22	30.0%	65.6%	33.7%	29.7%	100.8%	42.2%
2022-32	4.6%	6.0%	4.8%	4.7%	8.3%	5.7%
2022-42	3.6%	4.6%	3.7%	3.8%	5.5%	4.3%

Source: Form 41, U.S. Department of Transportation.

TABLE 11

U.S. MAINLINE AIR CARRIERS

SCHEDULED PASSENGER CAPACITY, TRAFFIC, AND LOAD FACTORS

	DOMESTIC			INTERNATIONAL			SYSTEM		
FISCAL YEAR	ASMs (BIL)	RPMs (BIL)	% LOAD FACTOR	ASMs (BIL)	RPMs (BIL)	% LOAD FACTOR	ASMs (BIL)	RPMs (BIL)	% LOAD FACTOR
Historical									
2010	581	480	82.7	279	230	82.2	860	710	82.5
2015	653	556	85.1	321	259	80.8	973	815	83.7
2018	756	645	85.3	342	279	81.6	1,098	924	84.1
2019	785	674	85.8	349	290	83.0	1,134	963	85.0
2020	542	374	69.0	176	127	72.4	718	502	69.8
2021E	582	422	72.6	169	90	53.4	751	512	68.2
Forecast									
2022	652	547	83.9	260	181	69.7	913	729	79.8
2027	895	766	85.6	421	345	82.0	1,316	1,111	84.4
2032	1,015	868	85.5	488	401	82.3	1,502	1,269	84.5
2037	1,161	995	85.7	561	462	82.3	1,723	1,457	84.6
2042	1,340	1,150	85.8	644	531	82.3	1,984	1,680	84.7
Avg Annual Growth									
2010-21	0.0%	-1.2%		-4.5%	-8.1%		-1.2%	-2.9%	
2021-22	12.2%	29.7%		53.8%	100.8%		21.6%	42.2%	
2022-32	4.5%	4.7%		6.5%	8.3%		5.1%	5.7%	
2022-42	3.7%	3.8%		4.6%	5.5%		4.0%	4.3%	

Source: Form 41, U.S. Department of Transportation.

TABLE 12

U.S. MAINLINE AIR CARRIERS

SCHEDULED INTERNATIONAL PASSENGER ENPLANEMENTS

	REVENUE PASSENGER ENPLANEMENTS (MIL)			
FISCAL YEAR	ATLANTIC	LATIN AMERICA	PACIFIC	TOTAL
Historical				
2010	24.5	37.2	12.9	74.6
2015	24.6	48.6	14.0	87.2
2018	26.0	56.9	13.3	96.2
2019	27.9	59.2	13.2	100.2
2020	10.8	30.3	5.6	46.7
2021E	5.7	40.9	0.8	47.4
Forecast				
2022	18.0	57.9	2.6	78.5
2027	31.7	75.5	12.8	120.0
2032	35.1	91.7	14.4	141.2
2037	38.9	110.7	16.1	165.7
2042	43.0	132.4	18.1	193.5
Avg Annual Growth				
2010-21	-12.4%	0.9%	-22.7%	-4.0%
2021-22	213.7%	41.6%	236.4%	65.6%
2022-32	6.9%	4.7%	18.8%	6.0%
2022-42	4.5%	4.2%	10.2%	4.6%

Source: Form 41, U.S. Department of Transportation.

TABLE 13

U.S. MAINLINE AIR CARRIERS

SCHEDULED PASSENGER CAPACITY, TRAFFIC, AND LOAD FACTORS BY INTERNATIONAL TRAVEL REGIONS

	ATLANTIC			LATIN AMERICA			PACIFIC			INTERNATIONAL		
FISCAL YEAR	ASMs (BIL)	RPMs (BIL)	% LOAD FACTOR	ASMs (BIL)	RPMs (BIL)	% LOAD FACTOR	ASMs (BIL)	RPMs (BIL)	% LOAD FACTOR	ASMs (BIL)	RPMs (BIL)	% LOAD FACTOR
Historical												
2010	131	109	82.9	78	62	79.2	70	59	84.1	279	230	82.2
2015	133	107	80.0	101	81	80.3	86	71	82.5	321	259	80.8
2018	138	112	81.0	111	92	82.2	92	75	81.7	342	279	81.6
2019	146	121	82.9	112	94	83.5	91	75	82.6	349	290	83.0
2020	69	48	69.3	63	48	76.2	44	31	71.8	176	127	72.4
2021E	57	27	47.8	92	59	63.5	20	4	22.4	169	90	53.4
Forecast												
2022	108	80	74.0	118	86	73.0	35	16	45.0	260	181	69.7
2027	176	144	81.8	141	117	82.8	104	84	81.3	421	345	82.0
2032	198	162	81.8	172	143	82.8	118	97	82.4	488	401	82.3
2037	220	180	81.8	209	173	82.8	133	109	82.4	561	462	82.3
2042	245	200	81.8	251	208	82.8	149	122	82.4	644	531	82.3
Avg Annual Growth												
2010-21	-7.3%	-11.8%		1.5%	-0.5%		-10.9%	-21.0%		-4.5%	-8.1%	
2021-22	89.6%	193.4%		27.2%	46.3%		74.5%	251.2%		53.8%	100.8%	
2022-32	6.2%	7.3%		3.9%	5.2%		13.0%	20.0%		6.5%	8.3%	
2022-42	4.2%	4.7%		3.9%	4.5%		7.5%	10.8%		4.6%	5.5%	

Source: Form 41, U.S. Department of Transportation.

TABLE 14

U.S. MAINLINE AIR CARRIER FORECAST ASSUMPTIONS

SEATS PER AIRCRAFT MILE

		INTERNATIONAL				
FISCAL YEAR	DOMESTIC (Seats/Mile)	ATLANTIC (Seats/Mile)	LATIN AMERICA (Seats/Mile)	PACIFIC (Seats/Mile)	TOTAL (Seats/Mile)	SYSTEM (Seats/Mile)
Historical						
2010	152.0	231.7	171.7	287.2	220.9	169.2
2015	157.7	237.0	173.9	272.1	219.5	173.8
2018	164.2	247.5	178.1	265.2	223.2	178.9
2019	166.0	251.6	177.9	269.9	225.6	180.7
2020	166.7	256.2	178.5	255.0	221.5	177.5
2021E	171.7	255.4	178.8	205.8	202.4	177.8
Forecast						
2022	172.7	250.1	175.7	251.9	212.0	182.4
2027	172.1	250.6	178.1	279.3	225.6	186.2
2032	175.0	253.0	180.6	284.0	226.8	189.0
2037	177.9	255.4	183.0	288.8	228.0	191.6
2042	180.9	257.8	185.5	293.6	229.4	194.2
Avg Annual Growth						
2010-21	1.1%	0.9%	0.4%	-3.0%	-0.8%	0.5%
2021-22	0.6%	-2.1%	-1.8%	22.4%	4.7%	2.6%
2022-32	0.1%	0.1%	0.3%	1.2%	0.7%	0.4%
2022-42	0.2%	0.2%	0.3%	0.8%	0.4%	0.3%

Source: Form 41, U.S. Department of Transportation.

TABLE 15

U.S. MAINLINE AIR CARRIER FORECAST ASSUMPTIONS

AVERAGE PASSENGER TRIP LENGTH

		INTERNATIONAL				
FISCAL YEAR	DOMESTIC (Miles)	ATLANTIC (Miles)	LATIN AMERICA (Miles)	PACIFIC (Miles)	TOTAL (Miles)	SYSTEM (Miles)
Historical						
2010	1,015	4,433	1,660	4,587	3,077	1,296
2015	1,023	4,336	1,669	5,080	2,969	1,292
2018	1,029	4,299	1,610	5,638	2,895	1,277
2019	1,030	4,330	1,582	5,709	2,890	1,278
2020	1,016	4,442	1,577	5,634	2,725	1,209
2021E	1,050	4,756	1,434	5,809	1,906	1,141
Forecast						
2022	1,048	4,449	1,481	6,064	2,312	1,213
2027	1,041	4,544	1,545	6,617	2,877	1,299
2032	1,056	4,599	1,556	6,747	2,842	1,317
2037	1,070	4,626	1,564	6,770	2,789	1,330
2042	1,084	4,650	1,572	6,779	2,742	1,340
Avg Annual Growth						
2010-21	0.3%	0.6%	-1.3%	2.2%	-4.3%	-1.2%
2021-22	-0.2%	-6.4%	3.3%	4.4%	21.3%	6.4%
2022-32	0.1%	0.3%	0.5%	1.1%	2.1%	0.8%
2022-42	0.2%	0.2%	0.3%	0.6%	0.9%	0.5%

Source: Form 41, U.S. Department of Transportation.

TABLE 16

U.S. MAINLINE AIR CARRIER FORECAST ASSUMPTIONS

PASSENGER YIELDS

	REVENUE PER PASSENGER MILE					
	DOMESTIC		INTERNATIONAL		SYSTEM	
FISCAL YEAR	CURRENT $ (Cents)	FY 2021 $ (Cents)	CURRENT $ (Cents)	FY 2021 $ (Cents)	CURRENT $ (Cents)	FY 2021 $ (Cents)
Historical						
2010	12.62	15.47	12.84	15.74	12.69	15.56
2015	14.79	16.65	14.16	15.94	14.59	16.42
2018	13.92	14.85	13.58	14.50	13.81	14.75
2019	14.12	14.80	13.47	14.11	13.92	14.59
2020	13.46	13.90	13.45	13.89	13.45	13.90
2021E	11.73	11.73	12.85	12.85	11.93	11.93
Forecast						
2022	13.36	12.81	13.51	12.83	13.39	12.84
2027	15.14	13.02	14.08	12.01	14.81	12.73
2032	16.57	12.67	15.35	11.68	16.18	12.38
2037	18.03	12.32	16.68	11.33	17.61	12.02
2042	19.59	11.94	18.13	10.98	19.13	11.66
Avg Annual Growth						
2010-21	-0.7%	-2.5%	0.0%	-1.8%	-0.6%	-2.4%
2021-22	13.8%	9.1%	5.1%	-0.2%	12.3%	7.6%
2022-32	2.2%	-0.1%	1.3%	-0.9%	1.9%	-0.4%
2022-42	1.9%	-0.4%	1.5%	-0.8%	1.8%	-0.5%

Source: Form 41, U.S. Department of Transportation.

TABLE 17

U.S. MAINLINE AIR CARRIER FORECAST ASSUMPTIONS

INTERNATIONAL PASSENGER YIELDS BY REGION

	REVENUE PER PASSENGER MILE							
	ATLANTIC		LATIN AMERICA		PACIFIC		TOTAL INTERNATIONAL	
FISCAL YEAR	CURRENT $ (Cents)	FY 2021 $ (Cents)	CURRENT $ (Cents)	FY 2021 $ (Cents)	CURRENT $ (Cents)	FY 2021 $ (Cents)	CURRENT $ (Cents)	FY 2021 $ (Cents)
Historical								
2010	12.73	15.61	13.33	16.35	12.50	15.33	12.84	15.74
2015	14.64	16.48	14.37	16.18	13.20	14.86	14.16	15.94
2018	14.38	15.35	14.12	15.07	11.73	12.52	13.58	14.50
2019	14.04	14.71	14.20	14.88	11.63	12.19	13.47	14.11
2020	13.49	13.93	14.51	14.99	11.76	12.15	13.45	13.89
2021E	11.84	11.84	12.59	12.59	22.48	22.48	12.85	12.85
Forecast								
2022	12.79	12.14	13.98	13.28	14.61	13.88	13.51	12.83
2027	14.32	12.22	14.94	12.74	12.46	10.63	14.08	12.01
2032	15.67	11.92	16.15	12.28	13.66	10.39	15.35	11.68
2037	17.12	11.62	17.33	11.77	14.95	10.15	16.68	11.33
2042	18.71	11.33	18.61	11.27	16.37	9.92	18.13	10.98
Avg Annual Growth								
2010-21	-0.7%	-2.5%	-0.5%	-2.3%	5.5%	3.5%	0.0%	-1.8%
2021-22	8.0%	2.6%	11.0%	5.4%	-35.0%	-38.3%	5.1%	-0.2%
2022-32	2.1%	-0.2%	1.5%	-0.8%	-0.7%	-2.9%	1.3%	-0.9%
2022-42	1.9%	-0.3%	1.4%	-0.8%	0.6%	-1.7%	1.5%	-0.8%

Source: Form 41, U.S. Department of Transportation.

TABLE 18

U.S. MAINLINE AIR CARRIER FORECAST ASSUMPTIONS

JET FUEL PRICES

	DOMESTIC		INTERNATIONAL		SYSTEM	
FISCAL YEAR	CURRENT $ (Cents)	FY 2021 $ (Cents)	CURRENT $ (Cents)	FY 2021 $ (Cents)	CURRENT $ (Cents)	FY 2021 $ (Cents)
Historical						
2010	219.16	268.72	220.12	269.90	219.49	269.13
2015	207.29	233.39	211.77	238.44	208.96	235.27
2018	206.47	220.40	208.42	222.47	207.16	221.13
2019	205.67	215.54	207.82	217.79	206.42	216.32
2020	166.65	172.15	167.21	172.72	166.84	172.34
2021E	177.22	177.22	171.86	171.86	175.49	175.49
Forecast						
2022	224.23	214.99	217.45	208.49	222.04	212.89
2027	204.61	175.94	198.42	170.62	202.61	174.22
2032	232.54	177.88	225.51	172.50	230.27	176.14
2037	259.69	177.35	251.84	171.99	257.16	175.62
2042	278.88	169.93	270.45	164.80	276.16	168.28
Avg Annual Growth						
2010-21	-1.9%	-3.7%	-2.2%	-4.0%	-2.0%	-3.8%
2021-22	26.5%	21.3%	26.5%	21.3%	26.5%	21.3%
2022-32	0.4%	-1.9%	0.4%	-1.9%	0.4%	-1.9%
2022-42	1.1%	-1.2%	1.1%	-1.2%	1.1%	-1.2%

Source: Form 41, U.S. Department of Transportation

TABLE 19

U.S. COMMERCIAL AIR CARRIERS

AIR CARGO REVENUE TON MILES[1, 2, 3]

	ALL-CARGO CARRIER RTMS (Millions)			PASSENGER CARRIER RTMS (Millions)			TOTAL RTMS (Millions)		
FISCAL YEAR	DOMESTIC	INT'L.	TOTAL	DOMESTIC	INT'L.	TOTAL	DOMESTIC	INT'L.	TOTAL
Historical									
2010	11,306	15,971	27,276	1,495	6,246	7,742	12,801	22,217	35,018
2015	11,636	16,359	27,995	1,455	6,277	7,733	13,091	22,636	35,727
2018	14,182	19,465	33,647	1,580	7,532	9,112	15,761	26,997	42,759
2019	14,737	19,668	34,405	1,468	6,984	8,452	16,205	26,652	42,856
2020	16,663	21,964	38,627	1,124	4,130	5,255	17,787	26,094	43,882
2021E	18,555	26,580	45,135	1,320	4,850	6,169	19,875	31,430	51,304
Forecast									
2022	19,176	26,064	45,240	1,654	5,694	7,348	20,830	31,759	52,589
2027	22,040	30,365	52,405	1,969	9,291	11,260	24,009	39,656	63,666
2032	24,912	37,163	62,075	2,137	10,592	12,729	27,049	47,755	74,804
2037	27,964	44,584	72,548	2,300	11,801	14,102	30,265	56,386	86,650
2042	31,288	52,989	84,277	2,464	12,983	15,448	33,752	65,973	99,725
Avg Annual Growth									
2010-21	4.6%	4.7%	4.7%	-1.1%	-2.3%	-2.0%	4.1%	3.2%	3.5%
2021-22	3.3%	-1.9%	0.2%	25.3%	17.4%	19.1%	4.8%	1.0%	2.5%
2022-32	2.7%	3.6%	3.2%	2.6%	6.4%	5.6%	2.6%	4.2%	3.6%
2022-42	2.5%	3.6%	3.2%	2.0%	4.2%	3.8%	2.4%	3.7%	3.3%

Source: Form 41, U.S. Department of Transportation

[1] Includes freight/express and mail revenue ton miles on mainline air carriers and regionals/commuters.

[2] Domestic figures from 2000 through 2002 exclude Airborne Express, Inc.; international figures for 2003 and beyond include new reporting of contract service by U.S. carriers for foreign flag carriers.

[3] Domestic figures from 2003 and beyond include Airborne Express. Inc.

TABLE 20

U.S. COMMERCIAL AIR CARRIERS

INTERNATIONAL AIR CARGO REVENUE TON MILES BY REGION[1, 2]

FISCAL YEAR	ATLANTIC (MILLIONS)	LATIN AMERICA (MILLIONS)	PACIFIC (MILLIONS)	OTHER INTERNATIONAL (MILLIONS)	TOTAL (MILLIONS)
Historical					
2010	6,786	1,990	7,897	5,545	22,217
2015	6,627	1,639	9,018	5,352	22,636
2018	7,554	1,846	10,422	7,176	26,997
2019	7,426	1,661	10,429	7,135	26,652
2020	6,669	1,296	10,198	7,931	26,094
2021E	7,626	1,623	11,531	10,650	31,430
Forecast					
2022	8,136	1,716	12,407	9,500	31,759
2027	10,297	1,970	15,752	11,636	39,656
2032	11,976	2,182	19,019	14,579	47,755
2037	13,523	2,351	22,538	17,974	56,386
2042	15,058	2,497	26,452	21,966	65,973
Avg Annual Growth					
2010-21	1.1%	-1.8%	3.5%	6.1%	3.2%
2021-22	6.7%	5.7%	7.6%	-10.8%	1.0%
2022-32	3.9%	2.4%	4.4%	4.4%	4.2%
2022-42	3.1%	1.9%	3.9%	4.3%	3.7%

Source: Form 41, U.S. Department of Transportation

[1]Includes freight/express and mail revenue ton miles on mainline air carriers and regionals/commuters.

[2]Figures for 2003 and beyond include new reporting of contract service by U.S. carriers for foreign flag carriers.

TABLE 21

U.S. MAINLINE AIR CARRIERS

PASSENGER JET AIRCRAFT

Passenger	LARGE NARROWBODY				LARGE WIDEBODY						
CALENDAR YEAR	2 ENGINE	3 ENGINE	4 ENGINE	TOTAL	2 ENGINE	3 ENGINE	4 ENGINE	TOTAL	LARGE JETS	REGIONAL JETS	TOTAL JETS
Historical											
2010	3,120	8	1	3,129	470	9	43	522	3,651	71	3,722
2015	3,319	2	0	3,321	492	0	31	523	3,844	99	3,943
2018	3,678	0	0	3,678	541	0	0	541	4,219	98	4,317
2019	3,775	0	0	3,775	553	0	0	553	4,328	60	4,388
2020	2,860	0	0	2,860	298	0	0	298	3,158	23	3,181
2021E	2,828	0	0	2,828	281	0	0	281	3,109	23	3,132
Forecast											
2022	3,429	0	0	3,429	426	0	0	426	3,855	60	3,915
2027	3,463	0	0	3,463	503	0	0	503	3,966	0	3,966
2032	3,765	0	0	3,765	589	0	0	589	4,354	0	4,354
2037	4,203	0	0	4,203	676	0	0	676	4,879	0	4,879
2042	4,748	0	0	4,748	784	0	0	784	5,532	0	5,532
Avg Annual Growth											
2010-21	-0.9%	N.A.	N.A.	-0.9%	-4.6%	N.A.	N.A.	-5.5%	-1.5%	-9.7%	-1.6%
2021-22	21.3%	N.A.	N.A.	21.3%	51.6%	N.A.	N.A.	51.6%	24.0%	N.A.	25.0%
2022-32	0.9%	N.A.	N.A.	0.9%	3.3%	N.A.	N.A.	3.3%	1.2%	N.A.	1.1%
2022-42	1.6%	N.A.	N.A.	1.6%	3.1%	N.A.	N.A.	3.1%	1.8%	N.A.	1.7%

Note: N.A. - Not Applicable

TABLE 22

U.S. MAINLINE AIR CARRIERS

CARGO JET AIRCRAFT

	LARGE NARROWBODY				LARGE WIDEBODY				
CALENDAR YEAR	2 ENGINE	3 ENGINE	4 ENGINE	TOTAL	2 ENGINE	3 ENGINE	4 ENGINE	TOTAL	TOTAL
Historical									
2010	153	104	31	288	265	200	97	562	850
2015	228	22	2	252	309	156	72	537	789
2018	213	11	2	226	392	120	100	612	838
2019	216	10	2	228	419	120	112	651	879
2020	200	10	0	210	414	115	109	638	848
2021E	213	8	0	221	434	111	110	655	876
Forecast									
2022	219	7	0	226	469	118	122	709	935
2027	301	2	0	303	618	113	128	859	1,162
2032	408	0	0	408	744	110	128	982	1,390
2037	486	0	0	486	987	56	111	1,154	1,640
2042	622	0	0	622	1,235	8	94	1,337	1,959
Avg Annual Growth									
2010-21	3.1%	-20.8%	N.A.	-2.4%	4.6%	-5.2%	1.1%	1.4%	0.3%
2021-22	2.8%	-12.5%	N.A.	2.3%	8.1%	6.3%	10.9%	8.2%	6.7%
2022-32	6.4%	N.A.	N.A.	6.1%	4.7%	-0.7%	0.5%	3.3%	4.0%
2022-42	5.4%	N.A.	N.A.	5.2%	5.0%	-12.6%	-1.3%	3.2%	3.8%

Note: N.A. - Not Applicable

TABLE 23

TOTAL JET FUEL AND AVIATION GASOLINE FUEL CONSUMPTION

U.S. CIVIL AVIATION AIRCRAFT

(Millions of Gallons)

	JET FUEL					AVIATION GASOLINE			
	U.S. AIR CARRIERS[1, 2]								
FISCAL YEAR	DOMESTIC	INT'L.	TOTAL	GENERAL AVIATION	TOTAL	AIR CARRIER	GENERAL AVIATION	TOTAL	TOTAL FUEL CONSUMED
Historical									
2010	12,036	6,315	18,351	1,435	19,786	2	221	223	20,009
2015	12,834	6,541	19,374	1,383	20,757	2	196	198	20,955
2018	14,580	7,121	21,701	1,820	23,521	2	232	234	23,755
2019	14,648	7,043	21,691	1,510	23,202	2	200	202	23,404
2020	10,527	4,723	15,249	1,342	16,592	2	204	206	16,797
2021E	11,548	4,813	16,361	1,519	17,880	2	205	207	18,087
Forecast									
2022	12,686	6,087	18,773	1,680	20,453	2	206	208	20,661
2027	16,652	8,326	24,979	2,058	27,037	2	203	205	27,242
2032	17,967	9,176	27,143	2,292	29,435	2	197	199	29,634
2037	19,566	10,051	29,617	2,505	32,122	2	194	196	32,318
2042	21,476	10,978	32,454	2,707	35,161	2	194	196	35,357
Avg Annual Growth									
2010-21	-0.4%	-2.4%	-1.0%	0.5%	-0.9%	0.0%	-0.7%	-0.7%	-0.9%
2021-22	9.9%	26.5%	14.7%	10.6%	14.4%	0.0%	0.6%	0.6%	14.2%
2022-32	3.5%	4.2%	3.8%	3.2%	3.7%	0.0%	-0.5%	-0.4%	3.7%
2022-42	2.7%	3.0%	2.8%	2.4%	2.7%	0.0%	-0.3%	-0.3%	2.7%

Source: Air carrier jet fuel, Form 41, U.S. Department of Transportation; all others, FAA APO estimates.

[1]Includes both passenger (mainline and regional air carrier) and cargo carriers.

[2]Forecast assumes 1.0% annual improvement in available seat miles per gallon for U.S. Commercial Air Carrier

TABLE 24

U.S. REGIONAL CARRIER FORECAST ASSUMPTIONS

	AVERAGE SEATS PER AIRCRAFT MILE			AVERAGE PASSENGER TRIP LENGTH			REVENUE PER PASSENGER MILE**	
FISCAL YEAR	DOMESTIC (Seats/Mile)	INT'L (Seats/Mile)	TOTAL (Seats/Mile)	DOMESTIC (Miles)	INT'L. (Miles)	TOTAL (Miles)	CURRENT $ (Cents)	2021 $ (Cents)
Historical								
2010	56.1	53.2	56.1	464	503	465	15.74	19.30
2015	60.0	62.6	60.1	476	695	480	10.93	12.31
2018	64.1	70.8	64.3	487	680	491	11.32	12.09
2019	64.5	70.9	64.7	492	670	496	11.48	12.03
2020	65.1	70.7	65.3	495	675	498	11.01	11.38
2021E	66.5	72.9	66.7	511	662	514	9.63	9.63
Forecast								
2022	65.1	73.2	65.3	487	648	490	10.82	10.37
2027	66.9	74.7	67.0	498	644	500	12.39	10.66
2032	68.0	76.2	68.2	504	653	507	13.55	10.37
2037	69.1	77.7	69.3	511	662	514	14.75	10.07
2042	70.3	79.2	70.5	518	671	521	16.01	9.76
Avg Annual Growth								
2010-21	1.6%	2.9%	1.6%	0.9%	2.5%	0.9%	-4.4%	-6.1%
2021-22	-2.1%	0.4%	-2.1%	-4.7%	-2.0%	-4.6%	12.3%	7.7%
2022-32	0.4%	0.4%	0.4%	0.4%	0.1%	0.3%	2.3%	0.0%
2022-42	0.4%	0.4%	0.4%	0.3%	0.2%	0.3%	2.0%	-0.3%

Source: Form 41 and 298C, U.S. Department of Transportation.

** Reporting carriers.

TABLE 25

U.S. REGIONAL CARRIERS

SCHEDULED PASSENGER TRAFFIC

(In Millions)

	REVENUE PASSENGERS			REVENUE PASSENGER MILES		
FISCAL YEAR	DOMESTIC	INTERNATIONAL	TOTAL	DOMESTIC	INTERNATIONAL	TOTAL
Historical						
2010	162	3	164	75,029	1,347	76,376
2015	153	3	156	72,737	2,116	74,853
2018	154	3	157	74,852	2,295	77,147
2019	159	4	163	78,302	2,376	80,679
2020	94	2	96	46,385	1,229	47,614
2021E	105	2	107	53,798	1,221	55,020
Forecast						
2022	123	2	125	59,976	1,436	61,411
2027	179	3	182	88,975	2,020	90,995
2032	200	4	203	100,849	2,290	103,139
2037	226	4	230	115,680	2,626	118,306
2042	258	5	262	133,609	3,034	136,643
Avg Annual Growth						
2010-21	-3.8%	-3.3%	-3.8%	-3.0%	-0.9%	-2.9%
2021-22	17.0%	19.9%	17.0%	11.5%	17.6%	11.6%
2022-32	5.0%	4.7%	5.0%	5.3%	4.8%	5.3%
2022-42	3.8%	3.6%	3.8%	4.1%	3.8%	4.1%

Source: Form 41 and 298C, U.S. Department of Transportation.

TABLE 26

U.S. REGIONAL CARRIERS

SCHEDULED PASSENGER CAPACITY, TRAFFIC, AND LOAD FACTORS

	DOMESTIC			INTERNATIONAL			TOTAL		
YEAR	ASMs (MIL)	RPMs (MIL)	% LOAD FACTOR	ASMs (MIL)	RPMs (MIL)	% LOAD FACTOR	ASMs (MIL)	RPMs (MIL)	% LOAD FACTOR
Historical									
2010	98,455	75,029	76.2	1,857	1,347	72.5	100,312	76,376	76.1
2015	90,647	72,737	80.2	2,819	2,116	75.0	93,467	74,853	80.1
2018	93,860	74,852	79.7	3,023	2,295	75.9	96,883	77,147	79.6
2019	98,019	78,302	79.9	3,116	2,376	76.3	101,135	80,679	79.8
2020	70,554	46,385	65.7	1,811	1,229	67.9	72,364	47,614	65.8
2021E	76,017	53,798	70.8	1,836	1,221	66.5	77,853	55,020	70.7
Forecast									
2022	77,092	59,976	77.8	1,956	1,436	73.4	79,048	61,411	77.7
2027	111,724	88,975	79.6	2,699	2,020	74.9	114,423	90,995	79.5
2032	126,693	100,849	79.6	3,060	2,290	74.8	129,754	103,139	79.5
2037	145,009	115,680	79.8	3,503	2,626	75.0	148,512	118,306	79.7
2042	167,279	133,609	79.9	4,041	3,034	75.1	171,319	136,643	79.8
Avg Annual Growth									
2010-21	-2.3%	-3.0%		-0.1%	-0.9%		-2.3%	-2.9%	
2021-22	1.4%	11.5%		6.5%	17.6%		1.5%	11.6%	
2022-32	5.1%	5.3%		4.6%	4.8%		5.1%	5.3%	
2022-42	3.9%	4.1%		3.7%	3.8%		3.9%	4.1%	

Source: Form 41 and 298C, U.S. Department of Transportation.

TABLE 27

U.S. REGIONAL CARRIERS

PASSENGER AIRCRAFT

	REGIONAL AIRCRAFT											
				31 TO 40 SEATS			OVER 40 SEATS			TOTAL FLEET		
AS OF JANUARY 1	LESS THAN 9 SEATS	10 TO 19 SEATS	20 TO 30 SEATS	PROP	JET	TOTAL	PROP	JET	TOTAL	NON JET	JET	TOTAL
Historical												
2010	440	92	82	144	28	172	99	1,728	1,827	857	1,756	2,613
2015	346	68	13	32	0	32	57	1,628	1,685	516	1,628	2,144
2018	360	77	20	11	3	14	54	1,795	1,849	522	1,798	2,320
2019	374	72	19	11	0	11	39	1,846	1,885	515	1,846	2,361
2020	276	74	20	11	0	11	40	1,434	1,474	421	1,434	1,855
2021E	268	69	16	10	0	10	38	1,406	1,444	401	1,406	1,807
Forecast												
2022	259	67	15	3	3	6	49	1,623	1,672	394	1,626	2,020
2027	218	56	13	0	2	2	53	1,550	1,603	341	1,552	1,893
2032	177	46	11	0	0	0	60	1,530	1,590	293	1,530	1,823
2037	139	36	8	0	0	0	66	1,759	1,825	249	1,759	2,008
2042	101	26	6	0	0	0	75	1,979	2,054	208	1,979	2,187
Avg Annual Growth												
2010-21	-4.4%	-2.6%	-13.8%	-21.5%	N.A.	-22.8%	-8.3%	-1.9%	-2.1%	-6.7%	-2.0%	-3.3%
2021-22	-3.2%	-3.2%	-3.2%	-70.0%	N.A.	-40.0%	28.9%	15.4%	15.8%	-1.8%	15.6%	11.8%
2022-32	-3.7%	-3.7%	-3.7%	N.A.	N.A.	N.A.	2.0%	-0.6%	-0.5%	-2.9%	-0.6%	-1.0%
2022-42	-4.6%	-4.6%	-4.6%	N.A.	N.A.	N.A.	2.2%	1.0%	1.0%	-3.1%	1.0%	0.4%

Note: N.A. - Not Applicable

TABLE 28

ACTIVE GENERAL AVIATION AND AIR TAXI AIRCRAFT

	FIXED WING						ROTORCRAFT						TOTAL		
	PISTON			TURBINE									GENERAL		
AS OF DEC. 31	SINGLE ENGINE	MULTI-ENGINE	TOTAL	TURBO PROP	TURBO JET	TOTAL	PISTON	TURBINE	TOTAL	EXPERI-MENTAL**	LIGHT SPORT AIRCRAFT**	OTHER	AVIATION FLEET	TOTAL PISTONS	TOTAL TURBINES
Historical*															
2010	139,519	15,900	155,419	9,369	11,484	20,853	3,588	6,514	10,102	24,784	6,528	5,684	223,370	159,007	27,367
2015	127,887	13,254	141,141	9,712	13,440	23,152	3,286	7,220	10,506	27,922	2,369	4,941	210,031	144,427	30,372
2018	130,179	12,861	143,040	9,925	14,596	24,521	3,082	6,907	9,989	27,531	2,554	4,114	211,749	146,122	31,428
2019	128,926	12,470	141,396	10,242	14,888	25,130	3,089	7,109	10,198	27,449	2,675	4,133	210,981	144,485	32,239
2020	124,059	11,947	136,006	10,317	15,316	25,633	2,930	6,816	9,746	26,367	2,570	3,818	204,140	138,936	32,449
2021E	123,105	11,865	134,970	10,275	15,755	26,030	2,920	6,900	9,820	27,000	2,765	3,820	204,405	137,890	32,930
Forecast															
2022	122,020	11,795	133,815	10,250	16,230	26,480	2,925	7,030	9,955	27,495	2,905	3,940	204,590	136,740	33,510
2027	116,225	11,490	127,715	10,245	18,830	29,075	2,970	7,705	10,675	29,455	3,600	4,405	204,925	130,685	36,780
2032	110,560	11,285	121,845	10,460	21,535	31,995	3,070	8,515	11,585	30,985	4,295	4,490	205,195	124,915	40,510
2037	105,565	11,135	116,700	10,780	24,290	35,070	3,180	9,360	12,540	32,460	4,985	4,525	206,280	119,880	44,430
2042	101,860	11,055	112,915	11,455	27,000	38,455	3,305	10,225	13,530	33,785	5,655	4,565	208,905	116,220	48,680
Avg Annual Growth															
2010-21	-1.1%	-2.6%	-1.3%	0.8%	2.9%	2.0%	-1.9%	0.5%	-0.3%	0.8%	-7.5%	-3.5%	-0.8%	-1.3%	1.7%
2021-22	-0.9%	-0.6%	-0.9%	-0.2%	3.0%	1.7%	0.2%	1.9%	1.4%	1.8%	5.1%	3.1%	0.1%	-0.8%	1.8%
2022-32	-1.0%	-0.4%	-0.9%	0.2%	2.9%	1.9%	0.5%	1.9%	1.5%	1.2%	4.0%	1.3%	0.0%	-0.9%	1.9%
2022-42	-0.9%	-0.3%	-0.8%	0.6%	2.6%	1.9%	0.6%	1.9%	1.5%	1.0%	3.4%	0.7%	0.1%	-0.8%	1.9%

* Source: 2001-2010, 2012-2018, FAA General Aviation and Air Taxi Activity (and Avionics) Surveys.

**Experimental Light-sport category that was previously shown under Sport Aircraft is moved under Experimental Aircraft category, starting in 2012.

Note: An active aircraft is one that has a current registration and was flown at least one hour during the calendar year.

TABLE 29

ACTIVE GENERAL AVIATION AND AIR TAXI HOURS FLOWN

(In Thousands)

	FIXED WING						ROTORCRAFT						TOTAL		
	PISTON			TURBINE									GENERAL		
AS OF DEC. 31	SINGLE ENGINE	MULTI-ENGINE	TOTAL	TURBO PROP	TURBO JET	TOTAL	PISTON	TURBINE	TOTAL	EXPERI-MENTAL**	LIGHT SPORT AIRCRAFT**	OTHER	AVIATION FLEET	TOTAL PISTONS	TOTAL TURBINES
Historical*															
2010	12,161	1,818	13,979	2,325	3,375	5,700	794	2,611	3,405	1,226	311	181	24,802	14,773	8,311
2015	11,217	1,608	12,825	2,538	3,837	6,375	798	2,496	3,294	1,295	191	162	24,142	13,623	8,871
2018	12,092	1,694	13,785	2,736	4,592	7,328	601	2,322	2,922	1,153	187	131	25,506	14,386	9,650
2019	12,700	1,731	14,431	2,619	3,926	6,546	628	2,369	2,997	1,269	189	135	25,566	15,059	8,914
2020	11,603	1,336	12,939	2,344	3,336	5,681	537	1,871	2,408	1,176	202	86	22,492	13,477	7,552
2021E	11,546	1,421	12,967	2,493	3,879	6,372	568	2,036	2,604	1,115	219	104	23,380	13,535	8,408
Forecast															
2022	11,478	1,464	12,942	2,618	4,403	7,022	586	2,116	2,702	1,198	232	116	24,211	13,528	9,137
2027	10,903	1,502	12,405	2,880	5,809	8,689	647	2,425	3,072	1,416	298	144	26,024	13,052	11,114
2032	10,328	1,496	11,824	2,946	6,739	9,685	703	2,731	3,434	1,543	362	145	26,994	12,527	12,417
2037	9,921	1,513	11,433	3,038	7,628	10,666	748	3,027	3,775	1,660	427	147	28,108	12,182	13,692
2042	9,742	1,552	11,294	3,229	8,513	11,743	797	3,331	4,129	1,758	491	149	29,563	12,091	15,074
Avg Annual Growth															
2010-21	-0.5%	-2.2%	-0.7%	0.6%	1.3%	1.0%	-3.0%	-2.2%	-2.4%	-0.9%	-3.1%	-4.9%	-0.5%	-0.8%	0.1%
2021-22	-0.6%	3.0%	-0.2%	5.0%	13.5%	10.2%	3.2%	3.9%	3.8%	7.4%	6.0%	11.2%	3.6%	-0.1%	8.7%
2022-32	-1.1%	0.2%	-0.9%	1.2%	4.3%	3.3%	1.8%	2.6%	2.4%	2.6%	4.6%	2.3%	1.1%	-0.8%	3.1%
2022-42	-0.8%	0.3%	-0.7%	1.1%	3.4%	2.6%	1.6%	2.3%	2.1%	1.9%	3.8%	1.3%	1.0%	-0.6%	2.5%

* Source: 2001-2010, 2012-2018, FAA General Aviation and Air Taxi Activity (and Avionics) Surveys.

**Experimental Light-sport category that was previously shown under Sport Aircraft is moved under Experimental Aircraft category, starting in 2012.

Note: An active aircraft is one that has a current registration and was flown at least one hour during the calendar year.

TABLE 30

ACTIVE PILOTS BY TYPE OF CERTIFICATE, EXCLUDING STUDENT PILOTS*

AS OF DEC. 31	RECREA-TIONAL	SPORT PILOT	PRIVATE	COMMERCIAL	AIRLINE TRANSPORT	ROTOR-CRAFT ONLY	GLIDER ONLY	TOTAL LESS STUDENT PILOTS	INSTRUMENT RATED PILOTS[1]
Historical**									
2010	212	3,682	202,020	123,705	142,198	15,377	21,275	508,469	318,001
2015	190	5,482	170,718	101,164	154,730	15,566	19,460	467,310	304,329
2018	144	6,246	163,695	99,880	162,145	15,033	18,370	465,513	311,017
2019	127	6,467	161,105	100,863	164,947	14,248	19,143	466,900	314,168
2020	105	6,643	160,860	103,879	164,193	13,629	19,753	469,062	316,651
2021	85	6,801	161,459	104,610	163,934	13,191	20,328	470,408	317,169
Forecast									
2022	80	6,970	161,800	105,250	166,000	13,350	21,000	474,450	318,100
2027	70	7,915	159,800	107,050	171,550	13,850	23,300	483,535	325,700
2032	55	9,115	154,500	107,600	178,550	14,850	24,200	488,870	333,800
2037	45	10,570	149,000	107,550	186,600	16,100	24,600	494,465	341,600
2042	20	11,850	145,150	107,350	194,300	17,350	24,700	500,720	349,450
Avg Annual Growth									
2010-21	-8.0%	5.7%	-2.0%	-1.5%	1.3%	-1.4%	-0.4%	-0.7%	0.0%
2021-22	-5.9%	2.5%	0.2%	0.6%	1.3%	1.2%	3.3%	0.9%	0.3%
2022-32	-3.7%	2.7%	-0.5%	0.2%	0.7%	1.1%	1.4%	0.3%	0.5%
2022-42	-6.7%	2.7%	-0.5%	0.1%	0.8%	1.3%	0.8%	0.3%	0.5%

** Source: FAA U.S. Civil Airmen Statistics.

*Starting with April 2016, there is no expiration date on the new student pilot certificates. This generates a cumulative increase in the student pilot numbers and breaks the link between student pilot and private pilot or higher level certificates. Since there is no sufficient data yet to forecast the student certificates unter the new rule, student pilot forecast is suspended and excluded from this table.

[1]Instrument rated pilots should not be added to other categories in deriving total.

Note: An active pilot is a person with a pilot certificate and a valid medical certificate.

TABLE 31

GENERAL AVIATION AIRCRAFT FUEL CONSUMPTION

(In Millions of Gallons)

	FIXED WING								TOTAL FUEL CONSUMED		
	PISTON		TURBINE		ROTORCRAFT						
CALENDAR YEAR	SINGLE ENGINE	MULTI-ENGINE	TURBO PROP	TURBO JET	PISTON	TURBINE	EXPERI-MENTAL* * / OTHER	LIGHT SPORT**	AVGAS	JET FUEL	TOTAL
Historical*											
2010	133	54	187	1,123	11	125	22	1	221	1,435	1,656
2015	128	40	191	1,063	10	128	15	1	196	1,383	1,578
2018	152	50	234	1,455	9	132	20	1	232	1,820	2,052
2019	131	45	213	1,170	8	127	16	1	200	1,510	1,711
2020	146	35	201	1,036	8	105	14	1	204	1,342	1,546
2021E	145	37	214	1,192	8	113	14	1	205	1,519	1,724
Forecast											
2022	144	38	224	1,340	8	116	15	1	206	1,680	1,886
2027	136	39	243	1,685	9	130	17	2	203	2,058	2,261
2032	128	38	244	1,908	10	141	19	2	197	2,292	2,489
2037	123	38	245	2,106	11	154	20	2	194	2,505	2,699
2042	120	39	254	2,292	11	161	21	2	194	2,707	2,902
Avg Annual Growth											
2010-21	0.8%	-3.3%	1.2%	0.5%	-2.4%	-0.9%	-4.1%	-2.1%	-0.7%	0.5%	0.4%
2021-22	-0.6%	2.6%	4.8%	12.4%	2.7%	2.9%	6.7%	5.0%	0.6%	10.6%	9.4%
2022-32	-1.1%	0.1%	0.9%	3.6%	1.8%	1.9%	2.4%	4.1%	-0.5%	3.2%	2.8%
2022-42	-0.9%	0.2%	0.6%	2.7%	1.5%	1.6%	1.9%	3.5%	-0.3%	2.4%	2.2%

*Source: FAA APO Estimates.

**Experimental Light-sport category that was previously shown under Sport Aircraft is moved under Experimental Aircraft category, starting in 2012.

Note: Detail may not add to total because of independent rounding.

TABLE 32

TOTAL COMBINED AIRCRAFT OPERATIONS AT AIRPORTS WITH FAA AND CONTRACT TRAFFIC CONTROL SERVICE

(In Thousands)

			GENERAL AVIATION			MILITARY				NUMBER OF TOWERS	
FISCAL YEAR	AIR CARRIER	AIR TAXI/ COMMUTER	ITINERANT	LOCAL	TOTAL	ITINERANT	LOCAL	TOTAL	TOTAL	FAA	CONTRACT
Historical											
2010	12,658	9,410	14,864	11,716	26,580	1,309	1,298	2,607	51,255	264	244
2015	13,755	7,895	13,887	11,691	25,579	1,292	1,203	2,495	49,724	264	252
2018	15,686	7,126	14,130	12,354	26,485	1,319	1,155	2,474	51,770	264	254
2019	16,192	7,234	14,245	13,109	27,354	1,349	1,134	2,483	53,264	264	256
2020	11,737	5,472	12,608	12,333	24,941	1,192	1,020	2,212	44,362	264	256
2021	12,214	5,882	13,759	13,441	27,200	1,288	1,075	2,362	47,659	264	258
Forecast											
2022	13,782	6,285	14,569	13,731	28,300	1,288	1,075	2,362	50,729	264	258
2027	20,928	5,963	15,636	14,951	30,587	1,288	1,075	2,362	59,840	264	258
2032	23,074	6,286	15,839	15,214	31,053	1,288	1,075	2,362	62,775	264	258
2037	25,112	6,617	16,046	15,486	31,533	1,288	1,075	2,362	65,624	264	258
2042	27,081	6,967	16,260	15,768	32,027	1,288	1,075	2,362	68,437	264	258
Avg Annual Growth											
2010-21	-0.3%	-4.2%	-0.7%	1.3%	0.2%	-0.1%	-1.7%	-0.9%	-0.7%		
2021-22	12.8%	6.8%	5.9%	2.2%	4.0%	0.0%	0.0%	0.0%	6.4%		
2022-32	5.3%	0.0%	0.8%	1.0%	0.9%	0.0%	0.0%	0.0%	2.2%		
2022-42	3.4%	0.5%	0.6%	0.7%	0.6%	0.0%	0.0%	0.0%	1.5%		

Source: FAA Air Traffic Activity.

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TABLE 33

TOTAL TRACON OPERATIONS

(In Thousands)

FISCAL YEAR	AIR CARRIER	AIR TAXI/ COMMUTER	GENERAL AVIATION	MILITARY	OVERFLIGHT	TOTAL
Historical						
2010	12,575	8,512	10,761	2,050	4,840	38,738
2015	13,610	6,999	10,350	1,961	4,116	37,036
2018	15,519	6,475	10,795	1,953	4,113	38,856
2019	16,014	6,600	10,960	1,946	3,706	39,227
2020	11,617	5,153	9,691	1,763	3,050	31,274
2021	12,045	5,462	10,742	1,894	3,393	33,536
Forecast						
2022	13,608	5,803	11,417	1,896	3,686	36,410
2027	20,698	5,019	12,240	1,896	4,486	44,339
2032	22,831	5,309	12,380	1,896	4,775	47,189
2037	24,856	5,609	12,523	1,895	5,052	49,936
2042	26,813	5,924	12,670	1,895	5,324	52,627
Avg Annual Growth						
2010-21	-0.4%	-4.0%	0.0%	-0.7%	-3.2%	-1.3%
2021-22	13.0%	6.2%	6.3%	0.1%	8.7%	8.6%
2022-32	5.3%	-0.9%	0.8%	0.0%	2.6%	2.6%
2022-42	3.4%	0.1%	0.5%	0.0%	1.9%	1.9%

Source: FAA Air Traffic Activity.

TABLE 34

IFR AIRCRAFT HANDLED
AT FAA EN ROUTE TRAFFIC CONTROL CENTERS
(In Thousands)

	IFR AIRCRAFT HANDLED			
FISCAL YEAR	COMMERCIAL	GENERAL AVIATION	MILITARY	TOTAL
Historical				
2010	30,965	6,550	2,982	40,498
2015	33,116	7,007	1,795	41,918
2018	35,713	7,403	1,724	44,840
2019	35,682	6,275	1,525	43,483
2020	25,537	5,071	1,297	31,905
2021	26,386	6,094	1,430	33,910
Forecast				
2022	29,634	6,463	1,430	37,527
2027	42,013	6,966	1,430	50,409
2032	46,410	7,151	1,430	54,991
2037	50,632	7,346	1,430	59,408
2042	54,733	7,552	1,430	63,714
Avg Annual Growth				
2010-21	-1.4%	-0.7%	-6.5%	-1.6%
2021-22	12.3%	6.1%	0.0%	10.7%
2022-32	4.6%	1.0%	0.0%	3.9%
2022-42	3.1%	0.8%	0.0%	2.7%

Source: FAA Air Traffic Activity

UCC-205

Proposed sale of Ontic for $1,365 million to CVC Fund Vll

30 July 2019

BBA Aviation plc, a market-leading provider of global aviation support and aftermarket services, is pleased to announce that it has entered into an agreement for the sale of Ontic, a leading provider of high-quality, OEM-licensed parts for legacy aerospace platforms, to CVC Fund VII, for an enterprise value of $1,365 million, subject, *inter alia* to shareholder approval and regulatory consents.

Transaction highlights

- Sale of Ontic for an enterprise value of $1,365 million, on a cash-free, debt-free basis
- Transaction multiple meaningfully above BBA's trading multiple of 11.4x FY18 underlying EBITDA
- Transaction unanimously supported by the BBA Board as being in the best interests of shareholders
- Transaction will enable enhanced focus and investment in the company’s market-leading Signature business, which the board believes to be a significant source of future shareholder value creation
- Transaction should allow for a capital return to shareholders expected to be between $750 million and $850 million, to help ensure that the net debt of the retained group remains near the lower end of the stated target range of net debt to underlying adjusted EBITDA of 2.5 to 3.0 times at 31 December 2019, on a covenant basis
- Transaction is conditional upon approval by BBA's shareholders and various other approvals (including the consent of certain group lenders or replacement of certain financial indebtedness, and consent to the release of applicable security by the group's pension trustee)
- Completion is expected in Q4 2019

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Mark Johnstone, BBA Aviation CEO, commented: "We are delighted that we have reached an agreement to sell our Ontic business to CVC Fund VII for $1,365 million, delivering compelling value for BBA shareholders. While maintaining a strong balance sheet, we also expect to return between $750 and $850 million to shareholders and will evaluate how best to structure this return after consultation with our shareholders.

"Ontic was acquired by BBA in February 2006 for $67 million and has grown successfully through the acquisition of licences, organic and inorganic growth, and a disciplined approach to investment. This success has been based on trusted partner relationships with key aviation original equipment manufacturers. It now supports more than 39,000 legacy aircraft, through its portfolio of over 165 licences for more than 7,000 parts and over 1,200 customers worldwide.

"I would like to take this opportunity to thank all of our Ontic employees for their contribution to BBA Aviation over the years, and wish them well in the next stage of their journey.

"The Ontic disposal will allow BBA to focus on its core Signature business, the leading global FBO operator and service provider for the B&GA market. BBA shareholders will continue to benefit from Signature's ability to outperform the B&GA market through the cycle, as well as its ability to take advantage of its significant opportunities for future growth.

"We remain committed to delivering long-term sustainable value from Signature, a strongly free cash generative business, which

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after funding investment requirements, should underpin both progressive dividends and ongoing returns of capital to shareholders.

"The ERO disposal process is ongoing and we expect to update the market in due course. Disposal proceeds would provide an opportunity to further enhance our proposed return of capital."

James Mahoney, Senior Managing Director, CVC Capital Partners commented: "Ontic is a growing, highly resilient business and a leading player in what we believe to be a very attractive market. We see multiple opportunities to develop the business further and look forward to working closely with Ontic's excellent management team to take the company to the next level."

Latest news

The latest news from around the CVC network

09 FEB 2024

Carlyle Agrees to Sell Jagex to CVC Capital Partners and Haveli Inv

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FitchRatings

RATING ACTION COMMENTARY

Fitch Affirms TransDigm at 'B' on Announcement of Esterline Acquisition

Thu 11 Oct, 2018 - 1:02 PM ET

Fitch Ratings-New York-11 October 2018: Fitch Ratings has affirmed the Long-Term Issuer Default Ratings (IDR) of TransDigm Group, Inc. (NYSE: TDG) and its subsidiary TransDigm Inc. (TDI) at 'B'. This follows the company's announcement that it has agreed to acquire Esterline Technologies Corp. (ESL) for a total consideration of approximately $4 billion including assumed debt. Fitch has also affirmed the ratings of TDI's senior secured credit facilities at 'BB'/'RR1' and TDI's and TransDigm UK Holdings plc's senior subordinated notes at 'B-'/'RR5'.

The transaction is expected to close in the second half of calendar 2019 and is subject to approvals by regulators and shareholders of ESL. TDG expects to finance the transaction with a combination of cash on hand (approximately $2 billion) and the issuance of incremental term loans. The Rating Outlook is Stable. The ratings cover approximately $12.7 billion of outstanding debt. A full list of rating actions follows at the end of this release.

KEY RATING DRIVERS

The affirmation of TDG's ratings is based on Fitch's updated projections for the company including the impact of the ESL acquisition. The anticipated increase in the company's leverage metrics following the acquisition will not trigger Fitch's negative rating sensitivities, as outlined below, and Fitch believes the company's overall credit profile will not change significantly. Fitch's base case projections for the company already assumed

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are not significant enough to drive a rating change.

TDG announced that it has reached an agreement to purchase ESL for a total of $4 billion funded through new debt issuance and cash on hand. The purchase price equates to $122.5 a share, which comprises an approximately 38% premium to the closing price of ESL's stock on Tuesday, Oct. 9, 2018. ESL manufactures specialty aerospace, defense and industrial products with high proprietary and sole source content. Fitch expects ESL will report approximately $2 billion of revenue and $300 million of EBITDA in fiscal year ended Sept. 30, 2018, compared to TDG's anticipated revenue of $3.8 billion and EBITDA of $1.8 billion also in the fiscal year ended Sept. 30, 2018.

The acquisition is expected to be fully accretive by the middle of fiscal year 2020, and Fitch projects TDG will generate $5 billion in revenues and $2 billion EBITDA by Sept. 30, 2019. The acquisition will enable the company to expand horizontally. Fitch estimates the new debt associated with the acquisition will increase TDG's adjusted leverage (adjusted debt/EBITDAR) from approximately 7.1x at the end of fiscal 2018 to approximately 8.0x at the end of fiscal 2019, but Fitch expects the company's adjusted leverage will be approximately 7.1x on a pro forma basis including ESL's full results.

TDG's ratings are supported by strong FCF generation (cash from operations less capex and regular dividends), good liquidity, strong margins, healthy commercial aerospace markets, higher U.S. defense spending, and a favorable debt maturity schedule. TDG generates significant cash flow due to the ability to command a premium for its products. A high percentage of sales from a relatively stable and profitable aftermarket business, low research and development costs, low capex and a high percentage of sole source products support TDG's industry-leading 47% EBITDA margins and above 20% FCF margins.

Rating concerns include the company's high leverage, declining interest coverage, long-term cash deployment strategy which focuses on acquisitions and occasional debt-funded special dividends, and weak collateral support for the secured bank facility in terms of asset coverage. Even though TDG is a serial acquirer and has a demonstrated ability to seamlessly integrate multiple acquisitions annually, Fitch is concerned with the integration risk as the ESL acquisition will be the largest acquisition in the company's history.

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DERIVATION SUMMARY

TDG does not have any similarly sized peers with comparable operating profiles. The company has some of the highest operating margins and percentage of sole-source and proprietary product among aerospace and defense companies rated by Fitch. The company's diversification, high content of aftermarket sales, strong operations and cash generation are commensurate with higher-rated aerospace & defense companies such as Rockwell Collins Inc. However, TDG's financial policies, which include an appetite for high-leverage, debt-funded acquisitions and special dividends, override its strong, non-leverage credit metrics.

KEY ASSUMPTIONS

Fitch's key assumptions within the rating case for the issuer include:
--The transaction will close in the second half of calendar 2019;
--ESL revenues will be only partially accretive with TDG's financial results in fiscal 2019 and will be fully reflected only by fiscal 2020;
--TDG will finance the $4 billion acquisition by the issuance of additional term loan in the range of $2 billion to $3 billion and will finance the remainder with cash on balance sheet;
--TDG's margins will decrease in fiscal 2019 following the acquisition of ESL; EBITDA margins will decrease to 38% down from 47% by 2020 as ESL's results will be fully consolidated;
--TDG will make additional acquisitions in fiscal 2019 and beyond,
--TDG will maintain leverage in the range of 7x-8x over the rating horizon;
--Excess cash will be paid to shareholders in the form of special dividends or share repurchases if the company does not make acquisitions;
--The company will maintain cash balances of $500 million-$1 billion through rating horizon
--Fitch assumes the company will issue new debt in the range of $500 million to $1.5 billion annually. Fitch expects the majority of the newly issued debt will be in the form of senior secured term loans, however this should not pressure our RR5 recovery expectations for the senior subordinated notes.

KEY RECOVERY RATING ASSUMPTIONS

The recovery analysis assumes TDG would be considered a going concern and would be

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assesses the going concern pro forma EBITDA at approximately $1.82 billion based on the company's stable operations, high operating margins and significant percentage of revenues derived from aftermarket products. The $1.82 billion ongoing EBITDA assumption represents an approximately 20% decline from Fitch's projected pro forma EBITDA at the end of fiscal 2018.

Fitch expects the EV multiple used in the TDG recovery analysis will fluctuate in the range of 7x-8x, and Fitch is currently using a 7.5x multiple to calculate a post-reorganization valuation. Enterprise value-to-forward EBITDA multiples ranged from 4.8x-8.8x on the three Aerospace & Defense (A&D) bankruptcy plan observations available, with two of the three exit multiples being lower than the median 6.1x cross-sector exit multiple in Fitch's U.S. corporate bankruptcy database. The A&D defaulters typically had significant operational issues; low product, contract and customer diversification; or delays in receipt of contractual revenues in addition to over-leveraged capital structures. While TDG has a highly leveraged capital structure, Fitch believes the company's business profile is stronger than the profiles in the A&D bankruptcy observations.

Fitch utilizes the 7.5x EV multiple based on TDG's solid contract and product diversifications, high percentage of sole-source and proprietary products, and significant EBITDA derivation from higher margin and more stable aftermarket sales. In addition, recent transactions for similar companies have been completed at EBITDA multiples in the range of 11x-12x, as evidenced by a recent purchase of Orbital ATK, Inc. by Northrop Grumman Corporation at an approximately 14x EBITDA multiple earlier in 2018.

The $600 million revolving credit facility (RFC) and the $300 million accounts receivable securitization facility (ARSF) are assumed to be fully drawn upon default. The ARSF, RFC and first lien senior secured term loans are senior to the senior subordinated unsecured notes in the waterfall.

The waterfall results in a 100% recovery corresponding to a Recovery Rating of 'RR1' for the first lien (assumed at $10.6 billion following the completion of the acquisition) and ARSF ($300 million). The waterfall also indicates a 14% recovery corresponding to 'RR5' for the senior subordinated unsecured notes ($5.1 billion).

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metrics and the company's cash-deployment strategies. Positive rating actions could be considered if the company modifies its cash-deployment strategy and focuses on debt reduction.

Future Developments That May, Individually or Collectively, Lead to Negative Rating Actions

-A negative rating action may be considered if there is significant cash flow margin erosion without commensurate deleveraging of the company.

-Fitch may consider a negative rating action if TDG's adjusted leverage (adjusted debt to EBITDAR) and FFO-adjusted leverage increase and remain between 8.0x and 8.25x, and above 9.5x, respectively, driven by weakening of the global economy, a downturn in the aerospace sector, or by issuance of additional debt to fund special dividends or acquisitions.

-Fitch may take a negative rating action on the senior subordinated notes if their recovery prospects deteriorate due to an issuance of new senior secured debt.

LIQUIDITY

Good Liquidity: Fitch anticipates recently completed and future acquisitions will allow TDG to accelerate its revenue, EBITDA and FCF growth over the rating horizon. TDG has adequate financial flexibility and good liquidity supported by a $600 million revolving credit facility and a sizable cash balance, as the company typically holds above $500 million in cash.

As of June 30, 2018, TDG held $1.9 billion in cash and equivalents and $685 million of revolver availability after giving effect to $15 million of letters of credit outstanding. The company does not have significant debt maturities until 2020, when $550 million of senior subordinated notes become due. Fitch anticipates the company will refinance the maturing debt and estimates TDG's liquidity will typically fluctuate between $1 billion to $1.5 billion over the rating horizon.

Debt Structure: TDG's capital structure consists of senior secured credit facilities, senior subordinated unsecured notes and a $300 million trade receivable securitization facility. As of July 18, 2018, the company had a $600 million senior secured revolver maturing in 2022, three outstanding senior secured term loan tranches under its credit facility, with a total amount outstanding of approximately $7.6 billion, and $5.1 billion of aggregate outstanding

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due 2021. The tranche F matures in June 2023, the tranche G matures in August 2023, and the tranche E matures in May 2025. On May 8, 2018 TDG UK, a first time issuer and direct wholly owned subsidiary of TDG, issued $500 million of subordinated notes due in 2026. TDI is a co-obligor of the $500 million senior subordinated debt issued by TDG UK.

FULL LIST OF RATING ACTIONS

Fitch has taken the following ratings actions:
TransDigm Group Inc.
--Long-term IDR affirmed at 'B'.

TransDigm Inc.
--IDR affirmed at 'B';
--Senior secured revolving credit facility affirmed at 'BB'/'RR1';
--Senior secured term loans affirmed at 'BB'/'RR1';
--Senior subordinated notes affirmed at 'B-'/'RR5'.

TransDigm UK Holdings plc
--Senior subordinated notes affirmed at 'B-'/'RR5'.

The Rating Outlook is Stable.

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Craig D. Fraser
Managing Director
+1-212-908-0280

Summary of Financial Statement Adjustments - Fitch has made no material adjustments that are not disclosed within the company's public filings.

Media Relations: Elizabeth Fogerty, New York, Tel: +1 212 908 0526, Email: elizabeth.fogerty@thefitchgroup.com

Additional information is available on www.fitchratings.com

The following issuer(s) did not participate in the rating process, or provide additional information, beyond the issuer's available public disclosure: TransDigm Inc.,TransDigm UK Holdings plc,TransDigm Group Inc.

Applicable Criteria

Corporate Rating Criteria - Effective from 23 March 2018 to 19 February 2019 (pub. 23 Mar 2018)
Corporates Notching and Recovery Ratings Criteria (pub. 23 Mar 2018)
Parent and Subsidiary Rating Linkage (pub. 16 Jul 2018)
Sector Navigators (pub. 23 Mar 2018)

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TransDigm Group Inc.	-	Long Term Issuer Default Rating	Unsolicited
TransDigm Inc.	-	Long Term Issuer Default Rating	Unsolicited
TransDigm Inc. USD 600 mln Floating LIBOR 0.03% revolving credit facility 28-Feb-2020	89364MBA1	Long Term Rating	Unsolicited
TransDigm Inc. USD 1.24 bln Floating LIBOR 0.03% term loan 28-Feb-2020	89364MAX2	Long Term Rating	Unsolicited

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Forward Looking Statements

TRANSDIGM GROUP INC.

Statements in this presentation which are not historic facts are forward-looking statements under the provisions of the Private Securities Litigation Reform Act of 1995, including but not limited to expectations of Esterline's future performance, profitability, growth and earnings; expectations of TransDigm's earnings per share and the financial impact of the proposed transaction; the financing of the proposed transaction; and the timing of the proposed transaction. All statements other than statements of historical fact that address activities, events or developments that we expect, believe or anticipate will or may occur in the future are forward-looking statements, including, in particular, statements about our plans, objectives, strategies and prospects regarding, among other things, the acquired business. We have identified some of these forward-looking statements with words like "believe," "may," "will," "should," "expect," "intend," "plan," predict," "anticipate," "estimate" or "continue" and other words and terms of similar meaning. All forward-looking statements involve risks and uncertainties which could affect TransDigm's actual results and could cause its actual results or the benefits of the proposed transaction to differ materially from those expressed in any forward-looking statements made by, or on behalf of TransDigm. These risks and uncertainties include, but are not limited to, closing conditions to the proposed transaction may not be achieved, the occurrence of any event, change or other circumstance that could give rise to the termination of the Merger Agreement, the effect of the announcement or pendency of the proposed transaction on the TransDigm's and Esterline's business relationships, operating results and business generally, risks related to diverting management's attention from ongoing business operations, the outcome of any legal proceedings that may be instituted related to the Merger Agreement or the proposed transaction, unexpected costs, charges or expenses resulting from the proposed transaction, Esterline's actual financial results for the year ended September 28, 2018 may differ from expected results, TransDigm may have difficulty obtaining required approvals, TransDigm may have difficulty implementing its strategic value drivers, and TransDigm may be impacted by the effects of general economic and industry conditions. Except as required by law, TransDigm undertakes no obligation to revise or update the forward-looking information contained in this presentation.

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Additional Information

TRANSDIGM GROUP INC.

Additional Information and Where to Find it

Esterline intends to file with the SEC a proxy statement in connection with the contemplated transactions. The definitive proxy statement will be sent or given to Esterline stockholders and will contain important information about the contemplated transactions. INVESTORS AND SECURITY HOLDERS ARE URGED TO READ CAREFULLY AND IN THEIR ENTIRETY THE PROXY STATEMENT AND ANY OTHER RELEVANT DOCUMENTS FILED WITH THE SEC WHEN THEY BECOME AVAILABLE. Investors and security holders may obtain a free copy of the proxy statement (when it is available) and other documents filed with the SEC at the SEC's website at www.sec.gov.

Certain Information Concerning Participants

TransDigm and Esterline and their respective directors and executive officers may be deemed to be participants in the solicitation of proxies from Esterline investors and security holders in connection with the contemplated transactions. Information about TransDigm's directors and executive officers is set forth in its proxy statement for its 2018 Annual Meeting of Stockholders and its most recent annual report on Form 10-K. Information about Esterline's directors and executive officers is set forth in its proxy statement for its 2018 Annual Meeting of Stockholders and its most recent annual report on Form 10-K. These documents may be obtained for free at the SEC's website at www.sec.gov. Additional information regarding the interests of participants in the solicitation of proxies in connection with the contemplated transactions will be included in the proxy statement that Esterline intends to file with the SEC.

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Agenda

TRANSDIGM GROUP INC.

- Transaction Overview
- Esterline Overview
- Acquisition Rationale & Value Creation Strategy
- Q&A

Transaction Overview

TRANSDIGM GROUP INC.

Transaction Description

- Acquisition of 100% of Esterline Technologies' outstanding stock by merger

Transaction Consideration

- All cash offer - $122.50 per share
- Aggregate value: $4.0Bn*

Financial Impact

- Funded with combination of cash and debt

Timing

- Closing subject to receipt of regulatory approvals in the United States and other jurisdictions, as well as other customary closing conditions
- Expect to close within the second half of calendar 2019

*Aggregate value is Equity Value plus Net Debt; FY2019E EBITDA per Wall Street analyst consensus estimates (CapIQ)

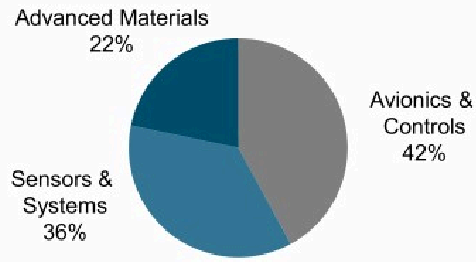
Esterline Technologies Overview

TRANSDIGM GROUP INC.

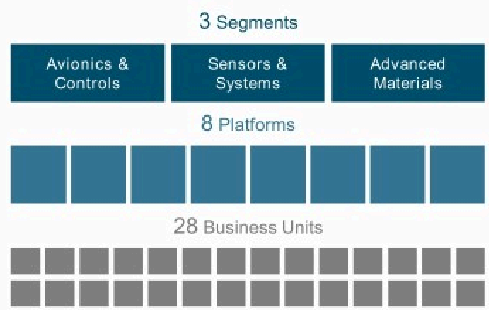
Esterline at a Glance

- Esterline Technologies designs, manufactures and markets highly engineered products and systems to aerospace and defense customers
- FY2018E Revenue: ~$2,000MM
- FY2018E EBITDA: ~$300MM+
- Headquarters: Bellevue, WA
- Employees: 12,500+
- Large global footprint

Segment Revenue Breakdown[1]



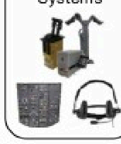
Organization Structure



(1) Segment breakdown based on FY2017 revenue

Esterline Segment Overview

TRANSDIGM GROUP INC.

Segment	Business Overview	Key Products
Avionics & Controls	• Manufactures avionics systems, control and communication systems, and interface technologies • Products have been integrated into many existing aircraft designs, including every Boeing and Airbus commercial aircraft platform currently in production • Products meet critical operational requirements and provide customers with significant technological advantages	Avionics Systems  Control & Communication Systems  Interface Technologies 
Sensors & Systems	• Develops and manufactures high-precision temperature, pressure and speed sensors, as well as electrical and fiber optic interconnect systems, electrical power switching, control and data communication devices, and other related systems • Comprised of advanced sensors capabilities, connection technologies, and power systems for end markets including commercial and military aircraft, nuclear power, and the rail sector as well as other adjacent markets • Principal customers include airlines, airframers, prime aerospace suppliers, jet engine manufacturers, and industrial manufactures	Advanced Sensors  Connection Technologies  Power Systems 
Advanced Materials	• Defense technologies for military air and ground end customers and engineered materials for commercial aerospace and nuclear power • For military end markets, sole source provider of combustibles and chaff, and a leading producer of countermeasures to the U.S. Government • For commercial aerospace, nuclear, and industrial end markets, offering includes high-performance elastomer products, vibration-tolerant clamps, wire management solutions, thermal insulation, and metal fabrication	Engineered Materials  Defense Technologies 

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Acquisition Rationale

TRANSDIGM

TransDigm's Consistent Goal – "Private Equity-Like" Returns to Shareholders

- Effective use of cash, transaction fits well with our capital allocation strategy
- Complementary proprietary aerospace products with significant aftermarket and strong positions on a broad base of platforms
- Like TransDigm, Esterline runs a decentralized organization
- TransDigm has a long and proven track record of integrating acquisitions and creating value for shareholders

Learn more about LSEG

Business

Esterline Technologies exploring potential sale - sources

By **Mike Stone**

July 20, 2018 6:37 PM EDT · Updated 6 years ago

Aa

(Reuters) - Aerospace parts maker Esterline Technologies Corp is exploring a potential sale, two people familiar with the matter said on Friday.

Earlier on Friday, the Wall Street Journal reported that the company was exploring a sale, adding that the process was at an early stage and there was no guarantee of a deal.

Esterline did not immediately respond to requests for comment.

Shares of the company, which has a market capitalisation of more than $2 billion, were up around 10 percent at $83 in afternoon trading.

Esterline makes cockpit components and sensors for commercial jetliners, business jets and military aircraft such as Lockheed Martin F-35 fighter jets.

Any deal would add to a spate of consolidation in the industry, as companies look to deploy accrued cash at the same time as defence spending kicks up and firms search for more ways to grow capacity.

In September last year United Technologies Corp acquired Rockwell Collins for $30 billion, and in March TransDigm Group continued an acquisition spree with a $525 million deal for Extant Components Group.

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Feedback

Most recently, in June, Northrop Grumman won U.S. antitrust approval to complete its $7.8 billion acquisition of rocket maker Orbital ATK.

Reporting by Mike Stone in Farnborough, England; Additional reporting by Sanjana Shivdas in Bengaluru; Editing by Anil D'Silva and Rosalba O'Brien

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6:07 PM UTC

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7:19 PM UTC

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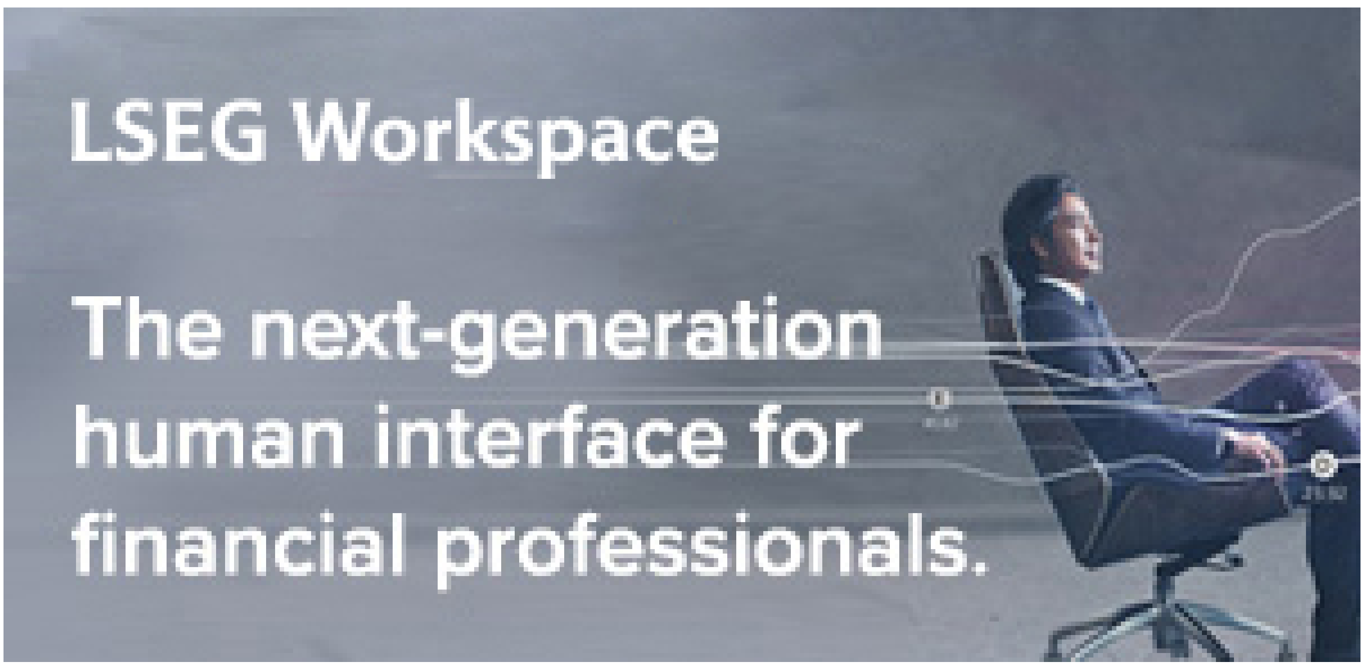
6:30 PM UTC



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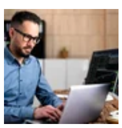

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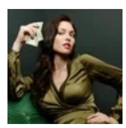

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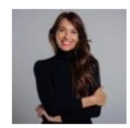

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NYCB shares eye rebound after sell-off on 'material weakness' disclosure

Finance · March 4, 2024 · 9:23 AM EST

New York Community Bancorp shares were on track for a bounce back on Monday following a drubbing in the previous session after the lender replaced its CEO and flagged "material weaknesses" in internal controls related to a loan review.

Partnerships & M&A

India's Tata Motors to separate passenger, commercial vehicle businesses into two listed firms

7:05 AM EST

Finance

Higher interest rates drag Swiss National Bank to $3.6 billion loss

4:38 AM EST

Boards

Swedish pension fund Alecta's chairperson resigns after a week

March 3, 2024

Mergers & Acquisitions

Bayer purchases heart drug for up to $310 mln

2:45 AM EST

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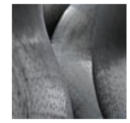

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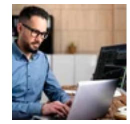

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Jefferies

EQUITY RESEARCH
Esterline Technologies Corp. (ESL)

TRANS(digm)forming Into Deal Close

November 21, 2018

Key Takeaway

ESL reported FQ4:18 (Sept) EPS of $1.87 vs. our est./cons. of $1.39/$1.44. Revenues were up +1.3% (6% organic), but 1% below our expectations. Segment operating earnings were $0.52 ahead of our expectations driven by Avionics (+$0.25) and Sensors (+$0.23). Given the pending acquisition by TDG for $122.50 per share, ESL did not issue FY19 guidance or host a conference call.

FQ4:18 Results - Revs Miss, But Profitability Better on Lower R&D and Productivity

Revs were up 1% y-o-y, or 6% excluding Kirkhill's results a year ago. Segment earnings grew 55% y-o-y due to improved gross margins (34% vs. 31% a year ago) and lower R&D. The latter particularly benefited Avionics and Sensors. The quarter also excluded Kirkhill, which was a loss of $4.5MM a year ago. Segment margins of 17.6% were up from 11.5% in Q4:17 and 310 bps above our est. of 14.5%. The standout performer was Sensors & Systems with margins of 15.9% almost double the 8.8% a year ago as the segment benefited from operating leverage and lower R&D, but also improvements from the H1 restructuring of the Power Systems business.

Solid Bookings Support 3% Organic Growth in FY19

We estimate organic growth was 6% in FYQ4, excluding the impact of Kirkhill. ESL is benefiting from higher commercial production rates and short-cycle defense demand coupled with the transition of new programs to production such as the E2. The latter should also boost profitability as R&D declines as a percentage of sales. Book-to-bill was favorable with trailing 12-month B2B of 1.12x. Backlog ended the year at $1.5BB, up 15% y-o-y. We forecast revenues of $2.06BB in 2019, up 1% y-o-y or 3% on an organic basis excluding the divestiture of Kirkhill.

Dropping to the Bottom Line and Cash

For FQ4, overall segment margins outperformed our expectations by 310 bps and expanded 610 bps from year ago results . With the absence of Kirkhill operating losses, improved mix in Avionics, and performance within Advanced Materials, we forecast operating margins of 10.4% in FY19, up from the 9.3% in FY18. In FY18, ESL generated CFO of $214MM, up 11% y-o-y. FCF was $161MM including capex of $53MM. We forecast FCF of $174MM and $181MM in FY19 and FY20, respectively driven by higher net income.

Trading at a Premium Given Pending Acquisition

ESL currently trades at a consensus FY2 P/E multiple of ~25.9X, 62% above its 3 year avg of ~16.0X. On a market relative basis, the stock is 66% above the S&P (15.6X) vs. an avg discount of 4% over the past three years.

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Target | Estimate Change

RATING	HOLD
PRICE	$116.80^
MARKET CAP	$3.5B
PRICE TARGET (PT)	$122.50 (FROM $92.00)
UPSIDE SCENARIO PT	122.50
DOWNSIDE SCENARIO PT	85.00

^Prior trading day closing price unless otherwise noted.

FY Sep	2017A	2018A	2019E	2020E
EPS ($)	4.15	↑ 4.17	↑ 4.55	↑ 4.70
Previous		*3.65*	*4.35*	*4.65*
FY P/E	28.1x	28.0x	25.7x	24.9x

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The Long View

Scenarios

Base Case

- TDG deal closes
- Organic revenue grow 4% in FY20 with some improvement in commercial aerospace and defense sales for company.
- Operating margins expand 100 bps to 10.3% in FY20 up from the 9.3% reported in FY18.
- Assumes tax rate of 25.5%.
- 2020 EPS (Sept year-end): $4.70; Target Multiple: 26.0X Target Price $122.50

Upside Scenario

Upside Scenario

- TDG deal closes
- Organic revenue growth accelerates to 6% due to new commercial aerospace program wins and industrial markets
- International cockpit retrofit opportunities
- Commercial air transports continue to order high margin spares
- Assumes 25.5% tax rate
- 2020 EPS: $5.00; Target Multiple 24.5x; Target Price $122.50

Downside Scenario

- Based on our base case estimates and deal breaks
- Airline traffic weakens and potential content losses
- Further declines for the A400M and A380 programs as they near end of production runs.
- Potential for additional price concessions.
- Assumes 25.5% tax rate
- 2020 EPS: $4.70; Target Multiple: 18.0x; Target Price $85

Investment Thesis / Where We Differ

We arrive at a target price of $122.50 based on the

Catalysts

- Closing of the Acquisition by TDG, which is expected to close

Long Term Analysis

LT Earnings CAGR	7-10%
Organic Revenue Growth	1-3%
Acquisition Contribution	1-2%
Operating Margin Expansion	1-2%

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Financial Summary

Net Debt/Capital	19.0%

52-Week Range:	$119.07 - $67.15
Total Entprs. Value	$3.9B
Avg. Daily Value MM ($)	53.22
Insider Ownership	0.3%
Institutional Ownership	97.5%
Float (%)	1.0%

Estimates

Estimates								
$	Prev.	2017A	Prev.	2018A	Prev.	2019E	Prev.	2020E
Rev. (MM)		2,002.2	2,041.0	↓ 2,035.0	2,068.0	↓ 2,061.3	2,145.0	↓ 2,138.0
Cons. EPS		4.15	3.68	↑ 4.17	4.52	↓ 4.51	4.72	↑ 4.78
EBITDA (MM)		299.9	281.0	↑ 289.0	321.0	↑ 325.0	349.0	↓ 336.0
EPS								
Q1		0.82	0.46	↑ 0.50		0.77		-
Q2		1.20		0.80		0.95		-
Q3		1.08		1.00		1.08		-
Q4		1.22	1.39	↑ 1.87		1.76		-
FY Sep		4.15	3.65	↑ 4.17	4.35	↑ 4.55	4.65	↑ 4.70
Valuation								
		2017A		2018A		2019E		2020E
P/Rev		1.7x		1.7x		1.7x		1.6x
FY P/E		28.1x		28.0x		25.7x		24.9x
EV/Rev		1.9x		1.9x		1.9x		1.8x
EV/EBITDA		12.9x		13.4x		11.9x		11.5x

Investment Considerations

We show in Exhibit 1 FQ4:18 earnings results.

FQ4:18 Earnings Variance

	FQ4 2017	FQ4 2018	% Chg.	FQ4:18 JEF EST	Actual vs. Estimate	JEF estimates	EPS Contribution
Revenues	528.7	535.3	1.3%	541.0	-$5.7	-1%	
Costs and expenses							
Cost of Sales	362.4	351.0	-3.2%	348.5	2.5	1%	$0.08
SG&A	88.3	87.4	-1.0%	96.2	(8.8)	-9%	($0.30)
R&D	28.8	17.5	-39.4%	32.7	(15.2)	-47%	($0.51)
Other	0.0	5.7		0.1			
Total Costs	479.6	461.6	-3.8%	477.5	(15.9)	-3%	($0.54)
GAAP Operating Profit	49.1	73.7	50.3%	63.5	10.2	16%	$0.35
Interest income & other	0.2	0.6		0.2	0.4	237%	$0.01
Interest expense	(7.6)	(7.2)	-4.2%	(8.3)	1.1	-13%	$0.04
Income before taxes	41.7	67.1	61.0%	55.3	11.7	21%	$0.40
Taxes	(10.0)	(16.9)	69.1%	(12.7)	(4.2)	33%	($0.14)
GAAP Net Income (Before Minority	31.7	50.2	58.4%	42.7	7.6	18%	$0.26
Non-controlling interests	(0.4)	(0.3)		(1.6)		-83%	$0.00
GAAP Net Income	**31.3**	**49.9**	**59.7%**	**41.1**	**8.8**	**22%**	**$0.30**
Adjustments	1.4	5.4		0.0			
Adjusted Net Income	**32.7**	**55.3**	69.4%	**41.1**	14.2	35%	$0.48
Diluted share count	30.1	29.6	-1.5%	29.9	(0.2)	-1%	($0.01)
GAAP EPS (Diluted)	**$1.04**	**$1.69**	**62.2%**	**$1.39**	**$0.30**	21%	$0.30
Adjusted EPS (Diluted)	**$1.09**	**$1.87**	**72.0%**	**$1.39**	**$0.48**	34%	$0.48
Source: Company reports							
Operating margin	9.3%	13.8%	4.5%	11.7%	2.0%	17.4%	
EBT as a % of revenue	7.9%	12.5%	4.6%	10.2%	2.3%	22.5%	
Tax rate %	23.9%	25.1%	1.2%	22.9%	2.2%	9.7%	
Net income as a % of revenue	6.0%	9.4%	3.4%	7.9%	1.5%	19.0%	
Revenue by Segment	**FQ4 2017**	**FQ4 2018**	**% Chg.**	**FQ4 2018**	**Actual vs. Estimate**		
Avionics & Controls	$225.3	$235.2	4%	$239.7	(4.5)	-2%	
Sensors & Systems	189.7	201.5	6%	196.1	5.5	3%	$0.18
Advanced Materials	113.9	98.5	-14%	105.2	(6.7)	-6%	
Total Revenue	$529.0	$535.3	1%	$541.0	(5.7)	-1%	
Operating Income By Segment	$86.7						
Avionics & Controls	28.9	36.0	25%	$28.6	7.4	26.0%	$0.25
Sensors & Systems	16.8	32.1	91%	25.3	6.8	26.8%	$0.23
Advanced Materials	15.1	26.0	72%	24.7	1.3	5.1%	$0.04
Segment Earnings	$60.7	$94.1	55%	$78.7	15.5	19.7%	$0.52
Operating Margin							
Avionics & Controls	12.8%	15.3%	2.5%	11.9%	3.4%	28.4%	
Sensors & Systems	8.8%	15.9%	7.1%	12.9%	3.0%	23.3%	
Advanced Materials	13.2%	26.4%	13.2%	23.5%	2.9%	12.2%	
Segment Operating Margin	11.5%	17.6%	6.1%	14.5%	3.0%	20.9%	

Source: Jefferies estimates, company data, Factset

Valuation and Price Target

Valuation Relative to Peers

ESL trades at a 66% premium to peers on a P/E basis and ~20% premium on EV/EBITDA basis, respectively as shown in Exhibit 2.

Exhibit 2: Relative Valuation Table (11/20/18)

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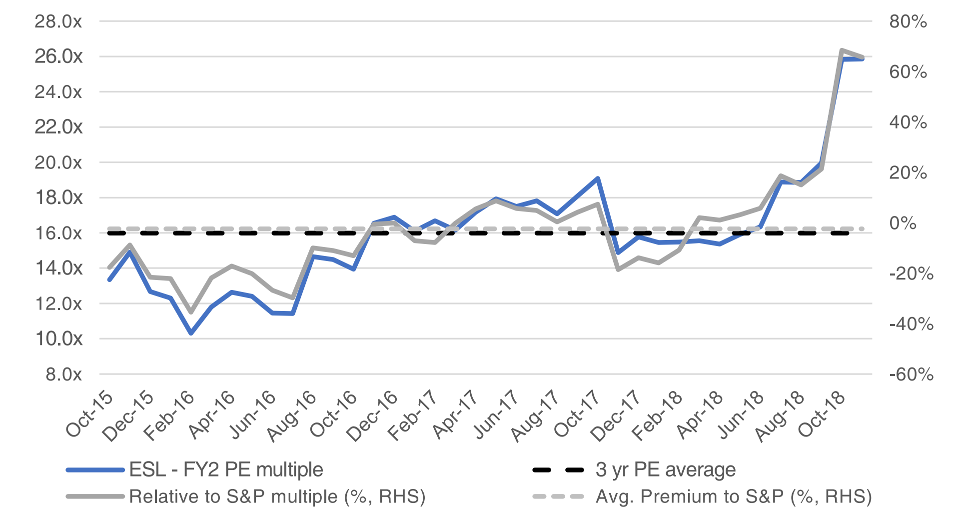
	Ticker	JEF Rating	Stock Px 11/19/2018	Consensus BUY Rating	Market Cap	Enterprise Value	P/E 2018E	P/E 2019E	P/E 2020E	EV / SALES 2018E	EV / SALES 2019E	EV / SALES 2020E	EV / EBITDA 2018E	EV / EBITDA 2019E	EV / EBITDA 2020E	Yield Dividend	Yield FCF
Hexcel	HXL	Hold	$58.87	40%	5,068	6,129	19.4x	17.1x	15.4x	2.8x	2.6x	2.4x	12.1x	10.8x	10.0x	0.9%	4.5%
Astronics	ATRO	N/C	$30.00	60%	650	1,115	20.3x	16.1x	13.9x	0.8x	0.8x	1.3x	11.7x	9.6x	N/A	0.0%	3.4%
Curtis Wright	CW	N/C	$106.45	63%	4,661	5,287	17.1x	15.6x	15.0x	1.9x	1.8x	2.0x	10.9x	10.0x	9.9x	0.6%	6.2%
Moog	MOG.A	N/C	$81.78	75%	2,658	3,686	30.5x	15.4x	14.0x	1.0x	0.9x	1.2x	11.9x	9.0x	8.6x	0.6%	6.6%
Parker-Hannifin	PH	Hold	$167.57	57%	22,178	26,689	16.1x	14.5x	13.4x	1.6x	1.5x	1.8x	11.1x	10.1x	9.6x	1.7%	7.4%
Spirit	SPR	Buy	$81.81	75%	8,672	9,892	13.2x	11.0x	9.8x	1.2x	1.1x	1.2x	9.1x	8.0x	7.3x	0.5%	6.7%
WWD	WWD	Hold	$79.49	50%	4,911	6,240	28.2x	17.7x	15.4x	2.1x	1.8x	2.1x	17.1x	12.0x	10.7x	0.7%	6.0%
Avg. Defense Primes				60%			**20.7x**	**15.3x**	**13.8x**	**1.6x**	**1.5x**	**1.7x**	**12.0x**	**9.9x**	**9.3x**	**0.7%**	**5.8%**
Esterline Technologies	**ESL**	**Hold**	**$117.35**	**0%**	**3,461**	**3,864**	**28.1x**	**25.4x**	**24.6x**	**1.9x**	**1.9x**	**1.8x**	**13.4x**	**11.9x**	**11.5x**	**0.0%**	**5.0%**
Premium / Discount							**36%**	**66%**	**78%**	**15%**	**25%**	**4%**	**12%**	**20%**	**23%**		

We move our PT to $122.50 from $92 based on the TDG acquisition.

Trading Above Historical Average PE and at a Premium to S&P

ESL currently trades at a consensus FY2 P/E multiple of ~25.9X, 62% above its 3 year average of ~16.0X. On a market relative basis, the stock is 66% above S&P (15.6X) vs. an average discount of 4% over the past three years.

Exhibit 1 - ESL - FY2 PE multiple and premium/discount to S&P



Source: Jefferies estimates, Factset

On EV/EBITDA multiple, ESL is trading at 12.1X, 36% above its historical average of 8.9X and at a ~12% premium to the S&P multiple of 10.8X.

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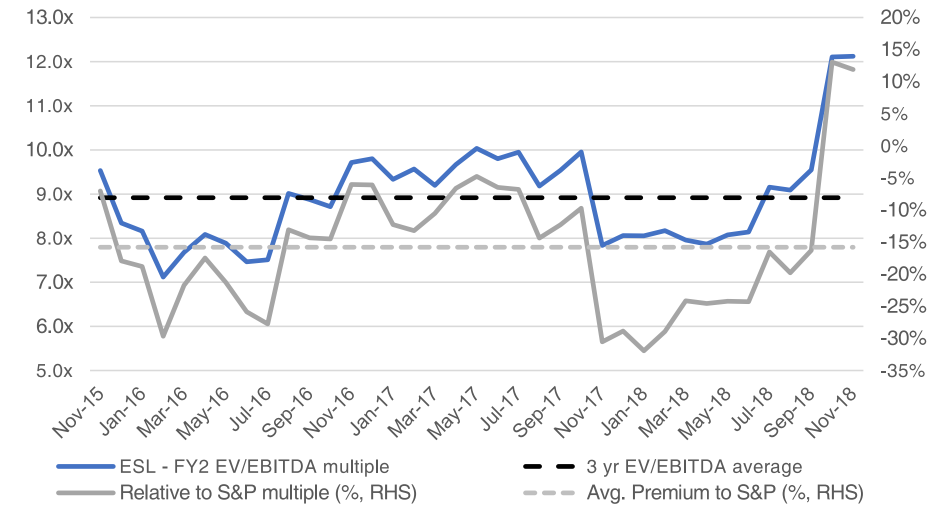
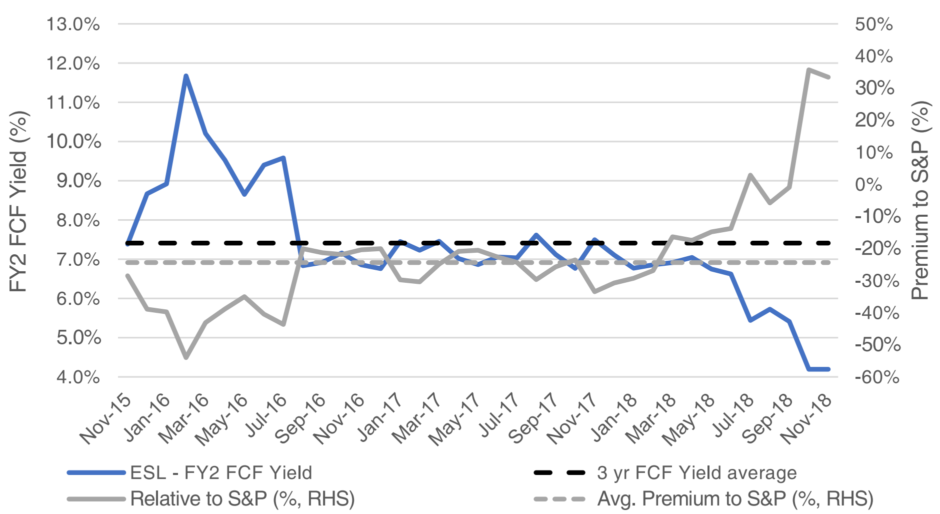
Exhibit 2 - ESL - FY2 EV/EBITDA multiple and premium/discount to S&P



Source: Jefferies estimates, Factset

On FCF yield basis, ESL currently trades on a consensus FY2 FCF yield of 4.2%, which reflects ~77% premium valuation vs. its 3-year average of 7.4% yield. On a market relative basis, the stock is trading at a 34% premium to S&P's average FCF yield of 5.6% (vs a 3-year average discount of 24%).

Exhibit 3 - ESL - FY2 FCF yield and premium/discount to S&P



Source: Jefferies estimates, Factset

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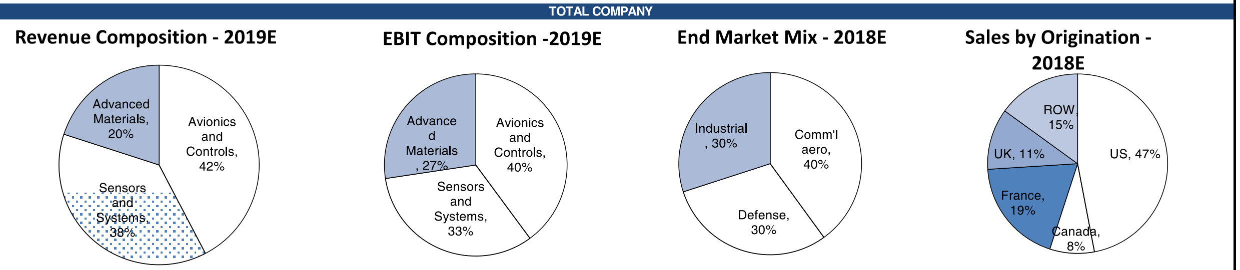
Exhibit 4 - Esterline Overview

ESTERLINE

TOTAL COMPANY



2018E	AVIONICS & CONTROLS	SEGMENT SENSORS & SYSTEMS	ADVANCED MATERIALS	SEGMENT TOTAL
Sales ($MM)	$887	$782	$393	$2,061
% of sales	43%	38%	19%	100%
Operating profit ($MM)	$110	$89	$90	$290
Operating margin	12.4%	11.4%	23.0%	14.1%
% of operating profit	38%	31%	31%	100%
Customers / end-market split	Aerospace, Defense, Gaming, Medical	Aerospace, Military	Aerospace, Military	
Products sold	**Avionics Systems:** Cockpits, flight management systems, enhanced vision systems, and GPS **Control Systems**: Components for aircraft cockpits, data concentrators, and software services **Comm Systems**: Signals intelligence receivers **Interface**: Components for medical, gaming and defense applications	**Advanced Sensors:** Temperature, pressure, density, speed, torque, mass flow sensors. Sole supplier of temperture probes for use on GE CFM-56 engine **Power Systems**: Contactors, relays, primary, and secondary power distribution **Connection Technologies**: Interconnect solutions for harsh environments, connectors, backshells, conduits, planet probe interconnectors, and launcher umbilicals.	**Defense Technology:** Countermeasures including flares, chaff, and decoys **Engineering Materials:** Seals, clamps, insulation, thermal fire barriers, and high temperature aero structures	Major programs include A400M($1.1MM), P-8($1MM), A380 ($900K), F-35($800K), T-6B ($600K), B787 ($600K), SJ100 ($600K), A350 ($450K) and KC-390 ($350K)
Competitors	Astronautics, BAE, Bose, Eaton, Elbit, EMS, Essex Industries, GE, Honeywell, IAI, L3, Otto Controls, RAFI, Rockwell Collins, SELEX, Telephonics, Thales, Ultra Electronics, Universal Avionics Systems,	Ametek, Amphenol, Eaton, Meggit, STPI-Deutsch, TE Connectivity, Woodward, and Zodiac	Chemring, Doncasters, Hi-Temp, J&M, JPR Hutchinson, Kmass, Meggit, Rheinmetall, Trelleborg, ULVA, United Technologies, UMPCO, and Woodward	--
Customers	Airbus, Aristocrat Technologies, BAE Systems, Boeing, Bombardier, FAA, General Electric, Honeywell, L3, Leonardo, Lockheed, Nuance, Philips, Pilatus, Rockwell Collins, Simex, Stat-Diagnostic, Textron, Thales, and Triman.	Airbus, BJG, Boeing, Bombardier, Flame, General Electric, Rolls-Royce, Safran, TTI, and United Technologies	Boeing, General Dynamics, KLX, Lockheed Martin, Northrop Grumman, Orbital ATK, Rikei, Rolls-Royce, Spirit AeroSystems	--

Source: Jefferies estimates, company data

Exhibit 5 - Quarterly Income Statement

	2018					2019E				
(millions, except per share dat	Q1	Q2	Q3	Q4E	Year	Q1E	Q2E	Q3E	Q4E	YearE
Revenues	$482	$518	$500	$535	$2,035	$476	$513	$513	$560	$2,061
Costs and Expenses										
COGS	334	354	330	351	1,369	323	345	340	348	1,357
SGA	99	102	99	87	387	91	97	96	106	391
R&D	26	25	23	17	91	21	23	23	25	93
Other Items	(3)	3	(0)	6	6	1	1	1	2	6
Total Operating Costs	455	484	452	462	1,852	437	467	461	481	1,846
Total Operating Profit (EBIT)	27	34	48	74	183	39	46	51	79	215
Interest income & other	0	0	1	1	2	0	0	0	0	1
Interest expense	(8)	(8)	(8)	(7)	(31)	(7)	(7)	(7)	(7)	(28)
Pretax Income	19	26	41	67	154	32	39	44	72	187
Taxes	(54)	(2)	(11)	(17)	(84)	(8)	(10)	(12)	(19)	(49)
Net income	(34)	24	30	50	70	24	29	33	53	139
Noncontrolling Interests	(0)	(0)	0	(0)	(1)	(0)	(0)	(0)	(0)	(2)
Net income attributable to ESL	(35)	24	30	50	69	23	29	33	53	137
Discontinued ops	0	0	0	0	0	0	0	0	0	0
Net income from continuing op	**(35)**	**24**	**30**	**50**	**69**	**23**	**29**	**33**	**53**	**137**
Tax & other adjustments	50	0	0	5	55	0	0	0	0	0
Net income (adjusted)	**15**	**24**	**30**	**55**	**124**	**23**	**29**	**33**	**53**	**137**
Shares Outstanding										
Basic	29.9	29.6	29.4	29.4	29.6	30.0	30.0	30.0	30.0	29.8
Diluted	29.9	29.7	29.5	29.6	29.7	30.2	30.2	30.2	30.2	30.2
Earnings per share										
Diluted EPS (cont. ops)	**($1.16)**	**$0.80**	**$1.00**	**$1.69**	**$2.32**	**$0.77**	**$0.95**	**$1.06**	**$1.76**	**$4.55**
Tax & other adjustments	1.67	0.00	0.00	0.18	1.86	0.00	0.00	0.02	0.00	0.00
Adjusted EPS	**$0.50**	**$0.80**	**$1.00**	**$1.87**	**$4.17**	**$0.77**	**$0.95**	**$1.08**	**$1.76**	**$4.55**

Source: Jefferies estimates, company data

Exhibit 6 - Annual Income Statement

	2016		2017		2018A		2019E		2020E	
	dollars	% of sales	dollars	% of sales	dollars	% of sales	dollars	% of sales	dollars	% of sales
Total Revenues	**1,993**	100.0%	**2,000**	100.0%	**2,035**	100.0%	**2,061**	100.0%	**2,138**	100.0%
Costs and expenses										
Segment COGS	1,332	66.8%	1,340	67.0%	1,369	67.3%	1,357	65.8%	1,404	65.7%
SG&A	397	19.9	375	18.7	387	19.0	391	19.0	413	19.3
R&D	100	5.0	110	5.5	91	4.5	93	4.5	94	4.4
Other operating costs	(0)	(0.0)	(8)	(0.4)	6	0.3	6	0.3	6	0.3
Total operating costs	**1,828**	91.7%	**1,817**	90.8%	**1,852**	91.0%	**1,846**	89.6%	**1,917**	89.7%
Segment profit (EBIT)	**166**	8.3%	**183**	9.2%	**183**	9.0%	**215**	10.4%	**221**	10.3%
Net interest expense	(30)		(30)		(29)		(27)		(27)	
Other income (expense)	0		0		0		(0)		(0)	
Income before taxes (GAAP)	**136**	6.8%	**153**	7.7%	**154**	7.5%	**187**	9.1%	**194**	9.1%
GAAP Taxes (rate %)	(22)	16.1%	(33)	21.5%	(84)	54.6%	(49)	25.9%	(49)	25.5%
Noncontrolling interests	(1)		(2)		(1)		(2)		(2)	
Net Income (GAAP)	**113**	5.7%	**119**	5.9%	**69**	3.4%	**137**	6.7%	**143**	6.7%
Tax & other adjustments	$28		$6		$55		$0		$0	
Net Income (Adjusted)	**141**	7.1%	**125**	6.3%	**124**	6.1%	**137**	6.7%	**143**	6.7%
Reported GAAP EPS	**$3.80**		**$3.96**		**$2.32**		**$4.55**		**$4.70**	
Adjusted Diluted EPS	**$4.74**		**$4.20**		**$4.17**		**$4.55**		**$4.70**	
Basic shares (millions)	29		30		30		30		30	
Diluted shares (millions)	30		30		30		30		30	

Source: Jefferies estimates, company data

Operating Segment Data

	2016	% of sales	2017	% of sales	2018A	% of sales	2019E	% of sales	2020E	% of sales
Revenue										
Avionics & Controls	$862	43.2%	$841	42.0%	$862	42.3%	$887	43.0%	$927	43.3%
Sensors & Systems	696	34.9%	724	36.2%	766	37.6%	782	37.9%	798	37.3%
Advanced Materials	436	21.9%	435	21.8%	407	20.0%	393	19.1%	414	19.4%
Total Revenue	**$1,993**	100%	**$2,000**	100%	**$2,035**	100%	**$2,061**	100%	**$2,138**	100%
Operating Income (margin)										
Avionics & Controls	$81	9.3%	$91	10.8%	$104	12.1%	$110	12.4%	$116	12.5%
Sensors & Systems	82	11.9%	87	12.0%	85	11.1%	89	11.4%	93	11.6%
Advanced Materials	75	17.1%	74	17.0%	71	17.5%	90	23.0%	98	23.7%
Segment Operating Income	**$238**	11.9%	**$252**	12.6%	**$260**	12.8%	**$290**	14.1%	**$307**	14.3%
Corporate	**(72)**	3.6%	**(69)**	3.4%	**($72)**	3.5%	**(75)**	3.6%	**(86)**	4.0%
Operating Income	**$166**	8.3%	**$183**	9.2%	**$188**	9.3%	**$215**	10.4%	**$221**	10.3%
Revenue YoY % change										
Avionics & Controls	4%		-2%		2%		3%		5%	
Sensors & Systems	-3%		4%		6%		2%		2%	
Advanced Materials	-6%		0%		-6%		-4%		5%	
Total Revenue	**0%**		**0%**		**2%**		**1%**		**4%**	
Operating profit change YoY										
Avionics & Controls	-14%		13%		14%		6%		5%	
Sensors & Systems	0%		5%		-2%		5%		4%	
Advanced Materials	-18%		-1%		-4%		27%		9%	
Total Operating Income	**-11%**		**6%**		**3%**		**11%**		**6%**	
Incremental	**314%**		**209%**		**25%**		**111%**		**22%**	

Source: Jefferies estimates, company data

Annual Sources and Uses of Funds

(millions, except per share data)	2016	2017	2018A	2019E	2020E
Operating Activities					
Net income (incl. minorities)	**99**	**113**	**124**	**139**	**144**
Depreciation & Amortization	100	104	106	110	115
Other	9	(12)	10	10	10
Op cash flow pre-working capital	**208**	**205**	**240**	**259**	**269**
Change in inventory	(2)	(16)	(12)	(15)	(19)
Change in receivables	(44)	(3)	(7)	(16)	(17)
Change in payables	5	7	(6)	2	5
Changes in working capital	**(41)**	**(12)**	**(26)**	**(29)**	**(31)**
Cash Flow from Operations	**167**	**193**	**214**	**230**	**239**
Investment activities					
Capital expenditures	(68)	(58)	(53)	(56)	(58)
Net cash used in acquisitions	0	0	0	0	0
Other investing activities, net	3	1	0	0	0
Cash Flow from Investments	**(66)**	**(57)**	**(53)**	**(56)**	**(58)**
Financing Activities					
Change in debt	(17)	(121)	0	0	0
Shareholders' equity	(13)	28	(44)	0	0
Dividends paid	0	0	(30)	0	0
Other financing cash flows	1	(1)	0	0	0
Cash Flow from Financing	**(29)**	**(94)**	**(73)**	**0**	**0**
Effect of FX	(5)	8	0	0	0
Net cash from discontinued	0	0	0	0	0
Net change in cash items	**67**	**49**	**88**	**174**	**181**
Cash at the beginning of the period	259	259	308	396	569
Cash at the end of the period	**326**	**308**	**396**	**569**	**751**

Source: Company reports and Jefferies & Company, Inc. estimates.

Source: Jefferies estimates, company data

Annual Balance Sheet

(millions, except per share data)	2016	2017	2018A	2019E	2020E
Assets					
Cash and cash equivalents	259	308	396	569	751
Account receivables	422	431	437	453	470
Prepaid expenses	18	19	19	19	19
Inventories	447	478	490	505	524
Other current assets	22	20	20	20	20
Total Current Assets	**1,173**	**1,269**	**1,376**	**1,580**	**1,797**
PPE	338	349	296	242	185
Goodwill	1,025	1,054	1,054	1,054	1,054
Intangible assets, net	393	359	359	359	359
Other Assets	25	33	33	33	33
Total Assets	**3,029**	**3,120**	**3,230**	**3,380**	**3,540**
Liabilities					
Accounts payable	127	139	132	134	139
Accrued liabilities	236	230	230	230	230
Income taxes payable	10	1	1	1	1
Current maturities of long-term debt	17	17	17	17	17
Other current liabilities	11	7	7	7	7
Total Current Liabilities	**400**	**394**	**387**	**389**	**394**
Other liabilities	325	182	182	182	182
Long-term debt, net of current maturiti	699	709	709	709	709
Total Liabilities	**1,424**	**1,285**	**1,278**	**1,280**	**1,285**
Noncontrolling interest	11	11	11	13	14
Total Stockholders equity	**1,595**	**1,825**	**1,933**	**2,080**	**2,233**
Total liabilities and S/E	**3,029**	**3,120**	**3,222**	**3,373**	**3,532**

Source: Jefferies estimates, company data

Company Description

Esterline Technologies

Esterline Technologies (NYSE: ESL) is a diversified supplier of cockpit components, sensors, electrical systems, and various advanced materials used in a wide range of aerospace and military applications. Approximately 40% of the company's sales base is derived from the commercial aerospace market, another 30% is in military products, with the remaining 30% spread across medical equipment and industrial end markets. No single product or platform represents more than 3% of the company's consolidated revenues. Esterline's products include cockpit systems & components; aircraft and industrial turbine engine sensors; electrical power switching systems; advanced rubbers & plastics used in high stress environments; aircraft countermeasure flares & chaff; and combustible materials used in artillery and mortar shells. Several programs of note carry substantial ESL content: Boeing's entire family of commercial aircraft; the T-6B Texan II military trainer aircraft; the CFM56 engine used on all Boeing 737NGs and over half of Airbus A320s (the most widely used engine in the civil aviation market today); the Sikorsky UH-60M Blackhawk; the Lockheed Martin F-35 Joint Strike Fighter; and several major business jet platforms.

Company Valuation/Risks

Esterline Technologies

Our PT is based on: 1) EV/EBITDA of 12.8X; 2) 21.3X our FY20E EPS. Risks: weaker aero markets & failure to expand margins.

Hexcel Corporation

PT reflects 5% premium to peers. Our PT of $69 is based on i) P/E multiple of 20X FY19 EPS; ii) avg. 13X EBITDA multiple; and iii) 5% FCF yield. Risks: downturn in civil aircraft production.

Parker Hannifin

We value the shares based on a combination of EV/Sales and EV/EBITDA multiples taking into account both the historical range over prior cycle and the peer group to derive our $170 PT. Risks: changes in economic growth, the ability to supplement growth with acquisitions and changes in FX.

Spirit AeroSystems Holdings, Inc.

Our blended PT of $106 is based on: 1) EV/EBITDA of 10.4X; 2) 15.4x our 2019 EPS of $7.45; 3) a 6% FCF yield. Key risks include disruption in the civil jet market and related to A350 and other programs.

Woodward

Our PT of $88 is now based off of FY20 estimates. Our PT assumes 1) 17.6X our FY20E EPS of $5.30 and 2) 10.9X EBITDA of $588MM (5% premium to peers given superior EPS growth). Risks include: commodity driven capex, and loss of key platforms.

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Investment Recommendation Record

(Article 3(1)e and Article 7 of MAR)

Recommendation Published	November 20, 2018 , 23:32 ET.
Recommendation Distributed	November 21, 2018 , 00:00 ET.

Company Specific Disclosures

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Underperform - Describes securities that we expect to provide a total return (price appreciation plus yield) of minus 10% or less within a 12-month period.

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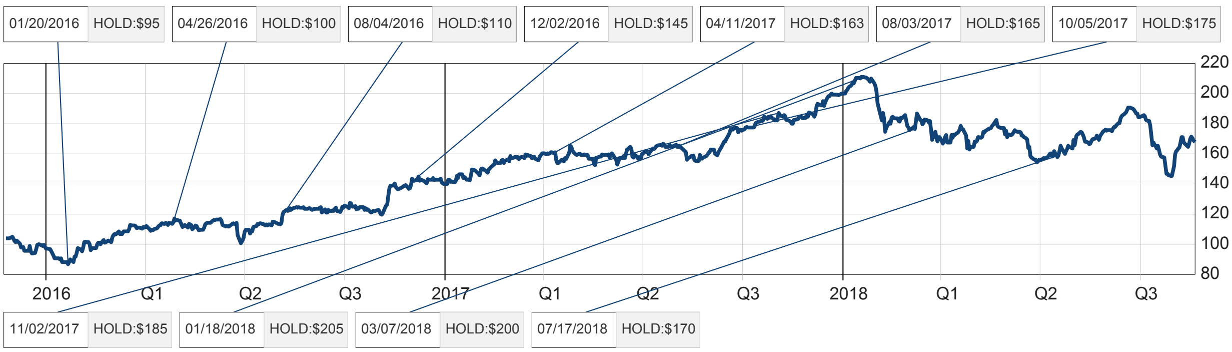
Other Companies Mentioned in This Report

- Hexcel Corporation (HXL: $58.26, HOLD)
- Parker Hannifin (PH: $163.71, HOLD)
- Spirit AeroSystems Holdings, Inc. (SPR: $78.24, BUY)
- Woodward (WWD: $79.55, HOLD)

WESCO_UCC00003697

Rating and Price Target History for: Parker Hannifin (PH) as of 11-19-2018



Rating and Price Target History for: Spirit AeroSystems Holdings, Inc. (SPR) as of 11-19-2018

Rating and Price Target History for: Woodward (WWD) as of 11-19-2018

Notes: Each box in the Rating and Price Target History chart above represents actions over the past three years in which an analyst initiated on a company, made a change to a rating or price target of a company or discontinued coverage of a company.

Legend:

I: Initiating Coverage

D: Dropped Coverage

B: Buy

H: Hold

UP: Underperform

Distribution of Ratings

Distribution of Ratings						
			IB Serv./Past12 Mos.		JIL Mkt Serv./Past12 Mos.	
	Count	Percent	Count	Percent	Count	Percent
BUY	1160	55.56%	94	8.10%	12	1.03%
HOLD	807	38.65%	14	1.73%	0	0.00%
UNDERPERFORM	121	5.80%	0	0.00%	0	0.00%

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Kaman Completes Sale of Distribution Segment to Littlejohn & Co.

August 26, 2019 04:01 PM Eastern Daylight Time

BLOOMFIELD, Conn.--(BUSINESS WIRE)--Kaman Corp. (NYSE:KAMN) announced today that it has completed the sale of its Distribution segment to affiliates of Littlejohn & Co. for total cash consideration of $700 million, excluding certain working capital adjustments.

Kaman is a premier designer and manufacturer of critical components, structures, and systems for commercial, military and industrial customers through its Aerospace business, and operates fourteen facilities around the world with approximately 3,000 employees.

“The completion of the sale of our Distribution segment marks a return to Kaman’s roots as a highly focused aerospace and engineered products company,” said Neal J. Keating, Chairman, President and CEO. “With a stronger balance sheet and increased financial flexibility, Kaman is well positioned to invest in new technologies, to deliver innovative solutions that meet our customers’ needs, and to pursue strategic acquisition opportunities that will accelerate our future growth.”

Kaman plans to use proceeds from the transaction to pay down debt outstanding under its credit facility, accelerate internal development efforts, pursue strategic acquisitions focused on attractive engineered product end markets and continue returning capital to shareholders.

About Kaman Corporation

Kaman Corporation produces and/or markets widely used proprietary aircraft bearings and components; super precision, miniature ball bearings; complex metallic and composite aerostructures for commercial, military and general aviation fixed and rotary wing aircraft; safe and arm solutions for missile and bomb systems for the U.S. and allied militaries; production of the K-MAX® medium-to-heavy lift helicopter and support for the company's SH-2G Super Seasprite maritime aircraft. The company, which was founded in 1945 by aviation pioneer Charles H. Kaman, is headquartered in Bloomfield, Connecticut. More information is available at www.kaman.com.

Contacts

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EX-99.2 6 investorpresentationfili.htm EXHIBIT 99.2

Exhibit 99.2

Creating Tomorrow's KAMAN Today

Investor Presentation
Sale Of Distribution
June 26, 2019

UCC-211

Forward Looking Statements

FORWARD-LOOKING STATEMENTS

This presentation includes "forward looking statements" relating to the announced transactions and future operations of the Company, whi of words such as "will," "expect," "poise," "believe," "plans," "strategy," "prospects," "estimate," "seek," "target," "anticipate," "intend," "f "would," "could," and other words of similar meaning in connection with a discussion of the proposed transaction or future operating or fi Forward-looking statements also may be included in other publicly available documents issued by the Company and in oral stateme representatives from time to time. These statements are based on assumptions currently believed to be valid but involve significant risks ai are beyond our control, which could cause our actual results to differ from those expressed in the forward looking statements. Such risks ar others, the ability of the parties to satisfy the conditions precedent and consummate the announced transactions; the ability of the parties with respect to the Hart-Scott-Rodino Antitrust Improvements Act and other applicable antitrust laws in a timely manner; the timing of cc transactions; the ability to implement the anticipated business plans following closing and achieve anticipated benefits and savings; the required third party consents; the ability of the Purchasers to secure the equity and debt financing required to consummate the announc estimated revenues, earnings, cash flow, charges and expenditures. Additional risks and uncertainties that could cause our actual results t the forward looking statements are identified in our reports filed with the SEC, including our Quarterly Reports on Form 10-Q, our Annual I Current Reports on Form 8-K. The forward looking statements included in this presentation are made only as of the date of this presentati undertake any obligation to update the forward looking statements to reflect subsequent events or circumstances.

Non-GAAP Figures

Management believes that the Non-GAAP financial measures (i.e. financial measures that are not computed in accordance with Generally / Principles) identified by an asterisk (*) used in this presentation or in other disclosures provide important perspectives into the Company's o The Company does not intend for the information to be considered in isolation or as a substitute for the related GAAP measures. Other con measures differently. Reconciliations from GAAP measures to the Non-GAAP measures are presented herein.

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Transaction Overview

Transaction Details	▪ Kaman enters definitive agreement to sell its Distribution seg Littlejohn & Co. for $700.0 million ▪ Anticipated net cash proceeds of approximately $600 million ▪ Purchase price represents 10.4x of Distributions TTM Adjuste
Timing	▪ Expected to close in Q3 2019 ▪ Subject to customary closing conditions and regulatory a ▪ Not subject to shareholder approval

Provides substantial financial flexibility to enha shareholder value and expand our engineered produc

Strategic Rationale

- Creates a competitive, differentiated company focused on products with a clear investment thesis
- Increases margin profile, unlocking value for shareholders
- Current market conditions create favorable timing for the sal
- Provides flexibility to pursue value-enhancing growth oppor meaningfully increase the scale of our engineered product bu

Market leading portfolio of engineered produc
supporting customers across a number of end m

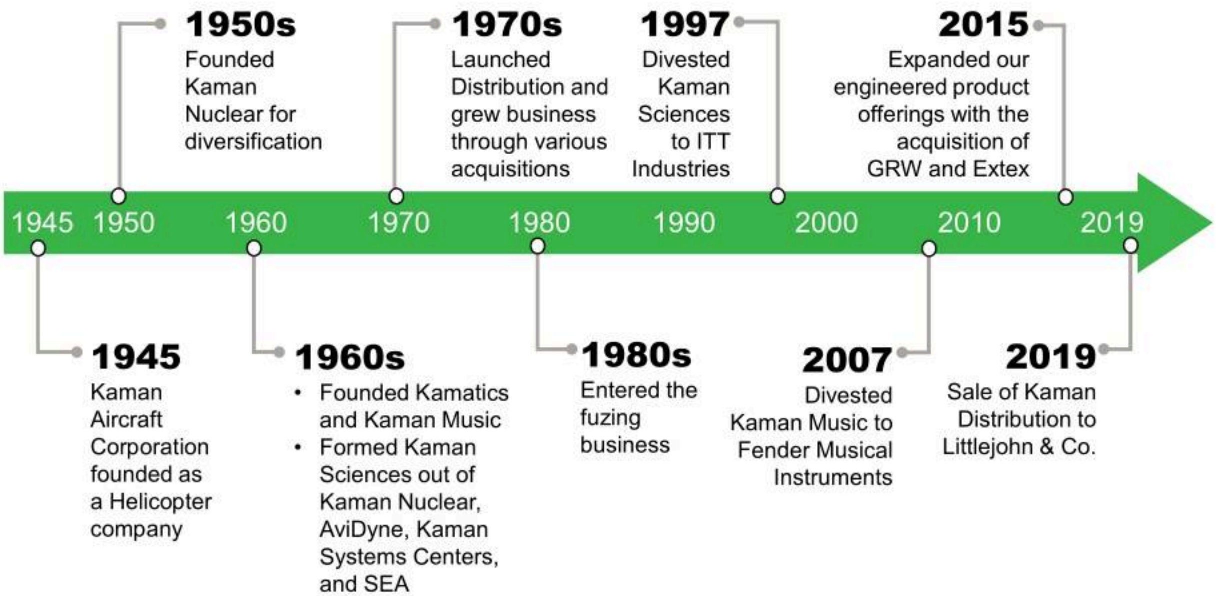
Use of Proceeds

- Further invest in our differentiated products
  - Proceeds provide "dry powder" for strategic acquisitions
  - Accelerate new product development
- De-lever and optimize the balance sheet
- Flexibility for additional return of capital to shareholders

Invest in Growth, Strengthen Financial Positio
Drive Shareholder Value

Overview of Kaman's History

Continued evolution of our Strategy; Focused on Growing with Highly Engineered Sol



2019 a

Kaman
leading er
product p
combinat
organic gr
M&A v
maximizin

…Moving Forward

Differentiated Products	Growth through Innovation	Strategic Capital Allocation	Foc S
Technologically differentiated product offering supported by strong end markets.	Accelerate internal investments driving growth through innovative products and technologies.	Invest in strategic expansion opportunities.	Eva str ef an E ar s $15 -

Highly Differentiated Products, Earning Higher Marg More Focused Capital Allocation Strategy

Questions

Non-GAAP Reconciliation

Adjusted Operating Income / Segment Adjusted EBITDA

Adjusted Operating Income is defined as operating income, less items that are not indicative of the operating perfc segments or corporate function for the period presented. Segment Adjusted EBITDA is defined as Adjusted Operatinc and Amortization. Management uses these measures to evaluate performance period over period, to analyze underlyin and to assess their performance relative to their competitors. We believe that this information is useful for investor seeking to analyze and compare companies on the basis of operating performance.

Distribution Segment (in thousands)		QTD March 29, 2019	YTD December 31, 2018	QTD March 3(2018
GAAP Operating Income		$12,697	$51,529	$
Restructuring and severance		-	655	
Adjusted Operating Income	a	$12,697	$52,184	$
Depreciation and Amortization	b	3,892	14,154	
Segment Adjusted EBITDA	a + b	$16,589	$66,338	$

Valuation Multiple				
Purchase price			$700,000	
Segment Adjusted EBITDA			$66,338	
Multiple			10.6x	

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Mergermarket

UCC-212

← Back

Ontic Engineering & Manufacturing Inc M&A Deal Profile

Acquirer CVC Capital Partners Divestor Signature Aviation plc Outright purchase Deal value USD 1.3bn (EUR 1.2bn) Completed | Fri, 01 Nov 2019

Proprietary

Ontic sale result of PE-heavy auction, sources say

08 Aug 2019 | 16:30 EDT

BBA Aviation [LON:BBA] ran a full sale process for **Ontic** that was attended heavily by financial sponsors, said two sources familiar with the matter.

Chatsworth, California-based Ontic is a provider of aviation parts and maintenance, repair and overhaul (MRO) services for the aerospace industry. The company was sold by BBA Aviation to **CVC Capital Partners** for an enterprise value of USD 1.365bn on 30 July. On the company's most recent earnings call on 5 August, CEO Mark Johnstone said the trailing twelve month EBITDA multiple of the deal was around 17x.

The company generated USD 68m of EBITDA off of USD 216m in revenue for 2018. BBA has said it expects Ontic to hit USD 100m of EBITDA by the end of 2021. Using these figures, the deal value, respectively, represents a 20x and 13.65x multiple.

One of the sources said in addition to CVC, **Veritas Capital** and **Berkshire Partners** also studied Ontic during the **Lazard**-led process.

Extant Aerospace, which was acquired by **TransDigm Group** [NYSE:TDG] last year for USD 525m, is a good comp for Ontic, said one of the sources. In the run up to the sale, this news service reported that Extant generated approximately USD 30m of EBITDA, suggesting a deal multiple in the high teens.

Last year, BBA Aviation acquired Firstmark, an aerospace focused aftermarket provider, for USD 97m as an addition to Ontic.

BBA has two major businesses: Ontic and Signature, its fixed base operation (FBO) operation. For 2018, Signature generated 90.6% of BBA's approximately USD 2.3bn revenue. Ontic accounted for the remainder.

Last year, BBA Aviation completed the strategic review of its Engine Repair and Overhaul (ERO) business and reclassified the business as held for sale. In a trading update issued in May, the company said "the ERO disposal process is ongoing and we expect to update the market in due course."

In 2018, this news service reported that BBA was exploring a sale for its Dallas Airmotive business, which is a part of ERO. The company was also reported to be working with Lazard. A deal was never announced.

JP Morgan Cazenove also acted as financial advisor alongside Lazard.

Lazard and BBA Aviation declined to comment. CVC Capital Partners, Veritas and Berkshire Partners did not return requests for comment.

by Richard Tekneci in New York and Claudia Montoto in Chicago

ION

Relevant Intelligence

ECM Pulse — Away we go: Galderma to follow Douglas off IPO start line in packed calendar until summer

an hour ago | Proprietary

DOUGLAS plans Frankfurt stock exchange IPO, targets EUR 1.1bn equity contribution

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7 hours ago

Lahi-Tapiola could be attempting takeover of Pihlajalinna - report (translated)

11 hours ago

Ahlsell to acquire Industrivarer AS

01 Mar 2024

Deoleo has received some 20 expressions of interest, CEO says (translated)

01 Mar 2024

APAC Event Driven Week in Review: CSR agrees to Saint-Gobain bid, Samsonite, KFC Holdings Japan, SoluM, Megaport on takeover radar, Tsuruha takes driver seat in Welcia/Aeon tie-up

29 Feb 2024 | Proprietary

CA Communications' telecom agency services division acquired by PE-backed UPSTACK

29 Feb 2024

Carlyle's Jagex sale to CVC, Haveli could spur more software exits – LTE Charts of the Week

29 Feb 2024 | Proprietary

Writable acquired by HMH (Veritas Capital)

28 Feb 2024

GEMS aims to raise more than USD 3bn in debt refinancing exercise ahead of CVC exit

28 Feb 2024 | Proprietary

Morning Flash AP (Australia): Altium/Renesas landmark deal; Zip, FleetPartners potential take-private; CVC's revised bid put APM in play

28 Feb 2024 | Proprietary

Allfunds's potential sale attracts interest of Euroclear, Brookfield - report (translated)

28 Feb 2024

SoluM draws interest from Avery Dennison, CVC - report (translated)

28 Feb 2024

Naturgy postpones planned business spinoff (translated)

28 Feb 2024

APM to grant CVC exclusive due diligence after receiving revised AUD 2.0/share indicative offer

27 Feb 2024

Hotelbeds works toward late 1H24 IPO, set to hire more banks– sources

27 Feb 2024 | Proprietary

CVC to move Multiversity to continuation fund amid minority stake sale rumours - report (translated)

26 Feb 2024

Douglas could announce IPO in the coming days - report (translated)

26 Feb 2024

Morning Flash: Legion calls on Twilio to sell Segment business, PPG continues to rejigger portfolio, Thomas H. Lee to take Agiliti private

26 Feb 2024 | Proprietary

ECM Pulse — Ready to rumble: Douglas to reopen European IPO season but some investors need convincing

26 Feb 2024 | Proprietary

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Exhibit 99.1

TransDigm to Acquire Esterline Technologies in $4 Billion All Cash Transaction

CLEVELAND and BELLEVUE, October 10, 2018 /PRNewswire/ -- TransDigm Group Incorporated (NYSE: TDG) and Esterline Technologies Corporation (NYSE:ESL) announced today that they have entered into a definitive agreement under which TransDigm will purchase all of the outstanding shares of common stock of Esterline for $122.50 per share in cash, which represents a premium of 38% to Esterline's closing price on October 9, 2018, or a total transaction value of approximately $4.0 billion including the assumption of debt. The transaction has been approved by the Boards of Directors of both companies. TransDigm expects the acquisition to be financed primarily through cash on hand and the incurrence of new term loans, and currently anticipates the acquisition to be modestly accretive to TransDigm's adjusted earnings per share within the first year of ownership.

The acquisition of Esterline expands TransDigm's platform of proprietary and sole source content for the aerospace and defense industries, including significant aftermarket exposure. Headquartered in Bellevue, Washington, Esterline is an industry leader in specialized manufacturing for these sectors with anticipated fiscal year 2018 revenue of approximately $2.0 billion. The company consists of 28 business units organized across eight platforms to deliver specialty aerospace, defense and industrial products. The company employs over 12,500 employees in more than 50 operating locations throughout the world.

Esterline has attractive platform positions in both the OEM and aftermarket and has substantial content on many important commercial aircraft variants, many regional and business jet aircraft and major defense platforms.

"We are pleased to have reached agreement to acquire a collection of businesses that fit well with our focused and consistent strategy," stated W. Nicholas Howley, TransDigm's Executive Chairman. "Esterline's core aerospace and defense business consists of primarily proprietary, sole source products with significant and growing aftermarket exposure. We view this as highly complementary to our existing business. We are confident that the combination of Esterline's leading positions and our proven track record of driving performance will enable us to deliver the private equity-like returns our investors have come to expect from this investment."

Kevin Stein, TransDigm's President and Chief Executive Officer stated, "We are excited to acquire Esterline's wide range of complementary products and see a path to create significant value for TransDigm shareholders, customers and stakeholders. Upon completion of the transaction, Bob Henderson, TransDigm's current Vice-Chairman, will oversee the integration and operations of Esterline. Mr. Henderson has been a key member of TransDigm's management team for close to 25 years and has overseen the integration of numerous acquisitions during this period, including our recent acquisition of Kirkhill from Esterline."

"Our combination with TransDigm delivers a compelling value for our shareholders," said Curtis Reusser, Chairman, President and Chief Executive Officer of Esterline. "I am pleased with the outcome of our thoughtful strategic review process, and we believe it is the best result for all Esterline stakeholders. I am very proud of the commitment and focus of our employees to serving the needs of our customers, and I am confident the combined companies will be well positioned to succeed in the global market we serve."

The acquisition will be financed through a combination of existing cash on hand of approximately $2 billion and the incurrence of new term loans. TransDigm has obtained commitments for the full amount of financing

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required for the transaction. Immediately upon closing, the combined company will maintain the financial flexibility to meet any anticipated operating, acquisition, and other opportunities that may arise though a combination of cash on hand, undrawn revolver, and under certain circumstances, additional availability under its credit agreement.

The transaction is subject to customary closing conditions, including Esterline stockholder approval and the receipt of required regulatory approvals. The companies expect to complete the transaction in the second half of calendar 2019.

Advisors

Morgan Stanley & Co. LLC acted as financial advisor to TransDigm. Wachtell, Lipton, Rosen & Katz and Baker & Hostetler LLP acted as TransDigm's lead legal counsel. Goldman Sachs & Co. LLC acted as financial advisor to Esterline and Evercore Group L.L.C. served as advisor to Esterline's Board of Directors. Skadden, Arps, Slate, Meagher & Flom served as legal counsel to Esterline.

Conference Call

TransDigm will hold a conference call to discuss this announcement beginning at 10:45 a.m. ET Wednesday, October 10. To join the call, dial (888) 558-9538 and enter the passcode 5278399. International callers should dial (760) 666-3183 and use the same passcode. A slideshow accompanying the presentation will be posted to http://www.transdigm.com prior to the call. A telephone replay will be available for one week by dialing (855) 859-2056 and entering the pass code 5278399. International callers should dial (404) 537-3406 and use the same passcode.

About TransDigm Group

TransDigm Group Incorporated, through its wholly-owned subsidiaries, is a leading global designer, producer and supplier of highly engineered aircraft components for use on nearly all commercial and military aircraft in service today. Major product offerings, substantially all of which are ultimately provided to end-users in the aerospace industry, include mechanical/electro-mechanical actuators and controls, ignition systems and engine technology, specialized pumps and valves, power conditioning devices, specialized AC/DC electric motors and generators, NiCad batteries and chargers, engineered latching and locking devices, rods and locking devices, engineered connectors and elastomers, cockpit security components and systems, specialized cockpit displays, aircraft audio systems, specialized lavatory components, seatbelts and safety restraints, engineered interior surfaces and related components, lighting and control technology, military personnel parachutes, high performance hoists, winches and lifting devices, and cargo loading, handling and delivery systems.

About Esterline

Esterline Corporation is a leading worldwide supplier to the aerospace and defense industry specializing in three core business segments: Advanced Materials; Avionics & Controls; and Sensors & Systems.

Operations within the Advanced Materials segment focus on technologies including high-temperature-resistant materials and components used for a wide range of military and commercial aerospace purposes, and combustible ordinance and electronic warfare countermeasure products.

Operations within the Avionics & Controls segment focus on technology interface systems for commercial and military aircraft and similar devices for land- and sea-based military vehicles, integrated cockpit systems, display technologies for avionics, training and simulation markets, secure communications systems, specialized medical equipment, and other high-end industrial applications.

The Sensors & Systems segment includes operations that produce high-precision temperature and pressure sensors, specialized harsh-environment connectors, electrical power distribution equipment, and other related systems principally for aerospace and defense customers.

Forward-Looking Statements

Statements in this press release which are not historic facts are forward-looking statements under the provisions of the Private Securities Litigation Reform Act of 1995, including but not limited to expectations of Esterline's future performance, profitability, growth and earnings; expectations of TransDigm's earnings per share and the financial impact of the proposed transaction; the financing of the proposed transaction; and the timing of the proposed transaction. All statements other than statements of historical fact that address activities, events or developments that we expect, believe or anticipate will or may occur in the future are forward-looking statements, including, in particular, statements about our plans, objectives, strategies and prospects regarding, among other things, the acquired business. We have identified some of these forward-looking statements with words like "believe," "may," "will," "should," "expect," "intend," "plan," predict," "anticipate," "estimate" or "continue" and other words and terms of similar meaning. All forward-looking statements involve risks and uncertainties which could affect TransDigm's actual results and could cause its actual results or the benefits of the proposed transaction to differ materially from those expressed in any forward-looking statements made by, or on behalf of TransDigm. These risks and uncertainties include, but are not limited to, closing conditions to the proposed transaction may not be achieved, the occurrence of any event, change or other circumstance that could give rise to the termination of the Merger Agreement, the effect of the announcement or pendency of the proposed transaction on the TransDigm's and Esterline's business relationships, operating results and business generally, risks related to diverting management's attention from ongoing business operations, the outcome of any legal proceedings that may be instituted related to the Merger Agreement or the proposed transaction, unexpected costs, charges or expenses resulting from the proposed transaction, Esterline's actual financial results for the year ended September 28, 2018 may differ from expected results, TransDigm may have difficulty obtaining required approvals, TransDigm may have difficulty implementing its strategic value drivers, and TransDigm may be impacted by the effects of general economic and industry conditions. Except as required by law, TransDigm undertakes no obligation to revise or update the forward-looking information contained in this press release.

Additional Information and Where to Find It

This communication is being made in respect of the proposed transaction involving Transdigm and Esterline. In connection with the proposed transaction, Esterline intends to file relevant materials with the Securities and Exchange Commission (the "SEC"), including a preliminary proxy statement on Schedule 14A. Promptly after filing its definitive proxy statement with the SEC, Esterline will mail the definitive proxy statement and a proxy card to each stockholder of Esterline entitled to vote at the stockholder meeting relating to the proposed transaction. This communication is not a substitute for the proxy statement or any other document that Esterline may file with the SEC or send to its stockholders in connection with the proposed transaction. BEFORE MAKING ANY VOTING DECISION, STOCKHOLDERS OF ESTERLINE ARE URGED TO READ THESE MATERIALS (INCLUDING ANY AMENDMENTS OR SUPPLEMENTS THERETO) AND ANY OTHER RELEVANT DOCUMENTS IN CONNECTION WITH THE PROPOSED TRANSACTION THAT ESTERLINE WILL FILE WITH THE SEC WHEN THEY BECOME AVAILABLE BECAUSE THEY WILL CONTAIN IMPORTANT INFORMATION ABOUT ESTERLINE AND THE PROPOSED TRANSACTION. The definitive proxy statement, the preliminary proxy statement and other relevant materials in connection with the proposed transaction (when they become available), and any other documents filed by Esterline with the SEC, may be obtained free of charge at the SEC's website (http://www.sec.gov) or at Esterline's website (http://www.esterline.com/) or by contacting Esterline's Investor Relations at 500 108th Avenue NE, Suite 1500, Bellevue, Washington 98004, or by calling (425) 453-9400.

Participants in the Solicitation

Esterline and TransDigm and their respective directors and executive officers may be deemed to be participants in the solicitation of proxies from Esterline's stockholders with respect to the proposed transaction. Information about Esterline's directors and executive officers and their ownership of Esterline's common stock is set forth in its proxy statement for its 2018 Annual Meeting of Stockholders which was filed with the SEC on December 27, 2017, and its Annual Report on Form 10-K for the fiscal year ended September 29, 2017, which was filed with the SEC on November 21, 2017, and the Amendment No. 1 on Form 10-K/A, which was filed with the SEC on March 30, 2018. Information about TransDigm's directors and executive officers is set forth in its proxy statement for its 2018 Annual Meeting of Stockholders and its most recent Annual Report on Form 10-K. These documents may be obtained for free at the SEC's website at www.sec.gov. Additional information regarding the potential participants, and their direct or indirect interests in the proposed transaction, by security holdings or otherwise, will be set forth in the proxy statement and other materials to be filed with SEC in connection with the proposed transaction.

Contact:	TransDigm Liza Sabol Director of Investor Relations (216) 706-2945 ir@transdigm.com	Esterline John Hobbs Sr. Director, Investor Relations (425) 453-9400

UNITED STATES
SECURITIES AND EXCHANGE COMMISSION
WASHINGTON, D.C. 20549

FORM 10-K

☑ ANNUAL REPORT PURSUANT TO SECTION 13 OR 15(d) OF THE SECURITIES EXCHANGE ACT OF 1934

For the fiscal year ended September 28, 2018.

OR

☐ TRANSITION REPORT PURSUANT TO SECTION 13 OR 15(d) OF THE SECURITIES EXCHANGE ACT OF 1934

For the transition period from ___________to ___________

Commission file number 1-6357

ESTERLINE TECHNOLOGIES CORPORATION

(Exact name of registrant as specified in its charter)

Delaware	13-2595091
(State or other jurisdiction of incorporation or organization)	(I.R.S. Employer Identification No.)

500 108th Avenue N.E., Bellevue, Washington 98004
(Address of principal executive offices)(Zip Code)

Registrant's telephone number, including area code (425) 453-9400

Securities registered pursuant to Section 12(b) of the Act:

Title of each class	**Name of each exchange on which registered**
Common Stock ($.20 par value)	New York Stock Exchange

Securities registered pursuant to Section 12(g) of the Act: None

Indicate by check mark if the registrant is a well-known seasoned issuer, as defined in Rule 405 of the Securities Act. Yes ☑ No ☐

Indicate by check mark if the registrant is not required to file reports pursuant to Section 13 or Section 15(d) of the Act. Yes ☐ No ☑

Indicate by check mark whether the registrant: (1) has filed all reports required to be filed by Section 13 or 15(d) of the Securities Exchange Act of 1934 during the preceding 12 months (or for such shorter period that the Registrant was required to file such reports), and (2) has been subject to such filing requirements for the past 90 days. Yes ☑ No ☐

Indicate by check mark whether the registrant has submitted electronically, every Interactive Data File required to be submitted pursuant to Rule 405 of Regulation S-T (§232.405 of this chapter) during the preceding 12 months (or for such shorter period that the registrant was required to submit such files). Yes ☑ No ☐

Indicate by check mark if disclosure of delinquent filers pursuant to Item 405 of Regulation S-K is not contained herein, and will not be contained, to the best of registrant's knowledge, in definitive proxy or information statements incorporated by reference in Part III of this Form 10-K or any amendment to this Form 10-K. ☑

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Indicate by check mark whether the registrant is a large accelerated filer, an accelerated filer, a non-accelerated filer, smaller reporting company, or an emerging growth company. See definitions of "accelerated filer," "large accelerated filer," "smaller reporting company," and "emerging growth company" in Rule 12b-2 of the Exchange Act.

Large accelerated filer	☑	Accelerated filer	☐
Non-accelerated filer	☐	Smaller reporting company	☐
Emerging growth company	☐		

If an emerging growth company, indicate by check mark if the registrant has elected not to use the extended transition period for complying with any new or revised financial accounting standards provided pursuant to Section 13(a) of the Exchange Act. ☐

Indicate by check mark whether the registrant is a shell company (as defined in Rule 12b-2 of the Exchange Act). Yes ☐ No ☑

As of November 15, 2018, 29,495,076 shares of the Registrant's common stock were outstanding. The aggregate market value of shares of common stock held by non-affiliates as of March 30, 2018, was $2,152,587,537 (based upon the closing sales price of $73.15 per share).

Documents Incorporated by Reference

Part III incorporates information by reference to the registrant's definitive proxy statement, to be filed with the Securities and Exchange Commission within 120 days after the close of the fiscal year ended September 28, 2018.

PART I

This Report includes a number of forward-looking statements that reflect the Company's current views with respect to future events and financial performance. Please refer to the section addressing forward-looking information on page 10 for further discussion. In this report, "we," "our," "us," "Company," and "Esterline" refer to Esterline Technologies Corporation and subsidiaries, unless otherwise noted or context otherwise indicates.

Item 1. Business

General

Esterline, a Delaware corporation formed in 1967, is a leading specialized manufacturing company principally serving aerospace and defense customers. We design, manufacture and market highly engineered products and systems for application within the industries we serve. The Company's year-end is the twelve-month period ending the last Friday of September of each year.

Proposed Acquisition by TransDigm Group Incorporated

On October 9, 2018, the Company entered into an Agreement and Plan of Merger (as amended, the "Merger Agreement") with TransDigm Group Incorporated, a Delaware corporation ("TransDigm"), and Thunderbird Merger Sub Inc., a Delaware corporation and wholly owned subsidiary of TransDigm ("Merger Sub"). Upon the terms and subject to the conditions set forth in the Merger Agreement, at the closing, Merger Sub will merge with and into the Company, with the Company continuing as the surviving corporation in the merger and as a wholly owned subsidiary of TransDigm (the "Merger"). The parties anticipate that the Merger will be consummated in 2019.

Pursuant to the Merger Agreement, at the effective time of the Merger (the "Effective Time"), each share of our common stock, par value $0.20 per share, issued and outstanding immediately prior to the Effective Time (other than (A) shares held (i) in the Company's treasury, (ii) by the Company or any wholly owned subsidiary of the Company or (iii) by TransDigm, Merger Sub or any other direct or indirect wholly owned subsidiary of TransDigm, (B) certain equity awards, or (C) shares owned by shareholders who are entitled to demand and have properly exercised and perfected appraisal rights under the General Corporation Law of the State of Delaware and have not failed to perfect, nor effectively withdrawn or lost rights to appraisal, which in each case will be treated as described in the Merger Agreement) will be converted into the right to receive $122.50 per share in cash, without interest and subject to any withholding taxes.

Consummation of the Merger is subject to certain customary conditions, including, without limitation: (i) the adoption of the Merger Agreement and approval of the Merger by the Company's shareholders; (ii) the expiration or termination of the applicable waiting period under the Hart-Scott-Rodino Antitrust Improvements Act of 1976, as amended; (iii) the receipt of other required regulatory or foreign investment approvals; and (iv) the absence of any judgement or law that has the effect of enjoining or otherwise prohibiting the consummation of the Merger and the other transactions contemplated by the Merger Agreement. Each party's obligation to consummate the Merger is subject to certain other conditions, including the accuracy of the other party's representations and warranties and the other party's compliance with its covenants and agreements contained in the Merger Agreement (in each case, subject to certain qualifications). Each party must use its reasonable best efforts to take actions necessary to satisfy the regulatory conditions, and the Merger Agreement includes a commitment by TransDigm to obtain applicable consents and approvals under antitrust laws and assume the risks related to certain conditions and requirements that may be imposed by regulators in connection with securing such consents and approvals up to specified thresholds and limitations.

The parties to the Merger Agreement have each made customary representations and warranties in the Merger Agreement. The Company has agreed to certain covenants, including with respect to, among other things, the operation of the business of the Company and its subsidiaries prior to the closing. In addition, the Merger Agreement contains a provision prohibiting the Company from initiating or knowingly encouraging, or facilitating any proposal, offer or indication of interest (whether or not in writing) from any person that would be an alternative transaction to the Merger and, subject to a customary "fiduciary out" exception regarding the Board's ability to exercise its fiduciary duties, providing non-public information in connection with,and engaging in discussions or negotiations regarding, unsolicited alternative acquisition proposals.

The Merger Agreement includes termination provisions for both the Company and TransDigm. Under the Merger Agreement, the Company may be required to pay a termination fee of $128,855,000 if the Merger Agreement is terminated under certain circumstances described in the Merger Agreement, including if the Company terminates the Merger Agreement, prior to receiving shareholder approval, in order to enter into a definitive acquisition agreement regarding an alternative acquisition proposal.

Certain terms of the Merger Agreement are summarized in this Annual Report on Form 10-K, and the foregoing description of the Merger Agreement is qualified in its entirety by reference to the full text of the Merger Agreement and the First Amendment to the

Merger Agreement, which have been filed as exhibits to the Company's Current Reports on Form 8-K filed with the SEC on October 10, 2018, and October 11, 2018, respectively.

Development of Business

Our current business and strategic plan focuses on continued development of our products principally for aerospace and defense markets in three key technology segments: Avionics & Controls, Sensors & Systems, and Advanced Materials. Our products are often mission critical and have been designed into particular military and commercial platforms. The rigorous testing and certification processes many of these products must complete before they enter service create a significant barrier to entry for competing products in each specific platform. We are concentrating our efforts to expand our capabilities in the aerospace and defense markets. We do so with a level of customer intimacy that allows us to anticipate the global needs of our customers and respond with products and comprehensive solutions that meet their needs. These efforts focus on continuous research guided by product development roadmaps we develop in consultation with our customers, the strategic alignment of operations to leverage and expand our capabilities as a trusted supplier to our customers across the breadth of our product offerings.

Our products have a long history in the aerospace and defense industry and are found on most military and commercial aircraft, helicopters, and many land-based systems. For example, our products are used on the majority of active and in-production U.S. military aircraft and on every Boeing commercial aircraft platform manufactured in the past 75 years. In addition, our products are supplied to Airbus, many of the major regional and business jet manufacturers, and the major aircraft engine manufacturers. We work closely with OEMs on new, highly engineered products with the objective of such products becoming designed into our customers' platforms; this integration often results in sole-source positions for OEM production and aftermarket business. We broadly categorize our commercial and military aerospace aftermarket sales as retrofit, repair services, and spare parts. Spare parts alone made up approximately 12% of total sales in fiscal 2018. Retrofit and repair services, which represent 3% of total sales in fiscal 2018, carry higher margins than OEM sales but lower margins than spare parts sales. In many cases, our aftermarket sales span the entire life of an aircraft.

We differentiate ourselves through our engineering and manufacturing capabilities and our reputation for safety, quality, on-time delivery, reliability, and innovation – all embodied in the Esterline Operating System. This systematic approach to our business helps ensure all employees are focused on continuous improvement, teamwork, a safe work environment and compliance. Safety of our operations is a critical factor in our business, and accordingly, we train our employees using a behavior-based approach that focuses on safety-designed work habits and on-going safety audits. Our industries are highly regulated, and compliance with applicable regulations, including export control and anti-bribery regulations, is an important focus in our business. We have a global code of business conduct and ethics, and we provide corporate-wide training and maintain local ethics advisors and export control specialists in our business units to support our compliance efforts.

Our sales are diversified across three broad markets: defense, commercial aerospace and general industrial. For fiscal 2018, approximately 30% of our sales were from the defense market, 45% from the commercial aerospace market, and 25% from the general industrial market.

Financial Information About Industry Segments

A summary of net sales to unaffiliated customers, operating earnings and identifiable assets attributable to our business segments for fiscal 2018, 2017, and 2016 is reported in Note 17 to the Company's Consolidated Financial Statements under Item 8 of this report.

Description of Business

Avionics & Controls

Our Avionics & Controls business segment includes avionics systems, control and communication systems, and interface technologies capabilities. Avionics systems designs, develops and integrates cockpit avionics solutions as well as providing visualization solutions for commercial and defense applications. Control and communication systems designs and manufactures technology interface solutions for military and commercial aircraft and land- and sea-based military vehicles. Interface technologies manufactures and develops custom control panels and input systems for medical, industrial, military and gaming industries.

We are a market leader in global positioning systems (GPS), head-up displays, enhanced vision systems, flight management systems, touchscreen display solutions and secure communication systems, all of which are used in a broad variety of applications. In addition, we develop, manufacture and market sophisticated, highly reliable component systems including lighted push-button and rotary switches, keyboards, lighted indicators, panels and displays.

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Our products have been integrated into many existing aircraft designs, including every Boeing commercial aircraft platform currently in production. We are a Tier 1 supplier on the Boeing 787 and 777X programs to design and manufacture all of the cockpit overhead panels and embedded software for these systems. We provide high-quality and affordable visual display solutions to the air traffic control, naval, ground vehicles and unmanned systems and simulation and training markets. Our simulation and training solutions include a 360-degree rear projection display that offers high contrast and resolution and various types of large field-of-view collimated displays, and a deployable display with a roll-up, seamless spherical screen. We manufacture control sticks, grips and wheels, as well as specialized switching systems. In this area we primarily serve commercial and military aviation and ground-based military equipment manufacturing customers. For example, we are a leading manufacturer of pilot control grips for most types of military fighter jets and helicopters. Additionally, our software engineering center supports our customers' needs with applications such as flight management systems, air data computers and engine control systems.

Our proprietary products meet critical operational requirements and provide customers with significant technological advantages in areas such as night vision compatibility and active-matrix liquid-crystal displays (a technology enabling pilots to read display screens in a variety of light conditions as well as from extreme angles). Our products are incorporated in a wide variety of platforms ranging from military helicopters, fighters and transports, to commercial wide- and narrow-body, regional and business jets. In fiscal 2018 some of our largest customers for these products included Airbus, BAE Systems, The Boeing Company, Bombardier, Honeywell, L3 Technologies, Leonardo, Lockheed Martin, Pilatus, Rockwell Collins, Textron, Thales, Triman, and the U.S. Department of Defense (DoD).

In addition, we design and manufacture ruggedized military personal communication equipment, primarily headsets, handsets and field communications. We are the sole supplier of Active Noise Reduction (ANR) headsets to the British Army's tracked and wheeled vehicle fleets under the Bowman communication system program. We also supply ANR headsets to the U.S. Army's tracked and wheeled vehicle fleets. Additionally, we are the primary ANR headset supplier to the Canadian Army and have a long-standing relationship with various allied armies around the world. In fiscal 2018 some of our largest customers for these products included The Boeing Company, Lockheed Martin, NATO Supply Procurement Agency, and the U.S. Department of Defense (DoD).

We also manufacture a full line of keyboard, switch and input technologies for specialized medical equipment, high-tech gaming applications, and communication systems for military applications. These products include custom keyboards, keypads, and input devices that integrate cursor control devices, barcode scanners, displays, video, and voice activation and touch screens. We also produce medical instruments that are used for point-of-use and point-of-care diagnostics. We have developed a wide variety of technologies, including plastic and vinyl membranes that protect high-use switches and fully depressible buttons, and backlit elastomer switch coverings that are resistant to exposure from harsh chemicals. These technologies now serve as the foundation for a small but growing portion of our product line. In fiscal 2018 some of our largest customers for these products included Allegion, Aristocrat Technologies, General Electric, Nuance, Philips, and Stat-Diagnostica.

Sensors & Systems

Our Sensors & Systems business segment includes power systems, connection technologies and advanced sensors capabilities. We develop and manufacture high-precision temperature, pressure and speed sensors principally in aerospace customers, electrical interconnect systems for severe environments for aerospace, defense, geophysics & marine, rail, and nuclear customers, as well as electrical power switching, control and data communication devices, and other related systems principally for aerospace and defense customers. We are the sole-source and aftersales supplier of temperature probes for use on all versions of the General Electric/Snecma CFM-56 jet engine. The CFM-56 jet engine has an installed base of over 30,000, and is standard equipment on the Next-Generation Boeing 737 aircraft and approximately 60% of Airbus aircraft. We manufacture sensors for the environmental control system for Boeing 787 aircraft, and provide the primary power distribution assembly for the Embraer E-2 commercial jet, Mitsubishi Regional Jet, and the Airbus A400M military transport. Additionally, we have a Tier 1 position with Rolls-Royce for a large suite of sensors for the engines that power the A400M and A350. We design and manufacture interconnect solutions for harsh environments, including connectors, backshells, conduits, planet probe interconnectors, launcher umbilicals and fiber optics. We also design and manufacture composite connectors for the Boeing 787. The principal customers for our products in this business segment are jet engine manufacturers, airframe and industrial manufacturers. In fiscal 2018 some of our largest customers for these products included Airbus, BJG Electronics, The Boeing Company, Bombardier, Celestica, Flame, General Electric, Jupitor, Lufthansa, Northrop Grumman, Rolls-Royce, Safran, Stork, TTI, Inc., and United Technologies Corporation (UTC) Aerospace Systems.

Advanced Materials

Our Advanced Materials business segment includes engineered materials and defense technologies capabilities. We develop and manufacture a wide array of high-performance clamping and fastening devices used in a range of commercial aerospace, space and military applications, and highly engineered thermal components for commercial aerospace and industrial applications. We also develop and manufacture combustible ordnance and countermeasures for military applications.

Specialized High-Performance Applications. Our elastomer products are engineered to address specific customer requirements where superior performance in high temperature, high pressure, caustic, abrasive and other difficult environments is critical. These products include clamping devices and thermal fire barrier insulation products. Some of the products include proprietary elastomers that are specifically designed for use on or near a jet engine. In fiscal 2018 some of the largest customers for these products included The Boeing Company, KLX Aerospace Solutions, and Wesco. On March 15, 2018, we sold the assets and certain liabilities of the Kirkhill business to TransDigm, Inc.

We also develop and manufacture high temperature, lightweight metallic insulation systems for aerospace and marine applications. Our commercial aerospace programs include the Boeing 737, Airbus A320 and A380 series aircraft, the International Aero Engines V2500, and Rolls-Royce BR710 engines. Our insulation material is used on diesel engine manifolds for earthmoving and agricultural applications. In addition, we specialize in the development of thermal protection for fire, nuclear, and petro-chemical industries. We design and manufacture high temperature components for industrial and marine markets. Our manufacturing processes consist of cutting, pressing, and welding stainless steel, inconel, and titanium fabrications. In fiscal 2018 some of the largest customers of these products included Airbus, Rolls-Royce, and Spirit AeroSystems.

Ordnance and Countermeasure Applications. We develop and manufacture combustible ordnance and warfare countermeasure devices for military customers. We manufacture molded fiber cartridge cases, mortar increment casings, igniter tubes and other combustible ordnance components primarily for the DoD. We are currently the sole supplier of combustible casings utilized by the U.S. Armed Forces. Sales are made either directly to the DoD or through prime contractors and General Dynamics. These products include the combustible case for the U.S. Army's new generation 155mm Modular Artillery Charge System, the 120mm combustible case used with the main armament system on the U.S. Army and Marine Corps' M1-A1/2 tanks, and the 60mm, 81mm and 120mm combustible mortar increments. We were selected as the exclusive provider of high- and low-velocity payloads for 40mm infrared training rounds. We are one of two suppliers to the U.S. Army of infrared decoy flares used by aircraft to help protect against radar and infrared guided missiles. We are currently the only supplier to the U.S. Army of chaff countermeasures against radar-based threats. In fiscal 2018, in addition to the DoD, some of the largest customers of these products included General Dynamics and Mason & Hanger Group.

A summary of product lines contributing sales of 10% or more of total sales for fiscal 2018, 2017, and 2016 is reported in Note 17 to the Consolidated Financial Statements under Item 8 of this report.

Marketing and Distribution

We believe that a key to continued success is our ability to meet customer requirements both domestically and internationally. We have and will continue to improve our worldwide sales and distribution channels in order to provide wider market coverage and to improve the effectiveness of our customers' supply chain. For example, our medical device assembly operation in Shanghai, China, serves our global medical customers, our service center in Singapore improves our capabilities in Asia for our temperature sensor customers, and our engineering and marketing offices in Bangalore, India, facilitate marketing opportunities in India. Other enhancements include combining sales and marketing forces of our operating units where appropriate, cross-training our sales representatives on multiple product lines, and cross-stocking our spares and components.

In the technical and highly engineered product segments in which we compete, relationship selling is particularly important in targeted marketing segments where customer and supplier design and engineering inputs need to be tightly integrated. Participation in industry trade shows is an effective method of meeting customers, introducing new products, and exchanging technical specifications. In addition to technical and industry conferences, our products are supported through direct internal international sales efforts, as well as through manufacturer representatives and selected distributors. As of September 28, 2018, 351 sales people, 225 representatives, and 290 distributors supported our operations.

Backlog

Backlog was $1.5 billion at September 28, 2018, and $1.3 billion at September 29, 2017. We estimate that approximately $466 million of backlog is scheduled to be shipped after fiscal 2019.

Backlog is subject to cancellation until delivered, and therefore, we cannot assure that our backlog will be converted into revenue in any particular period or at all. Except for the released portion, backlog also does not include fixed-price, multi-year contracts.

Competition

Our products and services are affected by varying degrees of competition. We compete with other companies in most markets we serve. Many of these companies have far greater sales volumes and financial resources than we do. Some of our competitors are also our customers or suppliers on certain programs. The principal competitive factors in the commercial markets in which we participate are customer intimacy, product performance, on-time delivery performance, quality, service and price. Part of product performance requires expenditures in research and development that lead to product improvement. The market for many of our products may be affected by rapid and significant technological changes and new product introductions. Our principal competitors include Astronautics, BAE, Bose, Eaton, Elbit, EMS, Essex Industries, GE Aerospace, Honeywell, IAI, L-3, Otto Controls, RAFI, SELEX, Telephonics, Thales, Ultra Electronics, United Technologies Corporation, Universal Avionics Systems Corporation, and Zodiac in our Avionics & Controls segment; Ametek, Amphenol, Eaton, Meggitt, STPI-Deutsch, TE Connectivity, Woodward and Zodiac in our Sensors & Systems segment; and Alloy Surfaces, AMTEC, Chemring, Doncasters, Hi-Temp, J&M, JPR Hutchinson, Kmass, Meggitt (including Dunlop Standard Aerospace Group), Rheinmetall, Trelleborg, ULVA, UTC Aerospace Systems, UMPCO, and Woodward Products in our Advanced Materials segment.

Research and Development

Our product development and design programs utilize an extensive base of professional engineers, technicians and support personnel, supplemented by outside engineering and consulting firms when needed. In fiscal 2018 we expended $90.9 million for research, development and engineering, compared with $109.8 million in fiscal 2017 and $99.7 million in fiscal 2016, net of customer and government funding. Research and development expense has averaged 5.0% of sales per year for the three years ended September 28, 2018. In fiscal 2018 research and development expense was 4.5% of sales. We believe continued product development is key to our long-term growth, and consequently, we consistently invest in research and development. Examples include research and development projects relating to avionics displays, power systems, and controls. We actively participate in customer-funded research and development programs.

Foreign Operations

Our foreign operations consist of manufacturing facilities located in Belgium, Canada, China, the Dominican Republic, France, Germany, India, Mexico, Morocco, and the United Kingdom, and include sales and service operations located in Brazil, China, and Singapore. For further information regarding foreign operations, see Note 17 to the Consolidated Financial Statements under Item 8 of this report.

U.S. Government Contracts and Subcontracts

As a contractor and subcontractor to the U.S. government (primarily the DoD), we are subject to various laws and regulations that are more restrictive than those applicable to private sector contractors. Approximately 6% of our sales was made directly to the U.S. government in fiscal 2018. In addition, we estimate that our subcontracting activities to contractors for the U.S. government accounted for approximately 15% of sales during fiscal 2018. In total, we estimate that approximately 21% of our sales during the fiscal year were subject to U.S. government contracting regulations. Such contracts may be subject to termination, reduction or modification in the event of changes in government requirements, reductions in federal spending, and other factors.

Historically, our U.S. government contracts and subcontracts have been predominately fixed-price contracts. Generally, fixed-price contracts offer higher margins than cost-plus contracts in return for accepting the risk that increased or unexpected costs may reduce anticipated profits or cause us to sustain losses on the contracts. The accuracy and appropriateness of certain costs and expenses used to substantiate our direct and indirect costs for the U.S. government under both cost-plus and fixed-price contracts are subject to extensive regulation and audit by the Defense Contract Audit Agency, an arm of the DoD. The contracts and subcontracts to which we are a party are also subject to profit and cost controls and standard provisions for termination at the convenience of the U.S. government. Upon termination, other than for our default, we will normally be entitled to reimbursement for allowable costs and to an allowance for profit.

Trade Compliance Regulations

We are subject to U.S. export laws and regulations, including the U.S. Export Administration Regulations (EAR) and International Traffic in Arms Regulations (ITAR), that generally restrict the export of defense products, technical data, and defense services. In March 2014 we entered into a Consent Agreement with the U.S. Department of State's Directorate of Defense Trade Controls Office of Defense Trade Controls Compliance (DTCC) to resolve alleged ITAR civil violations. The Consent Agreement was closed in fiscal 2017.

Our trade activities are also subject to customs and border control regulations, anti-bribery and anti-corruption regulations, and regulations that apply to supply chain activities, such as those relating to conflict minerals and the registration, evaluation, authorization and restriction of chemicals, as well as the defense federal acquisition regulations. Our failure to comply with applicable regulations could result in penalties, loss, or suspension of contracts, breach of contract claims, or other consequences, and the costs to maintain compliance with these regulations may be higher than we anticipate. Any of these consequences could adversely affect our operations or financial condition.

Intellectual Property

Although we hold a number of patents and licenses, we do not believe that our operations are dependent on our patents and licenses. We have trademark registrations on our important business names and/or product names filed in key jurisdictions where our businesses operate and sell products. In general, we rely on technical superiority, continual product improvement, exclusive product features, lean manufacturing and operational excellence, including superior lead time, on-time delivery performance and quality, and customer relationships to maintain competitive advantage.

Seasonality

The timing of our revenues is impacted by the purchasing patterns of our customers, and as a result we do not generate revenues evenly throughout the year. Moreover, our first fiscal quarter, October through December, includes significant holiday vacation periods in both Europe and North America. This leads to decreased order and shipment activity; consequently, first quarter results are typically weaker than other quarters and not necessarily indicative of our performance in subsequent quarters. Our year-end is the twelve month period ending the last Friday of September of each year.

Sources and Availability of Raw Materials and Components

The sources and availability of certain raw materials and components are not as critical as they would be for manufacturers of a single product line, due to our vertical integration and diversification. However, certain components, supplies and raw materials for our operations are purchased from single sources. In such instances, we strive to develop alternative sources and design modifications to minimize the effect of business interruptions.

Environmental Matters

We are subject to federal, state, local and foreign laws, regulations and ordinances that (i) govern activities or operations that may have adverse environmental effects, such as discharges to air and water, as well as handling and disposal practices for solid and hazardous waste, and (ii) impose liability for the costs of cleaning up, and certain damages resulting from, sites or past spills, disposals or other releases of hazardous substances.

At various times we have been identified as a potentially responsible party pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), and analogous state environmental laws, for the cleanup of contamination resulting from past disposals of hazardous wastes at certain sites to which we, among others, sent wastes in the past. CERCLA requires potentially responsible persons to pay for cleanup of sites from which there has been a release or threatened release of hazardous substances. Courts have interpreted CERCLA to impose strict, joint and several liability on all persons liable for cleanup costs. As a practical matter, however, at sites where there are multiple potentially responsible persons, the costs of cleanup typically are allocated among the parties according to a volumetric or other standard.

We have accrued liabilities for environmental remediation costs expected to be incurred. Environmental exposures are provided for at the time they are known to exist or are considered probable and estimable.

Employees

We had 12,609 employees at September 28, 2018, of which 3,995 were based in the United States, 4,445 in Europe, 1,555 in Mexico, 910 in Canada, 816 in the Middle East and Asia, 693 in Morocco, and 195 in the Dominican Republic. Approximately 17% of the U.S.-based employees were represented by labor unions. Our non-U.S. operations are subject to union and national trade union agreements and to local regulations governing employment.

Financial Information About Foreign and Domestic Operations and Export Sales

See risk factor below entitled "Political and economic changes in foreign countries and markets, including foreign currency fluctuations, may have a material effect on our operating results" under Item 1A of this report and Note 17 to the Consolidated Financial Statements under Item 8 of this report.

Available Information About the Registrant

You can access financial and other information on our website, www.esterline.com. We make available through our website, free of charge, copies of our annual report on Form 10-K and Form 10-K/A, quarterly reports on Form 10-Q, current reports on Form 8-K and amendments to those reports filed or furnished pursuant to Section 13(a) or Section 15(d) of the Securities Exchange Act of 1934, as amended (the "Exchange Act"), as soon as reasonably practicable after filing such material electronically or otherwise furnishing it to the Securities and Exchange Commission (SEC). The SEC also maintains a website at www.sec.gov, which contains reports, proxy and information statements, and other information regarding public companies, including Esterline. Any reports filed with the SEC may also be obtained from the SEC's Reference Room at 100 F Street, NE, Washington, DC 20549. Our Corporate Governance Guidelines, charters for our required board committees, and our Code of Business Conduct and Ethics, which includes a code of ethics applicable to our accounting and financial employees, including our Chief Executive Officer and Chief Financial Officer, are available on our website, www.esterline.com on the Corporate Governance tab. Both of these documents are also available in print (at no charge) to any shareholder upon request. Our website and the information contained therein or connected thereto are not incorporated by reference into this Form 10-K.

Executive Officers of the Registrant

The names and ages of all executive officers of the Company and the positions and offices held by such persons as of November 21, 2018, are as follows:

Name	Position with the Company	Age
Curtis C. Reusser	Chairman, President and Chief Executive Officer	58
Stephen M. Nolan	Executive Vice President and Chief Financial Officer	49
Paul P. Benson	Executive Vice President and Chief Human Resources Officer	54
Roger A. Ross	Executive Vice President and President, Sensors & Systems	50
Donald E. Walther	Executive Vice President and General Counsel	50
Albert S. Yost	Executive Vice President and President, Advanced Materials and Avionics & Controls	53

Mr. Reusser has been Chairman, President and Chief Executive Officer since March 2014, and served as President and Chief Executive Officer from October 2013 to March 2014. Previously, he was President, Aircraft Systems of UTC Aerospace Systems for United Technologies Corporation, a provider of a broad range of high-technology products and services to the global aerospace and building systems industries, from July 2012 to October 2013. Mr. Reusser has a B.S. degree in Industrial and Mechanical Engineering from the University of Washington and a Certificate in Business Management from the University of San Diego.

Mr. Nolan has been Executive Vice President and Chief Financial Officer since February 5, 2018. From February 5, 2015, to January 2018, he was Senior Vice President and Chief Financial Officer of Vista Outdoor, Inc., a leading global manufacturer of consumer products in the outdoor sports and recreation markets that was spun out of Alliant Techsystems Inc., or ATK, in connection with the merger of ATK and Orbital Sciences in 2015. Prior to that time, he served as Senior Vice President of Strategy and Business Development of Orbital ATK (a designer and supplier of space, defense and aviation-related systems) from July 2013 to February 2015. From February 2013 through July 2013, he served as Orbital ATK's Interim Senior Vice President of Business Development. From 2010 to 2013, he was Orbital ATK's Vice President, Strategy and Business Development, Aerospace Systems. Mr. Nolan has an M.B.A. from the Massachusetts Institute of Technology, an M.S. in Civil Engineering from the University of Massachusetts Amherst and a B.S. in Mathematics and Engineering from Trinity College at the University of Dublin.

Mr. Benson has been Executive Vice President and Chief Human Resources Officer since June 2016. From April 2015 to June 2016, he was Vice President and Chief Human Resources Officer. Prior to that time, he was Vice President, Human Resources from December 2014 to March 2015 and Senior Director, Human Resources from November 2014 to December 2014. Prior to that time, he was Senior Human Resources Director at Hewlett Packard Company, a technology products and services company, from 2006 to November 2014. Mr. Benson has an M.B.A. from Arizona State University and a B.A. degree in Business from St. Martin's College.

Mr. Ross has been Executive Vice President and President, Sensors & Systems since June 2016. From August 2015 to June 2016, he was President, Sensors & Systems Segment. Prior to that time, he was Senior Vice President, Actuation & Propeller Systems, at UTC Aerospace Systems for United Technologies Corporation, a provider of a broad range of high-technology products and services to the global aerospace and building systems industries, from January 2014 to July 2015. From January 2010 to December 2013, he was Vice President, Aerostructures Aftermarket at UTC Aerospace Systems for United Technologies Corporation. Mr. Ross has an M.B.A. from the University of Colorado, and M.S. and B.S. degrees in Mechanical Engineering from Colorado State University.

Mr. Walther has been Executive Vice President and General Counsel since May 15, 2018. From 2011 to May 2018, he was Executive Vice President and General Counsel at The Heico Companies, LLC, a parent holding company for a diverse portfolio of manufacturing, construction and industrial services businesses. Mr. Walther has a J.D. and M.B.A. from the University of Chicago, and B.S. degrees in French and Political Science from Duke University.

Mr. Yost has been Executive Vice President and President, Advanced Materials and Avionics & Controls since June 2016. From August 2015 to June 2016, he was President, Avionics & Controls and Advanced Materials Segments. Prior to that time, he was President, Advanced Materials Segment since March 2015 and President, Advanced Materials and Treasurer from March 2014 to

February 2015. From July 2011 to February 2014, he was Group Vice President and Treasurer. Mr. Yost has an M.B.A. from Utah State University and a B.A. degree in Economics from Brigham Young University.

Forward-Looking Statements

This annual report on Form 10-K includes forward-looking statements. These statements may be identified by the use of forward-looking terminology such as "anticipate," "believe," "continue," "could," "estimate," "expect," "intend," "may," "might," "plan," "potential," "predict," "should" or "will" or the negative thereof or other variations thereon or comparable terminology. In particular, statements about our expectations, beliefs, plans, objectives, assumptions or future events or performance contained in this report under the headings "Risks Relating to Our Business and Our Industry," "Management's Discussion and Analysis of Financial Condition and Results of Continuing Operations" and "Business" are forward-looking statements.

We have based these forward-looking statements on our current expectations, assumptions, estimates and projections. While we believe these expectations, assumptions, estimates and projections are reasonable, such forward-looking statements are only predictions and involve known and unknown risks and uncertainties, many of which are beyond our control. These and other important factors, including those discussed in this report under the headings "Risks Relating to Our Business and Our Industry," "Management's Discussion and Analysis of Financial Condition and Results of Continuing Operations" and "Business" may cause our actual results, performance or achievements to differ materially from any future results, performance or achievements expressed or implied by these forward-looking statements. Some of the key factors that could cause actual results to differ from our expectations are:

- A significant reduction in defense spending;
- Loss of a significant customer or defense program;
- Our ability to comply with the complex laws and regulations that affect our business;
- Our inability to execute on our integration plans or otherwise integrate acquired operations or complete acquisitions;
- A significant downturn in the aerospace industry;
- A decrease in demand for our products as a result of competition, technological innovation or otherwise; and

The effect of the restatements of our previously issued financial results for fiscal 2017, 2016, the 2015 transition period, fiscal 2015 and any actual or unasserted

- our ability to remediate the material weaknesses in our internal control over financial reporting described in Item 9A, "Control and Procedures" of this Annual Report.

Additionally, our actual sales and operating earnings may vary from quarter to quarter due to the timing of revenue recognition, sales mix and changes in manufacturing efficiency.

This annual report on Form 10-K also includes forward-looking statements regarding the proposed acquisition of the Company by TransDigm. Actual results may differ materially from those projected as a result of certain risks and uncertainties relating to the proposed Merger, including but not limited to: (1) the ability to (i) obtain the approval of the Company's shareholders as required for the Merger, (ii) receive (if not waived) the required regulatory or other foreign investment approvals for the Merger (and the risk that such approvals may result in the imposition of conditions that could adversely affect the combined company or the expected benefits of the transactions) and (iii) satisfy the other conditions to the consummation of the Merger on a timely basis or at all; (2) the outcome of consultation with employees, their works councils or other employee representatives; (3) the potential that a governmental entity or a regulatory body may prohibit, delay or refuse to grant approval for the consummation of the Merger and may require conditions, limitations or restrictions in connection with such approvals that can adversely affect the anticipated benefits of the proposed Merger or cause the parties to abandon the proposed Merger; (4) unexpected or significant transaction costs and/or unknown liabilities; (5) negative effects of the announcement or the consummation of the transaction on the market price of the Company's common stock, its business (including relationships with customers, suppliers or other business relationship), financial conditions, results of operations and financial performance; (6) risks associated with legal proceedings related to the Merger and the outcome of any legal proceedings related to the Merger; (7) adverse effects of general industry, economic, business, and/or competitive factors; (8) unforeseen events, changes or other circumstances that could give rise to the termination of the Merger Agreement or affect the ability to recognize benefits of the Merger; (9) the potential that the proposed Merger may disrupt current plans and operations and present potential difficulties in employee retention as a result of the Merger; (10) other risks to consummation of the Merger, including the risk that the Merger will not be consummated within the expected time period or at all; and (11) the risks described from time to time in the Company's reports filed with the SEC under the heading "Risk Factors," including this Annual Report on Form 10-K for the fiscal year ended September 28, 2018, Quarterly Reports on Form 10-Q and Current Reports on Form 8-K and in other of the Company's filings with the SEC. These risks, as well as other risks associated with the proposed Merger, are more fully discussed in the preliminary proxy statement filed by the Company with the SEC on November 7, 2018, in connection with the proposed Merger. There can be no assurance that the Merger will be completed, or if it is completed, that it will close within the anticipated time period or that the expected benefits of the Merger will be realized.

Given these risks and uncertainties, you should not place undue reliance on such forward-looking statements. The forward-looking statements included or incorporated by reference into this report are made only as of the date hereof. We do not undertake and specifically decline any obligation to update any such statements or to publicly announce the results of any revisions to any such statements to reflect future events or developments.

Item 1A. Risk Factors

Risks Related to the Merger

The proposed Merger is subject to conditions, some or all of which may not be satisfied or completed within the expected timeframe, if at all. Failure to complete the proposed Merger could adversely affect our business and the market price of our common stock.

The completion of the Merger is subject to a number of conditions, including, among other things, receipt of the approval of the shareholders and of certain regulatory and foreign investment approvals. A governmental entity or a regulatory body may prohibit, delay or refuse to grant approval for the consummation of the Merger and may require conditions, limitations or restrictions in connection with such approvals in excess of the thresholds and limitations that TransDigm agreed to in the Merger Agreement. There can be no assurance that the conditions to the closing of the Merger will be satisfied or waived within the expected timeframe, or that the Merger will be completed. Failure to complete the Merger could adversely affect our business and the market price of our common stock in a number of ways, including:

- If the Merger Agreement is terminated and our Board of Directors seeks another business combination, our shareholders cannot be certain that we will be able to find a party willing to enter into a transaction on terms equivalent to or more attractive than the terms that TransDigm has agreed to in the Merger Agreement;
- The merger agreement may be terminated in certain circumstances that require us to pay TransDigm a termination fee of $128,855,000;
- The time and resources, financial and other, committed by our management to matters relating to the Merger that could otherwise have been devoted to pursuing other beneficial opportunities;
- We may experience negative reactions from the financial markets or from our key business relationships, including our customers, suppliers, or employees; and
- We will be required to pay certain costs relating to the Merger, whether or not the Merger is completed.

The announcement and pendency of the proposed Merger could adversely affect our business, financial condition, results of operations and cash flows.

The announcement and pendency of the proposed Merger could disrupt our business and create uncertainty about it, which could adversely affect our business, financial condition, results of operations and cash flows, regardless of whether the Merger is completed. These risks to our business, all of which could be exacerbated by a delay in the consummation of the Merger, include, among other things:

- The fact that the Merger Agreement contains restrictions on the conduct of our business prior to completing the Merger which could delay or prevent us from undertaking business opportunities that may arise or taking other actions with respect to its operations that we might believe were otherwise appropriate or desirable;
- The time and effort of management required to consummate the merger, which could disrupt our business operations and may divert employees' attention away from our day-to-day operations;
- Potential uncertainty in the marketplace, which could lead current and prospective customers to purchase from other vendors or delay purchasing from us;
- Our current and prospective employees may experience uncertainty about their future roles following the consummation of the proposed Merger, which may impair our ability to attract and retain key personnel;
- Difficulties maintaining relationships or contractual arrangements with customers, providers, suppliers, joint venture partners and regulators;
- The fact that the Merger Agreement contains provisions that make it more difficult for us to be acquired by any party other than TransDigm, and restricts us from soliciting other acquisition proposals during the pendency of the merger; and
- Potential future stockholder litigation relating to the merger could prevent or delay the merger, and the related costs, including, but not limited to, costs associated with the indemnification of directors and officers.

Our important business relationships may be disrupted due to uncertainties associated with the proposed Merger, which could adversely affect our business.

Some of the parties with which we do or desire to do business with may be uncertain about continuing or completing a business relationship with us as a result of the proposed Merger. For example, customers, partners, resellers, vendors, suppliers, joint venture partners and others may attempt to negotiate changes in their existing business relationships with us on terms that are less favorable to us, or may not enter into business relationships with us, or they may consider canceling or not renewing a business relationship or contract with us, or they may enter into alternative business relationships with other parties. Some of our customers, partners, resellers, vendors, suppliers, joint venture partners and others may have rights to terminate contracts that are triggered upon completion of the proposed Merger, and may exercise their rights and remedies that may exist under current agreements. These disruptions could have an adverse effect on our business, financial condition, results of operations and cash flows. Any delay in completion of the Merger, or termination of the Merger Agreement, could exacerbate these risks and adverse effects.

Risks Relating to Our Business and Our Industry

We identified material weaknesses in our internal control over financial reporting at our Sensors & Systems power systems business unit which could, if not remediated, adversely affect our ability to report our financial condition and results of operations in a timely and accurate manner, which may adversely affect investor confidence in our company and, as a result, the value of our common stock.

Our management is responsible for establishing and maintaining adequate internal control over our financial reporting, as defined in applicable rules under the Exchange Act. In Part II, Item 9A, "Controls and Procedures" of this Form 10-K, our management identified material weaknesses in our internal control over financial reporting.

The assessment was based on criteria established in Internal Control-Integrated Framework issued by the Committee of Sponsoring Organizations of the Treadway Commission in 2013. We have developed a remediation plan designed to address the material weaknesses, but our remediation efforts are not complete and are ongoing. If our remedial measures are insufficient to address the material weaknesses, or if additional material weaknesses in our internal control are discovered or occur in the future, it may materially adversely affect our ability to report our financial condition and results of operations in a timely and accurate manner. If we are unable to report our results in a timely and accurate manner, we may not be able to comply with the applicable covenants in our financing arrangements, and may be required to seek additional waivers or repay amounts under these financing arrangements earlier than anticipated, which could adversely impact our liquidity and financial condition.

Although we review and evaluate internal control systems to allow management to report on the sufficiency of our internal controls, we cannot assure you that we will not discover additional material weaknesses in our internal control over financial reporting. The next time we evaluate our internal control over financial reporting, if we identify one or more new material weaknesses or are unable to timely remediate our existing weaknesses, we may be unable to assert that our internal controls are effective. If we are unable to assert that our internal control over financial reporting is effective, or if our independent registered public accounting firm is unable to express an opinion on the effectiveness of our internal controls, we could lose investor confidence in the accuracy and completeness of our financial reports, which would have a material adverse effect on the price of our common stock.

The loss of a significant customer or defense program could have a material adverse effect on our operating results.

Some of our operations are dependent on a relatively small number of customers and aerospace and defense programs, which change from time to time. Significant customers in fiscal 2018 included The Boeing Company, Flame, General Electric, Hawker Beechcraft, Honeywell, Lockheed Martin, Northrop Grumman, Rolls-Royce, the DoD, and UTC Aerospace Systems. There can be no assurance that our current significant customers will continue to buy our products at current levels. The loss of a significant customer or the cancellation of orders related to a sole-source defense program could have a material adverse effect on our operating results if we were unable to replace the related sales.

Our revenues and operating results are subject to fluctuations that may cause our operating results to decline.

Our business is susceptible to seasonality, economic cycles and changes to business conditions, and as a result, our operating results have fluctuated widely in the past and are likely to continue to do so. Our revenue tends to fluctuate based on a number of market factors, including domestic and foreign economic conditions and developments affecting the specific industries and customers we serve. For example, it is possible that a global recession could occur and result in a more severe downturn in commercial aviation and defense. In addition, our operating and financial results are impacted by acquisitions, divestitures or adverse business developments. Our ability to effectively manage our portfolio of businesses and our business operations as well as respond to business changes will have an impact on our financial and operating results.

It is also possible that in the future our operating results in a particular quarter or quarters will not meet the expectations of securities analysts or investors, causing the market price of our common stock or senior notes to decline. We believe that quarter-to-quarter comparisons of our operating results are not a good indication of our future performance and should not be relied upon to predict our future performance.

We may be unable to realize expected benefits from our business integration efforts and our profitability may be hurt or our business otherwise might be adversely affected.

In 2014 we began to consolidate certain facilities to create greater cost efficiencies through shared services in sales, general administration and support functions across our segments. In fiscal 2018 we continued to focus on achieving direct and indirect overhead reductions, improving our operational efficiencies at our facilities and developing shared services. These integration activities are intended to generate operating expense savings through direct and indirect overhead expense reductions as well as other savings and realizing these savings may be difficult. If we do not successfully manage our continuing integration activities, or any other similar activities that we may undertake in the future, expected efficiencies and benefits might be delayed or not realized, and our operations and business could be disrupted. Risks associated with these actions include inability to complete or delay in the planned transfer of business activities to other locations due to dependency on third-party agreements or certification of projects affected by the transfer, unanticipated costs in implementing the initiatives, delays in implementation of anticipated workforce reductions, adverse effects on employee morale, creation of customer or supplier uncertainty that may impact our business, and the failure to meet operational targets due to the loss of employees. If any of these risks are realized, our ability to achieve anticipated cost reductions may be impaired or our business may otherwise be harmed, which could have a material adverse effect on our competitive position, results of operations, cash flows or financial condition.

We are subject to numerous regulatory requirements for the export and sale of our products and services worldwide that could adversely affect our business.

We are also subject to a variety of U.S. and international export control laws and regulations such as the EAR and ITAR, which generally restrict the export of defense products, technology, technical data and defense services. Our trade activities are also subject to international sanctions that significantly restrict or prohibit the sale of certain goods and services in specified countries, including Russia, in which our customers operate or support programs. Our failure to comply with any of these regulations could result in penalties, loss, or suspension of contracts or other consequences. In addition, we may need to hold shipments or expend significant resources to re-work, re-design or re-certify our products to achieve compliance with applicable export control regulations. If we are required to take any of these measures, we may lose revenue opportunities, expend significant resources and/or be exposed to late-delivery penalties or other claims from our customers. Any of these could adversely affect our operations and financial condition. In September 2017, the Consent Agreement with the DTCC arising from our earlier handling of ITAR-controlled transactions, including the substance of prior voluntary disclosures and other aspects of ITAR compliance errors was closed.

We are subject to the Foreign Corrupt Practices Act, or FCPA, the U.K. Bribery Act and other anti-bribery and anti-corruption laws that generally prohibit companies and their intermediaries from bribing foreign officials and non-governmental commercial parties for the purpose of obtaining or keeping business or otherwise obtaining favorable treatment. In particular, we may be held liable for actions taken by our strategic or local partners even though our partners are not subject to these laws. Any determination that we have violated the FCPA, the U.K. Bribery Act or similar laws could result in sanctions that could have a material adverse effect on our business, financial condition and results of operation.

Our financial performance may be adversely affected by information system business disruptions or failures.

Our business may be impacted by information technology attacks or system failures. Cybersecurity attacks, in particular, are evolving and include, but are not limited to, malicious software, attempts to gain unauthorized access to data, and other electronic security breaches that could lead to disruptions in systems, unauthorized release of confidential or otherwise protected information and corruption of data. We have experienced cybersecurity attacks in the past and may experience them in the future, potentially with more frequency. In addition, we have numerous, unique communications, data management and operations support systems across our enterprise that require expertise and significant resources to maintain and upgrade. We have taken measures to mitigate potential risks to our information technology and systems and are implementing plans to modernize and upgrade our systems, in part to comply with U.S. government contracting requirements and with the European Union (EU) General Data Protection Regulation. However, our plans to upgrade our systems will take time to deploy across our enterprise and the timing, nature and scope of system disruptions and failures are unpredictable. As a result, we may experience production downtimes, operational delays or other detrimental impacts on our operations or ability to provide products and services to our customers. Our ability to collect and report financial information from our businesses may be impacted. The compromising of confidential or otherwise protected information, destruction or corruption of data, security breaches, or other manipulation or improper use of our systems or networks could occur. We may also experience financial losses from remedial actions, including significant expenditures to restore or replace systems, loss of business or potential liability under contracts or pursuant to regulations that require us to maintain confidential and other data securely, and/or damage to our reputation. Any of these consequences could have a material adverse effect on our competitive position, results of operations, cash flows or financial condition.

Our future financial results could be adversely impacted by asset impairment charges.

We are required to test both acquired goodwill and other indefinite-lived intangible assets for impairment on an annual basis based upon a fair value approach, rather than amortizing them over time. We have chosen to perform our annual impairment reviews of goodwill and other indefinite-lived intangible assets during the fourth quarter of each fiscal year. We also are required to test goodwill for impairment between annual tests if events occur or circumstances change that would more likely than not reduce our enterprise fair value below its book value.

As we have grown through acquisitions, we have accumulated $1.0 billion of goodwill, $40.4 million of indefinite-lived intangible assets, and $265.7 million of definite-lived intangible assets, out of total assets of $3.0 billion at September 28, 2018. As a result, the amount of any annual or interim impairment could be significant and could have a material adverse effect on our reported financial results for the period in which the charge is taken.

We performed our annual impairment review for fiscal 2018 as of the first day of our fiscal fourth quarter, and our review indicated that no impairment of goodwill or other indefinite-lived assets exists at any of our reporting units.

Reductions in defense spending could adversely affect our business.

Approximately 30% of our business is dependent upon defense spending. The defense industry is dependent upon the level of equipment expenditures by the armed forces of countries around the world, and especially those of the United States, which represent a significant portion of worldwide defense expenditures. Reductions in defense spending in 2019 and beyond are possible, which could have significant future consequences to our business, including termination or disruption of programs and personnel reductions that could impact our manufacturing operations and engineering capabilities.

We may have exposure to greater than anticipated tax liabilities and a higher effective tax rate.

We are subject to income taxes in the United States and foreign jurisdictions. Our effective tax rate is influenced by a number of factors, including, but not limited to, the mix of earnings in countries with differing statutory tax rates, modification on tax policy, interpretation of existing tax laws, and our ability to sustain our reporting positions on examination. Any adverse changes in those factors could have a negative effect on our effective tax rate and financial results.

The Tax Cuts and Jobs Act (the Act) was enacted on December 22, 2017. The Act reduces the U.S. federal corporate tax rate from 35% to 21%, requires companies to pay a one-time transition tax on earnings of certain foreign subsidiaries that were previously tax deferred and creates new taxes on certain foreign sourced earnings.

The SEC recognized that a company's review of certain income tax effects of the Act may be incomplete at the time financial statements are issued. Accordingly, the SEC issued Staff Accounting Bulletin 118, which provides that if a company does not have the necessary information available for certain effects of the Act, the Company may record provisional numbers and adjust those amounts during the measurement period not to extend beyond one year.

As of the date of this filing, we had not completed the accounting for the tax effects of the Act; however, in certain cases, as described below, we made a reasonable estimate of the effects on our existing deferred tax balances and the one-time transition tax. In other cases, we were not able to make a reasonable estimate and continued to account for those items based on our existing accounting under ASC 740, Income Taxes, and the provisions of the tax laws that were in effect immediately prior to enactment. For the items for which we were able to determine a reasonable estimate, we estimated a provisional amount of $49.9 million. In all cases, we will continue to make and refine the calculations as additional analysis is completed in the first quarter of fiscal 2019. In addition, the estimates may also be affected by further rules and interpretations of the Act.

In addition, foreign governments have introduced proposals for changes in tax legislation, or have adopted tax laws in response to the guidelines provided by the Organization for Economic Co-Operation and Development to address base erosion and profit shifting. These changes will increase tax uncertainty and may adversely impact our effective tax rate.

Our operations depend on our production facilities throughout the world. These production facilities are subject to physical and other risks that could disrupt production.

Our production facilities could be damaged or disrupted by a natural disaster, war, political unrest, terrorist activity or a pandemic. In addition, our facilities are subject to local labor conditions that may lead to labor strikes, work stoppages or high levels of employee turnover that could also disrupt our business operations. Several of our production facilities are located in California, and thus are in areas with above average seismic activity and may also be at risk of damage in wildfires. Although we have obtained property damage and business interruption insurance for our production facilities, a major catastrophe such as an earthquake or other natural disaster at any of our sites, or significant labor strikes, work stoppage, political unrest, war or terrorist activities in any of the areas where we conduct operations, could result in a prolonged interruption of our business. Any disruption resulting from these events could cause significant delays in shipments of products and the loss of sales and customers. We cannot assure you that we will have insurance to adequately compensate us for any of these events.

We may not be able to compete effectively.

Our products and services are affected by varying degrees of competition. We compete with other companies and divisions and units of larger companies in most markets we serve, many of which have greater sales volumes or financial, technological or marketing resources than we do. Our principal competitors include: Astronautics, BAE, Bose, Eaton, ECE, Elbit, EMS, GE Aerospace, Honeywell, IAI, L-3, Otto Controls, RAFI, SELEX, Telephonics, Thales, Ultra Electronics, United Technologies Corporation, and Universal Avionics Systems Corporation in our Avionics & Controls segment; Ametek, Amphenol, Astronics, Honeywell, Kulite, Meggitt, Safran, TE Connectivity and United Technologies Corporation in our Sensors & Systems segment; and Chemring, Doncasters, Hi-Temp, J&M, JPR Hutchinson, Kmass, Meggitt (including Dunlop Standard Aerospace Group), Rheinmetall, Trelleborg, ULVA, UMPCO, and UTC Aerospace Systems in our Advanced Materials segment. The principal competitive factors in the commercial markets in which we participate are product performance, on-time delivery performance, quality, service and price. Maintaining product performance requires expenditures in research and development that lead to product improvement and new product introduction. Companies with more substantial financial resources may have a better ability to make such expenditures. The business model for some of our businesses is based upon access to the aftermarket and its premium pricing over OEM pricing. The strategic goal of our major OEM customers is to increase their access to the aftermarket from their supplier base, which would correspondingly decrease our sales to aftermarket customers. We cannot assure that we will be able to continue to successfully compete in our markets, which could adversely affect our business, financial condition, and results of operations.

The amount of debt we have outstanding, as well as any debt we may incur in the future, could have an adverse effect on our operational and financial flexibility.

As of September 28, 2018, we had approximately $654.9 million of long-term debt outstanding, including a credit facility and $17.5 million in current maturities of long-term debt. The credit facility is secured by substantially all of the Company's assets.

Our level of debt could have significant consequences to our business, including the following:

- Depending on interest rates and debt maturities, a substantial portion of our cash flow from operations could be dedicated to paying principal and interest on our debt, thereby reducing funds available for our acquisition strategy, capital expenditures or other purposes, including repurchases of outstanding shares of common stock, depending on market conditions, share price and other factors;
- A significant amount of debt could make us more vulnerable to changes in economic conditions or increases in prevailing interest rates;
- Our ability to obtain additional financing for acquisitions, capital expenditures or for other purposes could be impaired;
- The increase in the amount of debt we have outstanding increases the risk of non-compliance with some of the covenants in our debt agreements which require us to maintain specified financial ratios; and
- We may be more leveraged than some of our competitors, which may result in a competitive disadvantage.

Political and economic changes in foreign countries and markets, including foreign currency fluctuations, may have a material effect on our operating results.

Foreign sales originating from non-U.S. locations were approximately 51% of our total sales in fiscal 2018, and we have manufacturing facilities in a number of foreign countries. A substantial portion of our Avionics & Controls operations is based in Belgium, Canada and the U.K., and a substantial portion of our Sensors & Systems operations is based in France and the U.K. We also have manufacturing operations in China, the Dominican Republic, Germany, India, Japan, Mexico, and Morocco. Doing business in foreign countries is subject to numerous risks, including political and economic instability, restrictive trade policies of foreign governments, changes in the local labor-relations climate, economic conditions in local markets, health concerns, inconsistent product regulations or unexpected changes in regulatory and other legal requirements by foreign agencies or governments, the imposition of product tariffs and the burdens of complying with a wide variety of international and U.S. export laws and differing regulatory requirements. U.S. international trade policy is uncertain under the new administration, including, for example, the government's decision to renegotiate the North American Free Trade Agreement, which could cause an increase in customs duties that in turn could adversely affect intercompany transactions among Esterline's operating subsidiaries in Canada, Mexico and the U.S., and increase transaction costs with third-party suppliers and customers. Further, the U.K. voter approval of an exit from the EU, known as "Brexit," caused and may continue to cause significant volatility in global stock markets and currency exchange rate fluctuations and may create further global economic uncertainty that may adversely impact the economies of the U.K., the EU and other nations in which we conduct business. To the extent that foreign sales are transacted in a foreign currency, we are subject to the risk of loss due to foreign currency fluctuations. In addition, we have substantial assets denominated in foreign currencies, primarily the British pound, Canadian dollar and euro, that are not offset by liabilities denominated in those foreign currencies. These net foreign currency investments are subject to material changes in the event of fluctuations in foreign currencies against the U.S. dollar.

A global recession may adversely affect our business operations and results, capital, and cost of capital.

In the event of a global recession, our customers may choose to delay or postpone purchases from us until the economy and their businesses strengthen. Decisions by current or future customers to forgo or defer purchases and/or our customers' inability to pay for our products may adversely affect our earnings and cash flow. A recession could also adversely affect our future cost of debt and equity. Any inability to obtain adequate financing from debt and equity sources could force us to self-fund strategic initiatives or even forgo some opportunities, potentially harming our financial position, results of operations, and liquidity.

A downturn in the aircraft market could adversely affect our business.

The aerospace industry is cyclical in nature and affected by periodic downturns that are beyond our control. The principal customers for manufacturers of commercial aircraft are the commercial and regional airlines, which can be adversely affected by a number of factors, including a recession, increasing fuel and labor costs, intense price competition, outbreak of infectious disease and terrorist attacks, as well as economic cycles, all of which can be unpredictable and are outside our control. Any decrease in demand resulting from a downturn in the market could adversely affect our business, financial condition, and results of operations.

Our backlog is subject to modification or termination, which may reduce our sales in future periods.

We currently have a backlog of orders based on our contracts with customers. Under many of our contracts, our customers may unilaterally modify or terminate their orders at any time. In addition, the maximum contract value specified under a government contract awarded to us is not necessarily indicative of the sales that we will realize under that contract. For example, we are a sole-source prime contractor for many different military programs with the U.S. DoD. We depend heavily on the government contracts underlying these programs. Over its lifetime, a program may be implemented by the award of many different individual contracts and subcontracts. The funding of government programs is subject to congressional appropriation.

Changes in defense procurement models may make it more difficult for us to successfully bid on projects as a prime contractor and limit sole-source opportunities available to us.

In recent years the trend in combat system design and development appears to be evolving toward the technological integration of various battlefield components, including combat vehicles, command and control network communications, advanced technology artillery systems and robotics. If the U.S. military procurement approach continues to require this kind of overall battlefield combat system integration, we expect to be subject to increased competition from aerospace and defense companies which have significantly greater resources than we do.

We may lose money or generate less than expected profits on our contracts, including our fixed-price contracts.

Our customers set demanding specifications for product performance, reliability and cost. Some of our government contracts and subcontracts provide for a predetermined, fixed price for the products we make regardless of the costs we incur. Therefore, we must absorb cost overruns, notwithstanding the difficulty of estimating all of the costs we will incur in performing these contracts and in projecting the ultimate level of sales that we may achieve. Our failure to accurately scope the statement of work, anticipate technical problems, estimate costs accurately, integrate technical processes effectively, reduce dependency on sole-source or poor-performing suppliers, control costs or otherwise meet contractual obligations such as timely delivery and meeting quality specifications during performance of a contract may reduce the profitability or cause a loss on the contract. While we believe that we have recorded adequate provisions in our financial statements for losses on our fixed-price and other contracts as required under GAAP, we cannot assure that our contract loss provisions will be adequate to cover all actual future losses. Therefore, we may incur losses on contracts that we had expected to be profitable, or such contracts may be less profitable than expected.

Our business is subject to government contracting regulations, and our failure to comply with such laws and regulations could harm our operating results and prospects.

We estimate that approximately 21% of our sales in fiscal 2018 were attributable to contracts in which we were either the prime contractor to, or a subcontractor to a prime contractor to, the U.S. government. As a contractor and subcontractor to the U.S. government, we must comply with laws and regulations relating to the formation, security, administration and performance of federal government contracts that affect how we do business with our customers and may impose added costs to our business. For example, these regulations and laws include provisions that contracts we have been awarded are subject to:

- Protest or challenge by unsuccessful bidders;
- Unilateral termination, reduction or modification in the event of changes in government requirements; and
- Significant data security requirements for our information systems.

The accuracy and appropriateness of certain costs and expenses used to substantiate our direct and indirect costs for the U.S. government under both cost-plus and fixed-price contracts are subject to extensive regulation and audit by the Defense Contract Audit Agency, an arm of the U.S. DoD. Responding to governmental audits, inquiries or investigations may involve significant expense and divert management attention. Our failure to comply with these or other government procurement laws and regulations could result in contract termination, suspension or debarment from contracting with the federal government, loss of opportunities to participate in future government programs, civil fines and damages, and criminal prosecution and penalties, any of which could have a material adverse effect on our operating results.

A significant portion of our business depends on U.S. government contracts, which are often subject to competitive bidding, and a failure to compete effectively or accurately anticipate the success of future projects could adversely affect our business.

We obtain many of our U.S. government contracts through a competitive bidding process that subjects us to risks associated with:

- The frequent need to bid on programs in advance of the completion of their design, which may result in unforeseen technological difficulties and/or cost overruns;
- The substantial time and effort, including design, development and marketing activities, required to prepare bids and proposals for contracts that may not be awarded to us; and
- The design complexity and rapid rate of technological advancement of defense-related products.

In addition, in order to win the award of developmental programs, we must be able to align our research and development and product offerings with the government's changing concepts of national defense and defense systems. The government's termination of, or failure to fully fund, one or more of the contracts for our programs would have a negative impact on our operating results and financial condition. Furthermore, we serve as a subcontractor on several military programs that, in large part, involve the same risks as prime contracts.

Overall, we rely on key contracts with U.S. government entities for a significant portion of our sales and business. A substantial reduction in these contracts would materially adversely affect our operating results and financial position.

The market for our products may be affected by our ability to adapt to technological change.

The rapid change of technology is a key feature of all of the markets in which our businesses operate. To succeed in the future, we will need to design, develop, manufacture, assemble, test, market, and support new products and enhancements to our existing products in a timely and cost-effective manner. Historically, our technology has been developed through internal research and development expenditures, as well as customer-sponsored research and development programs. There is no guarantee that we will continue to maintain, or benefit from, comparable levels of research and development in the future. In addition, our competitors may develop technologies and products that are more effective than those we develop or that render our technology and products obsolete or noncompetitive. Furthermore, our products could become unmarketable if new industry standards emerge. We cannot assure that our existing products will not require significant modifications in the future to remain competitive or that new products we introduce will be accepted by our customers, nor can we assure that we will successfully identify new opportunities, continue to have the needed financial resources to develop new products in a timely or cost-effective manner, or execute on a research and development program effectively to yield an expected return or any return on investment.

The airline industry is heavily regulated and if we fail to comply with applicable requirements, our results of operations could suffer.

Governmental agencies throughout the world, including the U.S. Federal Aviation Administration (FAA), prescribe standards and qualification requirements for aircraft components, including virtually all commercial airline and general aviation products, as well as regulations regarding the repair and overhaul of aircraft engines. Specific regulations vary from country to country, although compliance with FAA requirements generally satisfies regulatory requirements in other countries. We include, with the replacement parts that we sell to our customers, documentation certifying that each part complies with applicable regulatory requirements and meets applicable standards of airworthiness established by the FAA or the equivalent regulatory agencies in other countries. In order to sell our products, we and the products we manufacture, must also be certified by our individual OEM customers. If any of the material authorizations or approvals qualifying us to supply our products is revoked or suspended, then the sale of the subject product would be prohibited by law, which would have an adverse effect on our business, financial condition, and results of operations.

From time to time, the FAA or equivalent regulatory agencies in other countries propose new regulations or changes to existing regulations, which are usually more stringent than existing regulations. If these proposed regulations are adopted and enacted, we may incur significant additional costs to achieve compliance, which could have a material adverse effect on our business, financial condition, and results of operations.

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We depend on the continued contributions of our executive officers and other key management, each of whom would be difficult to replace.

Our future success depends to a significant degree upon the continued contributions of our senior management and our ability to attract and retain other highly qualified management personnel. We face competition for management from other companies and organizations. Therefore, we may not be able to retain our existing management personnel or fill new management positions or vacancies created by expansion or turnover at our existing compensation levels. Although we have entered into change of control agreements with members of senior management, we do not have employment contracts with our key executives, nor have we purchased “key-person” insurance on the lives of any of our key officers or management personnel to reduce the impact to our company that the loss of any of them would cause. Specifically, the loss of any of our executive officers would disrupt our operations and divert the time and attention of our remaining officers, and failure to attract and retain highly qualified management personnel would damage our business prospects. In addition, our current and prospective employees may experience uncertainty about their future roles following the announcement of the proposed Merger, which may impair our ability to attract and retain key personnel prior to the consummation of the proposed Merger.

If we are unable to protect our intellectual property rights adequately, the value of our products could be diminished.

Our success is dependent in part on obtaining, maintaining and enforcing our proprietary rights and our ability to avoid infringing on the proprietary rights of others. While we take precautionary steps to protect our technological advantages and intellectual property and rely in part on patent, trademark, trade secret and copyright laws, we cannot assure that the precautionary steps we have taken will completely protect our intellectual property rights. Because patent applications in the United States are maintained in secrecy until either the patent application is published or a patent is issued, we may not be aware of third-party patents, patent applications and other intellectual property relevant to our products that may block our use of our intellectual property or may be used in third-party products that compete with our products and processes. In the event a competitor successfully challenges our products, processes, patents or licenses or claims that we have infringed upon their intellectual property, we could incur substantial litigation costs defending against such claims, be required to pay royalties, license fees or other damages or be barred from using the intellectual property at issue, any of which could have a material adverse effect on our business, operating results, and financial condition.

In addition to our patent rights, we also rely on unpatented technology, trade secrets and confidential information. Others may independently develop substantially equivalent information and techniques or otherwise gain access to or disclose our technology. We may not be able to protect our rights in unpatented technology, trade secrets and confidential information effectively. We require each of our employees and consultants to execute a confidentiality agreement at the commencement of an employment or consulting relationship with us. However, these agreements may not provide effective protection of our information or, in the event of unauthorized use or disclosure, they may not provide adequate remedies.

Future asbestos claims could harm our business.

We are subject to potential liabilities relating to certain products we manufactured containing asbestos. We had insurance coverage for asbestos exposures in products prior to November 1, 2003. Since November 1, 2003, insurance coverage for asbestos claims has been unavailable. Our policy coverage for exposures prior to November 1, 2003, declines ratably, by formula, as the number of years increases since coverage expired. Accordingly, we continue to have partial insurance coverage for exposure to asbestos contained in our products prior to November 1, 2003. To date, asbestos claims have not been material to our consolidated results of operations or financial position.

As a result of the termination of the NASA Space Shuttle program, manufacturing of rocket engine insulation material containing asbestos ceased in July 2010. In December 2011, we dismantled our facility used to manufacture the asbestos-based insulation for the Space Shuttle program. We have an agreement for indemnification for certain losses we may incur as a result of asbestos claims relating to a product we previously manufactured, but we cannot assure that this indemnification agreement will fully protect us from losses arising from asbestos claims.

To the extent we are not insured or indemnified for losses from asbestos claims relating to our products, asbestos claims could adversely affect our operating results and our financial condition.

Environmental laws and regulations may subject us to significant liability.

Our business and our facilities are subject to a number of federal, state, local and foreign laws, regulations and ordinances governing, among other things, the use, manufacture, storage, handling and disposal of hazardous materials and certain waste products. Among these environmental laws are rules by which a current or previous owner or operator of land may be liable for the costs of investigation, removal or remediation of hazardous materials at such property. In addition, these laws typically impose liability regardless of whether the owner or operator knew of, or was responsible for, the presence of any hazardous materials.

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Persons who arrange for the disposal or treatment of hazardous materials may be liable for the costs of investigation, removal or remediation of such substances at the disposal or treatment site, regardless of whether the affected site is owned or operated by them.

Because we own and operate, and previously owned and operated, a number of facilities that use, manufacture, store, handle or arrange for the disposal of various hazardous materials, we may incur costs for investigation, removal and remediation, as well as capital costs, associated with compliance with environmental laws. At the time of our asset acquisition of the Electronic Warfare Passive Expendables Division of BAE Systems North America (BAE), certain environmental remedial activities were required under a Part B Permit issued to the infrared decoy flare facility by the Arkansas Department of Environmental Quality under the Federal Resource Conservation and Recovery Act. The Part B Permit was transferred to our subsidiary, Armtec Defense Products Co., along with the remedial obligations. Under the terms of the asset purchase agreement, BAE agreed to perform and pay for these remedial obligations at the infrared decoy flare facility up to a maximum amount of $25.0 million. BAE is currently conducting monitoring activities as required under the asset purchase agreement.

Although environmental costs have not been material in the past, we cannot assure that these matters, or any similar liabilities that arise in the future, will not exceed our resources, nor can we completely eliminate the risk of accidental contamination or injury from these materials.

An accident at our operations could harm our business.

We are subject to potential liabilities in the event of an accident at our facilities, including due to spills or other releases of hazardous substances that are handled in our operating processes or explosion events at our combustible ordnance and flare countermeasure operations. Products in our ordnance and flare operations are highly flammable during certain phases of the manufacturing process. Accordingly, our facilities are designed to isolate these operations from direct contact with employees. Our overall safety infrastructure is compliant with regulatory guidelines. In addition, we utilize hazard detection and intervention systems across our operations. Our employees receive safety training and participate in internal safety demonstrations, and key employee safety statistics are measured and reported as part of the Esterline Operating System. We continuously track safety effectiveness in relation to the U.S. Bureau of Labor Statistics, OSHA, and the HSE in the U.K. to help ensure performance is within industry standards. In addition, we perform on-going process safety hazard analyses, which are conducted by trained safety teams to identify risk areas that arise. We monitor progress through review of safety action reports that are produced as part of our operations. Although we believe our safety programs are robust and our compliance with our programs is high, it is possible for an accident to occur. We have had incidents in the past, including accidents at our Arkansas plant in 2014 and 2016 and an accident at our Wallop plant in 2016 and a release of hazardous substances at our Valencia, California, plant in 2018. The accidents in 2016 resulted in three serious injuries and the closure of our Arkansas plant for approximately four months and the accident in 2018 resulted in employees seeking medical treatment and a suspension of activities at the plant during remediation. We are insured in excess of our deductible on losses from property, loss of business, and for personal liability claims from an accident; however, we may not be able to maintain insurance coverage in the future at an acceptable cost. Significant losses not covered by insurance could have a material adverse effect on our business, financial condition, and results of operations.

We may be required to defend lawsuits or pay damages in connection with the alleged or actual harm caused by our products.

We face an inherent business risk of exposure to product liability claims in the event that the use of our products is alleged to have resulted in harm to others or to property. For example, our operations expose us to potential liabilities for personal injury or death as a result of the failure of an aircraft component that has been designed, manufactured or serviced by us. We may incur significant liability if product liability lawsuits against us are successful. While we believe our current general liability and product liability insurance is adequate to protect us from future product liability claims, we cannot assure that coverage will be adequate to cover all claims that may arise. Additionally, we may not be able to maintain insurance coverage in the future at an acceptable cost. Significant losses not covered by insurance or for which third-party indemnification is not available could have a material adverse effect on our business, financial condition, and results of operations.

Implementing our acquisition strategy involves risks, and our failure to successfully implement this strategy could have a material adverse effect on our business.

One of our key strategies is to grow our business by selectively pursuing acquisitions. Since 1996 we have completed over 30 acquisitions, and we are continuing to actively pursue additional acquisition opportunities, some of which may be material to our business and financial performance. Although we have been successful with this strategy in the past, we may not be able to grow our business in the future through acquisitions for a number of reasons, including:

- Encountering difficulties identifying and executing acquisitions;
- Increased competition for targets, which may increase acquisition costs;

- Consolidation in our industry reducing the number of acquisition targets;
- Competition laws and regulations preventing us from making certain acquisitions; and
- Acquisition financing not being available on acceptable terms or at all.

In addition, there are potential risks associated with growing our business through acquisitions, including the failure to successfully integrate and realize the expected benefits of an acquisition. For example, with any past or future acquisition, there is the possibility that:

- The business culture of the acquired business may not match well with our culture;
- Technological and product synergies, economies of scale and cost reductions may not occur as expected;
- Management may be distracted from overseeing existing operations by the need to integrate acquired businesses;
- We may acquire or assume unexpected liabilities;
- Unforeseen difficulties may arise in integrating operations and systems;
- We may fail to retain and assimilate employees of the acquired business;
- We may experience problems in retaining customers and integrating customer bases; and
- Problems may arise in entering new markets in which we may have little or no experience and managing the resulting portfolio changes.

Failure to continue implementing our acquisition strategy, including successfully integrating acquired businesses, could have a material adverse effect on our business, financial condition and results of operations.

Item 2. Properties

The following table summarizes our properties that are greater than 100,000 square feet or related to a principal operation, including identification of the business segment, as of September 28, 2018:

Location	Type of Facility	Business Segment	Approximate Square Footage	Owned or Leased
East Camden, AR	Office & Plant	Advanced Materials	276,000	Leased
Stillington, U.K.	Office & Plant	Advanced Materials	275,000	Owned
Montréal, Canada	Office & Plant	Avionics & Controls	272,000	Owned
Everett, WA	Office & Plant	Avionics & Controls	216,000	Leased
Champagné, France	Office & Plant	Sensors & Systems	189,000	Owned
Tijuana, Mexico	Office & Plant	Advanced Materials	141,000	Leased*
Coeur d'Alene, ID	Office & Plant	Avionics & Controls	140,000	Leased
Coachella, CA	Office & Plant	Advanced Materials	140,000	Owned
Marolles, France	Office & Plant	Sensors & Systems	140,000	Owned
Kortrijk, Belgium	Office & Plant	Avionics & Controls	130,000	Owned
Tijuana, Mexico	Office & Plant	Sensors & Systems	129,000	Leased*
Buena Park, CA	Office & Plant	Sensors & Systems	115,000	Owned**
Tangier, Morocco	Office & Plant	Sensors & Systems	115,000	Leased
Bourges, France	Office & Plant	Sensors & Systems	109,000	Owned
Farnborough, U.K.	Office & Plant	Sensors & Systems	103,000	Leased
Sylmar, CA	Office & Plant	Avionics & Controls	103,000	Leased
Kent, WA	Office & Plant	Advanced Materials	100,000	Owned
Valencia, CA	Office & Plant	Advanced Materials	88,000	Owned
Gloucester, U.K.	Office & Plant	Advanced Materials	68,000	Leased
Tijuana, Mexico	Office & Plant	Sensors & Systems	63,000	Leased*
Tijuana, Mexico	Office & Plant	Sensors & Systems	61,000	Leased*

* Included in the Company's Tijuana manufacturing campus.
** The building is located on a parcel of land covering 16.1 acres that is leased by the Company.

In total, we owned approximately 2,000,000 square feet and leased approximately 2,300,000 square feet of manufacturing facilities and properties as of September 28, 2018.

Item 3. Legal Proceedings

From time to time we are involved in legal proceedings arising in the ordinary course of business. We believe that adequate reserves for these liabilities have been made and that there is no litigation pending that could have a material adverse effect on our results of operations and financial condition.

See Note 12 to the consolidated financial statements included in Part 1, Item 8 of this report for information regarding legal proceedings.

Item 4. Mine Safety Disclosures

Not applicable.

PART II

Item 5. Market for Registrant's Common Equity, Related Stockholder Matters and Issuer Purchases of Equity Securities

Market Price of Esterline Common Stock
In Dollars

For Fiscal Years	2018		2017	
	High	Low	High	Low
Quarter				
First	$ 96.95	$ 68.30	$ 94.73	$ 69.85
Second	78.90	67.15	96.50	80.76
Third	79.55	69.05	102.70	83.35
Fourth	92.45	72.40	100.60	76.00

Principal Market – New York Stock Exchange

At the end of fiscal 2018, there were approximately 206 holders of record of the Company's common stock.

On June 19, 2014, our Board of Directors approved a $200 million share repurchase program. On March 11, 2015, our Board of Directors approved an additional $200 million for the share repurchase program. Under the program, we are authorized to repurchase up to $400 million of outstanding shares of common stock from time to time, depending on market conditions, share price and other factors. We made no repurchases of common stock during the fourth quarter of fiscal 2018. In the first half of fiscal 2018, the Company repurchased 601,400 shares under this program at an average price paid per share of $72.25, for an aggregate purchase price of $43.4 million. Since the program began, the Company has repurchased 3,737,327 shares for an aggregate purchase price of $352.0 million, with $48.0 million in shares remaining available for repurchase in the future.

No cash dividends were paid during fiscal 2018 and 2017. Our current secured credit facility restricts the amount of dividends we can pay. We do not anticipate paying any dividends in the foreseeable future.

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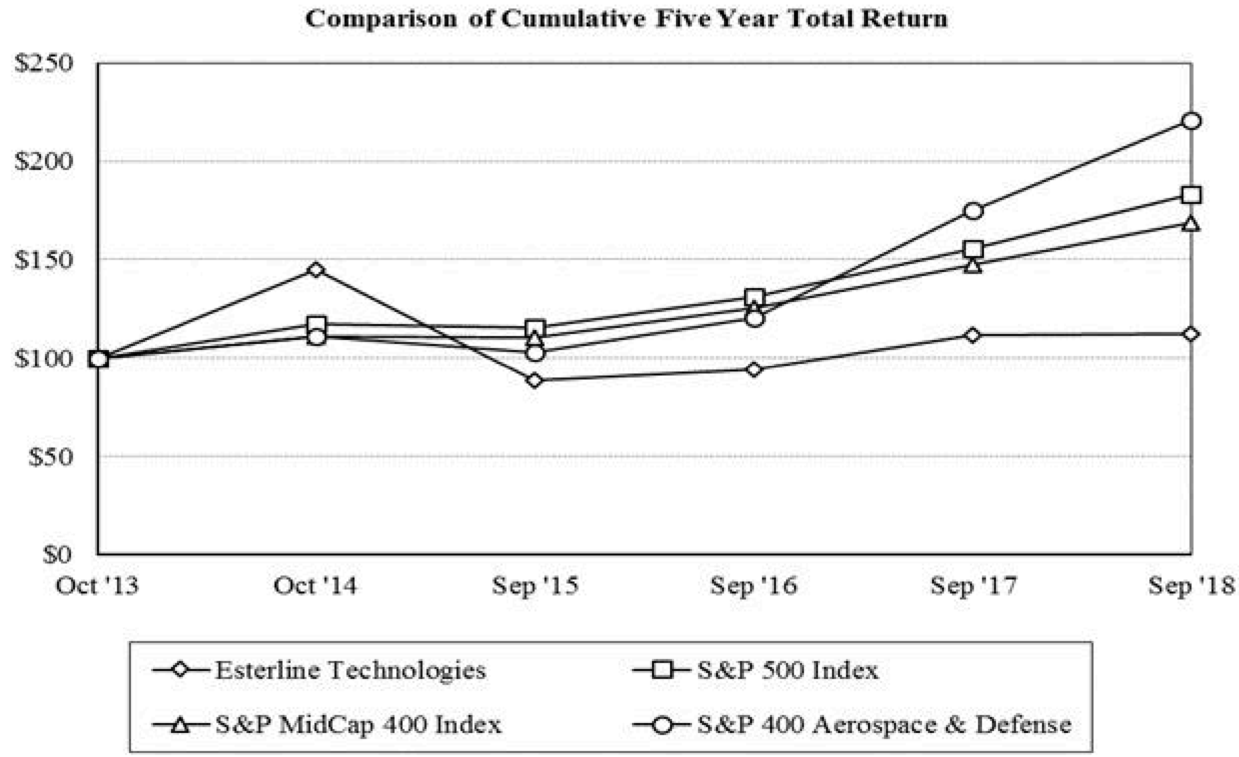
The following graph shows the performance of the Company's common stock compared to the S&P 500 Index, the S&P MidCap 400 Index, and the S&P 400 Aerospace & Defense Index for a $100 investment made on October 25, 2013.



Item 6. Selected Financial Data

Selected Financial Data
In Thousands, Except Per Share Amounts

For Fiscal Years	2018	2017	2016	2015 (Unaudited) (Recast)	2014
Operating Results [1]					
Net sales	$ 2,034,839	$ 2,000,304	$ 1,993,453	$ 2,002,793	$ 2,029,471
Cost of Sales	1,368,531	1,340,259	1,331,573	1,324,959	1,314,762
Selling, general & administrative	387,231	374,981	396,548	386,140	359,205
Research, development and engineering	90,869	109,778	99,710	100,803	97,591
Transaction costs	7,192	-	-	-	-
License fee income	(5,293)	-	-	-	-
Loss on sale of business	3,730	-	-	-	-
Restructuring charges	-	-	4,873	8,143	13,642
Insurance recovery	-	(7,789)	(5,000)	-	-
Other income	-	-	-	(12,503)	-
Operating earnings from continuing operations	182,579	183,075	165,749	195,251	244,271
Interest income	(1,912)	(527)	(367)	(632)	(555)
Interest expense	30,915	30,208	30,091	33,114	33,010
Loss on extinguishment of debt	-	-	-	11,451	533
Earnings from continuing operations before income taxes	153,576	153,394	136,025	151,318	211,283
Income tax expense	83,827	33,025	21,857	24,443	46,554
Earnings from continuing operations attributable to Esterline, net of tax	68,793	118,865	113,219	126,448	164,176
Earnings (loss) from discontinued operations attributable to Esterline, net of tax	665	(7,311)	(15,266)	(40,319)	(62,611)
Net earnings attributable to Esterline	69,458	111,554	97,953	86,129	101,565
Gross profit as a percent of sales	32.7%	33.0%	33.2%	33.8%	35.2%
Selling, general and administrative as a percent of sales	19.0%	18.7%	19.9%	19.3%	17.7%
Research, development and engineering as a percent of sales	4.5%	5.5%	5.0%	5.0%	4.8%
Earnings from continuing operations before income taxes as a percent of sales	7.5%	7.7%	6.8%	7.6%	10.4%
Earnings from continuing operations attributable to Esterline, net of tax, as a percent of sales	3.4%	5.9%	5.7%	6.3%	8.1%
Earnings (loss) per share attributable to Esterline - diluted:					
Continuing operations	$ 2.32	$ 3.96	$ 3.80	$ 4.05	$ 5.06
Discontinued operations	0.02	(0.24)	(0.51)	(1.29)	(1.93)
Earnings (loss) per share	2.34	3.72	3.29	2.76	3.13

Selected Financial Data
In Thousands, Except Per Share Amounts

For Fiscal Years	2018	2017	2016	2015	2014
Financial Structure					
Total assets	$ 3,036,917	$ 3,120,013	$ 3,029,390	$ 2,994,885	3,197,066
Credit facilities	-	50,000	155,000	160,000	100,000
Long-term debt, net	654,922	709,424	698,796	701,457	509,720
Total Esterline shareholders' equity	1,831,843	1,824,755	1,595,291	1,535,172	1,886,964
Weighted average shares outstanding - diluted	29,734	30,003	29,764	31,215	32,448
Other Selected Data					
Cash flows provided (used) by operating activities	$ 214,081	$ 193,449	$ 167,162	$ 144,295	$ 216,364
Cash flows provided (used) by investing activities	(2,042)	(57,440)	(65,943)	(173,568)	(89,851)
Cash flows provided (used) by financing activities	(138,707)	(94,426)	(29,388)	967	(55,208)
Net increase (decrease) in cash	64,580	49,306	67,165	(46,789)	58,966
EBITDA from continuing operations [2]	287,866	285,461	264,611	241,762	344,327
Capital expenditures [3]	53,292	58,040	68,472	49,341	45,678
Interest expense	30,915	30,208	30,091	30,090	33,010
Depreciation and amortization from continuing operations	105,287	102,386	98,862	88,689	100,056
Ratio of debt to EBITDA [4]	2.3	2.7	3.3	3.6	1.8
Ratio of debt to equity	36.7%	42.6%	54.6%	57.0%	33.0%

1 Operating results reflect the segregation of continuing operations from discontinued operations. See Note 1 to the Consolidated Financial Statements. Operating results include an acquisition of the business we refer to as Esterline Advanced Displays, or EAD, from Barco N.V. in January 2015.

2 EBITDA from continuing operations is a measurement not calculated in accordance with GAAP. We define EBITDA from continuing operations as net earnings plus loss from discontinued operations plus earnings attributable to noncontrolling interests plus income tax expense less interest income plus interest expense plus loss on extinguishment of debt plus depreciation and amortization (excluding amortization of debt issuance costs). We do not intend EBITDA from continuing operations to represent cash flows from continuing operations or any other items calculated in accordance with GAAP, or as an indicator of Esterline's operating performance. Our definition of EBITDA from continuing operations may not be comparable with EBITDA from continuing operations as defined by other companies. We believe EBITDA is commonly used by financial analysts and others in the aerospace and defense industries and thus provides useful information to investors. Our management and certain financial creditors use EBITDA as one measure of our leverage capacity and debt servicing ability, and is shown here with respect to Esterline for comparative purposes. EBITDA is not necessarily indicative of amounts that may be available for discretionary uses by us. The following table reconciles net earnings to EBITDA from continuing operations:

In Thousands

For Fiscal Years	2018	2017	2016	2015	2014
Net earnings attributable to Esterline	$ 69,458	$ 111,554	$ 97,953	$ 58,170	$ 101,565
Earnings (loss) from discontinued operations attributable to Esterline, net of tax	665	(7,311)	(15,266)	(37,053)	(62,611)
Earnings attributable to noncontrolling interests	(956)	(1,504)	(949)	(401)	(553)
Income tax expense	83,827	33,025	21,857	16,486	46,554
Interest income	(1,912)	(527)	(367)	(578)	(555)
Interest expense	30,915	30,208	30,091	30,090	33,010
Loss on extinguishment of debt	-	-	-	11,451	533
Depreciation and amortization from continuing operations	105,287	102,386	98,862	88,689	100,056
EBITDA from continuing operations	$ 287,866	$ 285,461	$ 264,611	$ 241,762	$ 344,327

3 Excludes capital expenditures accounted for as a capitalized lease obligation of $95, $4,010, $11,260 and $2,753 in fiscal 2018, 2017, 2016 and 2014, respectively.

4 We define the ratio of debt to EBITDA as total debt divided by EBITDA.

Item 7. Management's Discussion and Analysis of Financial Condition and Results of Operations

OVERVIEW

On October 9, 2018, we entered into the Merger Agreement providing for the acquisition of the Company by TransDigm. If the Merger is consummated, we will become a wholly owned subsidiary of TransDigm. Each Company shareholder will receive $122.50 per share in cash, subject to any withholding taxes. The Merger, which is expected to close in 2019, is subject to the receipt of approval by the Company's shareholders, certain required regulatory or foreign investment approvals, and the satisfaction of certain other customary closing conditions. Upon completion of the Merger, shares of our common stock will cease trading on the NYSE.

The Company will hold a special meeting of our stockholders to vote on adoption of the Merger Agreement, and will provide additional information regarding the proposed Merger and the Merger Agreement to our stockholders and the SEC in connection with the special meeting.

For additional information related to the Merger and the Merger Agreement, please refer to the full text of the Merger Agreement and the First Amendment to the Merger Agreement, which have been filed as Exhibits to the Company's Current Reports on Form 8-K filed with the SEC on October 10, 2018, and October 11, 2018, respectively.

We operate our businesses in three segments: Avionics & Controls, Sensors & Systems and Advanced Materials. Our segments are structured around our technical capabilities. All segments include sales to domestic, international, defense and commercial customers.

The Avionics & Controls segment includes avionics systems, control and communication systems, and interface technologies capabilities. Avionics systems designs and develops cockpit systems integration and avionics solutions for commercial and military applications and visualization solutions for a variety of demanding defense and commercial aerospace applications. Control and communication systems designs and manufactures technology interface systems for military and commercial aircraft and land- and sea-based military vehicles. Additionally, control and communication systems designs and manufactures military audio and data products for severe battlefield environments and communication control systems to enhance security and aural clarity in military applications. Interface technologies manufactures and develops custom control panels and input systems for medical, industrial, military and gaming industries.

The Sensors & Systems segment includes power systems, connection technologies and advanced sensors capabilities. Power systems develops and manufactures electrical power switching and other related systems, principally for aerospace and defense customers. Connection technologies develops and manufactures highly engineered connectors for harsh environments and serves the aerospace, defense & space, power generation, rail and industrial equipment markets. Advanced sensors develops and manufactures high-precision temperature and pressure sensors for aerospace and defense customers.

The Advanced Materials segment includes engineered materials and defense technologies capabilities. Engineered materials develops and manufactures thermally engineered components and high-performance elastomer clamping devices used in commercial aerospace and military applications. Defense technologies develops and manufactures combustible ordnance components and warfare countermeasure devices for military customers. This segment includes results from the Kirkhill business prior to its March 15, 2018 sale.

Our current business and strategic plan focuses on the continued development of products and solutions principally for aerospace and defense markets. We are concentrating our efforts to expand our capabilities in these markets, anticipate the global needs of our customers and respond to such needs with comprehensive solutions. These efforts focus on continuous research and new product development, acquisitions and strategic realignments of operations to expand our capabilities as a more comprehensive supplier to our customers across our entire product offering.

In March 2014 we entered into a Consent Agreement with the DTCC to resolve alleged ITAR civil violations. The Consent Agreement was closed in fiscal 2017.

In fiscal 2017 we evaluated the ongoing performance challenges at our elastomer business based in Brea, California, known as the Kirkhill business, resulting in the decision to explore all strategic options associated with the business. The historic volatility of this business's results of operations was a consideration in this evaluation. In March 2018 the Board of Directors approved the sale of the Kirkhill business, and on March 15, 2018, we sold the assets and certain liabilities of this business to TransDigm, Inc. for $50 million before selling costs. We incurred a $3.7 million loss on sale of the business and an after tax gain of $2.1 million. The after-tax gain was due to the release of a capital loss valuation reserve of $4.9 million and an additional tax benefit of $4.1 million recognized as a result of the loss on the sale of the business. Based on current discontinued operations accounting guidance, the sale of the Kirkhill business does not qualify as a discontinued operation, and was therefore included in the Advanced Materials segment. Operating earnings (loss) for the Kirkhill business are summarized below:

In Thousands	2018	2017
Net Sales	$ 35,488	$ 98,327
Cost of Sales	40,617	92,984
Gross Profit (Loss)	(5,129)	5,343
Selling, general & administrative	5,836	12,771
Research, development and engineering	1,026	2,613
Loss on sale of business	3,730	-
Operating Earnings (Loss)	$ (15,721)	$ (10,041)
Loss (Gain) on Sale of Business, Net of Tax:		
Loss on sale of business	3,730	-
Income Tax Expense (Benefit):		
Release of Capital Loss Valuation Reserve	(4,897)	-
Income Tax Expense (Benefit)	(970)	-
	$ (2,137)	$ -

In June 2014 our Board of Directors approved a share repurchase program and authorized the repurchase of up to $200 million of outstanding shares of common stock. In March 2015 our Board of Directors authorized an additional $200 million for the repurchase of outstanding shares of common stock under the program. Under the program, the Company is authorized to repurchase up to $400 million of the outstanding shares of common stock from time to time, depending on market conditions, share price and other factors. In the first half of fiscal 2018 the Company repurchased 601,400 shares under this program at an average price paid per share of $72.25, for an aggregate purchase price of $43.4 million. There were no shares repurchased during fiscal 2017. In fiscal 2016 we repurchased 304,577 shares under this program at an average price paid per share of $61.51, for an aggregate purchase price of $18.7 million. Since the program began, the Company has repurchased 3,737,327 shares for an aggregate purchase price of $352.0 million, with $48.0 million in shares remaining available for repurchase in the future.

Fourth Quarter of Fiscal 2018

Consolidated sales for the fourth quarter of fiscal 2018 were $535.3 million compared with $528.7 million in the prior-year period. The $6.6 million increase was mainly due to higher sales for Avionics & Controls segment products of $9.6 million

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and higher sales of Sensors & Systems segment products of $12.5 million. These increases were partially offset by lower sales in fiscal 2018 as a result of the March 2018 sale of the Kirkhill business in the Advanced Materials segment.

Gross margin was 34.4% in the fourth quarter of fiscal 2018 compared with 31.4% in the prior-year period. Gross margin in the fourth quarter of fiscal 2018 benefited from strong gross margin in our Sensors & Systems and Advanced Materials segments, while the gross margin in Avionics & Controls was slightly weaker compared with the prior-year period. For further explanation regarding changes in sales and gross profit in the fourth quarter of fiscal 2018 over the prior-year period, refer to the table at the end of the Overview section for a roll forward presentation of sales and gross profit.

Selling, general and administrative expenses increased by $0.9 million to $89.2 million, or 16.7% of sales, in the fourth quarter of fiscal 2018 from the prior-year period.

Transaction costs related to the possible sale of the Company were $5.4 million in the fourth quarter of fiscal 2018. These costs consisted of legal and advisory fees.

Research, development and engineering expense decreased by $11.4 million to $17.5 million, or 3.3% of sales, in the fourth quarter of fiscal 2018 from the prior-year period. The decrease primarily reflected lower research, development and engineering activity across all segments as certain programs moved forward into production.

As explained in Note 10 to the Consolidated Financial Statements included in Part 1, Item 1 of this report, the Tax Cuts and Jobs Act (the Act) was enacted on December 22, 2017. The Act reduces the U.S. federal corporate tax rate from 35% to 21%, requires companies to pay a one-time transition tax on earnings of certain foreign subsidiaries that were previously tax deferred, and creates new taxes on certain foreign sourced earnings. The income tax rate was 25.1% in the fourth quarter of fiscal 2018 compared with 23.3% in the prior-year period. The income tax rate in the fourth quarter, excluding the impact of the Act of $1.4 million, was 23.1%. The difference in the effective tax rate was primarily driven by the repeal of certain benefits of foreign tax regimes in fiscal 2017 with an offset associated with a reduction in the U.S. federal statutory tax rate in fiscal 2018.

Earnings from continuing operations in the fourth quarter of fiscal 2018 were $49.9 million, or $1.69 per diluted share, compared with $31.5 million, or $1.05 per diluted share, in the prior-year period. Income from discontinued operations in the fourth quarter of fiscal 2018 was $2.8 million, or $0.09 per diluted share, compared with a loss of $1.1 million, or $0.04 per diluted share, in the prior-year period. Net income in the fourth quarter of fiscal 2018 was $52.7 million, or $1.78 per diluted share, compared with $30.4 million, or $1.01 per diluted share, in the prior-year period.

<u>Fiscal 2018</u>

Sales for fiscal 2018 were $2.035 billion compared to $2.000 billion in the prior-year period. The $34.5 million increase in sales was mainly due to increased segment sales at Avionics & Controls and Sensors & Systems, partially offset by lower Advanced Materials sales due to the sale of the Kirkhill business.

Consolidated gross margin was 32.7% and 33.0% in fiscal 2018 and 2017, respectively. Avionics & Controls and Sensors & Systems segment gross margin were weaker than the prior-year period and Advanced Materials segment gross margin increased over the prior-year period.

Selling, general and administrative expense increased by $12.3 million to $387.2 million, or 19.0% of sales, compared with fiscal 2017, mainly due to the effect of changes in foreign currency rates and higher professional fees principally for government contract data security compliance requirements.

Transaction costs related to exploring strategic options for the possible sale of the Company were $7.2 million in fiscal 2018.

Research, development and engineering spending decreased by $18.9 million to $90.9 million or 4.5% of sales, compared with fiscal 2017, reflecting lower activity across all segments.

In fiscal 2018 we granted exclusive licenses to third parties to manufacture, repair and sell certain legacy avionics components and control devices for $7.5 million. We recorded $5.3 million in license fee income, net of the write-off of the related intangible assets of $2.2 million. We are paid a 15% royalty on future sales of the licensed products. License fee income is reported as a separate line item on the Consolidated Statement of Operations and Comprehensive Income (Loss) and is included in Avionics & Controls segment earnings.

In fiscal 2017 we received a $7.8 million insurance recovery resulting from an energetic incident at one of our countermeasure operations, which occurred in fiscal 2016. The insurance recovery is reported as a separate line item on the Consolidated Statement of Operations and Comprehensive Income (Loss) and is included in Advanced Materials segment earnings.

The income tax rate was 54.6% in fiscal 2018 compared with 21.5% in the prior-year period. The income tax rate in fiscal 2018, excluding the effect of the Act of $49.9 million, was 22.1%. At September 28, 2018, we had not completed our accounting for the tax effects of enactment of the Act; however, we made a reasonable estimate of the effects on our existing deferred tax balances and the one-time transition tax based on our total post-1986 earnings and profits that we previously deferred from U.S. income tax. In the fourth quarter of fiscal 2018 we updated our provisional estimate related to the measurement of our deferred income tax balance from $6.6 million to $7.2 million and our estimate of the one-time provisional transition tax liability from $42.0 million to $39.2 million. In addition, we recorded a provisional estimate of $3.5 million of tax expense on our foreign earnings, which previously had been deferred from U.S. income tax. In addition, the income tax rate for fiscal 2018 also reflected a $4.9 million tax benefit from a release of a capital loss valuation reserve due to a realized capital gain upon the sale of the Kirkhill business.

Earnings from continuing operations in fiscal 2018 were $68.8 million, or $2.32 per diluted share, compared with $118.9 million, or $3.96 per diluted share, in the prior-year period. Income from discontinued operations in fiscal 2018 was $0.7 million, or $0.02 per diluted share, compared with a loss of $7.3 million, or $0.24 per diluted share, in the prior-year period. Net income for fiscal 2018 was $69.5 million, or $2.34 per diluted share, compared with $111.6 million, or $3.72 per diluted share, in the prior-year period.

Cash flows from operating activities were $214.1 million in fiscal 2018 compared with $193.4 million in the prior-year period, mainly reflecting a lower use of cash for working capital.

Our sales, gross profit and earnings results for the three- and twelve-month periods ended September 28, 2018, compared with the three- and twelve-month periods ended September 29, 2017, included a number of significant items which are summarized in the tables below.

The following is a roll forward of sales and gross profit from the fourth quarter of fiscal 2017 to the fourth quarter of fiscal 2018:

In Thousands	Avionics & Controls	Sensors & Systems	Advanced Materials	Total
Sales:				
Three-month period ended September 29, 2017	$ 225,634	$ 189,086	$ 113,930	$ 528,650
Foreign currency gain (loss)	(386)	(611)	(153)	(1,150)
Forward contract gain (loss)	(1,805)	(756)	-	(2,561)
Sales volume	11,796	13,830	6,510	32,136
Sale of business	-	-	(21,781)	(21,781)
Three-month period ended September 28, 2018	$ 235,239	$ 201,549	$ 98,506	$ 535,294
Gross Profit:				
Three-month period ended September 29, 2017	76,385	58,936	30,907	166,228
Foreign currency gain (loss)	(320)	(304)	(40)	(664)
Forward contract gain (loss)	(1,819)	(756)	-	(2,575)
Volume/mix	7,556	6,463	3,472	17,491
Lower (higher) manufacturing costs	(1,756)	7,465	(1,040)	4,669
Inventory cost and EAC adjustment	(368)	-	-	(368)
Sale of business	-	-	1,377	1,377
Other	(674)	(1,689)	530	(1,833)
Three-month period ended September 28, 2018	$ 79,004	$ 70,115	$ 35,206	$ 184,325

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The following is a roll forward of sales and gross profit from fiscal 2017 to fiscal 2018:

In Thousands		Avionics & Controls		Sensors & Systems		Advanced Materials		Total
Sales:								
Twelve-month period ended September 29, 2017	$	840,777	$	724,373	$	435,154	$	2,000,304
Foreign currency gain (loss)		7,133		25,718		5,469		38,320
Forward contract gain (loss)		7,196		8,573		-		15,769
Sales volume		6,437		7,401		29,447		43,285
Sale of business		-		-		(62,839)		(62,839)
Twelve-month period ended September 28, 2018	$	861,543	$	766,065	$	407,231	$	2,034,839
Gross Profit:								
Twelve-month period ended September 29, 2017		278,857		254,694		126,494		660,045
Foreign currency gain (loss)		(678)		(648)		1,312		(14)
Forward contract gain (loss)		7,201		8,573		-		15,774
Volume/mix		4,903		(4,265)		14,161		14,799
Lower (higher) manufacturing costs		(8,092)		(3,876)		(4,715)		(16,683)
Inventory cost and EAC adjustment		1,218		157		1,195		2,570
Sale of business		-		-		(10,472)		(10,472)
Other		(638)		408		519		289
Twelve-month period ended September 28, 2018	$	282,771	$	255,043	$	128,494	$	666,308

The following table shows the average foreign exchange rates for the British pound, Canadian dollar and euro relative to the U.S. dollar for the three- and twelve-month periods ended September 28, 2018, and September 29, 2017.

	Three-Months Ended			Twelve-Months Ended		
	September 28, 2018	September 29, 2017	Change	September 28, 2018	September 29, 2017	Change
GBP to USD	1.3022	1.3076	(0.4)%	1.3464	1.2712	5.9%
CAD to USD	0.7672	0.7973	(3.8)%	0.7814	0.7616	2.6%
EURO to USD	1.1641	1.1765	(1.1)%	1.1920	1.1060	7.8%

The following tables show the impact of changes in the foreign currency exchange rates for the British pound, Canadian dollar and euro relative to the U.S. dollar on operating earnings during the fourth quarter of fiscal 2018 compared with the prior-year period.

In Thousands		Avionics & Controls		Sensors & Systems		Advanced Materials		Total
Sales:								
Foreign currency gain (loss)	$	(386)	$	(611)	$	(153)	$	(1,150)
Forward contract gain (loss)		(1,805)		(756)		-		(2,561)
	$	(2,191)	$	(1,367)	$	(153)	$	(3,711)
Gross Profit:								
Foreign currency gain (loss)	$	(320)	$	(304)	$	(40)	$	(664)
Forward contract gain (loss)		(1,819)		(756)		-		(2,575)
	$	(2,139)	$	(1,060)	$	(40)	$	(3,239)
Operating Earnings (Loss):								
Foreign currency gain (loss)	$	982	$	575	$	1,301	$	2,858
Forward contract gain (loss)		(2,627)		(799)		(1,286)		(4,712)
	$	(1,645)	$	(224)	$	15	$	(1,854)

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The following tables show the impact of changes in the foreign currency exchange rates for the British pound, Canadian dollar and euro relative to the U.S. dollar on operating earnings during fiscal 2018 compared with the prior-year period.

In Thousands	Avionics & Controls	Sensors & Systems	Advanced Materials	Total
Sales:				
Foreign currency gain (loss)	$ 7,133	$ 25,718	$ 5,469	$ 38,320
Forward contract gain (loss)	7,196	8,573	-	15,769
	$ 14,329	$ 34,291	$ 5,469	$ 54,089
Gross Profit:				
Foreign currency gain (loss)	$ (678)	$ (648)	$ 1,312	$ (14)
Forward contract gain (loss)	7,201	8,573	-	15,774
	$ 6,523	$ 7,925	$ 1,312	$ 15,760
Operating Earnings (Loss):				
Foreign currency gain (loss)	$ (1,332)	$ (7,451)	$ 4,908	$ (3,875)
Forward contract gain (loss)	4,703	8,314	(3,205)	9,812
	$ 3,371	$ 863	$ 1,703	$ 5,937

Results of Operations

For further explanation, refer to the roll forward table of sales and gross profit at the end of the Overview section.

Fiscal 2018 Compared with Fiscal 2017

Sales for fiscal 2018 increased by $34.5 million, or 1.7%, from fiscal 2017.

In Thousands	Increase (Decrease) From Prior Year	**2018**	**2017**
Avionics & Controls	2.5%	$ 861,543	$ 840,777
Sensors & Systems	5.8%	766,065	724,373
Advanced Materials	(6.4)%	407,231	435,154
Total Net Sales		$ 2,034,839	$ 2,000,304

The $20.8 million increase in Avionics & Controls sales over fiscal 2017 mainly reflected the following:

- Higher sales volumes of control and communication systems of $36 million due to higher aftermarket sales of $16 million and increased OEM product sales
- Favorable effect of changes in foreign currency exchange rates of $14 million
- Favorable price increase for interface technologies of $2 million for medical applications
- Partially offset by
  - Lower sales volumes of avionics systems of $22 million mainly due to decreased simulator program and repair sales and cockpit retrofits
  - Lower sales volumes of interface technologies mainly for medical and gaming applications of $9 million

The $41.7 million increase in Sensors & Systems sales over the prior-year period principally reflected the following:

- Favorable effect of changes in foreign currency exchange rates of $34 million
- Higher sales volumes of connection technologies of $13 million mainly for industrial applications
- Higher sales volumes of advanced sensors of $6 million for OEM and aftermarket applications
- Partially offset by
  - Lower sales of power systems of $10 million principally due to the completion of an FAA requirement for GFI relays in fiscal 2017
  - Sales price reductions of $1 million for advanced sensors

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The $27.9 million decrease in Advanced Materials sales over the prior-year period mainly reflected the following:

- Lower sales of $63 million due to the sale of the Kirkhill business
- Partially offset by
  - Higher sales volumes of defense technologies of $16 million mainly due to production and delivery challenges experienced at our countermeasures business in the prior-year period
  - Higher sales of engineered products of $13 million, mainly for insulation and elastomer clamping devices
  - Favorable effect of changes in foreign currency exchange rates of $5 million

Foreign sales originating from non-U.S. locations, together with export sales by domestic operations, totaled $1.2 billion in fiscal 2018 and $1.2 billion in fiscal 2017, respectively, and accounted for 60.0% and 58.7% of our sales in fiscal 2018 and 2017, respectively.

Overall, gross margin was 32.7% and 33.0% for fiscal 2018 and 2017, respectively. Gross profit was $666.3 million and $660.0 million for fiscal 2018 and 2017, respectively. Gross profit and gross margin percentage by segment were as follows:

In Thousands	Increase (Decrease) From Prior Year	2018	2017
Avionics & Controls	1.4%	$ 282,771	$ 278,857
Sensors & Systems	0.1%	255,043	254,694
Advanced Materials	1.6%	128,494	126,494
Total Gross Profit		$ 666,308	$ 660,045
Avionics & Controls	(0.4)%	32.8%	33.2%
Sensors & Systems	(1.9)%	33.3%	35.2%
Advanced Materials	2.5%	31.6%	29.1%
Gross Margin Percentage		32.7%	33.0%

Avionics & Controls segment gross margin was 32.8% and 33.2% for fiscal 2018 and 2017, respectively. Segment gross profit was $282.8 million compared with $278.9 million in the prior-year period. The $4 million increase in gross profit mainly reflected the following:

- A $15 million increase in volume/mix due to higher sales of control and communication systems of $14 million and interface technologies of $1 million
- A favorable effect of changes in foreign currency exchange rates of $7 million
- Partially offset by
  - An unfavorable avionics systems volume/mix of $10 million
  - Higher manufacturing and other expense of $8 million mainly reflecting start-up costs of a new cockpit control program

Sensors & Systems segment gross margin was 33.3% and 35.2% for fiscal 2018 and 2017, respectively. Segment gross profit was $255.0 million compared with $254.7 million in the prior-year period. The roll forward of gross margin from the prior-year period to fiscal 2018 reflected the following:

- A favorable effect of changes in foreign currency exchange rates of $8 million
- A $7 million increase in volume/mix due higher sales of connection technologies and advanced sensors
- Partially offset by an $11 million decrease in volume/mix due to lower sales of power systems, principally reflecting the completion of an FAA requirement for GFI relays in 2017

Advanced Materials segment gross margin was 31.6% and 29.1% for fiscal 2018 and 2017, respectively. Segment gross profit was $128.5 million compared with $126.5 million in the prior-year period. The $2 million increase in Advanced Materials segment gross profit principally reflected the following:

- Higher sales volume of combustible ordnance and flare countermeasure devices of $8 million
- Higher sales volumes of engineered materials of $7 million
- Favorable effect of changes in foreign currency exchange rates of $1 million
- Partially offset by
  - The higher gross profit of $10 million at Kirkhill in the prior-year period
  - Higher manufacturing costs of $4 million mainly at our Valencia, California plant. The higher manufacturing costs principally reflected cleanup costs of $3 million due to an accidental release of hazardous material at the

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Valencia, California plant. The incident resulted in employees seeking medical treatment and a suspension of activities at the plant during remediation.

Selling, general and administrative expenses (which include corporate expenses) totaled $387.2 million, or 19.0% of sales, and $375.0 million, or 18.7% of sales, for fiscal 2018 and 2017, respectively. The $12.3 million increase in selling, general and administrative expense mainly reflected the following:

- Unfavorable effect of changes in foreign currency exchange rates of $7 million
- Higher professional fees of $6 million mainly for information technologies expenses driven by government contract data security compliance requirements
- Increased incentive compensation and stock option expense of $3 million, severance expense of $2 million and higher health and welfare expense of $1 million
- A $2 million write-off of capitalized software costs
- Partially offset by:
  - Lower pension expense of $4 million
  - Prior-year bad debt for long-term contracts of $3 million
  - A $2 million decrease in selling, general and administrative expense due to the sale of the Kirkhill business

Research, development and engineering spending was $90.9 million, or 4.5% of sales, for fiscal 2018 compared with $109.8 million, or 5.5% of sales, for the prior-year period. The $18.9 million decrease in research, development and engineering principally reflected lower activity across all three segments including Embraer E2 and Embraer KC-390 developments.

Segment earnings (operating earnings excluding corporate expenses and other income or expense) for fiscal 2018 totaled $260.4 million, or 12.8% of sales, compared with $251.8 million, or 12.6% of sales, for fiscal 2017. Segment earnings by segment were as follows:

In Thousands	Increase (Decrease) From Prior Year	2018	2017
Avionics & Controls	14.1%	$ 103,883	$ 91,040
Sensors & Systems	(1.9)%	85,214	86,902
Advanced Materials	(3.5)%	71,298	73,891
Total Segment Earnings		$ 260,395	$ 251,833
Avionics & Controls	1.3%	12.1%	10.8%
Sensors & Systems	(0.9)%	11.1%	12.0%
Advanced Materials	0.5%	17.5%	17.0%
Segment Earnings Percentage		12.8%	12.6%

Avionics & Controls segment earnings were $103.9 million, or 12.1% of sales, for fiscal 2018 and $91.0 million, or 10.8% of sales, for fiscal 2017. The $13 million increase in Avionics & Controls segment earnings mainly reflected the following:

- An $8 million decrease in research, development and engineering expenses mainly for Embraer KC-390 developments
- License fee income of $5 million from licensing certain avionics components to third-party manufacturers
- A $4 million increase in gross profit
- Partially offset by
  - Unfavorable effect of changes in foreign currency exchange rates of $3 million
  - A $1 million increase in selling, general and administrative expense

Sensors & Systems segment earnings were $85.2 million, or 11.1% of sales, for fiscal 2018 compared with $86.9 million, or 12.0% of sales, for fiscal 2017. The $2 million decrease in Sensors & Systems segment earnings principally reflected the following:

- A $7 million increase in selling, general and administrative expense mainly reflecting the write off of capitalized information technologies implementation costs of $2 million and severance and legal costs of $2 million
- Unfavorable effect of changes in foreign currency exchange rates of $7 million
- Partially offset by $12 million decrease in research, development and engineering expenses mainly for the Embraer E2 development

Advanced Materials segment earnings were $71.3 million, or 17.5% of sales, for fiscal 2018, compared with $73.9 million, or 17.0% of sales, for fiscal 2017. The $3 million decrease in Advanced Materials segment earnings mainly reflected the following:

- A prior-year period $8 million insurance recovery from an incident at one of our countermeasure operations
- A $4 million loss on the sale of the Kirkhill business
- Partially offset by
  - A $4 million decrease in operating expenses due to the sale of the Kirkhill business
  - A $2 million increase in gross profit
  - A $3 million decrease in selling, general and administrative expenses due mainly to cost reduction initiatives

Interest expense was $30.9 million during fiscal 2018, compared with $30.2 million in the prior-year period.

As explained in Note 10 to the Consolidated Financial Statements included in Part 1, Item 1 of this report, the Tax Cuts and Jobs Act (the Act) was enacted on December 22, 2017. We recorded a provisional amount related to the remeasurement of our deferred income tax balance of $7.2 million and a provisional amount related to our one-time transition tax liability of $42.7 million. We expect that the provisional tax liability will be paid over an eight-year period.

The income tax rate in fiscal 2018 was 54.6% mainly due to the effect of the Act. The income tax rate for fiscal 2018, excluding the impact of the Act of $49.9 million, was 22.1%. In addition, the income tax rate for fiscal 2018 also reflected a $4.9 million tax benefit from a release of a capital loss valuation reserve due to a realized capital gain upon the sale of the Kirkhill business.

The 21.5% income tax rate in fiscal 2017 reflected the following items: the Company recognized $8.6 million of discrete tax benefits primarily related to a reduction of the income tax rate in France for fiscal 2020 and the early adoption of the accounting standard update for employee share-based payment awards.

During the next 12 months it is reasonably possible that approximately $0.8 million of tax benefits that are currently unrecognized could be recognized as a result of settlement of examinations and/or the expiration of applicable statutes of limitations. We recognize interest related to unrecognized tax benefits in income tax expense.

New orders for fiscal 2018 were $2.3 billion compared with $2.0 billion for fiscal 2017. Backlog was $1.5 billion at September 28, 2018, and $1.3 billion at September 29, 2017. The increase in orders and backlog was across all three segments. Approximately $466 million is scheduled to be delivered after fiscal 2019. Backlog is subject to cancellation until delivery.

Fiscal 2017 Compared with Fiscal 2016

Sales for fiscal 2017 increased by $6.9 million, or 0.3%, from fiscal 2016.

In Thousands	Increase (Decrease) From Prior Year		2017		2016
Avionics & Controls	(2.4)%	$	840,777	$	861,636
Sensors & Systems	4.1%		724,373		695,712
Advanced Materials	(0.2)%		435,154		436,105
Total Net Sales		$	2,000,304	$	1,993,453

The $21 million decrease in Avionics & Controls sales over fiscal 2016 mainly reflected the following;

- Lower sales volumes of avionics systems of $10 million mainly due to the T-6B military trainer program for the U.S. Navy nearing completion
- Lower sales volumes of control and communication systems of $17 million due to decreased sales of headset communication devices and cockpit switch components for older generation aircraft nearing end of service life
- Lower sales volumes of interface technologies mainly for industrial applications of $5 million
- Partially offset by favorable effect of changes in foreign currency exchange rates of $11 million

The $29 million increase in Sensors & Systems sales over the prior-year period principally reflected the following:

- Higher sales of power systems of $15 million principally for ground fault indicators of $6 million due to an FAA requirement completed in the third quarter of fiscal 2017, and higher sales of power systems for defense and industrial applications

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- Higher sales volumes of connection technologies systems for industrial applications of $9 million
- Higher sales of advanced sensors of $8 million due to equally strong OEM and aftermarket demand
- Partially offset by unfavorable effect of foreign currency exchange rates of $3 million

The $1 million decrease in Advanced Materials sales over the prior-year period mainly reflected the following:

- Decreased sales volumes of engineered materials of $4 million mainly due to a new long-term contract for defense applications replacing a higher priced product
- Decreased sales volumes of combustible ordnance of $3 million
- Unfavorable effect of foreign currency exchange rates of $10 million
- These decreases were partially offset by higher sales volumes of countermeasure flare devices of $16 million mainly due to the return of full production following the May 2016 incident noted in the Overview section

Foreign sales originating from non-U.S. locations, together with export sales by domestic operations, totaled $1.2 billion for both fiscal 2017 and 2016, respectively, and accounted for 58.7% and 57.9% of our sales in fiscal 2017 and 2016, respectively.

Overall, gross margin was 33.0% and 33.2% for fiscal 2017 and 2016, respectively. Gross profit was $660.0 million and $661.9 million for fiscal 2017 and 2016, respectively. Gross profit was impacted by $3.9 million in restructuring expense and $4.3 million in integration expense in fiscal 2016. Gross profit and gross margin percentage by segment were as follows:

In Thousands	Increase (Decrease) From Prior Year	2017	2016
Avionics & Controls	(2.0)%	$ 278,857	$ 284,466
Sensors & Systems	4.2%	254,694	244,435
Advanced Materials	(4.9)%	126,494	132,979
Total Gross Profit		$ 660,045	$ 661,880
Avionics & Controls	0.2%	33.2%	33.0%
Sensors & Systems	0.1%	35.2%	35.1%
Advanced Materials	(1.4)%	29.1%	30.5%
Gross Margin Percentage		33.0%	33.2%

Avionics & Controls segment gross margin was 33.2% and 33.0% for fiscal 2017 and 2016, respectively. Segment gross profit was $278.9 million compared with $284.5 million in the prior-year period. The $6 million decrease in gross profit mainly reflected the following:

- A $17 million decrease due to sales volume/mix mainly due to lower sales of avionics systems for the T-6B
- Higher manufacturing expenses and other expenses of $8 million reflecting a lower recovery of fixed overhead on decreased sales and start-up manufacturing costs of a new cockpit control program
- Partially offset by
  - Integration and factory Kaikaku or layout expenses incurred in the prior year of $6 million
  - A $12 million favorable effect of change of foreign currency rates

Sensors & Systems segment gross margin was 35.2% and 35.1% for fiscal 2017 and 2016, respectively. Segment gross profit was $254.7 million compared with $244.4 million in the prior-year period. The $10 million increase in Sensors & Systems segment gross profit mainly reflected the following:

- A $16 million increase in volume/mix mainly due to higher sales of advanced sensors and power systems
- A $2 million decrease in restructuring expense for advanced sensors operations incurred in the prior-year period
- Partially offset by
  - Higher manufacturing costs of $7 million due to employee turnover and inefficient operations in mainly low-cost countries
  - A $1 million unfavorable effect of change in foreign currency exchange rates

Advanced Materials segment gross margin was 29.1% and 30.5% for fiscal 2017 and 2016, respectively. Segment gross profit was $126.5 million compared with $133.0 million in the prior-year period. The $6 million decrease in Advanced Materials segment gross profit principally reflected the following:

- A $5 million decrease from sales mix principally due to the new long-term contract on engineered materials noted above and a $2 million decrease from lower sales of combustible ordnance

- A $5 million increase in manufacturing expense mainly due to engineered materials elastomer manufacturing inefficiencies
- A $2 million unfavorable effect of change in foreign currency exchange rates
- Partially offset by
  - A $2 million in lower restructuring expenses incurred in the prior-year period
  - A $6 million increase from higher sales volume of flare countermeasures

Selling, general and administrative expenses (which include corporate expenses) totaled $375.0 million, or 18.7% of sales, and $396.5 million, or 19.9% of sales, for fiscal 2017 and 2016, respectively. The $22 million decrease in selling, general and administrative expense mainly reflected the following:

- An $8 million decrease in bad debt expense
- A $7 million decrease in integration expense
- A $7 million effect of change in foreign currency exchange rates
- Partially offset by a $2 million increase in enterprise software license fees

Research, development and engineering spending was $109.8 million, or 5.5% of sales, for fiscal 2017 compared with $99.7 million, or 5.0% of sales, for the prior-year period. The $10.1 million increase in research, development and engineering principally reflected higher activity across all three segments including Embraer E2, Lockheed Martin C-130 and Embraer KC-390 developments.

Segment earnings (operating earnings excluding corporate expenses and other income or expense) for fiscal 2017 totaled $251.8 million, or 12.6% of sales, compared with $237.5 million, or 11.9% of sales, for fiscal 2016. Segment earnings by segment were as follows:

In Thousands	Increase (Decrease) From Prior Year	2017	2016
Avionics & Controls	13.1%	$ 91,040	$ 80,521
Sensors & Systems	5.4%	86,902	82,466
Advanced Materials	(0.8)%	73,891	74,515
Total Segment Earnings		$ 251,833	$ 237,502
Avionics & Controls	1.5%	10.8%	9.3%
Sensors & Systems	0.1%	12.0%	11.9%
Advanced Materials	(0.1)%	17.0%	17.1%
Segment Earnings Percentage		12.6%	11.9%

Avionics & Controls segment earnings were $91.0 million, or 10.8% of sales, for fiscal 2017 and $80.5 million, or 9.3% of sales, for fiscal 2016. The $11 million increase in Avionics & Controls segment earnings mainly reflected the following:

- An $8 million decrease in bad debt expense
- An $8 million decrease in integration expense
- A $2 million favorable effect of foreign currency rates
- Partially offset by
  - A $6 million decrease in gross profit
  - A $2 million increase in research, development and engineering expenses

Sensors & Systems segment earnings were $86.9 million, or 12.0% of sales, for fiscal 2017 compared with $82.5 million, or 11.9% of sales, for fiscal 2016. The $4 million increase in Sensors & Systems segment earnings principally reflected the following:

- A $10 million increase in gross profit
- A $2 million decrease in restructuring expense
- Partially offset by
  - A $6 million increase in research, development and engineering expenses
  - A $2 million increase in selling, general and administrative expense mainly due to information technologies expenses

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Advanced Materials segment earnings were $73.9 million, or 17.0% of sales, for fiscal 2017, compared with $74.5 million, or 17.1% of sales, for fiscal 2016. The $1 million decrease in Advanced Materials segment earnings mainly reflected the following:

- A $6 million decrease in gross profit
- A $5 million increase in selling, general and administrative expense and research, development and engineering
- Partially offset by
  - A $3 million additional insurance recovery from the incident at our countermeasure operation
  - A $2 million decrease in restructuring expenses incurred in the prior-year period
  - A $6 million favorable effect of changes in foreign currency exchange rates

Interest expense was $30.2 million during fiscal 2017, compared with $30.1 million in the prior-year period.

The income tax rates were 21.5% and 16.1% for fiscal 2017 and 2016, respectively. The income tax rate in the current year was higher primarily due to U.K. limitations on interest expense deductions. Both years benefited from various tax credits, certain foreign interest deductions, and lower income tax rates on permanently invested foreign sourced income. The income tax rate in fiscal 2017 and 2016 principally reflected the following discrete income tax items:

- During fiscal 2017, we recognized $8.6 million of discrete tax benefits primarily related to a reduction of the income tax rate in France for fiscal year 2020 and beyond and the early adoption of the accounting standard update for employee share-based payment awards
- In fiscal 2016, we recognized approximately $2.9 million of discrete tax benefits principally related to the enactment of tax laws reducing the U.K. statutory income tax rate

Liquidity and Capital Resources

Working Capital and Statement of Cash Flows
Cash and cash equivalents at the end of fiscal 2018 totaled $372.4 million, an increase of $64.6 million from September 28, 2018. Net working capital increased to $900.9 million at the end of fiscal 2018 from $874.9 million at the end of the prior year.

Cash flows from operating activities were $214.1 million and $193.4 million in fiscal 2018 and 2017, respectively. The increase principally reflected lower uses of working capital. Sources and uses of cash flows from operating activities principally consisted of cash received from the sale of products and cash payments for material, labor and operating expense.

Cash flows used by investing activities were $2.0 million and $57.4 million in fiscal 2018 and 2017, respectively. Cash flows used by investing activities in fiscal 2018 mainly reflected purchases of capital assets of $53.3 million and proceeds from the sale of the Kirkhill business of $47.8 million and proceeds from the sale of discontinued operations assets and capital assets of $3.4 million. Cash flows used by investing activities in fiscal 2017 primarily reflected capital expenditures of $58.0 million.

Cash flows used by financing activities were $138.7 million and $94.4 million in fiscal 2018 and 2017, respectively. Cash flows used by financing activities in fiscal 2018 primarily reflected repayment of long-term debt and credit facilities of $142.6 million and $43.4 million in share repurchases, partially offset by proceeds from the issuance of long-term credit facilities of $45.0 million and $2.8 million from the issuance of common stock under our employee stock plans. Cash flows used by financing activities in fiscal 2017 primarily reflected repayment of long-term debt and credit facilities of $126.4 million, partially offset by $28.1 million from the issuance of common stock under our employee stock plans and $5.0 million in proceeds from our credit facilities.

Capital Expenditures
Net property, plant and equipment was $314.8 million at September 28, 2018, compared with $348.6 million at September 29, 2017. Capital expenditures for fiscal 2018 and 2017 were $53.3 million and $58.0 million, respectively, and included facilities, machinery, equipment and enhancements to information technology systems.

Debt Financing
U.S. Credit Facility
On April 9, 2015, we amended the secured credit facility to extend the expiration to April 9, 2020, increase the revolving credit facility to $500 million, and provide for a delayed-draw term loan facility of $250 million. We recorded $2.3 million in debt issuance costs. The credit facility is secured by substantially all the Company's assets and interest is based on standard inter-bank offering rates. The interest rate ranges from LIBOR plus 1.25% to LIBOR plus 2.00%, depending on the leverage ratios at the time the funds are drawn. At September 28, 2018, we did not have an outstanding balance under the secured credit facility. An additional $15.1 million of unsecured foreign currency credit facilities have been extended by foreign banks for a

total of $515.1 million available companywide. Available credit under the above credit facilities was $498.9 million at fiscal 2018 year end, when reduced by letters of credit of $16.2 million.

U.S. Term Loan, due April 2020
On August 3, 2015, we borrowed $250 million under the delayed-draw term loan provided for under the amended credit facility. The interest rate on this loan ranges from LIBOR plus 1.25% to LIBOR plus 2.00%, depending on the leverage ratios at the time the funds are drawn. At September 28, 2018, the interest rate was LIBOR plus 1.50%, which equaled 3.75%. The loan amortizes at 1.25% of the original principal balance quarterly through March 2020, with the remaining balance due in April 2020. At September 28, 2018, we had $180.0 million outstanding on the U.S. Term Loan.

3.625% Senior Notes, due April 2023
In April 2015 we issued €330.0 million in 3.625% Senior Notes, due April 2023 (2023 Notes) requiring semi-annual interest payments in April and October of each year until maturity. The notes are designated as a net investment hedge and translated to U.S. dollars each period, with the associated gains or losses recorded to AOCI. The net proceeds from the sale of the notes, after deducting $5.9 million of debt issuance costs, were $350.8 million. The 2023 Notes are general unsecured senior obligations of the Company. The 2023 Notes are unconditionally guaranteed on a senior basis by the Company and certain subsidiaries of the Company that are guarantors under the Company's existing secured credit facility. The 2023 Notes are subject to redemption at the option of the Company, in whole or in part, at redemption prices starting at 102.719% of the principal amount plus accrued interest during the period beginning April 15, 2018, and declining annually to 100% of principal and accrued interest on or after April 15, 2021. At September 28, 2018, we had $383.0 million outstanding on the 2023 Notes.

We believe cash on hand, funds generated from operations and other available debt facilities are sufficient to fund operating cash requirements and capital expenditures through fiscal 2019. We believe we will have adequate access to capital markets to fund future acquisitions.

Share Repurchase Program
On June 19, 2014, our Board of Directors approved a share repurchase program and authorized the repurchase of up to $200 million of outstanding shares of common stock. In March 2015 our Board of Directors authorized an additional $200 million. Under the program, the Company is authorized to repurchase up to $400 million of the outstanding shares of common stock from time to time, depending on market conditions, share price and other factors. In fiscal 2015, we repurchased 2,562,122 shares under this program at an average price paid per share of $101.29, for an aggregate purchase price of $259.5 million. In fiscal 2016, we repurchased 304,577 shares under this program at an average price paid per share of $61.51, for an aggregate purchase price of $18.7 million. There were no shares repurchased during fiscal 2017. In the first half of fiscal 2018, we repurchased 601,400 shares under this program at an average price paid per share of $72.25, for an aggregate purchase price of $43.4 million. Since the program began, the Company has repurchased 3,737,327 shares for an aggregate purchase price of $352.0 million, with $48.0 million in shares remaining available for repurchase in the future.

Permanent Investment of Undistributed Earnings of Foreign Subsidiaries
Our non-U.S. subsidiaries have $330 million in cash and cash equivalents at September 28, 2018. Cash and cash equivalents at our U.S. parent and subsidiaries aggregated $42 million at September 28, 2018, and cash flow from these operations and credit facilities are sufficient to fund working capital, capital expenditures, acquisitions and debt repayments of our domestic operations. We have available credit to our U.S. parent and subsidiaries of $498.9 million under our U.S. secured credit facility. We recorded a provisional amount of $3.5 million of tax expense on our foreign earnings, which previously had been deferred from U.S. income tax. The provisional amounts may change as new information becomes available, as the Act continues to be interpreted and as new technical guidance is issued. The amount of undistributed foreign earnings which remains indefinitely reinvested at September 28, 2018, is approximately $483.0 million. The amount of deferred income taxes related to the undistributed foreign earnings is not practical to compute due to the complexity of our international holding company structure and the complexity of computing foreign tax credits.

Government Refundable Advances
Government refundable advances consist of payments received from the Canadian government to assist in the research and development related to commercial aviation that is conducted at our Canadian operations, CMC Electronics, Inc. (CMC). These advances totaled $43.9 million and $45.5 million at September 28, 2018, and September 29, 2017, respectively. The estimated repayment of this advance is based on year-over-year revenue growth of specific CMC's commercial aviation specific product lines from 2013 to 2027. Imputed interest on the advance was negative 1.65% at September 28, 2018 resulting from future year-over-year revenue growth being lower than previously estimated.

Pension and Other Post-Retirement Benefit Obligations
Our pension plans principally include a U.S. pension plan maintained by Esterline, non-U.S. plans maintained by CMC, and other non-U.S. plans. Our principal post-retirement plans include non-U.S. plans maintained by CMC, which are non-contributory health care and life insurance plans.

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We account for pension expense using the end of the fiscal year as our measurement date, and we make actuarially computed contributions to our pension plans as necessary to adequately fund benefits. Our funding policy is consistent with the minimum funding requirements of ERISA. In fiscal 2018 and 2017, operating cash flow included $7.6 million and $5.3 million, respectively, of cash funding to the non-U.S. pension plans maintained primarily by CMC. There is no funding requirement for fiscal 2019 for the U.S. pension plans maintained by Esterline. We expect pension funding requirements for the CMC pension plans and other non-U.S. pension plans to be approximately $5.5 million in fiscal 2019. The rate of increase in future compensation levels is consistent with our historical experience and salary administration policies. The expected long-term rate of return on plan assets is based on long-term target asset allocations of 70% equity and 30% fixed income. We periodically review allocations of plan assets by investment type and evaluate external sources of information regarding long-term historical returns and expected future returns for each investment type, and accordingly, believe a 3.00% to 7.50% assumed long-term rate of return on plan assets is appropriate for the pension plans. Current allocations are consistent with the long-term targets.

We made the following assumptions with respect to our Esterline pension obligation in fiscal 2018 and 2017:

	2018	2017
Principal assumptions as of fiscal year end:		
Discount rate	4.35%	3.75%
Rate of increase in future compensation levels	4.48%	4.48%
Assumed long-term rate of return on plan assets	7.00%	7.00%

We made the following assumptions with respect to our CMC pension obligation in fiscal 2018 and 2017:

	2018	2017
Principal assumptions as of fiscal year end:		
Discount rate	3.84%	3.76%
Rate of increase in future compensation levels	2.75%	2.75%
Assumed long-term rate of return on plan assets	5.34%	5.19%

We made the following assumptions with respect to our other non-U.S. pension obligations in fiscal 2018 and 2017:

	2018	2017
Principal assumptions as of fiscal year end:		
Discount rate	1.50 - 9.75%	1.40 - 8.75%
Rate of increase in future compensation levels	3.20 - 10.31%	2.96 - 10.29%
Assumed long-term rate of return on plan assets	3.00 - 7.50%	3.25 - 8.25%

We use a discount rate for expected returns that is a spot rate developed from a yield curve established from high-quality corporate bonds and matched to plan-specific projected benefit payments. Although future changes to the discount rate are unknown, had the discount rate increased or decreased by 25 basis points in fiscal 2018, pension liabilities in total would have decreased $12.8 million or increased $13.5 million, respectively. Had the discount rate increased or decreased by 25 basis points, fiscal 2018 pension expense would have decreased $0.9 million or increased $0.8 million, respectively. Had the expected return on assets increased or decreased by 25 basis points, fiscal 2018 pension expense would have decreased $1.1 million or increased $1.1 million, respectively.

We made the following assumptions with respect to our Esterline post-retirement obligation in fiscal 2018 and 2017:

	2018	2017
Principal assumptions as of fiscal year end:		
Discount rate	4.35%	3.75%
Initial weighted average health care trend rate	6.00%	6.00%
Ultimate weighted average health care trend rate	6.00%	6.00%

We made the following assumptions with respect to our CMC post-retirement obligation in fiscal 2018 and 2017:

	2018	2017
Principal assumptions as of fiscal year end:		
Discount rate	3.48%	3.51%
Initial weighted average health care trend rate	5.70%	5.80%
Ultimate weighted average health care trend rate	4.10%	4.10%

Our health care trend rate was based on the experience of our plan and expectations for the future. A 100 basis points increase in the health care trend rate would increase our post-retirement benefit obligation by $1.3 million at September 28, 2018. A 100 basis points decrease in the health care trend rate would decrease our post-retirement benefit obligation by $1.1 million at September 28, 2018. Assuming all other assumptions are held constant, the estimated effect on fiscal 2018 post-retirement benefit expense from a hypothetical 100 basis points increase or decrease in the health care trend rate would not have a material effect on our post-retirement benefit expense.

Research and Development Expense

For the three years ended September 28, 2018, research and development expense averaged 5.0% of sales. In fiscal 2018 research and development expense was 4.5% of sales.

Contractual Obligations

The following table summarizes our outstanding contractual obligations as of fiscal 2018 year end. Liabilities for income taxes were excluded from the table, as we are not able to make a reasonably reliable estimate of the amount and period of related future payments.

In Thousands	Total	Less than 1 year	1–3 years	4–5 years	After 5 years
Long-term debt [1]	$ 734,930	$ 23,228	$ 189,472	$ 408,617	$ 113,613
Interest obligations	71,644	20,457	30,363	20,824	-
Operating lease obligations	41,475	12,592	16,109	8,792	3,982
Purchase obligations	776,221	714,048	61,540	633	-
Total contractual obligations	$ 1,624,270	$ 770,325	$ 297,484	$ 438,866	$ 117,595

[1] Includes $58.8 million representing interest on capital lease obligations. Approximately 33% of our interest obligations are from variable interest rate obligations. We assumed an interest rate of 3.75% for all future periods.

Seasonality

The timing of our revenues is impacted by the purchasing patterns of our customers and, as a result, we do not generate revenues evenly throughout the year. Moreover, our first fiscal quarter, October through December, includes significant holiday vacation periods in both Europe and North America. This leads to decreased order and shipment activity; consequently, first quarter results are typically weaker than other quarters and not necessarily indicative of our performance in subsequent quarters.

Disclosures About Market Risk

Interest Rate Risks

Our debt includes fixed rate and variable rate obligations at September 28, 2018. Our ratio of fixed and variable rate to total obligations was 67% and 33%, respectively at September 28, 2018. We are not subject to interest rate risk on the fixed rate obligations. We are subject to interest rate risk on the U.S. Term Loan and U.S. credit facility. For long-term debt, the table below presents principal cash flows and the related weighted-average interest rates by contractual maturities.

A hypothetical 10% increase or decrease in average market rates would not have a material effect on our pretax income.

In Thousands	Long-Term Debt – Variable Rate	
	Principal Amount	Average Rates [1]
Maturing in:		
2019	$ 12,500	*
2020	167,500	*
2021	-	*
2022	-	*
2023	-	*
2024 and thereafter	-	*
Total	$ 180,000	
Fair value at 9/28/2018	$ 180,000	

[1] Borrowings under the U.S. Term Loan bear interest at a rate equal to either: (a) the LIBOR rate plus 1.50% or (b) the "Base Rate" (defined as the higher of Wells Fargo Bank, National Association's prime rate and the Federal funds rate plus 0.50%).

Currency Risks

We own significant operations in Canada, France and the United Kingdom. To the extent that sales are transacted in a foreign currency, we are subject to foreign currency fluctuation risk. Furthermore, we have assets denominated in foreign currencies that are not offset by liabilities in such foreign currencies. At September 28, 2018, we had the following monetary assets subject to foreign currency fluctuation risk: U.S. dollar-denominated backlog with customers whose functional currency is other than the U.S. dollar; U.S. dollar-denominated accounts receivable and payable; and certain forward contracts, which are not accounted for as a cash flow hedge. The foreign exchange rate for the dollar relative to the euro increased to 0.862 at September 28, 2018, from 0.846 at September 29, 2017; the dollar relative to the British pound increased to 0.767 from 0.746; and the dollar relative to the Canadian dollar increased to 1.291 from 1.247. Foreign currency transactions affecting monetary assets, forward contracts and backlog resulted in an $8.3 million loss in fiscal 2018, an $11.9 million loss in fiscal 2017, and a $19.8 million loss in fiscal 2016.

Our policy is to hedge a portion of our forecasted transactions and a portion of our net monetary assets, including the embedded derivatives in our backlog, using forward exchange contracts. We do not enter into any forward contracts for trading purposes. At September 28, 2018, and September 29, 2017, the notional value of foreign currency forward contracts was $450.3 million and $411.0 million, respectively. The notional value of our foreign currency forward contracts include $100 million related to the hedge of a portion of our net monetary assets, including the embedded derivatives in our backlog. The net fair value of our open foreign currency forward contracts was a $6.4 million liability and an $11.3 million asset at September 28, 2018, and September 29, 2017, respectively. If the U.S. dollar increased by a hypothetical 5%, the effect on the fair value of the foreign currency contracts at September 28, 2018, would be a decrease in the net liability of $20.1 million. If the U.S. dollar decreased by a hypothetical 5%, the effect on the fair value of the foreign currency contracts would be an increase in net liability of $24.8 million.

The following tables provide information about our significant derivative financial instruments, including foreign currency forward exchange agreements and certain firmly committed sales transactions denominated in currencies other than the functional currency at September 28, 2018, and September 29, 2017. The information about certain firmly committed sales contracts and derivative financial instruments is in U.S. dollar equivalents. For forward foreign currency exchange agreements, the following tables present the notional amounts at the current exchange rate and weighted-average contractual foreign currency exchange rates by contractual maturity dates.

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Firmly Committed Sales Contracts
Operations with Foreign Functional Currency
At September 28, 2018

Principal Amount by Expected Maturity

In Thousands Fiscal Years	Firmly Committed Sales Contracts in United States Dollar Canadian Dollar	Euro	British Pound
2019	$ 148,368	$ 131,356	$ 37,040
2020	37,904	24,863	10,002
2021	15,115	372	-
2022	10,675	12	-
2023 and thereafter	49,605	-	-
Total	$ 261,667	$ 156,603	$ 47,042

Derivative Contracts
Operations with Foreign Functional Currency
At September 28, 2018

Notional Amount by Expected Maturity
Average Foreign Currency Exchange Rate (USD/Foreign Currency) [1]

Related Forward Contracts to Sell U.S. Dollar for Canadian Dollar

In Thousands, Except for Average Contract Rate Fiscal Years	United States Dollar Notional Amount	Avg. Contract Rate
2019	$ 202,600	0.777
2020	72,500	0.786
Total	$ 275,100	
Fair value at 9/28/18	$ (686)	

[1] The Company has no derivative contracts maturing after fiscal 2020.

Derivative Contracts
Operations with Foreign Functional Currency
At September 28, 2018

Notional Amount by Expected Maturity
Average Foreign Currency Exchange Rate (USD/Foreign Currency) [1]

Related Forward Contracts to Sell U.S. Dollar for Euro

In Thousands, Except for Average Contract Rate Fiscal Years	United States Dollar Notional Amount	Avg. Contract Rate
2019	$ 110,959	1.223
2020	17,770	1.215
Total	$ 128,729	
Fair value at 9/28/18	$ (4,104)	

[1] The Company has no derivative contracts maturing after fiscal 2020.

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Derivative Contracts
Operations with Foreign Functional Currency
At September 28, 2018

Notional Amount by Expected Maturity
Average Foreign Currency Exchange Rate (USD/Foreign Currency) [1]

Related Forward Contracts to Sell U.S. Dollar for British Pound

In Thousands, Except for Average Contract Rate	United States Dollar	
Fiscal Years	Notional Amount	Avg. Contract Rate
2019	$ 37,697	1.360
2020	10,450	1.379
Total	$ 48,147	
Fair value at 9/28/18	$ (1,590)	

1 The Company has no derivative contracts maturing after fiscal 2020.

Firmly Committed Sales Contracts
Operations with Foreign Functional Currency
At September 29, 2017

Principal Amount by Expected Maturity

In Thousands	Firmly Committed Sales Contracts in United States Dollar		
Fiscal Years	Canadian Dollar	Euro	British Pound
2018	$ 112,895	$ 154,346	$ 28,990
2019	28,432	39,222	3,565
2020	11,911	7,131	69
2021	10,912	6,599	-
2022 and thereafter	41,598	9,641	-
Total	$ 205,748	$ 216,939	$ 32,624

Derivative Contracts
Operations with Foreign Functional Currency
At September 29, 2017

Notional Amount by Expected Maturity
Average Foreign Currency Exchange Rate (USD/Foreign Currency) [1]

Related Forward Contracts to Sell U.S. Dollar for Canadian Dollar

In Thousands, Except for Average Contract Rate	United States Dollar	
Fiscal Years	Notional Amount	Avg. Contract Rate
2018	$ 167,100	0.778
2019	64,500	0.772
Total	$ 231,600	
Fair value at 9/29/17	$ 7,767	

1 The Company had no derivative contracts maturing after fiscal 2019.

Derivative Contracts
Operations with Foreign Functional Currency
At September 29, 2017

Notional Amount by Expected Maturity
Average Foreign Currency Exchange Rate (USD/Foreign Currency) [1]

Related Forward Contracts to Sell U.S. Dollar for Euro

In Thousands, Except for Average Contract Rate	United States Dollar	
Fiscal Years	Notional Amount	Avg. Contract Rate
2018	$ 106,111	1.139
2019	19,880	1.214
Total	$ 125,991	
Fair value at 9/29/17	$ 5,066	

1 The Company had no derivative contracts maturing after fiscal 2019.

Derivative Contracts
Operations with Foreign Functional Currency
At September 29, 2017

Notional Amount by Expected Maturity
Average Foreign Currency Exchange Rate (USD/Foreign Currency) [1]

Related Forward Contracts to Sell U.S. Dollar for British Pound

In Thousands, Except for Average Contract Rate	United States Dollar	
Fiscal Years	Notional Amount	Avg. Contract Rate
2018	$ 42,431	1.390
2019	6,924	1.376
Total	$ 49,355	
Fair value at 9/29/17	$ (1,373)	

1 The Company had no derivative contracts maturing after fiscal 2019.

Critical Accounting Policies
Our financial statements and accompanying notes are prepared in accordance with U.S. generally accepted accounting principles. Preparing financial statements requires management to make estimates and assumptions that affect the reported amounts of assets, liabilities, revenues and expenses. Actual results may differ from estimates under different assumptions or conditions. These estimates and assumptions are affected by our application of accounting policies. Our critical accounting policies include revenue recognition, accounting for the allowance for doubtful accounts receivable, accounting for inventories, impairment of goodwill and intangible assets, impairment of long-lived assets, accounting for legal contingencies, accounting for pension benefits, and accounting for income taxes.

Revenue Recognition
We recognize revenue when the title and risk of loss have passed to the customer, there is persuasive evidence of an agreement, delivery has occurred or services have been rendered, the price is determinable, and the collectability is reasonably assured. We recognize product revenues at the point of shipment or delivery in accordance with the terms of sale. Sales are net of returns and allowances. Returns and allowances are not significant because products are manufactured to customer specification and are covered by the terms of the product warranty.

Revenues and profits on fixed-price contracts with significant engineering as well as production requirements are recorded based on the achievement of contractual milestones and the ratio of total actual incurred costs to date to total estimated costs for each contract (cost-to-cost method). We review cost performance and estimates to complete on our ongoing contracts at least quarterly. The impact of revisions of profit estimates are recognized on a cumulative catch-up basis in the period in

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which the revisions are made. Provisions for anticipated losses on contracts are recorded in the period they become evident. When change orders have been approved by both the Company and the customer for both scope and price and realization is deemed probable, the original contract price is adjusted and revenues are recognized on contract performance (as determined by the achievement of contractual milestones and the cost-to-cost method). For partially approved change orders, costs attributable to unpriced change orders are treated as costs of the contract performance in the period the costs are incurred. Claims are also recognized as contract revenue when approved by both the Company and the customer, based on contract performance. The new standard related to revenue recognition will have an impact on our consolidated financial statements. See Note 1 – Accounting Policies in the Notes to Financial Statements (Part II, Item 8 of this Form 10-K) for further discussion.

Allowance for Doubtful Accounts
We establish an allowance for doubtful accounts for losses expected to be incurred on accounts receivable balances. Judgment is required in estimation of the allowance and is based upon specific identification, collection history and creditworthiness of the debtor.

Inventories
We account for inventories on a first-in, first-out or average cost method of accounting at the lower of its cost or market. The determination of market requires judgment in estimating future demand, selling prices and cost of disposal. Judgment is required when determining inventory cost adjustments. Inventory cost adjustments are recorded when inventory is considered to be excess or obsolete based upon an analysis of actual on-hand quantities on a part-level basis relative to forecasted product demand and historical usage.

Impairment of Goodwill and Intangible Assets
Goodwill and indefinite-lived intangible assets are required to be tested for impairment at least annually. We are also required to test goodwill for impairment between annual tests if events occur or circumstances change that would more likely than not reduce our enterprise fair value below its book value. These events or circumstances could include a significant change in the business climate, including a significant sustained decline in an entity's market value, legal factors, operating performance indicators, competition, sale or disposition of a significant portion of the business, or other factors. We should recognize an impairment charge for the amount by which the carrying amount exceeds the reporting unit's fair value. The loss recognized should not exceed the total amount of goodwill allocated to that reporting unit.

As we have grown through acquisitions, we have accumulated $1.0 billion of goodwill and $40.4 million of indefinite-lived intangible assets out of total assets of $3.0 billion at September 28, 2018. The amount of any annual or interim impairment could be significant and could have a material adverse effect on our reported financial results for the period in which the charge is taken.

We performed our annual impairment review for fiscal 2018 as of the first day of our fiscal fourth quarter and our analysis indicates that no impairment of goodwill or other indefinite-lived assets exists at any of our reporting units.

The valuation of reporting units requires judgment in estimating future cash flows, discount rates and estimated product life cycles. In making these judgments, we evaluate the financial health of the business, including such factors as industry performance, changes in technology and operating cash flows.

We used available market data and a discounted cash flow analysis in completing our 2018 annual impairment test. We believe that our cash flow estimates are reasonable based upon the historical cash flows and future operating and strategic plans of our reporting units. In addition to cash flow estimates, our valuations are sensitive to the rate used to discount cash flows and future growth assumptions. The fair value of all our reporting units exceeds its book value by greater than 12%. A 0.5% change in the discount rate used in the cash flow analysis would result in a change in the fair value of our reporting units of approximately $125.2 million. A 0.5% change in the growth rate assumed in the calculation of the terminal value of cash flows would result in a change in the fair value of our reporting units by $83.9 million. None of these changes would have resulted in any of our reporting units being impaired.

Impairment of Long-Lived Assets
Long-lived assets that are to be disposed of are required to be reported at the lower of its carrying amount or fair value less cost to sell. An asset (other than goodwill and indefinite-lived intangible assets) is considered impaired when estimated future cash flows are less than the carrying amount of the asset. The first step of an impairment test of long-lived assets is to determine the amount of future undiscounted cash flow of the long-lived asset. In the event the undiscounted future cash flow is less than the carrying amount of the long-lived asset, a second step is required, and the long-lived asset is adjusted to its estimated fair value. Fair value is generally determined based upon estimated discounted future cash flows.

As we have grown through acquisitions, we have accumulated $265.7 million of definite-lived intangible assets. The amount of any annual or interim impairment could be significant and could have a material adverse effect on our reported financial results for the period in which the charge is taken.

Contingencies

We are party to various lawsuits and claims, both as plaintiff and defendant, and have contingent liabilities arising from the conduct of business. We are covered by insurance for general liability, product liability, workers' compensation and certain environmental exposures, subject to certain deductible limits. We are self-insured for amounts less than our deductible and where no insurance is available. An estimated loss from a contingency should be accrued by a charge to income if it is probable that an asset has been impaired or a liability has been incurred and the amount of the loss can be reasonably estimated. Disclosure of a contingency is required if there is at least a reasonable possibility that a loss has been incurred. We evaluate, among other factors, the degree of probability of an unfavorable outcome and the ability to make a reasonable estimate of the amount of loss.

Pension and Other Post-Retirement Benefits

We account for pension expense using the end of the fiscal year as our measurement date. We select appropriate assumptions including discount rate, rate of increase in future compensation levels and assumed long-term rate of return on plan assets and expected annual increases in costs of medical and other health care benefits in regard to our post-retirement benefit obligations. Our assumptions are based upon historical results, the current economic environment and reasonable expectations of future events. Actual results which vary from our assumptions are accumulated and amortized over future periods, and accordingly, are recognized in expense in these periods. Significant differences between our assumptions and actual experience or significant changes in assumptions could impact the pension costs and the pension obligation.

Income Taxes

The objectives of accounting for income taxes are to recognize the amount of taxes payable or refundable for the current year and deferred tax liabilities and assets for the future tax consequences of events that have been recognized in our financial statements or tax returns. Judgment is required in assessing the future tax consequences of events that have been recognized in our financial statements or tax returns. Variations in the actual outcome of these future tax consequences could materially impact our financial position and results of operations.

Item 7A. Quantitative and Qualitative Disclosures about Market Risk

We hereby incorporate by reference the information set forth under the section "Disclosures About Market Risk" under Item 7.

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Consolidated Statement of Operations
In Thousands, Except Per Share Amounts

	2018	2017	2016
Net Sales	$ 2,034,839	$ 2,000,304	$ 1,993,453
Cost of Sales	1,368,531	1,340,259	1,331,573
	666,308	660,045	661,880
Expenses			
Selling, general & administrative	387,231	374,981	396,548
Research, development and engineering	90,869	109,778	99,710
Transaction costs	7,192	-	-
License fee income	(5,293)	-	-
Loss on sale of business	3,730	-	-
Restructuring charges	-	-	4,873
Insurance recovery	-	(7,789)	(5,000)
Total Expenses	483,729	476,970	496,131
Operating Earnings from Continuing Operations	182,579	183,075	165,749
Interest Income	(1,912)	(527)	(367)
Interest Expense	30,915	30,208	30,091
Earnings from Continuing Operations Before Income Taxes	153,576	153,394	136,025
Income Tax Expense	83,827	33,025	21,857
Earnings from Continuing Operations Including Noncontrolling Interests	69,749	120,369	114,168
Earnings Attributable to Noncontrolling Interests	(956)	(1,504)	(949)
Earnings from Continuing Operations Attributable to Esterline, Net of Tax	68,793	118,865	113,219
Earnings (Loss) from Discontinued Operations Attributable to Esterline, Net of Tax	665	(7,311)	(15,266)
Net Earnings Attributable to Esterline	$ 69,458	$ 111,554	$ 97,953
Earnings (Loss) Per Share Attributable to Esterline - Basic:			
Continuing operations	$ 2.33	$ 4.00	$ 3.84
Discontinued operations	0.02	(0.25)	(0.52)
Earnings Per Share	$ 2.35	$ 3.75	$ 3.32
Earnings (Loss) Per Share Attributable to Esterline - Diluted:			
Continuing operations	$ 2.32	$ 3.96	$ 3.80
Discontinued operations	0.02	(0.24)	(0.51)
Earnings Per Share	$ 2.34	$ 3.72	$ 3.29

See Notes to Consolidated Financial Statements.

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Consolidated Statement of Comprehensive Income (Loss)
In Thousands

	2018	2017	2016
Net Earnings	$ 69,458	$ 111,554	$ 97,953
Change in Fair Value of Derivative Financial Instruments	(18,850)	17,783	18,627
Income Tax (Expense) Benefit	5,565	(4,969)	(4,959)
	(13,285)	12,814	13,668
Change in Pension and Post-Retirement Obligations	25,965	34,564	(16,622)
Income Tax (Expense) Benefit	(5,821)	(11,848)	6,029
	20,144	22,716	(10,593)
Cumulative Effect of Accounting Change	(7,682)	-	-
Foreign Currency Translation Adjustment	(38,496)	46,220	(42,867)
Comprehensive Income (Loss)	$ 30,139	$ 193,304	$ 58,161

See Notes to Consolidated Financial Statements.

Consolidated Balance Sheet
In Thousands, Except Share and Per Share Amounts

As of September 28, 2018, and September 29, 2017	2018	2017
Assets		
Current Assets		
Cash and cash equivalents	$ 372,406	$ 307,826
Accounts receivable, net of allowances of $16,203 and $16,035	441,696	430,524
Inventories	457,226	477,969
Income tax refundable	9,077	12,814
Prepaid expenses	19,975	19,239
Other current assets	3,497	13,836
Current assets of businesses held for sale	-	6,501
Total Current Assets	1,303,877	1,268,709
Property, Plant and Equipment		
Land	25,722	32,728
Buildings	259,367	269,220
Machinery and equipment	546,303	560,767
	831,392	862,715
Accumulated depreciation	516,586	514,081
	314,806	348,634
Other Non-Current Assets		
Goodwill	1,030,667	1,053,573
Intangibles, net	306,085	359,166
Deferred income tax benefits	44,008	56,793
Other assets	33,249	19,804
Non-current assets of businesses held for sale	4,225	13,334
Total Assets	$ 3,036,917	$ 3,120,013

See Notes to Consolidated Financial Statements.

***Consolidated Balance Sheet** (continued)*

In Thousands, Except Share and Per Share Amounts

As of September 28, 2018, and September 29, 2017	2018	2017
Liabilities and Shareholders' Equity		
Current Liabilities		
Accounts payable	$ 147,438	$ 138,595
Accrued liabilities	232,730	230,007
Current maturities of long-term debt	17,546	17,424
U.S. and foreign income taxes	5,160	582
Current liabilities of businesses held for sale	144	7,184
Total Current Liabilities	403,018	393,792
Long-Term Liabilities		
Credit facilities	-	50,000
Long-term debt, net of current maturities	654,922	709,424
Deferred income tax liabilities	28,899	43,978
Pension and post-retirement obligations	57,755	66,981
Long-term U.S. income taxes payable	32,902	-
Other liabilities	16,294	18,838
Non-current liabilities of businesses held for sale	-	1,724
Shareholders' Equity		
Common stock, par value $.20 per share, authorized 60,000,000 shares, issued 33,190,467 and 33,117,473 shares	6,638	6,623
Additional paid-in capital	751,031	738,329
Treasury stock at cost, repurchased 3,737,327 and 3,135,927 shares	(351,964)	(308,514)
Retained earnings	1,732,327	1,655,187
Accumulated other comprehensive loss	(306,189)	(266,870)
Total Esterline shareholders' equity	1,831,843	1,824,755
Noncontrolling interests	11,284	10,521
Total Shareholders' Equity	1,843,127	1,835,276
Total Liabilities and Shareholders' Equity	$ 3,036,917	$ 3,120,013

See Notes to Consolidated Financial Statements.

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Consolidated Statement of Cash Flows
In Thousands

	2018	2017	2016
Cash Flows Provided (Used) by Operating Activities			
Net earnings including noncontrolling interests	$ 70,414	$ 113,058	$ 98,902
Adjustments to reconcile net earnings including noncontrolling interests to net cash provided (used) by operating activities:			
Depreciation and amortization	106,724	103,770	100,258
Deferred income taxes	(9,064)	(4,490)	(22,274)
Share-based compensation	9,514	9,323	13,986
Gain on sale of discontinued operations	(2,404)	(793)	-
Loss on disposal of fixed assets	2,978	-	-
Loss on sale of business	3,730	-	-
Loss (gain) on assets held for sale	287	2,906	8,448
Working capital changes, net of effect of divestitures:			
Accounts receivable	(27,445)	(2,688)	(44,494)
Inventories	(4,494)	(16,045)	(1,554)
Prepaid expenses	(1,405)	(291)	4,554
Other current assets	272	1,108	373
Accounts payable	13,533	6,987	5,481
Accrued liabilities	(7,304)	(15,398)	(6,035)
U.S. and foreign income taxes	15,787	(16,956)	14,184
Long-term U.S. income taxes payable	32,902	-	-
Other assets and liabilities	10,056	12,958	(4,667)
	214,081	193,449	167,162
Cash Flows Provided (Used) by Investing Activities			
Purchase of capital assets	(53,292)	(58,040)	(68,472)
Escrow deposit	-	-	(1,125)
Proceeds from sale of business	47,814	-	-
Proceeds from sale of discontinued operations	2,344	600	3,654
Proceeds from sale of capital assets	1,092	-	-
	(2,042)	(57,440)	(65,943)

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In Thousands

	2018	2017	2016
Cash Flows Provided (Used) by Financing Activities			
Proceeds provided by stock issuance under employee stock plans	2,782	28,116	6,139
Withholding taxes on restricted stock units vested	(465)	(1,150)	-
Excess tax benefits from share-based compensation	-	-	567
Shares repurchased	(43,450)	-	(18,734)
Repayment of long-term credit facilities	(95,000)	(110,000)	(50,000)
Repayment of long-term debt	(47,574)	(16,392)	(12,360)
Proceeds from issuance of long-term credit facilities	45,000	5,000	45,000
	(138,707)	(94,426)	(29,388)
Effect of Foreign Exchange Rates on Cash and Cash Equivalents	(8,752)	7,723	(4,666)
Net Increase (Decrease) in Cash and Cash Equivalents	64,580	49,306	67,165
Cash and Cash Equivalents - Beginning of Year	307,826	258,520	191,355
Cash and Cash Equivalents - End of Year	$ 372,406	$ 307,826	$ 258,520
Supplemental Cash Flow Information:			
Cash paid for interest	$ 28,933	$ 27,441	$ 27,679
Cash paid for taxes	40,100	51,078	24,803
Supplemental Non-cash Investing and Financing Activities:			
Capital asset and lease obligation additions	$ 95	$ 4,010	$ 11,260

See Notes to Consolidated Financial Statements.

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Consolidated Statement of Shareholders' Equity and Noncontrolling Interests
In Thousands, Except Per Share Amounts

	2018	2017	2016
Esterline Shareholders' Equity			
Common Stock, Par Value $.20 Per Share			
Beginning of year	$ 6,623	$ 6,513	$ 6,476
Shares issued under employee stock plans	15	110	37
End of year	6,638	6,623	6,513
Additional Paid-in Capital			
Beginning of year	738,329	703,134	682,479
Shares issued under employee stock plans	3,188	26,727	6,669
Cumulative effect of accounting change	-	(855)	-
Share-based compensation expense	9,514	9,323	13,986
End of year	751,031	738,329	703,134
Treasury Stock			
Beginning of year	(308,514)	(308,514)	(289,780)
Shares repurchased	(43,450)	-	(18,734)
End of year	(351,964)	(308,514)	(308,514)
Retained Earnings			
Beginning of year	1,655,187	1,542,778	1,444,825
Cumulative effect of accounting change	7,682	855	-
Net earnings	69,458	111,554	97,953
End of year	1,732,327	1,655,187	1,542,778
Accumulated Other Comprehensive Income (Loss)			
Beginning of year	(266,870)	(348,620)	(308,828)
Change in fair value of derivative financial instruments, net of tax (expense) benefit of $5,565, $(4,969) and $(4,959)	(13,285)	12,814	13,668
Change in pension and post-retirement obligations, net of tax (expense) benefit of $(5,821), $(11,848) and $6,029	20,144	22,716	(10,593)
Cumulative effect of accounting change	(7,682)	-	-
Foreign currency translation adjustment	(38,496)	46,220	(42,867)
End of year	(306,189)	(266,870)	(348,620)
Total Esterline Shareholders' Equity	1,831,843	1,824,755	1,595,291
Noncontrolling Interests			
Beginning of year	10,521	10,574	10,324
Net changes in equity attributable to noncontrolling interests	763	(53)	250
End of year	11,284	10,521	10,574
Total Shareholders' Equity	$ 1,843,127	$ 1,835,276	$ 1,605,865

See Notes to Consolidated Financial Statements.

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NOTE 1: **Accounting Policies**

Nature of Operations
Esterline Technologies Corporation (the Company) designs, manufactures and markets highly engineered products. The Company serves the aerospace and defense industry, primarily in the United States and Europe. The Company also serves the industrial/commercial and medical markets.

Principles of Consolidation and Basis of Presentation
The consolidated financial statements include the accounts of the Company and all subsidiaries. All significant intercompany accounts and transactions have been eliminated. Classifications have been changed for certain amounts in prior periods to conform with the current year's presentation.

The Company's year-end is the twelve-month period ending the last Friday of September of each year.

Management Estimates
To prepare financial statements in conformity with U.S. generally accepted accounting principles, management is required to make estimates and assumptions that affect the reported amounts of assets and liabilities, disclosure of contingent assets and liabilities at the date of the financial statements, and the reported amounts of revenues and expenses during the reporting period. Actual results could differ from those estimates.

Concentration of Risks
The Company's products are principally focused on the aerospace and defense industry, which includes military and commercial aircraft original equipment manufacturers and their suppliers, commercial airlines, and the United States and foreign governments. Sales directly to the U.S. government or indirectly through subcontractors to the U.S. government account for approximately 21% of sales in fiscal 2018 and 2017. In addition, approximately 45% of our sales in fiscal 2018 were from the commercial aerospace market. Accordingly, the Company's current and future financial performance is dependent on the economic condition of the aerospace and defense industry. The commercial aerospace and defense markets have historically been subject to cyclical downturns during periods of weak economic conditions or material changes arising from domestic or international events. Management believes that the Company's sales are balanced across its customer base, which includes not only aerospace and defense customers but also medical and industrial commercial customers.

Revenue Recognition
The Company recognizes revenue when the title and risk of loss have passed to the customer, there is persuasive evidence of an agreement, delivery has occurred or services have been rendered, the price is determinable, and the collectability is reasonably assured. The Company recognizes product revenues at the point of shipment or delivery in accordance with the terms of sale. Sales are net of returns and allowances. Returns and allowances are generally not significant because products are manufactured to customer specification and are covered by the terms of the product warranty.

Revenues and profits on fixed-price contracts with significant engineering as well as production requirements are recorded based on the achievement of contractual milestones and the ratio of total actual incurred costs to date to total estimated costs for each contract (cost-to-cost method). Types of milestones include design review and prototype completion. The Company reviews cost performance and estimates to complete on its ongoing contracts at least quarterly. The impact of revisions of profit estimates are recognized on a cumulative catch-up basis in the period in which the revisions are made. Provisions for anticipated losses on contracts are recorded in the period they become evident. When change orders have been approved by both the company and the customer for both scope and price and realization is deemed probable, the original contract price is adjusted and revenues are recognized on contract performance (as determined by the achievement of contractual milestones and the cost-to-cost method). For partially approved change orders, costs attributable to unpriced change orders are treated as costs of the contract performance in the period the costs are incurred. Claims are also recognized as contract revenue when approved by both the Company and the customer, based on contract performance.

Research and Development
Expenditures for internally-funded research and development are expensed as incurred. Customer-funded research and development projects performed under contracts are accounted for as work-in-process as work is performed and recognized as cost of sales and sales under the proportional performance method. Research and development expenditures are net of government assistance and tax subsidies, which are not contingent upon paying income tax. In addition, government assistance for research and development is recorded as a reduction of research and development expense when repayment royalties are contingent upon sales generated directly from the funded research and development. If reimbursement is not tied directly to sales generated from the funded research and development, the government assistance is accounted for as a loan until the criteria for forgiveness have been met.

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Financial Instruments

Fair Value of Financial Instruments

The Company's financial instruments consist primarily of cash and cash equivalents, accounts receivable, accounts payable, short-term borrowings, long-term debt, foreign currency forward contracts, and from time to time interest rate swap agreements. The carrying amounts of cash and cash equivalents, accounts receivable, and accounts payable approximate their respective fair values because of the short-term maturities or expected settlement dates of these instruments. The fair market value of the Company's long-term debt and short-term borrowings was estimated at $685.3 million and $794.9 million at the end of fiscal 2018 and 2017, respectively. These estimates were derived using discounted cash flows with interest rates and quoted market prices currently available to the Company for issuance of debt with similar terms and remaining maturities.

Foreign Currency Exchange Risk Management

The Company is subject to risks associated with fluctuations in foreign currency exchange rates from the sale of products in currencies other than its functional currency. Furthermore, the Company has assets denominated in foreign currencies that are not offset by liabilities in such foreign currencies. The Company has significant operations in Canada, France, and the United Kingdom, and accordingly, the Company may experience gains or losses due to foreign exchange fluctuations.

The Company's policy is to hedge a portion of its forecasted transactions and a portion of its net monetary assets including the embedded derivatives in its backlog using forward exchange contracts in general, with maturities up to 24 months. These forward contracts have been designated as cash flow hedges. The portion of the net gain or loss on a derivative instrument that is effective as a hedge is reported as a component of other comprehensive income in shareholders' equity and is reclassified into earnings in the same period during which the hedged transaction affects earnings. The remaining net gain or loss on the derivative in excess of the present value of the expected cash flows of the hedged transaction is recorded in earnings immediately. If a derivative does not qualify for hedge accounting, or a portion of the hedge is deemed ineffective, the change in fair value is recorded in earnings. The amount of hedge ineffectiveness has not been material in any of the three fiscal periods ended September 28, 2018. At September 28, 2018, and September 29, 2017, the notional value of foreign currency forward contracts accounted for as a cash flow hedge was $309.0 million and $292.1 million, respectively. The notional value of the Company's foreign currency forward contracts include $100 million related to the hedge of a portion of its net monetary assets including the embedded derivatives in our backlog at both September 28, 2018, and September 29, 2017, respectively. The fair value of these contracts was a liability of $5.4 million and an asset of $13.5 million at September 28, 2018, and September 29, 2017, respectively. The Company does not enter into any forward contracts for trading purposes.

In April 2015 the Company issued €330.0 million in 3.625% Senior Notes due April 2023 (2023 Notes) and requiring semi-annual interest payments in April and October each year until maturity. The Company designated the 2023 Notes and accrued interest as a hedge of the investment in certain foreign business units. The foreign currency gain or loss that is effective as a hedge is reported as a component of other comprehensive income (loss) in shareholders' equity. To the extent that this hedge is ineffective, the foreign currency gain or loss is recorded in earnings. There was no ineffectiveness since inception of the hedge.

Depending on the interest rate environment, the Company may enter into interest rate swap agreements to convert the variable interest rates on notes payable to fixed interest rates.

Foreign Currency Translation

Foreign currency assets and liabilities are translated into their U.S. dollar equivalents based on year-end exchange rates. Revenue and expense accounts are translated at average exchange rates. Aggregate exchange gains and losses arising from the translation of foreign assets and liabilities are included in shareholders' equity as a component of comprehensive income. Accumulated loss on foreign currency translation adjustment was $261.1 million, $222.6 million, and $268.8 million as of the fiscal year ended September 28, 2018, September 29, 2017, and September 30, 2016, respectively.

Foreign Currency Transaction Gains and Losses

Foreign currency transaction gains and losses are included in results of operations and are primarily the result of revaluing assets and liabilities denominated in a currency other than the functional currency, the impact of changes in exchange rates, gains and losses on forward exchange contracts, and the change in value of foreign currency embedded derivatives in backlog. These foreign currency transactions resulted in an $8.3 million loss in fiscal 2018, an $11.9 million loss in fiscal 2017, and a $19.8 million loss in fiscal 2016.

Cash Equivalents

Cash equivalents consist of highly liquid investments with original maturities of three months or less at the date of purchase. Fair value of cash equivalents approximates carrying value.

Accounts Receivable

Accounts receivable are recorded at the net invoice price for sales billed to customers. Accounts receivable are considered past due when outstanding more than normal trade terms allow. An allowance for doubtful accounts is established when losses are

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expected to be incurred. Accounts receivable are written off to the allowance for doubtful accounts when the balance is considered to be uncollectible.

Inventories
Inventories are stated at the lower of cost or market using the first-in, first-out (FIFO) or average cost method. Inventory cost includes material, labor and factory overhead. The Company defers pre-production engineering costs as work-in-process inventory in connection with long-term supply arrangements that include contractual guarantees for reimbursement from the customer. Inventory cost adjustments are recorded when inventory is considered to be excess or obsolete based upon an analysis of actual on-hand quantities on a part level basis to forecasted product demand and historical usage.

Property, Plant and Equipment, and Depreciation
Property, plant and equipment is carried at cost and includes expenditures for major improvements. Depreciation is generally provided on the straight-line method based upon estimated useful lives ranging from 15 to 30 years for buildings and 3 to 10 years for machinery and equipment. Depreciation expense was $57.4 million, $58.2 million, and $49.5 million for fiscal 2018, 2017, and 2016, respectively. Assets under capital leases were $47.5 million, $50.5 million, and $48.2 million for fiscal 2018, 2017, and 2016, respectively. Amortization expense of assets accounted for as capital leases is included with depreciation expense. The fair value of liabilities related to the retirement of property is recorded when there is a legal or contractual obligation to incur asset retirement costs and the costs can be estimated. The Company records the asset retirement cost by increasing the carrying cost of the underlying property by the amount of the asset retirement obligation. The asset retirement cost is depreciated over the estimated useful life of the underlying property.

Debt Issuance Costs
Costs incurred to issue debt are deferred and amortized as interest expense over the term of the related debt using a method that approximates the effective interest method.

Long-lived Asset Impairments
The carrying amount of long-lived assets is reviewed periodically for impairment. An asset (other than goodwill and indefinite-lived intangible assets) is considered impaired when estimated future undiscounted cash flows are less than the carrying amount of the asset. In the event the carrying amount of such asset is not deemed recoverable, the asset is adjusted to its estimated fair value. Fair value is generally determined based upon estimated discounted future cash flows.

Assets of Business Held for Sale
Assets held for sale are to be reported at lower of its carrying amount or fair value less cost to sell. Judgment is required in estimating the sales price of assets held for sale and the time required to sell the assets. These estimates are based upon available market data and operating cash flows of the assets held for sale.

Contingencies
The Company is party to various lawsuits and claims, both as plaintiff and defendant, and has contingent liabilities arising from the conduct of business. The Company is covered by insurance for general liability, product liability, workers' compensation and certain environmental exposures, subject to certain deductible limits. The Company is self-insured for amounts less than our deductible and where no insurance is available. An estimated loss from a contingency should be accrued by a charge to income if it is probable that an asset has been impaired or a liability has been incurred and the amount of the loss can be reasonably estimated. The Company evaluates, among other factors, the degree of probability of an unfavorable outcome and the ability to make a reasonable estimate of the amount of loss.

Goodwill and Intangibles
Goodwill is not amortized, but is tested for impairment at least annually or when circumstances require. A reporting unit is generally defined at the operating segment level or at the component level one level below the operating segment, if said component constitutes a business. Goodwill is allocated to reporting units based upon the purchase price of the acquired unit, the valuation of acquired tangible and intangible assets, and liabilities assumed. The Company should recognize an impairment charge for the amount by which the carrying amount exceeds the reporting unit's fair value. The loss recognized should not exceed the total amount of goodwill allocated to that reporting unit.

Intangible assets are amortized over their estimated period of benefit, ranging from 2 to 20 years. Amortization expense is reflected in selling, general and administrative expense on the Consolidated Statement of Operations. The Company periodically evaluates the recoverability of intangible assets and takes into account events or circumstances that warrant revised estimates of useful lives or that indicate that an impairment exists.

Indefinite-lived intangible assets (other than goodwill) are tested annually for impairment or more frequently on an interim basis if circumstances require.

Environmental
Environmental exposures are provided for at the time they are known to exist or are considered probable and reasonably estimable. No provision has been recorded for environmental remediation costs which could result from changes in laws or other circumstances currently not known by the Company. Costs provided for future expenditures on environmental remediation are not discounted to present value.

Pension Plan and Post-Retirement Benefit Plan Obligations
The Company accounts for pension expense using the end of the fiscal year as its measurement date. Management selects appropriate assumptions including discount rate, rate of increase in future compensation levels and assumed long-term rate of return on plan assets and expected annual increases in costs of medical and other health care benefits in regard to the Company's post-retirement benefit obligations. These assumptions are based upon historical results, the current economic environment and reasonable expectations of future events. Actual results which vary from assumptions are accumulated and amortized over future periods, and accordingly, are recognized in expense in these periods. Significant differences between our assumptions and actual experience or significant changes in assumptions could impact the pension costs and the pension obligation.

Legal Expenses
The Company recognizes legal costs related to loss contingencies when the expense is incurred.

Share-Based Compensation
The Company measures the cost of employee services received in exchange for an award of equity instruments based on the grant-date fair value of the award.

Product Warranties
Estimated product warranty expenses are recorded when the covered products are shipped to customers and recognized as revenue. Product warranty expense is estimated based upon the terms of the warranty program.

Income Taxes
The Company recognizes the amount of taxes payable or refundable for the current year and deferred tax liabilities and assets for the future tax consequences of events that have been recognized in our financial statements or tax returns.

Earnings Per Share
Basic earnings per share is computed on the basis of the weighted average number of common shares outstanding during the year. Diluted earnings per share also includes the dilutive effect of stock options and restricted stock units. Common shares issuable from stock options that are excluded from the calculation of diluted earnings per share because they were anti-dilutive were 773,624, 637,800, and 602,900 for fiscal 2018, 2017, and 2016, respectively. The weighted average number of shares outstanding used to compute basic earnings per share was 29,598,000, 29,767,000, and 29,490,000 for fiscal 2018, 2017, and 2016, respectively. The weighted average number of shares outstanding used to compute diluted earnings per share was 29,734,000, 30,003,000, and 29,764,000 for fiscal 2018, 2017, and 2016, respectively.

Recent Accounting Pronouncements
In March 2018 the Financial Accounting Standards Board (FASB) issued an amendment to formally codify the guidance provided by the Securities and Exchange Commission (SEC) in Staff Accounting Bulletin (SAB) 118. SAB 118 provides additional guidance allowing companies to use a one-year measurement period, similar to that used in business combinations, to account for the impacts of the Tax Cuts and Jobs Act (the Act) in their financial statements. The Company has accounted for the impacts of the Act, including the use of reasonable estimates where necessary. The Company will continue to refine its estimates throughout the measurement period.

In February 2018 the FASB issued new guidance to allow a reclassification from accumulated other comprehensive income ("AOCI") to retained earnings for stranded tax effects resulting from the Act. In the fourth quarter of fiscal 2018, the Company remeasured deferred taxes related to unrealized gains on its investment balances using the reduced tax rate. As required by U.S. GAAP, the Company recognized the net tax benefit in the provision for income taxes in the Company's consolidated statement of operations, even though the deferred taxes were initially recognized in AOCI, which resulted in stranded tax effects. The Company elected to early adopt the standard effective June 30, 2018 and reclassified a $7.7 million net tax benefit from AOCI to retained earnings in the consolidated balance sheet. Adoption of the standard had no impact to the Company's consolidated statements of operations or cash flows statements.

In August 2017 the FASB amended its guidance on the financial reporting of hedging relationships. The new guidance eliminates the requirement to separately measure and report hedge ineffectiveness, expands permissible cash flow hedges on contractually specified components, and simplifies hedge documentation and effectiveness assessment. The guidance will be effective at the beginning of the Company's first quarter of fiscal year 2020 and will require a modified retrospective approach on existing cash flow and net investment hedges. The presentation and disclosure requirements will be applied prospectively. The Company is currently evaluating the impact this guidance will have on the Company's consolidated financial statements and the timing of adoption.

In March 2017 the FASB issued new guidance on the presentation of the net periodic cost of post-retirement benefit programs. The new standard requires sponsors of defined benefit post-retirement plans to present the non-service cost components of net periodic benefit cost separate from the service cost component on the income statement. The new standard also requires that the non-service cost components of net periodic benefit cost no longer be capitalized within assets. The Company is evaluating the effect the updated standard will have on the Company's consolidated financial statements and related disclosures. This new standard is effective for the Company in fiscal year 2019. The amendments of this standard should be applied retrospectively for the presentation of the service cost component and the other components of net periodic benefit costs.

In January 2017 the FASB issued new guidance regarding the goodwill impairment test. The new guidance eliminates the Step 2 valuation test when evaluating goodwill for impairment. The new guidance requires that an entity performs its annual or interim goodwill test by comparing the fair value of the reporting unit with its carrying amount. An entity should recognize an impairment charge for the amount by which the carrying amount exceeds the reporting unit's fair value. The loss recognized should not exceed the total amount of goodwill allocated to that reporting unit. The Company adopted this standard in fiscal year 2018. There was no impact to the Company's financial statements as a result of adopting this standard.

In October 2016 the FASB issued new guidance regarding income taxes. The new guidance will require the tax effects of intercompany transactions, other than sales of inventory, to be recognized currently, eliminating an exception under current Generally Accepted Accounting Principles (GAAP) in which the tax effects of intra-entity asset transfers are deferred until the transferred asset is sold to a third party or otherwise recovered through use. The Company is evaluating the effect the updated standard will have on the Company's consolidated financial statements and related disclosures. The guidance will be effective for the Company in fiscal year 2019. The standard is required to be adopted on a modified retrospective basis with a cumulative-effect adjustment recorded to retained earnings as of the beginning of the period of adoption.

In August 2016 the FASB issued new guidance addressing how certain cash receipts and cash payments are presented and classified in the statement of cash flows. The guidance will be effective for the Company in fiscal year 2019. The Company does not expect that the retrospective adoption of this standard at the beginning of the first quarter of 2019 will have a material impact on its financial statements.

In June 2016 the FASB issued a new standard on the measurement of credit losses, which will impact the Company's measurement of trade receivables. The new standard replaces the current incurred loss model with a forward-looking expected loss model that is likely to result in earlier recognition of losses. The Company is evaluating the effect the updated standard will have on the Company's consolidated financial statements and related disclosures. The new standard is effective for the Company in 2021, with early adoption permitted, but not earlier than 2020. Entities are required to apply the provisions to the standard through a cumulative-effect adjustment to retained earnings as of the effective date.

In February 2016 the FASB issued a new lease accounting standard, which provides revised guidance on accounting for lease arrangements by both lessors and lessees. The central requirement of the new standard is that lessees must recognize lease-related assets and liabilities for all leases with a term longer than 12 months. The Company is evaluating the effect the standard will have on the Company's consolidated financial statements and related disclosures. The new standard is effective for the Company in fiscal year 2020, using the modified retrospective method of adoption, with early adoption permitted.

Revenue Recognition
In May 2014 the FASB issued a comprehensive new revenue recognition standard that effectively replaces all current guidance on the topic. The guidance permits the use of either a retrospective or a cumulative effect transition method.

This new guidance is expected to change the revenue recognition practices for a number of revenue streams across the Company's businesses; the most significant will be for certain U.S. government contracts and commercial contracts that meet one or more of the mandatory criteria, which will move revenue recognition from a "point-in-time" basis to an "over-time" basis. The on-going effect of recording revenue on an "over-time" basis is not expected to be materially different than under the historical guidance.

The new guidance is also expected to change the recognition of certain development costs that are contractually guaranteed for reimbursement by our customers, as well as the related reimbursements. Contractually guaranteed reimbursements for development efforts are currently recognized as the development activities are performed. Under the new guidance, the contractually guaranteed reimbursement specific to the development effort will be deferred as a contract liability and recognized as revenue when future products are delivered to the customer in cases where the Company does not transfer all intellectual property rights related to the development effort to the customer or does not have an enforceable right to payment for performance completed to date. The costs associated with the development effort under an arrangement with contractually guaranteed reimbursement will also be deferred, up to the recoverable amount, and recognized through cost of goods sold as products are delivered to the customer. The ongoing effect of deferring contractually guaranteed reimbursements and the related costs until products are delivered to the customer is not expected to be materially different from the legacy guidance.

The new standard also significantly enhances required disclosures regarding revenue and related assets and liabilities.

The Company will adopt the standard at the start of the first quarter of fiscal year 2019 using the modified retrospective approach and recorded a cumulative effect adjustment to retained earnings based on the current terms and conditions of open contracts at the start of the first quarter of fiscal 2019. The Company estimated the cumulative effect of applying the standard as of the transition date will be an increase to retained earnings of approximately $6 million, net of tax, in the first quarter of fiscal 2019. The Company implemented the appropriate changes to business processes and controls to support recognition and disclosure under the new standard, including the new qualitative and quantitative disclosure that will include information on the nature, amount, timing and significant judgements impacting revenue from contracts with customers.

NOTE 2: **Allowance for Doubtful Accounts**

The allowance for doubtful accounts reflects the best estimate of probable losses inherent in the accounts receivable balance and is based on known past due accounts, historical experience and other currently available evidence. Activity in the allowance for doubtful accounts was as follows:

In Thousands	**2018**	**2017**	**2016**
Beginning balance	$ 16,035	$ 17,028	$ 10,050
Charged to expense	2,936	1,647	9,690
Other [1]	(486)	-	-
Write-offs	(2,282)	(2,640)	(2,712)
	$ 16,203	$ 16,035	$ 17,028

1 Other includes divestitures.

NOTE 3: **Inventories**

Inventories at the end of fiscal 2018 and 2017 consisted of the following:

In Thousands	**2018**	**2017**
Raw materials and purchased parts	$ 180,559	$ 194,034
Work in progress	164,714	167,543
Inventory costs under long-term contracts	8,791	10,648
Finished goods	103,162	105,744
	$ 457,226	$ 477,969

NOTE 4: **Goodwill**

The following table summarizes the changes in goodwill by segment for fiscal 2018 and 2017:

In Thousands	Avionics & Controls	Sensors & Systems	Advanced Materials	Total
Balance, September 30, 2016	$ 442,794	$ 385,567	$ 196,306	$ 1,024,667
Foreign currency translation adjustment	13,224	14,266	1,416	28,906
Balance, September 29, 2017	456,018	399,833	197,722	1,053,573
Sale of business	-	-	(7,022)	(7,022)
Foreign currency translation adjustment	(8,491)	(6,159)	(1,234)	(15,884)
Balance, September 28, 2018	$ 447,527	$ 393,674	$ 189,466	$ 1,030,667

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NOTE 5: **Intangible Assets**

Intangible assets at the end of fiscal 2018 and 2017 were as follows:

In Thousands		2018		2017	
	Weighted Average Years Useful Life	Gross Carrying Amount	Accum. Amort.	Gross Carrying Amount	Accum. Amort.
Amortized Intangible Assets:					
Programs	16	$ 603,403	$ 361,317	$ 625,470	$ 339,920
Core technology	11	9,977	8,283	15,926	13,123
Patents and other	12	88,335	66,425	89,736	60,335
Total		$ 701,715	$ 436,025	$ 731,132	$ 413,378
Indefinite-lived Intangible Assets:					
Trademarks		$ 40,395		$ 41,412	

Programs represent the valuation of systems or components sold under long-term supply agreements with aerospace companies, military contractors, and OEM manufacturers using similar technology. The valuation of the program includes the values of the program-specific technology, the backlog of contracts, and the relationship with customers which lead to potential future contracts. The valuation of the program is based upon its discounted cash flow at a market-based discount rate.

Amortization of intangible assets from continuing operations was $47.9 million, $44.2 million, and $49.4 million in fiscal 2018, 2017, and 2016, respectively.

Estimated amortization expense related to intangible assets for each of the next five fiscal years is as follows:

In Thousands Fiscal Year	
2019	$ 43,720
2020	41,502
2021	40,331
2022	34,977
2023	29,505

NOTE 6: **Accrued Liabilities**

Accrued liabilities at the end of fiscal 2018 and 2017 consisted of the following:

In Thousands	2018	2017
Payroll and other compensation	$ 120,434	$ 120,428
Commissions	4,170	4,442
Casualty and medical	16,999	16,067
Interest	6,445	6,592
Warranties	14,485	14,689
State and other tax accruals	6,666	5,222
Customer deposits	15,540	20,593
Deferred revenue	21,036	18,666
Contract reserves	4,682	5,109
Forward foreign exchange contracts	7,040	4,387
Litigation reserves	1,633	1,454
Environmental reserves	1,141	645
Deferred rent	1,321	1,645
Other	11,138	10,068
	$ 232,730	$ 230,007

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Accrued liabilities are recorded to reflect the Company's contractual obligations relating to warranty commitments to customers. Warranty coverage of various lengths and terms is provided to customers depending on standard offerings and negotiated contractual agreements. An estimate for warranty expense is recorded at the time of sale based on the length of the warranty, historical warranty return rates and repair costs.

Changes in the carrying amount of accrued product warranty costs are summarized as follows:

In Thousands		2018		2017
Balance, beginning of year	$	14,689	$	13,365
Warranty costs incurred		(2,146)		(1,875)
Product warranty accrual		7,613		4,658
Release of reserves		(5,398)		(1,907)
Foreign currency translation adjustment		(273)		448
Balance, end of year	$	14,485	$	14,689

NOTE 7: **Retirement Benefits**

Approximately 50% of U.S. employees have a defined benefit earned under the Esterline pension plan.

Under the Esterline defined benefit plan, pension benefits are earned under a cash balance formula with annual pay credits ranging from 2% to 6% effective January 1, 2003. Prior to 2003, pension benefits are based on years of service and five-year average compensation for the highest five consecutive years' compensation during the last ten years of employment. Participants elected either to continue earning benefits under the prior plan formula or to earn benefits under the cash balance formula. Effective January 1, 2003, all new participants are enrolled in the cash balance formula. Esterline also has an unfunded supplemental retirement plan for key executives providing for periodic payments upon retirement.

CMC Electonrics, Inc. (CMC) sponsors defined benefit pension plans and other retirement benefit plans for its employees in Canada. Pension benefits are based upon years of service and final average salary. Other retirement benefit plans are non-contributory health care and life insurance plans.

The Company sponsors a number of other non-U.S. defined benefit pension plans primarily in Belgium, France and Germany. These defined benefit plans generally provide benefits to employees based on formulas recognizing length of service and earnings.

The Company accounts for pension expense using the end of the fiscal year as its measurement date. In addition, the Company makes actuarially computed contributions to these plans as necessary to adequately fund benefits. The Company's funding policy is consistent with the minimum funding requirements of ERISA.

The accumulated benefit obligation and projected benefit obligation for Esterline's U.S. plans are $298.4 million and $308.6 million, respectively, with plan assets of $304.7 million as of September 28, 2018. The underfunded status for the Esterline plans is $3.9 million at September 28, 2018, of which $21.2 million is for the unfunded supplemental retirement plan for key executives. Contributions to the Esterline non-qualified plans totaled $1.4 million both in fiscal 2018 and 2017. There is no funding requirement for fiscal 2019 for the qualified U.S. pension plans maintained by Esterline.

The accumulated benefit obligation and projected benefit obligation for the CMC plans are $133.7 million and $134.6 million, respectively, with plan assets of $140.1 million as of September 28, 2018. The funded status for these CMC plans is $5.5 million at September 28, 2018. Contributions to the CMC plans totaled $4.5 million and $3.5 million in fiscal 2018 and 2017, respectively. The expected funding requirement for fiscal 2019 for the CMC plans is $4.5 million.

The accumulated benefit obligation and projected benefit obligation for the other non-U.S. plans are $41.1 million and $52.2 million, respectively, with plan assets of $25.0 million as of September 28, 2018. The underfunded status for these other non-U.S. plans is $27.2 million at September 28, 2018. Contributions to the other non-U.S. plans totaled $3.2 million and $1.8 million in fiscal 2018 and 2017, respectively. The expected funding requirement for fiscal 2019 for the other non-U.S. plans is $1.0 million.

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Principal assumptions of the Esterline, CMC and other non-U.S. plans are as follows:

	Esterline U.S. Defined Benefit Pension Plans		CMC Defined Benefit Pension Plans		Other Non-U.S. Defined Benefit Pension Plans	
	2018	**2017**	**2018**	**2017**	**2018**	**2017**
Principal assumptions as of year end:						
Discount rate	4.35%	3.75%	3.84%	3.76%	1.50 - 9.75%	1.40 - 8.75%
Rate of increase in future compensation levels	4.48%	4.48%	2.75%	2.75%	3.20 - 10.31%	2.96 - 10.29%
Assumed long-term rate of return on plan assets	7.00%	7.00%	5.34%	5.19%	3.00 - 7.50%	3.25 - 8.25%

	Esterline U.S. Post-Retirement Pension Plans		CMC Post-Retirement Pension Plans	
	2018	**2017**	**2018**	**2017**
Principal assumptions as of year end:				
Discount rate	4.35%	3.75%	3.48%	3.51%
Initial weighted average health care trend rate	6.00%	6.00%	5.70%	5.80%
Ultimate weighted average health care trend rate	6.00%	6.00%	4.10%	4.10%

The Company uses discount rates developed from a yield curve established from high-quality corporate bonds and matched to plan-specific projected benefit payments. Although future changes to the discount rate are unknown, had the discount rate increased or decreased by 25 basis points, pension liabilities in total would have decreased $12.8 million or increased $13.5 million, respectively. Had the discount rate increased or decreased by 25 basis points, fiscal 2018 pension expense would have decreased $0.9 million or increased $0.8 million, respectively. Had the expected return on assets increased or decreased by 25 basis points, fiscal 2018 pension expense would have decreased $1.1 million or increased $1.1 million, respectively. Management is not aware of any legislative or other initiatives or circumstances that will significantly impact the Company's pension obligations in fiscal 2019.

The Company's health care trend rate was based on the experience of its plans and expectations for the future. A 100 basis points increase in the health care trend rate would increase the post-retirement benefit obligation by $1.3 million. A 100 basis points decrease in the health care trend rate would decrease the post-retirement benefit obligation by $1.1 million. Assuming all other assumptions are held constant, the estimated effect on fiscal 2018 post-retirement benefit expense from a hypothetical 100 basis points increase or decrease in the health care trend rate would not have a material effect on our post-retirement benefit expense.

Plan assets are invested in a diversified portfolio of equity and debt securities consisting primarily of common stocks, bonds and government securities. The objective of these investments is to maintain sufficient liquidity to fund current benefit payments and achieve targeted risk-adjusted returns. Management periodically reviews allocations of plan assets by investment type and evaluates external sources of information regarding the long-term historical returns and expected future returns for each investment type, and accordingly, the 3.00% to 7.50% assumed long-term rate of return on plan assets is considered to be appropriate. Allocations by investment type are as follows:

		Actual	
	Target	**2018**	**2017**
Plan assets allocation as of fiscal year end:			
Equity securities	35 - 70%	59.5%	58.4%
Debt securities	30 - 65%	33.9%	35.3%
Cash	0%	6.6%	6.3%
Total		100.0%	100.0%

The following table presents the fair value of the Company's Pension Plan assets as of September 28, 2018, by asset category segregated by level within the fair value hierarchy, as described in Note 8.

In Thousands	Fair Value Hierarchy		
	Level 1	Level 2	Total
Asset category:			
Equity Funds:			
Registered Investment Company Funds - U.S. Equity	$ 121,689	$ -	$ 121,689
U.S. Equity Securities	61,227	-	61,227
Non-U.S. Equity Securities	47,505	-	47,505
Commingled Trust Funds - Non-U.S. Securities	-	48,983	48,983
Fixed Income Securities:			
Commingled Trust Funds - Fixed Income	-	81,081	81,081
Non-U.S. Foreign Commercial and Government Bonds	-	78,379	78,379
Cash and Cash Equivalents	30,937	-	30,937
Total	$ 261,358	$ 208,443	$ 469,801

The following table presents the fair value of the Company's Pension Plan assets as of September 29, 2017, by asset category segregated by level within the fair value hierarchy, as described in Note 8.

In Thousands	Fair Value Hierarchy		
	Level 1	Level 2	Total
Asset category:			
Equity Funds:			
Registered Investment Company Funds - U.S. Equity	$ 113,997	$ -	$ 113,997
U.S. Equity Securities	54,640	-	54,640
Non-U.S. Equity Securities	50,395	-	50,395
Commingled Trust Funds - Non-U.S. Securities	-	48,377	48,377
Fixed Income Securities:			
Commingled Trust Funds - Fixed Income	-	83,387	83,387
Non-U.S. Foreign Commercial and Government Bonds	-	77,931	77,931
Cash and Cash Equivalents	28,848	-	28,848
Total	$ 247,880	$ 209,695	$ 457,575

Valuation Techniques
Level 1 Equity Securities are actively traded on U.S. and non-U.S. exchanges and are either valued using the market approach at quoted market prices on the measurement date or at the net asset value of the shares held by the plan on the measurement date based on quoted market prices.

Level 2 fixed income securities are primarily valued using the market approach at either quoted market prices, pricing models that use observable market data, or bids provided by independent investment brokerage firms.

Level 2 primarily consists of commingled trust funds that are primarily valued at the net asset value provided by the fund manager. Net asset value is based on the fair value of the underlying investments.

Cash and cash equivalents include cash which is used to pay benefits and cash invested in a short-term investment fund that holds securities with values based on quoted market prices, but for which the funds are not valued on quoted market basis.

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Net periodic pension cost for the Company's defined benefit plans at the end of each fiscal year consisted of the following:

In Thousands	Defined Benefit Pension Plans			Post-Retirement Benefit Plans		
	2018	**2017**	**2016**	**2018**	**2017**	**2016**
Components of Net Periodic Cost						
Service cost	$ 15,790	$ 15,108	$ 12,861	$ 361	$ 385	$ 342
Interest cost	17,057	15,553	18,095	402	335	473
Expected return on plan assets	(27,918)	(25,866)	(24,491)	-	-	-
Settlement	-	21	2	-	-	-
Amortization of prior service cost	499	490	487	(5)	(5)	(17)
Amortization of actuarial (gain) loss	3,275	7,643	6,590	-	-	-
Net periodic cost (benefit)	$ 8,703	$ 12,949	$ 13,544	$ 758	$ 715	$ 798

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The funded status of the defined benefit pension and post-retirement plans at the end of fiscal 2018 and 2017 were as follows:

In Thousands	Defined Benefit Pension Plans		Post-Retirement Benefit Plans	
	2018	**2017**	**2018**	**2017**
Benefit Obligations				
Beginning balance	$ 509,256	$ 505,298	$ 13,542	$ 13,236
Currency translation adjustment	(5,735)	9,340	(450)	665
Service cost	15,790	15,108	361	385
Interest cost	17,057	15,553	402	335
Plan participants contributions	553	318	-	-
Actuarial (gain) loss	(16,124)	(11,420)	(349)	(529)
Other adjustments	(230)	(1,254)	-	-
Benefits paid	(25,180)	(23,687)	(586)	(550)
Ending balance	$ 495,387	$ 509,256	$ 12,920	$ 13,542
Plan Assets - Fair Value				
Beginning balance	$ 457,575	$ 425,781	$ -	$ -
Currency translation adjustment	(5,297)	8,170	-	-
Realized and unrealized gain (loss) on plan assets	33,859	41,566	-	-
Plan participants contributions	553	318	-	-
Company contribution	9,086	6,681	586	550
Other adjustments	474	-	-	-
Expenses paid	(1,269)	(1,254)	-	-
Benefits paid	(25,180)	(23,687)	(586)	(550)
Ending balance	$ 469,801	$ 457,575	$ -	$ -
Funded Status				
Fair value of plan assets	$ 469,801	$ 457,575	$ -	$ -
Benefit obligations	(495,387)	(509,256)	(12,920)	(13,542)
Net amount recognized	$ (25,586)	$ (51,681)	$ (12,920)	$ (13,542)
Amount Recognized in the Consolidated Balance Sheet				
Non-current asset	$ 22,776	$ 4,267	$ -	$ -
Current liability	(2,795)	(1,840)	(732)	(669)
Non-current liability	(45,567)	(54,108)	(12,188)	(12,873)
Net amount recognized	$ (25,586)	$ (51,681)	$ (12,920)	$ (13,542)
Amounts Recognized in Accumulated Other Comprehensive Income				
Net actuarial loss (gain)	$ 52,659	$ 78,713	$ 118	$ 476
Prior service cost	3,040	2,593	-	-
Ending balance	$ 55,699	$ 81,306	$ 118	$ 476

The accumulated benefit obligation for all pension plans was $473.2 million at September 28, 2018, and $486.0 million at September 29, 2017.

Estimated future benefit payments expected to be paid from the pension and post-retirement benefit plans or from the Company's assets are as follows:

In Thousands

Fiscal Year		
2019	$	30,199
2020		31,062
2021		33,024
2022		33,647
2023		35,142
2024 - 2028		183,504

Employees may participate in certain defined contribution plans. The Company's contribution expense under these plans totaled $10.1 million in both fiscal 2018 and 2017, and $10.7 million in fiscal 2016, respectively. The Company contributes a matching amount that varies by participating company and employee group based on the first 6% of earnings contributed. The three formulas used are: 25% of the first 6%; or 50% of the first 6%; or 100% of the first 2% and 50% on the next 4%.

NOTE 8: **Fair Value Measurements**

Fair value is defined as the price that would be received to sell an asset or paid to transfer a liability in an orderly transaction between market participants at the measurement date. A fair value hierarchy has been established that prioritizes the inputs to valuation techniques used to measure fair value. An asset's or liability's level within the fair value hierarchy is based on the lowest level of input that is significant to the fair value measurement. The hierarchy of fair value measurements is described below:

- Level 1 – Valuations are based on quoted prices that the Company has the ability to obtain in actively traded markets for identical assets and liabilities. Since valuations are based on quoted prices that are readily and regularly available in an active market or exchange traded market, a valuation of these instruments does not require a significant degree of judgment.
- Level 2 – Valuations are based on quoted prices for similar instruments in active markets, quoted prices for identical or similar instruments in markets that are not active, and model-based valuation techniques for which all significant assumptions are observable in the market.
- Level 3 – Valuations are based on model-based techniques for which some or all of the assumptions are obtained from indirect market information that is significant to the overall fair value measurement and which require a significant degree of management judgment.

The following table sets forth the Company's financial assets and liabilities that were measured at fair value on a recurring basis by level within the fair value hierarchy at the end of fiscal 2018 and 2017:

In Thousands	Level 2			
		2018		**2017**
Assets:				
Derivative contracts designated as hedging instruments	$	1,374	$	13,932
Derivative contracts not designated as hedging instruments		38		284
Embedded derivatives		1,296		746
Liabilities:				
Derivative contracts designated as hedging instruments	$	6,756	$	464
Derivative contracts not designated as hedging instruments		1,026		2,440
Embedded derivatives		684		2,239

In Thousands	Level 3			
		2018		**2017**
Assets:				
Estimated value of assets held for sale	$	4,225	$	19,835
Liabilities:				
Estimated value of liabilities held for sale	$	144	$	8,908

The Company's embedded derivatives are the result of entering into sales or purchase contracts that are denominated in a currency other than the Company's functional currency or the supplier's or customer's functional currency. The fair value is determined by calculating the difference between quoted exchange rates at the time the contract was entered into and the period-end exchange rate. These contracts are categorized as Level 2 in the fair value hierarchy.

The Company's derivative contracts consist of foreign currency exchange contracts and, from time to time, interest rate swap agreements. These derivative contracts are over the counter and their fair value is determined using modeling techniques that include market inputs such as interest rates, yield curves, and currency exchange rates. These contracts are categorized as Level 2 in the fair value hierarchy.

The Company's Board of Directors previously approved a plan to sell certain non-core business units. Based upon the estimated fair values, the Company adjusted the carrying value of the assets and liabilities of the businesses to fair value. Principle assumptions used in measuring the estimated value of assets and liabilities held for sale included estimated selling price of the discontinued business, discount rates, industry growth rates, and pricing of comparable transactions in the market.

NOTE 9: **Derivative Financial Instruments**

The Company may use derivative financial instruments in the form of foreign currency forward exchange contracts and interest rate swap contracts for the purpose of minimizing exposure to changes in foreign currency exchange rates on business transactions and interest rates, respectively. The Company's policy is to execute such instruments with banks the Company believes to be credit worthy and not to enter into derivative financial instruments for speculative purposes. These derivative financial instruments do not subject the Company to undue risk, as gains and losses on these instruments generally offset gains and losses on the underlying assets, liabilities, or anticipated transactions that are being hedged.

All derivative financial instruments are recorded at fair value in the Consolidated Balance Sheet. For a derivative that has not been designated as an accounting hedge, the change in the fair value is recognized immediately through earnings. For a derivative that has been designated as an accounting hedge of an existing asset or liability (a fair value hedge), the change in the fair value of both the derivative and underlying asset or liability is recognized immediately through earnings. For a derivative designated as an accounting hedge of an anticipated transaction (a cash flow hedge), the change in the fair value is recorded on the Consolidated Balance Sheet in Accumulated Other Comprehensive Income (AOCI) to the extent the derivative is effective in mitigating the exposure related to the anticipated transaction. The change in the fair value related to the ineffective portion of the hedge, if any, is immediately recognized in earnings. The amount recorded within AOCI is reclassified into earnings in the same period during which the underlying hedged transaction affects earnings.

The fair values of derivative instruments are presented on a gross basis, as the Company does not have any derivative contracts which are subject to master netting arrangements. The Company does not have any derivative instruments with credit-risk-related contingent features or that required the posting of collateral as of September 28, 2018. The cash flows from derivative contracts are recorded in operating activities in the Consolidated Statement of Cash Flows.

Foreign Currency Forward Exchange Contracts
The Company transacts business in various foreign currencies which subjects the Company's cash flows and earnings to exposure related to changes in foreign currency exchange rates. These exposures arise primarily from purchases or sales of products and services from third parties. Foreign currency forward exchange contracts provide for the purchase or sale of foreign currencies at specified future dates at specified exchange rates, and are used to offset changes in the fair value of certain assets or liabilities or forecasted cash flows resulting from transactions denominated in foreign currencies. As of September 28, 2018, and September 29, 2017, the Company had outstanding foreign currency forward exchange contracts principally to sell U.S. dollars with notional amounts of $452.0 million and $406.9 million, respectively. These notional values consist primarily of contracts for the British pound sterling, Canadian dollar and European euro, and are stated in U.S. dollar equivalents at spot exchange rates at the respective dates.

Interest Rate Swaps
The Company manages its exposure to interest rate risk by maintaining an appropriate mix of fixed and variable rate debt, which over time should moderate the costs of debt financing. When considered necessary, the Company may use financial instruments in the form of interest rate swaps to help meet this objective.

Embedded Derivative Instruments
The Company's embedded derivatives are the result of entering into sales or purchase contracts that are denominated in a currency other than the Company's functional currency or the supplier's or customer's functional currency.

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Net Investment Hedge
In April 2015 the Company issued €330.0 million in 3.625% Senior Notes due April 2023 (2023 Notes) and requiring semi-annual interest payments in April and October each year until maturity. The Company designated the 2023 Notes and accrued interest as a hedge of the investment in certain foreign business units. The foreign currency gain or loss that is effective as a hedge is reported as a component of other comprehensive income (loss) in shareholders' equity. To the extent that this hedge is ineffective, the foreign currency gain or loss is recorded in earnings. There was no ineffectiveness since inception of the hedge.

Fair Value of Derivative Instruments
Fair values of derivative instruments in the Consolidated Balance Sheet at the end of fiscal 2018 and 2017 consisted of:

In Thousands	Classification	Fair Value 2018	Fair Value 2017
Foreign Currency Forward Exchange Contracts:			
	Other current assets	$ 1,176	$ 11,433
	Other assets	236	2,783
	Accrued liabilities	6,643	2,506
	Other liabilities	1,139	398
Embedded Derivative Instruments:			
	Other current assets	$ 1,050	$ 604
	Other assets	246	142
	Accrued liabilities	398	1,657
	Other liabilities	286	582

The effect of derivative instruments on the Consolidated Statement of Operations and Comprehensive Income (Loss) for fiscal 2018 and 2017 consisted of:

Fair Value Hedges
The Company recognized the following gains (losses) on contracts designated as fair value hedges and embedded derivatives:

In Thousands Gain (Loss)	2018	2017
Fair Value Hedges:		
Recognized in cost of sales	$ (1,448)	$ 1,110
Recognized in selling, general & administrative	(1,486)	890
Embedded derivatives:		
Recognized in sales	$ 300	$ (1,709)

Cash Flow Hedges
The Company recognized the following gains (losses) on contracts designated as cash flow hedges:

In Thousands Gain (Loss)	2018	2017
Foreign currency forward exchange contracts:		
Recognized the effective portion in AOCI	$ (26,544)	$ 26,093
Reclassified from AOCI into sales	7,694	(8,310)

Net Investment Hedges
The Company recognized the following gains (losses) on contracts designated as net investment hedges:

In Thousands Gain (Loss)	2018	2017
2023 Notes and Accrued Interest:		
Recognized in AOCI	$ 6,823	$ (19,016)

During fiscal 2018 and 2017, the Company recorded gains of $3.4 million and $3.8 million, respectively, on foreign currency forward exchange contracts that have not been designated as an accounting hedge. These foreign currency exchange gains (losses) are included in selling, general and administrative expense.

There was no significant impact to the Company's earnings related to the ineffective portion of any hedging instruments during fiscal 2018 and 2017. In addition, there was no significant impact to the Company's earnings when a hedged firm commitment no longer qualified as a fair value hedge or when a hedged forecasted transaction no longer qualified as a cash flow hedge during fiscal 2018 and 2017.

Amounts included in AOCI are reclassified into earnings when the hedged transaction settles. The Company expects to reclassify approximately $4.8 million of net loss into earnings in fiscal year 2019. The maximum duration of a foreign currency cash flow hedge contract at September 28, 2018, is 24 months.

NOTE 10: **Income Taxes**

Income tax expense (benefit) from continuing operations for fiscal 2018, 2017 and 2016 consisted of:

In Thousands	2018	2017	2016
Current			
U.S. Federal	$ 46,421	$ 2,914	$ 13,848
State	(120)	146	(852)
Foreign	43,868	38,179	30,409
	90,169	41,239	43,405
Deferred			
U.S. Federal	4,750	2,744	(6,893)
State	348	(157)	2,060
Foreign	(11,440)	(10,801)	(16,715)
	(6,342)	(8,214)	(21,548)
Income tax expense	$ 83,827	$ 33,025	$ 21,857

U.S. and foreign components of earnings from continuing operations before income taxes for fiscal 2018, 2017 and 2016 were:

In Thousands	2018	2017	2016
U.S.	$ 42,507	$ 39,119	$ 66,036
Foreign	111,069	114,275	69,989
Earnings from continuing operations before income taxes	$ 153,576	$ 153,394	$ 136,025

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Primary components of the Company's deferred tax assets and liabilities at the end of the fiscal 2018 and 2017 resulted from temporary tax differences associated with the following:

In Thousands	2018	2017
Reserves and liabilities	$ 35,258	$ 52,632
Loss carryforwards	37,850	53,175
Tax credit carryforwards	35,308	39,078
Employee benefits	10,197	12,720
Retirement benefits	6,086	14,907
Non-qualified stock options	7,470	10,937
Hedging activities	2,614	-
Other	3,105	3,940
Total deferred tax assets	137,888	187,389
Less valuation allowance	(27,118)	(45,601)
Total deferred tax assets, net of valuation allowance	110,770	141,788
Depreciation and amortization	(18)	(6,503)
Intangibles and amortization	(85,072)	(111,196)
Deferred costs	(3,697)	(5,668)
Hedging activities	-	(2,450)
Other	(6,874)	(3,156)
Total deferred tax liabilities	(95,661)	(128,973)
Net deferred tax assets (liabilities)	$ 15,109	$ 12,815

The Company operates in numerous taxing jurisdictions and is subject to regular examinations by various U.S. federal, state and foreign jurisdictions. Additionally, the Company assumed tax liabilities and the rights to tax refunds in connection with various acquisitions and divestitures of businesses in prior years. The Company's income tax positions are based on research and interpretations of income tax laws in each of the jurisdictions in which the Company does business. Due to the subjectivity and complexity of the interpretations of the tax laws in each jurisdiction, the differences and interplay in the tax laws between those jurisdictions, as well as the inherent uncertainty in estimating the final resolution of complex tax audit matters, the Company's estimates of income tax liabilities and assets may differ from actual payments, assessments or refunds.

Management believes that it is more likely than not that the Company will realize the benefit of most of its deferred tax assets. Significant factors management considered in determining the probability of the realization of the deferred tax assets include expected future earnings and the reversal of deferred tax liabilities. Accordingly, no valuation allowance has been recorded on the deferred tax assets other than certain tax credits, capital losses and net operating losses. The U.S. federal capital loss carryforward of $106.8 million will begin to expire in fiscal 2020 if not utilized. The foreign net operating loss of $45.4 million can be carried forward indefinitely. The majority of the tax credit carryforwards can be carried forward indefinitely.

U.S. and various state and foreign income tax returns are open to examination, and presently there are foreign and state income tax returns under examination. Such examinations could result in challenges to tax positions taken, and accordingly, the Company may record adjustments to provisions based on the outcomes of such matters. However, the Company believes that the resolution of these matters, after considering amounts accrued, will not have a material adverse effect on its consolidated financial statements.

The incremental tax benefit received by the Company upon exercise of non-qualified employee stock options was $0.5 million, $2.1 million, and $0.6 million in fiscal 2018, 2017, and 2016, respectively.

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A reconciliation of the U.S. federal statutory income tax rate to the effective income tax rate for fiscal 2018, 2017 and 2016 was as follows:

	2018	2017	2016
U.S. statutory income tax rate	24.6%	35.0%	35.0%
Foreign taxes	-1.6%	-1.5%	-10.3%
Difference in foreign tax rates	4.2%	-4.2%	-4.4%
Mandatory repatriation tax	25.5%	0.0%	0.0%
Revaluation of deferred tax assets	4.4%	0.0%	0.0%
Unremitted earnings	2.3%	0.0%	0.0%
Change in foreign tax rates and laws	0.3%	-2.9%	0.0%
Research and development credits	-2.3%	-3.5%	-5.2%
Domestic manufacturing deduction	-1.0%	-0.3%	-1.0%
Net change in tax reserves	0.1%	-0.3%	-0.2%
State income taxes	-0.1%	0.5%	0.2%
Valuation allowance	-3.4%	-0.3%	0.8%
Subpart F income	0.7%	0.5%	0.7%
Other, net	0.9%	-1.5%	0.5%
Effective income tax rate	54.6%	21.5%	16.1%

The Tax Cuts and Jobs Act (the Act) was enacted on December 22, 2017. The Act reduces the U.S. federal corporate tax rate from 35% to 21%, requires companies to pay a one-time transition tax on earnings of certain foreign subsidiaries that were previously tax deferred and creates new taxes on certain foreign sourced earnings.

The increase in the year-over-year effective tax rate for fiscal 2018 is primarily attributable to the Act. The SEC recognized that a company's review of certain income tax effects of the Act may be incomplete at the time financial statements are issued. Accordingly, the SEC issued Staff Accounting Bulletin 118, which provides that if a company does not have the necessary information available for certain effects of the Act, the Company may record provisional numbers and adjust those amounts during the measurement period not to extend beyond one year.

At September 28, 2018, the Company had not completed the accounting for the tax effects of enactment of the Act; however, in certain cases, as described below, the Company made a reasonable estimate of the effects on its existing deferred tax balances, the one-time transition tax, and unremitted foreign earnings. During fiscal 2018, the Company recorded a provisional net charge of $49.9 million related to the Act based on reasonable estimates for those tax effects. Due to the timing of the enactment and the complexity in applying the provisions of the Act, the provisional net charge is subject to revisions as the Company continues to complete the analysis of the Act, collect and prepare necessary data, and interpret any additional guidance issued by the U.S. Treasury Department, Internal Revenue Service ("IRS"), FASB, and other standard-setting and regulatory bodies. Adjustments may materially impact the Company's provision for income taxes and effective tax rate in the period in which the adjustments are made. The Company's accounting for the estimated tax effects of the Act will be completed during the measurement period, which is not expected to extend beyond one year from the enactment date. The impacts of the Company's estimates are described further below.

Provisional Amounts

U.S. Deferred Tax Assets and Liabilities
The Company remeasured certain deferred tax assets and liabilities based on the rates at which they are expected to reverse in the future, which is generally 21%. However, the Company is still analyzing certain aspects of the Act and refining its calculations, including evaluation of limits on employee remuneration, which could affect the measurement of these balances or potentially give rise to new deferred tax amounts. The provisional amount recorded related to the remeasurement of the deferred tax balance was $7.2 million.

Foreign Tax Effects
The Company recorded an estimated $39.2 million charge in fiscal 2018 related to the transition tax, which was included in the provision for income taxes in the consolidated income statements and income taxes in the consolidated balance sheets. The Company has not yet completed the accounting for the transition tax as the analysis of deferred foreign income is not complete. To calculate the transition tax, the Company estimated the deferred foreign income for fiscal 2018 because these tax returns are not complete or due. Fiscal 2018 taxable income will be known once the respective tax returns are completed and filed. In addition, U.S. and foreign audit settlements may significantly impact the estimated transition tax. The impact of the U.S. and foreign audits on the transition tax will be known as the audits are concluded.

The Act subjects a U.S. corporation to tax on its Global Intangible Low Taxed Income (GILTI). Due to the complexity of the new GILTI tax rules, the Company is continuing to evaluate this provision of the Act and the application of GAAP. Under GAAP, the Company can make an accounting policy election to either treat taxes due on the GILTI inclusion as a current period expense or factor such amounts into the measurement of deferred taxes. The Company elected the current period expense method and has not reflected any corresponding deferred tax assets and liabilities associated with GILTI in the table of deferred income tax assets and liabilities.

On August 9, 2018, the Department of Treasury published in the Federal Register proposed regulations relating to the transition tax imposed by the Act. On October 10, 2018, the Department of Treasury published in the Federal Register proposed regulations relating to GILTI imposed by the Act. Once published in the Federal Register, the proposed regulations are subject to a 60-day comment period. Final regulations are expected to be issued after consideration of comments. The Company is currently evaluating the impact of the proposed regulations.

In February 2018, the FASB issued new guidance to allow a reclassification from accumulated other comprehensive income ("AOCI") to retained earnings for stranded tax effects resulting from the Act. In the fourth quarter of fiscal 2018, the Company remeasured deferred taxes related to pension and post-retirement obligations using the reduced tax rate. As required by U.S. GAAP, the Company recognized the net tax benefit in the provision for income taxes in the Company's consolidated statement of operations, even though the deferred taxes were initially recognized in AOCI, which resulted in stranded tax effects. The Company elected to early adopt the standard effective June 30, 2018 and reclassified a $7.7 million net tax benefit from AOCI to retained earnings in the consolidated balance sheet. Adoption of the standard had no impact to the Company's consolidated statements of operations or cash flows statements.

Deferred Tax Liability Associated with Certain Unremitted Earnings

The Company recorded a provisional amount of $3.5 million of tax expense on the Company's foreign earnings, which previously had been deferred from U.S. income tax. The provisional amounts may change as new information becomes available, as the Act continues to be interpreted and as new technical guidance is issued. The amount of undistributed foreign earnings which the Company remains indefinitely reinvested at September 28, 2018, is approximately $483.0 million. The amount of deferred income taxes is not practical to compute due to the complexity of the Company's international holding company structure, layers of regulatory requirements that have to be evaluated to determine the amount of allowable dividends, numerous potential repatriation scenarios that could be created to facilitate the repatriation of earnings to the U.S., and the complexity of computing foreign tax credits.

A reconciliation of the amount of unrecognized tax benefits for fiscal 2018, 2017 and 2016 is as follows:

In Thousands	2018	2017	2016
Unrecognized tax benefits as of the beginning of year	$ 8,848	$ 7,877	$ 11,389
Unrecognized gross benefit change:			
Gross increase due to prior-period adjustments	-	1,608	445
Gross decrease due to prior-period adjustments	(2,140)	-	(475)
Gross increase due to current-period adjustments	738	853	1,475
Gross decrease due to settlements with taxing authorities	(240)	-	(2,068)
Gross decrease due to a lapse of the statute of limitations	(1,122)	(1,490)	(2,889)
Total change in unrecognized gross benefit	(2,764)	971	(3,512)
Unrecognized tax benefits as of the end of the fiscal year	$ 6,084	$ 8,848	$ 7,877
Unrecognized tax benefits that, if recognized, would impact the effective tax rate	$ 5,240	$ 4,888	$ 6,626
Statement of operations:			
Total amount of interest income (expense) included in income tax expense	$ (289)	$ 33	$ (308)
Recognized in the statement of financial position:			
Total amount of accrued interest included in income taxes payable	$ 326	$ 616	$ 583

During the next 12 months it is reasonably possible that approximately $0.8 million of previously unrecognized tax benefits related to operating losses and tax credits could decrease as a result of settlement of examinations and/or the expiration of statutes of limitations. The Company recognizes interest related to unrecognized tax benefits in income tax expense.

The Company is no longer subject to income tax examinations by tax authorities in its major tax jurisdictions as follows:

Tax Jurisdiction	Years No Longer Subject to Audit
U.S. Federal	2014 and prior
Belgium	2015 and prior
Canada	2010 and prior
France	2013 and prior
United Kingdom	2015 and prior

NOTE 11: **Debt**

Long-term debt at the end of fiscal 2018 and 2017 consisted of the following:

In Thousands	2018	2017
U.S. credit facility	$ -	$ 50,000
U.S. Term Loan, due April 2020	180,000	225,000
3.625% Senior Notes, due April 2023	382,965	389,862
Government refundable advances	43,873	45,549
Debt issuance costs	(3,680)	(4,654)
Obligation under capital leases	69,310	71,091
	672,468	776,848
Less current maturities	17,546	17,424
Carrying amount of long-term debt	$ 654,922	$ 759,424

U.S. Credit Facility
On April 9, 2015, the Company amended the secured credit facility to extend the expiration to April 9, 2020, increase the revolving credit facility to $500 million, and provide for a delayed-draw term loan facility of $250 million. The Company recorded $2.3 million in debt issuance costs. The credit facility is secured by substantially all the Company's assets, and interest is based on standard inter-bank offering rates. The interest rate ranges from LIBOR plus 1.25% to LIBOR plus 2.00%, depending on the leverage ratios at the time the funds are drawn. At September 28, 2018, the Company had no outstanding balance under the secured credit facility. An additional $15.1 million of unsecured foreign currency credit facilities have been extended by foreign banks for a total of $515.1 million available companywide. Available credit under the above credit facilities was $498.9 million at fiscal 2018 year end, when reduced by letters of credit of $16.2 million.

U.S. Term Loan, due April 2020
On August 3, 2015, the Company borrowed $250 million under the delayed-draw term loan provided for under the amended credit facility (U.S. Term Loan, due 2020). The interest rate on the U.S. Term Loan, due 2020, ranges from LIBOR plus 1.25% to LIBOR plus 2.00%, depending on the leverage ratios at the time the funds are drawn. At September 28, 2018, the interest rate was LIBOR plus 1.50%, which equaled 3.75%. The loan amortizes at 1.25% of the original principal balance quarterly through March 2020, with the remaining balance due in April 2020.

3.625% Senior Notes, due April 2023
In April 2015 TA Mfg. Limited, a wholly owned subsidiary, issued €330.0 million in 3.625% Senior Notes, due April 2023 (2023 Notes) requiring semi-annual interest payments in April and October of each year until maturity. The notes are designated as a net investment hedge and translated to U.S. dollars each period, with the associated gains or losses recorded to AOCI. The net proceeds from the sale of the notes, after deducting $5.9 million of debt issuance costs, were $350.8 million. The 2023 Notes are general unsecured senior obligations of the Company. The 2023 Notes are unconditionally guaranteed on a senior basis by the Company and certain subsidiaries of the Company that are guarantors under the Company's existing secured credit facility. The 2023 Notes are subject to redemption at the option of the Company, in whole or in part, at redemption prices starting at 102.719% of the principal amount plus accrued interest during the period beginning April 15, 2018, and declining annually to 100% of principal and accrued interest on or after April 15, 2021.

Based on quoted market prices, the fair value of the Company's 2023 Notes was $392.1 million and $403.2 million as of September 28, 2018, and September 29, 2017, respectively. The carrying amounts of the secured credit facility and the U.S. Term Loan, due 2020, approximate fair value. The estimate of fair value for the 2023 Notes was based on Level 2 inputs as defined in the fair value hierarchy.

Government Refundable Advances
Government refundable advances consist of payments received from the Canadian government to assist in research and development related to commercial aviation based at our Canadian operation, CMC. The estimated repayment of this advance is based on year-over-year revenue growth of specific CMC's commercial aviation specific product lines from 2013 to 2027. Imputed interest on the advance was negative 1.65% at September 28, 2018 resulting from future year-over-year revenue growth being lower than previously estimated. The debt recognized was $43.9 million and $45.5 million as of September 28, 2018, and September 29, 2017, respectively.

Obligation Under Capital Lease
The Company leases building and equipment under capital leases. The present value of the minimum capital lease payments, net of the current portion, totaled $67.1 million as of September 28, 2018.

As of September 28, 2018, aggregate annual maturities of long-term debt and future non-cancelable minimum lease payments under capital lease obligations were as follows:

In Thousands

Fiscal Year	
2019	$ 23,228
2020	178,426
2021	11,046
2022	12,736
2023	395,881
2024 and thereafter	113,613
Total	734,930
Less:	
Debt issuance costs	3,680
Amount representing interest on capital leases	58,782
Total long-term debt	$ 672,468

A number of underlying agreements contain various covenant restrictions which include maintenance of net worth, payment of dividends, interest coverage, and limitations on additional borrowings. The Company was in compliance with these covenants at September 28, 2018.

NOTE 12: **Commitments and Contingencies**

Rental expense for operating leases for engineering, selling, administrative and manufacturing totaled $17.9 million, $17.7 million and $19.0 million in fiscal 2018, 2017, and 2016, respectively.

At September 28, 2018, the Company's rental commitments for noncancelable operating leases with a duration in excess of one year were as follows:

In Thousands

Fiscal Year	
2019	$ 12,592
2020	9,127
2021	6,982
2022	4,491
2023	4,301
2024 and thereafter	3,982
Total	$ 41,475

The Company is subject to purchase obligations for goods and services. The purchase obligations include amounts under legally enforceable agreements for goods and services with defined terms as to quantity, price and timing of delivery. As of September 28, 2018, the Company's purchase obligations were as follows:

In Thousands		Total		Less than 1 year		1–3 years		4–5 years		After 5 years
Purchase obligations	$	776,221	$	714,048	$	61,540	$	633	$	-

In March 2014 the Company entered into a Consent Agreement with the DTCC to resolve alleged ITAR civil violations. Among other things, the Consent Agreement required the Company to pay a $20 million penalty, of which $10 million was suspended and eligible for offset credit. In fiscal 2016, the DTCC approved costs the Company incurred to implement compliance measures to fully offset the $10 million suspended payment. The Consent Agreement was closed in fiscal 2017.

In fiscal 2016 the Company received a $5 million insurance recovery due to an energetic incident at one of our countermeasure operations, which occurred in the third quarter of fiscal 2016. The Company received a $7.8 million insurance recovery from this incident in fiscal 2017.

On August 6, 2018 an accidental release of hazardous material occurred at the Company's Valencia, California plant. The accident resulted in plant employees seeking medical treatment and a suspension of activities at the plant during remediation. Facility cleanup costs totaled $2.5 million in the fourth quarter of fiscal 2018, net of insurance recoveries.

The Company is a party to other various lawsuits and claims, both as plaintiff and defendant, and has contingent liabilities arising from the conduct of business, none of which, in the opinion of management, is expected to have a material effect on the Company's financial position or results of operations. The Company believes that it has made appropriate and adequate provisions for contingent liabilities.

Approximately 679 U.S.-based employees, or 17% of total U.S.-based employees, were represented by various labor unions. The Company's non-U.S. operations are subject to union and national trade union agreements and to local regulations governing employment.

NOTE 13 **Employee Stock Plans**

The Company has three share-based compensation plans, which are described below. The compensation cost that has been charged against income for those plans for fiscal 2018, 2017, and 2016 was $9.5 million, $9.3 million, and $14.0 million, respectively. The total income tax benefit recognized in the income statement for the share-based compensation arrangement for fiscal 2018, 2017, and 2016 was $1.5 million, $2.3 million, and $3.6 million, respectively.

Employee Stock Purchase Plan
The Company offers an employee stock purchase plan to its employees. The plan qualifies as a noncompensatory employee stock purchase plan under Section 423 of the Internal Revenue Code. Employees are eligible to participate through payroll deductions subject to certain limitations.

The plan has a safe harbor design where shares are purchased by participants at 95% of the fair market value on the purchase date and, therefore, compensation cost is not recorded. During fiscal 2018, employees purchased 20,340 shares at a fair market value price of $73.81 per share. As of September 28, 2018, deductions aggregating $0.4 million were accrued for the purchase of shares on December 15, 2018.

Employee Share-Save Scheme
The Company offers shares under its employee share-save scheme for U.K. employees. This plan allows participants the option to purchase shares at 95% of the market price of the stock as of the beginning of the offering period. The term of these options is three years. At the end of fiscal 2018, the Company had reserved 128,110 shares for issuance under its employee share-save scheme for U.K. employees, leaving a balance of 438,111 shares available for issuance in the future. The share-save scheme is not a "safe-harbor" design, and, therefore, compensation cost is recognized on this plan.

Under the employee share-save scheme, option exercise prices are equal to the fair market value of the Company's common stock on the date of grant. The Company granted 20,981, 11,338 and 70,673 options in fiscal 2018, 2017, and 2016, respectively. The weighted-average grant date fair value of options granted in fiscal 2018 was $68.83 per share. During fiscal 2018, 609 options were exercised at a weighted average exercise price of $60.65.

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The fair value of the awards under the employee share-save scheme was estimated using a Black-Scholes pricing model which uses the assumptions noted in the following table. The risk-free rate for the contractual life of the option is based on the U.S. Treasury zero coupon issues in effect the time of grant.

	2018	2017	2016
Volatility	38.89%	35.58%	33.21%
Risk-free interest rate	1.98%	1.75%	1.19%
Expected life (years)	3	3	3
Dividends	0	0	0

Equity Incentive Plan
The Company also provides an equity incentive plan for officers and key employees. At the end of fiscal 2018, the Company had 3,539,345 shares reserved for issuance to officers and key employees, of which 2,119,505 shares were available to be granted in the future.

Stock Options
The Board of Directors authorized the Compensation Committee to administer awards granted under the Company's 2013 Equity Incentive Plan and to establish the terms of such awards. Awards under the equity incentive plan may be granted to eligible employees of the Company over the 10-year period ending March 5, 2023. Options granted generally become exercisable ratably over a period of four years following the date of grant and expire on the tenth anniversary of the grant. Option exercise prices are equal to the fair market value of the Company's common stock on the date of grant. The weighted-average grant date fair value of the options granted in fiscal 2018 and 2017 was $30.80 per share and $32.72 per share, respectively.

The fair value of each option granted by the Company was estimated using a Black-Scholes pricing model which uses the assumptions noted in the following table. The Company uses historical data to estimate volatility of the Company's common stock and option exercise and employee termination assumptions. The range of the expected term reflects the results from certain groups of employees exhibiting different behavior. The risk-free rate for the periods within the contractual life of the grant is based upon the U.S. Treasury zero coupon issues in effect at the time of the grant. Forfeitures of stock options are recognized when the forfeitures occur.

	2018	2017	2016
Volatility	34.32%	34.97 - 35.42%	33.06 - 40.52%
Risk-free interest rate	2.15 - 2.47%	1.98 - 2.51%	1.61 - 2.24%
Expected life (years)	5 - 9	5 - 9	5 - 9
Dividends	0	0	0

The following table summarizes the changes in outstanding options granted under the Company's equity incentive plan:

	2018			2017			2016		
	Shares Subject to Option		Weighted Average Exercise Price	Shares Subject to Option		Weighted Average Exercise Price	Shares Subject to Option		Weighted Average Exercise Price
Outstanding, beginning of year	1,077,188	$	82.30	1,391,906	$	72.11	1,363,921	$	68.04
Granted	243,680		77.28	242,200		81.60	221,200		90.16
Exercised	(27,413)		58.69	(492,968)		51.70	(112,790)		48.61
Forfeited/cancelled	(89,125)		88.93	(63,950)		93.73	(80,425)		85.73
Outstanding, end of year	1,204,330	$	81.33	1,077,188	$	82.30	1,391,906	$	72.11
Exercisable, end of year	707,725	$	80.46	594,863	$	76.64	918,706	$	61.03

The aggregate intrinsic value of the option shares outstanding and exercisable at September 28, 2018, was $15.7 million and $10.6 million, respectively.

The number of option shares vested or that were expected to vest at September 28, 2018, was 1.2 million and the aggregate intrinsic value was $15.7 million. The weighted average exercise price and weighted average remaining contractual term of option shares vested or that were expected to vest at September 28, 2018, was $81.33 and 6.0 years, respectively. The weighted-average remaining contractual term of option shares currently exercisable is 4.5 years as of September 28, 2018.

The table below presents stock activity related to stock options exercised in fiscal 2018 and 2017:

In Thousands	2018	2017	2016
Proceeds from stock options exercised	$ 1,609	$ 28,116	$ 8,175
Tax benefits related to stock options exercised	109	2,271	406
Intrinsic value of stock options exercised	582	19,223	3,195

Total unrecognized compensation expense for stock options that have not vested as of September 28, 2018, is $6.3 million, which will be recognized over a weighted average period of 2.0 years.

The following table summarizes information for stock options outstanding at September 28, 2018:

	Options Outstanding			Options Exercisable	
Range of Exercise Prices	Shares	Weighted Average Remaining Life (years)	Weighted Average Price	Shares	Weighted Average Price
$ 41.00 - 55.00	102,250	2.4	$ 48.08	102,250	$ 48.08
55.01 - 65.00	131,875	2.3	62.69	131,875	62.69
65.01 - 75.00	260,405	7.8	70.22	62,675	68.20
75.01 - 85.00	237,475	7.2	82.10	98,075	81.04
85.01 - 100.00	324,800	6.5	94.50	197,350	95.15
100.01 - 117.53	147,525	5.8	110.40	115,500	110.45

Restricted Stock Units
The Company granted 45,985, 37,100 and 37,000 restricted stock units (RSUs) during fiscal 2018, 2017 and 2016, respectively. The fair value of each RSU granted by the Company is equal to the fair market value of the Company's common stock on the date of grant. RSUs granted generally have a three-year cliff vesting schedule.

The following table summarizes the changes in RSUs granted under the Company's equity incentive plan:

	2018		2017		2016	
	Shares	Weighted Average Grant Date Fair Value	Shares	Weighted Average Grant Date Fair Value	Shares	Weighted Average Grant Date Fair Value
Non-vested, beginning of year	85,558	$ 86.41	100,178	$ 90.07	117,281	$ 85.95
Granted	45,985	86.26	37,100	76.83	37,000	84.70
Vested	(22,466)	105.19	(44,520)	85.80	(48,053)	75.35
Forfeited/cancelled	(8,650)	88.86	(7,200)	91.71	(6,050)	94.58
Non-vested, end of year	100,427	$ 81.93	85,558	$ 86.41	100,178	$ 90.07

Total unrecognized compensation expense for RSUs that have not vested as of September 28, 2018, is $3.4 million, which will be recognized over a weighted average period of 1.9 years.

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The table below presents stock activity related to RSUs vested in fiscal 2018 and 2017:

In Thousands	2018	2017	2016
Tax benefits related to RSUs vested	$ 304	$ 1	$ 162
Intrinsic value of RSUs vested	1,666	3,631	3,847

Performance Shares
The Company granted 33,700 and 43,650 performance share plan (PSP) shares during fiscal 2018 and 2017, respectively. PSP shares will be paid out in shares of Esterline common stock at the end of the three-year performance period. The actual number of shares that will be paid out upon completion of the performance period is based on actual performance and may range from 0% to 300% of the target number of shares.

The following table summarizes the activity in the target PSP shares granted under the Company's equity incentive plan:

	2018	2017	2016
Non-vested, beginning of year	118,950	89,275	34,700
Granted	33,700	43,650	56,275
Vested	-	-	-
Forfeited/cancelled	(37,567)	(13,975)	(1,700)
Non-vested, end of year	115,083	118,950	89,275

NOTE 14: **Shareholders' Equity**

The authorized capital stock of the Company consists of 25,000 shares of preferred stock ($100 par value), 475,000 shares of serial preferred stock ($1.00 par value), each issuable in series, and 60,000,000 shares of common stock ($.20 par value). At the end of fiscal 2018, there were no shares of preferred stock or serial preferred stock outstanding.

Changes in outstanding common shares are summarized as follows:

	2018	2017
Shares Outstanding		
Shares issued, beginning of year	33,117,473	32,564,252
Shares issued under share-based compensation plans	72,994	553,221
Shares issued, end of year	33,190,467	33,117,473
Treasury stock purchased, beginning of year	(3,135,927)	(3,135,927)
Treasury stock purchased	(601,400)	-
Treasury stock purchased, end of year	(3,737,327)	(3,135,927)
Shares outstanding, end of year	29,453,140	29,981,546

In June 2014 the Company's Board of Directors approved a $200 million share repurchase program. In March 2015 the Company's Board of Directors approved an additional $200 million for the share repurchase program. Under the program, the Company is authorized to repurchase up to $400 million of outstanding shares of common stock from time to time, depending on market conditions, share price and other factors. Repurchases may be made in the open market or through private transactions, in accordance with SEC requirements. The Company may enter into a Rule 10(b)5-1 plan designed to facilitate the repurchase of all or a portion of the repurchase amount. The program does not require the Company to acquire a specific number of shares. Common stock repurchased can be reissued, and accordingly, the Company accounts for repurchased stock under the cost method of accounting.

In fiscal 2018 there were 601,400 shares repurchased at an average price of $72.25, for an aggregate purchase price of $43.4 million. There were no shares repurchased in fiscal 2017. Since the program began, the Company has repurchased 3,737,327 shares for an aggregate purchase price of $352.0 million, with $48.0 million in shares remaining available for repurchased in the future.

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The components of Accumulated Other Comprehensive Loss:

In Thousands	2018	2017
Unrealized gain (loss) on derivative contracts	$ (5,381)	$ 13,469
Tax effect	1,673	(3,892)
	(3,708)	9,577
Pension and post-retirement obligations	(55,817)	(81,782)
Tax effect	22,135	27,956
	(33,682)	(53,826)
Cumulative effect of accounting change	(7,682)	-
Currency translation adjustment	(261,117)	(222,621)
Accumulated other comprehensive loss	$ (306,189)	$ (266,870)

NOTE 15: **Restructuring**

On December 5, 2013, the Company announced the acceleration of its plans to consolidate certain facilities and create cost efficiencies through shared services in sales, general and administrative and support functions. Restructuring expense totaled $8.7 million in fiscal 2016. The costs are mainly for exit and relocation of facilities, losses on the write-off of certain property, plant and equipment, and severance. There were no restructuring expenses in fiscal 2018 and 2017.

NOTE 16: **Discontinued Operations**

The Company's Board of Directors previously approved the plan to sell certain non-core business units including Eclipse Electronic Systems, Inc. (Eclipse), a manufacturer of embedded communication intercept receivers for signal intelligence applications; Wallop Defence Systems, Ltd. (Wallop), a manufacturer of flare countermeasure devices; Pacific Aerospace and Electronics Inc. (PA&E), a manufacturer of hermetically sealed electrical connectors; a small distribution business; and a small manufacturing business. The Company incurred an after-tax gain (loss) of $2.1 million, $(2.1) million and $(8.4) million in fiscal 2018, 2017 and 2016, respectively, on the assets held for sale and sale of discontinued operations.

On May 4, 2016, the Company sold certain assets of Wallop for 2.5 million British pounds and deferred compensation up to a maximum payment of 9 million British pounds. The deferred compensation is payable based upon receipt of acceptable orders during a three-year period ending May 3, 2019, and is equal to the amount of the acceptable order times a specified percentage ranging from 26.5% to 31%. The Company has been paid $0.9 million in deferred compensation since the sale of these assets. As of September 28, 2018, there are no further earn-out payments expected. In the definitive purchase and sale agreement for the sale of these assets, the Company provided standard representations and warranties as well as indemnification to the buyer of the Wallop operation. The Company is obligated to indemnify the buyer for certain losses of up to 5.0 million British pounds, if, among other things, the Company breaches the representations and warranties. In fiscal 2018 the Company received notification of a claim from the buyer of the Wallop operation alleging breaches of representations and warranties primarily associated with defective products and late product deliveries. Although a loss is possible, the amount of any loss related to this claim cannot be estimated at this time. The Company does not expect the possible loss to have a material effect on the Company's financial position. On September 28, 2018, the Company sold the land and building of Wallop for 1.8 million British pounds.

On March 28, 2017, the Company sold a small manufacturing business for $0.6 million and a note receivable of $2.4 million, resulting in a gain on sale of the business of $0.8 million. The note receivable is due March 28, 2021, with an interest rate of 2.05%.

At September 28, 2018, the only remaining asset held for sale was a building formerly used by Eclipse. The building was sold on October 31, 2018 for $4.3 million.

The Company recorded an expense related to environmental remediation at a previously sold business for which the Company provided indemnification of $0.1 million in fiscal 2018, $0.9 million in fiscal 2017, and $0.8 million in fiscal 2016. The liability for this environmental obligation was $0.1 million at both September 28, 2018, and September 29, 2017.

The results of discontinued operations for the last three years were as follows:

In Thousands	Avionics & Controls	Sensors & Systems	Advanced Materials	Other	Total
2018					
Net Sales	$ -	$ -	$ -	$ -	$ -
Operating earnings (loss)	(396)	-	(632)	(142)	(1,170)
Tax expense (benefit)	286	-	(2,084)	(37)	(1,835)
Income (loss) from discontinued operations	$ (682)	$ -	$ 1,452	$ (105)	$ 665
Included in Operating Earnings (Loss):					
Gain (loss) on net assets held for sale	$ (287)	$ -	$ -	$ -	$ (287)
Gain (loss) on sale of discontinued operations	-	-	2,404	-	2,404

In Thousands	Avionics & Controls	Sensors & Systems	Advanced Materials	Other	Total
2017					
Net Sales	$ 4,964	$ -	$ -	$ -	$ 4,964
Operating earnings (loss)	(447)	894	(8,259)	(895)	(8,707)
Tax expense (benefit)	(470)	-	(614)	(312)	(1,396)
Income (loss) from discontinued operations	$ 23	$ 894	$ (7,645)	$ (583)	$ (7,311)
Included in Operating Earnings (Loss):					
Gain (loss) on net assets held for sale	$ 320	$ -	$ (3,226)	$ -	$ (2,906)
Gain (loss) on sale of discontinued operations	793	-	-	-	793

In Thousands	Avionics & Controls	Sensors & Systems	Advanced Materials	Other	Total
2016					
Net Sales	$ 17,572	$ -	$ 5,222	$ -	$ 22,794
Operating earnings (loss)	1,350	(379)	(15,761)	(788)	(15,578)
Tax expense (benefit)	1,487	(83)	(1,448)	(268)	(312)
Income (loss) from discontinued operations	$ (137)	$ (296)	$ (14,313)	$ (520)	$ (15,266)
Included in Operating Earnings (Loss):					
Gain (loss) on net assets held for sale	$ (2,457)	$ -	$ (5,991)	$ -	$ (8,448)

NOTE 17: **Business Segment Information**

The Company's businesses are organized and managed in three reporting segments: Avionics & Controls, Sensors & Systems and Advanced Materials. Operating segments within each reporting segment are aggregated. Operations within the Avionics & Controls segment focus on integrated cockpit systems, technology interface systems for commercial and military aircraft, and similar devices for land- and sea-based military vehicles, visualization solutions for defense and commercial applications, secure communication systems, military audio and data products, specialized medical equipment and other industrial applications. Sensors & Systems includes operations that produce high-precision temperature and pressure sensors, electrical power switching, electrical interconnection systems, and other related systems principally for aerospace and defense customers. The Advanced

Materials segment focuses on thermally engineered components for critical aerospace applications, high-performance elastomer products used in a wide range of commercial aerospace and military applications, and combustible ordnance and warfare countermeasure devices. All segments include sales to domestic, international, defense and commercial customers.

Geographic sales information is based on product origin. The Company evaluates these segments based on segment profits prior to net interest, other income/expense, corporate expenses and federal/foreign income taxes.

Details of the Company's operations by business segment for the last three fiscal years were as follows:

In Thousands	2018	2017	2016
Sales			
Avionics & Controls	$ 861,543	$ 840,777	$ 861,636
Sensors & Systems	766,065	724,373	695,712
Advanced Materials	407,231	435,154	436,105
	$ 2,034,839	$ 2,000,304	$ 1,993,453
Earnings from Continuing Operations			
Avionics & Controls	$ 103,883	$ 91,040	$ 80,521
Sensors & Systems	85,214	86,902	82,466
Advanced Materials	71,298	73,891	74,515
Segment Earnings	260,395	251,833	237,502
Corporate expense	(77,816)	(68,758)	(71,753)
Interest income	1,912	527	367
Interest expense	(30,915)	(30,208)	(30,091)
	$ 153,576	$ 153,394	$ 136,025

In Thousands	2018	2017	2016
Capital Expenditures			
Avionics & Controls	$ 9,805	$ 19,315	$ 36,423
Sensors & Systems [1]	24,264	22,804	14,319
Advanced Materials [2]	18,452	14,247	15,868
Corporate	771	1,674	1,862
	$ 53,292	$ 58,040	$ 68,472
Depreciation and Amortization			
Avionics & Controls	$ 41,668	$ 40,853	$ 38,909
Sensors & Systems	44,681	41,722	40,399
Advanced Materials	17,625	18,559	18,691
Discontinued Operations	-	-	12
Corporate	2,750	2,636	2,247
	$ 106,724	$ 103,770	$ 100,258

In Thousands	2018	2017	2016
Identifiable Assets			
Avionics & Controls	$ 1,346,689	$ 1,382,176	$ 1,302,441
Sensors & Systems	1,131,842	1,139,676	1,140,017
Advanced Materials	455,263	504,965	498,442
Discontinued Operations	6,950	21,192	29,488
Corporate [3]	96,173	72,004	59,002
	$ 3,036,917	$ 3,120,013	$ 3,029,390

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1 Excludes capital expenditures accounted for as a capitalized lease obligation of $0.5 million and $8.0 million in fiscal 2017 and 2016, respectively.
2 Excludes capital expenditures accounted for as a capitalized lease obligation of $0.1 million, $3.5 million and $3.3 million in fiscal 2018, 2017 and 2016, respectively.
3 Primarily cash and deferred tax assets (see Note 10).

The Company's operations by geographic area for the last three fiscal years were as follows:

In Thousands	2018	2017	2016
Sales 1			
Domestic			
Unaffiliated customers - U.S.	$ 813,732	$ 824,796	$ 837,939
Unaffiliated customers - export	187,695	199,494	172,209
Intercompany	35,543	55,338	77,472
	1,036,970	1,079,628	1,087,620
Canada			
Unaffiliated customers	188,572	181,778	183,832
Intercompany	6,063	8,449	3,378
	194,635	190,227	187,210
France			
Unaffiliated customers	448,709	413,641	398,909
Intercompany	70,988	56,824	51,461
	519,697	470,465	450,370
United Kingdom			
Unaffiliated customers	221,567	212,825	237,134
Intercompany	29,127	24,969	25,100
	250,694	237,794	262,234
All other Foreign			
Unaffiliated customers	174,564	167,770	163,430
Intercompany	187,749	185,192	167,565
	362,313	352,962	330,995
Eliminations	(329,470)	(330,772)	(324,976)
	$ 2,034,839	$ 2,000,304	$ 1,993,453

In Thousands	2018	2017	2016
Segment Earnings 2			
Domestic	$ 127,173	$ 118,648	$ 130,440
Canada	37,014	26,521	8,659
France	62,474	63,633	61,121
United Kingdom	20,761	22,950	25,646
All other foreign	12,973	20,081	11,636
	$ 260,395	$ 251,833	$ 237,502

	2018	2017	2016
Identifiable Assets 3			
Domestic	$ 979,917	$ 1,049,747	$ 1,055,021
Canada	507,687	499,418	450,047
France	752,856	753,854	770,593
United Kingdom	379,292	405,423	394,811
All other foreign	320,992	339,567	299,916
	$ 2,940,744	$ 3,048,009	$ 2,970,388

1 Based on country from which the sale originated and the sale was recorded.
2 Before corporate expense, shown on page 80.
3 Excludes corporate, shown on page 80.

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The Company's foreign operations consist of manufacturing facilities located in Belgium, Canada, China, the Dominican Republic, France, Germany, India, Mexico, Morocco, and the United Kingdom, and include sales and service operations located in Brazil, China, and Singapore. Intercompany sales are at prices comparable with sales to unaffiliated customers. U.S. government sales as a percent of Advanced Materials and Avionics & Controls sales were 14.7% and 7.1%, respectively, in fiscal 2018 and 6.0% of consolidated sales. U.S. government sales as a percent of Advanced Materials and Avionics & Controls sales were 9.6% and 3.0%, respectively, in fiscal 2017 and 3.5% of consolidated sales. In fiscal 2016 U.S. government sales as a percent of Advanced Materials and Avionics & Controls sales were 9.8% and 2.0%, respectively, and 3.1% of consolidated sales.

Product lines contributing sales of 10% or more of total sales in any of the last three fiscal years were as follows:

	2018	**2017**	**2016**
Connectors	17%	16%	16%
Avionics	16%	16%	16%

NOTE 18: **Subsequent Event**

On October 9, 2018, the Company entered into the Merger Agreement providing for the acquisition of the Company by TransDigm. If the Merger is consummated, we will become a wholly owned subsidiary of TransDigm. Each Company shareholder will receive $122.50 per share in cash, subject to any withholding taxes. The Merger, which is expected to close in 2019, is subject to the receipt of approval by the Company's shareholders, certain required regulatory or foreign investment approvals, and the satisfaction of certain other customary closing conditions.

The Merger Agreement includes termination provisions for both the Company and TransDigm. Under the Merger Agreement, the Company may be required to pay a termination fee of $128.9 million if the Merger Agreement is terminated under certain circumstances described in the Merger Agreement, including if the Company terminates the Merger Agreement, prior to receiving shareholder approval, in order to enter into a definitive acquisition agreement regarding an alternative acquisition proposal.

The Merger Agreement and the First Amendment to the Merger Agreement, which have been filed as exhibits to the Company's Current Reports on Form 8-K filed with the SEC on October 10, 2018, and October 11, 2018, respectively.

The Company incurred $7.2 million of Merger-related costs for the year ended September 28, 2018.

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NOTE 19: **Quarterly Financial Data (Unaudited)**

Condensed Consolidated Statements of Operations

In Thousands, Except Per Share Amounts	First Quarter	Second Quarter	Third Quarter	Fourth Quarter	Full Year
2018					
Net Sales	$ 482,045	$ 517,629	$ 499,871	$ 535,294	$ 2,034,839
Cost of Sales	333,709	353,902	329,951	350,969	1,368,531
Gross Profit	148,336	163,727	169,920	184,325	666,308
Selling, general & administrative	98,886	101,242	97,878	89,225	387,231
Research, development and engineering	25,842	24,725	22,830	17,472	90,869
Operating Earnings from Continuing Operations	26,633	33,924	48,292	73,730	182,579
Income Tax Expense (Benefit) [1]	53,789	2,079	11,094	16,865	83,827
Earnings from Continuing Operations	(34,815)	23,954	29,717	49,937	68,793
Earnings (Loss) from Discontinued Operations	(166)	(77)	(1,894)	2,802	665
Net Earnings	$ (34,981)	$ 23,877	$ 27,823	$ 52,739	$ 69,458
Earnings (Loss) Per Share Attributable to Esterline - Basic:					
Continuing operations	$ (1.16)	$ 0.81	$ 1.01	$ 1.69	$ 2.33
Discontinued operations	(0.01)	-	(0.06)	0.10	0.02
Earnings Per Share	$ (1.17)	$ 0.81	$ 0.95	$ 1.79	$ 2.35
Earnings (Loss) Per Share Attributable to Esterline - Diluted:					
Continuing operations	$ (1.16)	$ 0.80	$ 1.00	$ 1.69	$ 2.32
Discontinued operations	(0.01)	-	(0.06)	0.09	0.02
Earnings Per Share	$ (1.17)	$ 0.80	$ 0.94	$ 1.78	$ 2.34

In Thousands, Except Per Share Amounts	First Quarter	Second Quarter	Third Quarter	Fourth Quarter	Full Year
2017					
Net Sales	$ 458,416	$ 509,131	$ 504,107	$ 528,650	$ 2,000,304
Cost of Sales	315,504	331,925	330,408	362,422	1,340,259
Gross Profit	142,912	177,206	173,699	166,228	660,045
Selling, general & administrative	95,110	97,924	93,615	88,332	374,981
Research, development and engineering	21,706	29,041	30,190	28,841	109,778
Operating Earnings from Continuing Operations	28,696	55,430	49,894	49,055	183,075
Income Tax Expense (Benefit)	(463)	13,080	10,703	9,705	33,025
Earnings from Continuing Operations	21,128	34,440	31,764	31,533	118,865
Earnings (Loss) from Discontinued Operations	(5,336)	(34)	(815)	(1,126)	(7,311)
Net Earnings	$ 15,792	$ 34,406	$ 30,949	$ 30,407	$ 111,554
Earnings (Loss) Per Share Attributable to Esterline - Basic:					
Continuing operations	$ 0.71	$ 1.16	$ 1.07	$ 1.05	$ 4.00
Discontinued operations	(0.18)	-	(0.03)	(0.04)	(0.25)
Earnings Per Share Attributable to Esterline	$ 0.53	$ 1.16	$ 1.04	$ 1.01	$ 3.75
Earnings (Loss) Per Share Attributable to Esterline - Diluted:					
Continuing operations	$ 0.71	$ 1.15	$ 1.06	$ 1.05	$ 3.96
Discontinued operations	(0.18)	-	(0.03)	(0.04)	(0.24)
Earnings Per Share Attributable to Esterline	$ 0.53	$ 1.15	$ 1.03	$ 1.01	$ 3.72

1 Includes the impact of the Act mainly in the first and fourth quarter of fiscal 2018.

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The sum of the quarterly per share amounts may not equal per share amounts reported for year-to-date periods. This is due to changes in the number of weighted average shares outstanding and the effects of rounding for each period.

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Report of Independent Registered Public Accounting Firm

To the shareholders and the board of directors of Esterline Technologies Corporation

Opinion on the Financial Statements

We have audited the accompanying balance sheets of Esterline Technologies Corporation (the “Company“) as of September 28, 2018 and September 29, 2017, the related statements of operations, comprehensive income (loss), cash flows, shareholders’ equity, and noncontrolling interests, for each of the three years in the period ended September 28, 2018, and the related notes listed in the Index at Item 15(a) (collectively referred to as the “financial statements“). In our opinion, the financial statements present fairly, in all material respects, the financial position of the Company as of September 28, 2018 and September 29, 2017, and the results of its operations and its cash flows for each of the three years in the period ended September 28, 2018, in conformity with US generally accepted accounting principles.

We also have audited, in accordance with the standards of the Public Company Accounting Oversight Board (United States) (PCAOB), the Company's internal control over financial reporting as of September 28, 2018, based on criteria established in Internal Control-Integrated Framework issued by the Committee of Sponsoring Organizations of the Treadway Commission (2013 framework) and our report dated November 21, 2018 expressed an adverse opinion thereon.

Basis for Opinion

These financial statements are the responsibility of the Company‘s management. Our responsibility is to express an opinion on the Company‘s financial statements based on our audits. We are a public accounting firm registered with the PCAOB and are required to be independent with respect to the Company in accordance with the US federal securities laws and the applicable rules and regulations of the Securities and Exchange Commission and the PCAOB.

We conducted our audits in accordance with the standards of the PCAOB. Those standards require that we plan and perform the audit to obtain reasonable assurance about whether the financial statements are free of material misstatement, whether due to error or fraud. Our audits included performing procedures to assess the risks of material misstatement of the financial statements, whether due to error or fraud, and performing procedures that respond to those risks. Such procedures include examining, on a test basis, evidence regarding the amounts and disclosures in the financial statements. Our audits also included evaluating the accounting principles used and significant estimates made by management, as well as evaluating the overall presentation of the financial statements. We believe that our audits provide a reasonable basis for our opinion.

/s/ Ernst & Young LLP

We have served as the Company’s auditor since 2000.

Seattle, Washington
November 21, 2018

Report of Independent Registered Public Accounting Firm

To the shareholders and the board of directors of Esterline Technologies Corporation

Opinion on Internal Control over Financial Reporting

We have audited Esterline Technologies Corporation's internal control over financial reporting as of September 28, 2018, based on criteria established in Internal Control — Integrated Framework issued by the Committee of Sponsoring Organizations of the Treadway Commission (2013 framework) (the COSO criteria). In our opinion, because of the effect of the material weakness described below on the achievement of the objectives of the control criteria, Esterline Technologies Corporation (the Company) has not maintained effective internal control over financial reporting as of September 28, 2018, based on the COSO criteria.

A material weakness is a deficiency, or combination of deficiencies, in internal control over financial reporting, such that there is a reasonable possibility that a material misstatement of the company's annual or interim financial statements will not be prevented or detected on a timely basis. The following material weaknesses have been identified and included in management's assessment**:** Management has identified a deficiency in controls related to the reconciliation of intercompany charges between its French and U.S. power systems business units. Additionally, management's financial statement close process controls at its U.S. power systems business unit were not effective.

We also have audited, in accordance with the standards of the Public Company Accounting Oversight Board (United States) (PCAOB), the balance sheets of the Company as of September 28, 2018 and September 29, 2017, the related statements of operations, comprehensive income (loss), cash flows, shareholders' equity, and noncontrolling interests, for each of the three years in the period ended September 28, 2018, and the related notes. These material weaknesses were considered in determining the nature, timing and extent of audit tests applied in our audit of the 2018 consolidated financial statements, and this report does not affect our report dated November 21, 2018, which expressed an unqualified opinion thereon.

Basis for Opinion

The Company's management is responsible for maintaining effective internal control over financial reporting and for its assessment of the effectiveness of internal control over financial reporting included in the accompanying Management's Report on Internal Control over Financial Reporting. Our responsibility is to express an opinion on the Company's internal control over financial reporting based on our audit. We are a public accounting firm registered with the PCAOB and are required to be independent with respect to the Company in accordance with the U.S. federal securities laws and the applicable rules and regulations of the Securities and Exchange Commission and the PCAOB.

We conducted our audit in accordance with the standards of the PCAOB. Those standards require that we plan and perform the audit to obtain reasonable assurance about whether effective internal control over financial reporting was maintained in all material respects.

Our audit included obtaining an understanding of internal control over financial reporting, assessing the risk that a material weakness exists, testing and evaluating the design and operating effectiveness of internal control based on the assessed risk, and performing such other procedures as we considered necessary in the circumstances. We believe that our audit provides a reasonable basis for our opinion.

Definition and Limitations of Internal Control Over Financial Reporting

A company's internal control over financial reporting is a process designed to provide reasonable assurance regarding the reliability of financial reporting and the preparation of financial statements for external purposes in accordance with generally accepted accounting principles. A company's internal control over financial reporting includes those policies and procedures that (1) pertain to the maintenance of records that, in reasonable detail, accurately and fairly reflect the transactions and dispositions of the assets of the company; (2) provide reasonable assurance that transactions are recorded as necessary to permit preparation of financial statements in accordance with generally accepted accounting principles, and that receipts and expenditures of the company are being made only in accordance with authorizations of management and directors of the company; and (3) provide reasonable assurance regarding prevention or timely detection of unauthorized acquisition, use, or disposition of the company's assets that could have a material effect on the financial statements.

Because of its inherent limitations, internal control over financial reporting may not prevent or detect misstatements. Also, projections of any evaluation of effectiveness to future periods are subject to the risk that controls may become inadequate because of changes in conditions, or that the degree of compliance with the policies or procedures may deteriorate.

/s/ Ernst & Young LLP

Seattle, Washington
November 21, 2018

Item 9. Changes in and Disagreements with Accountants on Accounting and Financial Disclosure

None.

Item 9A. Controls and Procedures

Disclosure Controls and Procedures

Our principal executive and financial officers evaluated the effectiveness of our disclosure controls and procedures (as defined in Rules 13a-15(e) and 15d-15(e) under the Exchange Act) as of September 28, 2018, and have concluded that because of the material weaknesses in our internal control over financial reporting as discussed below, these controls and procedures were not effective.

Disclosure controls and procedures are designed to provide reasonable assurance that information required to be disclosed by us in the reports that we file or submit under the Securities Exchange Act of 1934, as amended, is recorded, processed, summarized and reported within the time period specified in the SEC rules and forms. These disclosure controls and procedures include, without limitation, controls and procedures designed to provide reasonable assurance that information required to be disclosed by us in the reports we file or submit is accumulated and communicated to management of the Company, including the principal executive officer and financial officers, as appropriate to allow timely decisions regarding required disclosure. In light of the material weaknesses discussed below, we performed additional analysis and other post-closing procedures to ensure our consolidated financial statements are prepared in accordance with generally accepted accounting principles. Accordingly, our management, including our principal executive and financial officers, have concluded that the consolidated financial statements included in this Form 10-K present fairly, in all material respects, our financial position, results of operations and cash flows for the periods presented in conformity with accounting principles generally accepted in the United States.

Management's Report on Internal Control Over Financial Reporting

Our management is responsible for establishing and maintaining adequate internal control over financial reporting, as such term is defined in applicable rules under the Securities Exchange Act of 1934. The Company's internal control over financial reporting was designed to provide reasonable assurance regarding the reliability of financial reporting and the preparation of financial statements for external purposes in accordance with accounting principles generally accepted in the United States of America.

The assessment of the effectiveness of the Company's internal control over financial reporting was based on criteria established in Internal Control-Integrated Framework (2013) issued by the Committee of Sponsoring Organizations of the Treadway Commission. Because of its inherent limitations, internal control over financial reporting can provide only reasonable assurance and may not prevent or detect misstatements. Management of the Company has assessed the effectiveness of the Company's internal control over financial reporting as of September 28, 2018, and concluded that, due to the two material weaknesses discussed below, the Company's internal control over financial reporting was not effective as of September 28, 2018.

A material weakness is a deficiency, or a combination of deficiencies, in internal control over financial reporting, such that there is a reasonable possibility that a material misstatement of the Company's annual or interim financial statements will not be prevented or detected on a timely basis. In fiscal 2017 we had a material weakness associated with our intercompany reconciliation process between entities within our U.S. power systems business unit. We also had a material weakness associated with our monitoring and financial statement close process at our U.S. power system business unit. These weaknesses resulted in the restatement of our 2015-2017 financial statements in our 2017 10-K/A. As of September 28, 2018, our remediation of these deficiencies is incomplete. Our independent registered public accounting firm, Ernst & Young LLP, has issued an audit report on the effectiveness of internal control over financial reporting. This report appears on page 86.

Remediation Efforts to Address Material Weaknesses

The Board of Directors and management are fully committed to maintaining a strong internal control environment. The Company has taken and will continue to take significant and comprehensive actions to remediate the material weaknesses in internal control over financial reporting.

In fiscal 2018 we replaced the financial staff at our U.S.-based power systems unit with a new platform finance director, unit finance director and controller with appropriate levels of experience.

We will continue to enhance our design, documentation and execution of the controls associated with the intercompany reconciliation process. In addition, we will continue to improve our monitoring and financial statement close process as well as our analytical procedures for reviewing U.S. power systems unit financial statements. Such steps will include the use of incremental resources and additional training of our personnel.

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We believe the remediation steps outlined above have improved and will continue to improve the effectiveness of our internal control over financial reporting. While we have made progress on strengthening our internal controls relative to the material weaknesses, we have not fully executed our remediation plan and tested all of U.S. power systems business unit remediation actions to verify the effectiveness of their design or operation.

The Board of Directors and management believe that the Company's remediation actions will provide an appropriate control environment going forward once the material weaknesses disclosed herein are remediated and other actions described herein have been taken.

As our management continues to evaluate and work to improve our disclosure controls and procedures and internal control over financial reporting, we may determine to take additional measures to address these deficiencies or determine to modify certain of the remediation measures described above.

Changes in Internal Control Over Financial Reporting

During the three months ended September 28, 2018, there were no changes in our internal control over financial reporting that materially affected, or are reasonably likely to materially affect, our internal control over financial reporting other than the remediation efforts to address the material weaknesses identified at our U.S. power systems business unit.

Item 9B. Other Information

None.

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PART III

Item 10. Directors and Executive Officers of the Registrant

We hereby incorporate by reference the information set forth under “Election of Directors,” “Section 16(a) Beneficial Ownership Reporting Compliance,” “Code of Ethics” and “Other Information as to Directors” in the definitive form of the Company’s Proxy Statement, relating to its Annual Meeting of Shareholders to be held on February 7, 2019.

Information regarding our executive officers required by this item appears in Item 1 of this report under “Executive Officers of the Registrant.”

Item 11. Executive Compensation

We hereby incorporate by reference the information set forth under “Other Information as to Directors,” “Executive Compensation – Compensation Discussion and Analysis,” “Compensation Committee Report,” “Statement Regarding Compensation Practices,” “Compensation Committee Interlocks and Insider Participation” and “Additional Information Regarding Executive Compensation” in the definitive form of the Company’s Proxy Statement, relating to its Annual Meeting of Shareholders to be held on February 7, 2019.

Item 12. Security Ownership of Certain Beneficial Owners and Management and Related Stockholder Matters

We hereby incorporate by reference the information set forth under “Security Ownership of Certain Beneficial Owners and Management” and “Equity Compensation Plan Information” in the definitive form of the Company’s Proxy Statement, relating to its Annual Meeting of Shareholders to be held on February 7, 2019.

Item 13. Certain Relationships and Related Transactions, and Director Independence

We hereby incorporate by reference the information set forth under “Certain Relationships and Related Transactions” and “Other Information as to Directors” in the definitive form of the Company’s Proxy Statement, relating to its Annual Meeting of Shareholders to be held on February 7, 2019.

Item 14. Independent Registered Public Accounting Firm Fees and Services

We hereby incorporate by reference the information set forth under “Audit Committee Report” and “Independent Registered Public Accounting Firm’s Fees” in the definitive form of the Company’s Proxy Statement relating to the Annual Meeting of Shareholders to be held on February 7, 2019.

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PART IV

Item 15. Exhibits and Financial Statement Schedules

(a)(1) Financial Statements.

Our Consolidated Financial Statements are as set forth under Item 8 of this report on Form 10-K.

(a)(2) Financial Statement Schedules.

All schedules for which provision is made in the applicable accounting regulations of the Securities and Exchange Commission are included in the financial statements and not required under the related instructions or are inapplicable and therefore have been omitted, except for Allowance for Doubtful Accounts disclosed in Note 2 of Consolidated Financial Statements are as set forth under Item 8 of this report on Form 10-K.

(a)(3) Exhibits.

See Exhibit Index on pages 92-96.

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Exhibit Number		Exhibit Index
2.1		Merger Agreement between Esterline Technologies Corporation, TransDigm Group Incorporated and Thunderbird Merger Sub Inc. dated October 9, 2018. (Incorporated by reference to Exhibit 2.1 to the Company's Current Report on Form 8-K filed on October 10, 2018 [Commission File Number 1-6357].)
2.2		First Amendment dated October 10, 2018 to the Merger Agreement between Esterline Technologies Corporation, TransDigm Group Incorporated and Thunderbird Merger Sub Inc. dated October 9, 2018. (Incorporated by reference to Exhibit 2.1 to the Company's Current Report on Form 8-K filed on October 11, 2018 [Commission File Number 1-6357].)
3.1		Restated Certificate of Incorporation for Esterline Technologies Corporation, dated June 6, 2002. (Incorporated by reference to Exhibit 3.1.2 to the Company's Current Report on Form 8-K filed on February 13, 2018 [Commission File Number 1-6357].)
3.2		Amended and Restated Bylaws of Esterline Technologies Corporation, effective February 8, 2018. (Incorporated by reference to Exhibit 3.2.1 to the Company's Current Report on Form 8-K filed on February 13, 2018 [Commission File Number 1-6357].)
4.1		Indenture dated April 8, 2015, relating to TA Mfg. Limited's 3.625% Senior Notes due 2023. (Incorporated by reference to Exhibit 4.1 to the Company's Current Report on Form 8-K filed on April 8, 2015 [Commission File Number 1-6357].)
10.1	*	Esterline Technologies Corporation Fiscal Year 2018 Annual Incentive Compensation Plan. (Incorporated by reference to Exhibit 10.1 to the Company's Annual Report on Form 10-K for the year ended September 29, 2017 [Commission File Number 1-6357].)
10.2	*	Esterline Technologies Corporation Long-Term Incentive Performance Share Plan, for fiscal years 2018 – 2020. (Incorporated by reference to Exhibit 10.2 to the Company's Annual Report on Form 10-K for the year ended September 29, 2017 [Commission File Number 1-6357].)
10.3	*	Esterline Technologies Corporation Supplemental Retirement Income Plan. (Incorporated by reference to Exhibit 10.15 to the Company's Annual Report on Form 10-K for the year ended October 27, 2006 [Commission File Number 1-6357].)
10.4	*	Esterline Technologies Corporation Long-Term Incentive Performance Share Plan, for fiscal years 2017 – 2019. (Incorporated by reference to Exhibit 10.2 to the Company's Annual Report on Form 10-K for the year ended September 30, 2016 [Commission File Number 1-6357].)
10.5	*	Esterline Technologies Corporation Long-Term Incentive Performance Share Plan, for fiscal years 2016 – 2018. (Incorporated by reference to Exhibit 10.2 to the Company's Quarterly Report on Form 10-Q for the quarter ended January 1, 2016 [Commission File Number 1-6357].)
10.6	*	Esterline Technologies Supplemental Executive Retirement and Deferred Compensation Plan. (Incorporated by reference to Exhibit 10.43 to the Company's Annual Report on Form 10-K for the year ended October 27, 2006 [Commission File Number 1-6357].)
10.7	*	Esterline Technologies Corporation 2002 Employee Stock Purchase Plan, as amended on November 22, 2016. (Incorporated by reference to Exhibit 10.9 to the Company's Annual Report on Form 10-K for the year ended September 30, 2016 [Commission File Number 1-6357].)
10.8	*	Esterline Technologies Corporation 2004 Equity Incentive Plan, as amended on March 3, 2010. (Incorporated by reference to Annex A of the Registrant's Definitive Proxy Statement on Schedule 14A, filed on January 22, 2010 [Commission File Number 1-6357].)
10.9	*	Esterline Technologies Corporation 2013 Equity Incentive Plan, as amended and restated effective December 16, 2016. (Incorporated by reference to Annex A of the Registrant's Definitive Proxy Statement on Schedule 14A, filed on December 29, 2016 [Commission File Number 1-6357].)

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Exhibit Number		Exhibit Index
10.10	*	Form of Global Stock Option Agreement for Esterline Technologies Corporation Amended and Restated 2004 Equity Incentive Plan. (Incorporated by reference to Exhibit 10.3 to the Company's Quarterly Report on Form 10-Q for the quarter ended January 25, 2013 [Commission File Number 1-6357].)
10.11	*	Form of Global Stock Option Agreement for Esterline Technologies Corporation 2013 Equity Incentive Plan (dated November 2016). (Incorporated by reference to Exhibit 10.14 to the Company's Annual Report on Form 10-K for the year ended September 29, 2016 [Commission File Number 1-6357].)
10.12	*	Form of Global Restricted Stock Unit Options Agreement for Esterline Technologies Corporation 2013 Equity Incentive Plan. (Incorporated by reference to Exhibit 10.15 to the Company's Annual Report on Form 10-K for the year ended September 29, 2016 [Commission File Number 1-6357].)
10.13	*	Form of Global Stock Option Agreement for Esterline Technologies Corporation 2013 Equity Incentive Plan. (Incorporated by reference to Exhibit 10.3 to the Company's Quarterly Report on Form 10-Q for the quarter ended May 1, 2015 [Commission File Number 1-6357].)
10.14	*	Form of Global Restricted Stock Unit Option Agreement for Esterline Technologies Corporation 2013 Equity Incentive Plan. (Incorporated by reference to Exhibit 10.4 to the Company's Quarterly Report on Form 10-Q for the quarter ended May 1, 2015 [Commission File Number 1-6357].)
10.15	*	Executive Officer Amended and Restated Termination Protection Agreement. (Incorporated by reference to Exhibit 10.19 of the Company's Annual Report on Form 10-K for the year ended October 2, 2015 [Commission File Number 1-6357].)
10.16	*	Offer Letter from Esterline Technologies Corporation to Paul P. Benson, dated November 6, 2014. (Incorporated by reference to Exhibit 10.3 to the Company's Quarterly Report on Form 10-Q for the quarter ended January 1, 2016 [Commission File Number 1-6357].)
10.17	*	Offer Letter from Esterline Technologies Corporation to Roger A. Ross dated July 27, 2015. (Incorporated by reference to Exhibit 10.1 to the Company's Current Report on Form 8-K filed on August 13, 2015 [Commission File Number 1-6357].)
10.18	*	Promotion Letter from Esterline Technologies Corporation to Marcia J. Mason dated August 1, 2012. (Incorporated by reference to Exhibit 10.5 to the Company's Quarterly Report on Form 10-Q for the quarter ended January 25, 2013 [Commission File Number 1-6357].)
10.19	*	Promotion Letter from Esterline Technologies Corporation to Albert S. Yost dated November 16, 2009. (Incorporated by reference to Exhibit 10.6 to the Company's Quarterly Report on Form 10-Q for the quarter ended January 25, 2013 [Commission File Number 1-6357].)
10.20	*	Offer Letter from Esterline Technologies Corporation to Curtis C. Reusser dated September 11, 2013. (Incorporated by reference to Exhibit 10.1 to the Company's Current Report on Form 8-K filed on September 12, 2013 [Commission File Number 1-6357].)
10.21	*	Offer Letter from Esterline Technologies Corporation to Stephen M. Nolan, dated December 20, 2017. (Incorporated by reference to Exhibit 10.1 to the Company's Current Report on Form 8-K filed on January 9, 2018 [Commission File Number 1-6357].)
10.22	*	Termination Protection Agreement, dated December 18, 2015, between Esterline Technologies Corporation and Roger A. Ross. (Incorporated by reference to Exhibit 10.1 to the Company's Quarterly Report on Form 10-Q for the quarter ended December 30, 2016 [Commission File Number 1-6357].)
10.23		Agreement for Lease for 4 & 5 Eastbrook Day Centre, Eastbrook Trading Centre among Sheldon Friendly Society, Darchem Engineering Limited and Esterline Technologies Corporation, dated as of March 10, 2016. (Incorporated by reference to Exhibit 10.1 to the Company's Quarterly Report on Form 10-Q for the quarter ended April 1, 2016 [Commission File Number 1-6357].)
10.24		Deed, by and among, Sheldon Friendly Society, Darchem Engineering Limited, and Darchem Holdings Limited dated March 25, 2008. (Incorporated by reference to Exhibit 10.50 to the Company's Annual Report on Form 10-K for the year ended October 2, 2015 [Commission File Number 1-6357].)

Exhibit Number	Exhibit Index
10.25	Seventh Amendment dated as of April 9, 2015, among Esterline Technologies Corporation, the foreign borrowers party thereto, the subsidiary guarantors party thereto, Wells Fargo Bank, National Association, as Administrative Agent, and the lenders thereto. (Incorporated by reference to Exhibit 10.1 to the Company's Current Report on Form 8-K filed on April 13, 2015 [Commission File Number 1-6357].)
10.26	Agreement, dated October 18, 2016, among Esterline Technologies Corporation, First Pacific Advisors, LLC and the other parties named in the Letter Agreement. (Incorporated by reference to Exhibit 10.1 to the Company's Current Report on 8-K dated October 18, 2016 [Commission File Number 1-6357].)
10.27	Consent Agreement between Esterline Technologies Corporation and the U.S. Department of State Bureau of Political Military Affairs filed on March 6, 2014. (Incorporated by reference to Exhibit 10.1 to the Company's Current Report on Form 8-K dated March 6, 2014 [Commission File Number 1-6357].)
10.28	Amended and Restated Master Acquisition Agreement by and among Barco NV, Barco Inc., Barco Integrated Solutions NV and Esterline Technologies Corporation dated as of November 14, 2014. (Incorporated by reference to Exhibit 10.48 to the Company's Annual Report on Form 10-K for the year ended October 31, 2014 [Commission File Number 1-6357].)
10.29	Property lease between Slibail Immobilier and Norbail Immobilier and Auxitrol S.A., dated April 29, 1997, relating to the manufacturing facility of Auxitrol at 5, allée Charles Pathé, 18941 Bourges Cedex 9, France, effective on the construction completed date (December 5, 1997). (Incorporated by reference to Exhibit 10.25 to the Company's Annual Report on Form 10-K for the year ended October 28, 2005 [Commission File Number 1-6357].)
10.30	Industrial and Build-to-Suit Purchase and Sale Agreement between The Newhall Land and Farming Company, Esterline Technologies Corporation and TA Mfg. Co., dated February 13, 1997, including Amendments, relating to premises located at 28065 West Franklin Parkway, Valencia, CA. (Incorporated by reference to Exhibit 10.26 to the Company's Annual Report on Form 10-K for the year ended October 28, 2005 [Commission File Number 1-6357].)
10.31	Lease Agreement, dated as of February 27, 1998, between Glacier Partners and Advanced Input Devices, Inc., as amended by Lease Amendment #1, dated February 27, 1998. (Incorporated by reference to Exhibit 10.31 to the Company's Annual Report on Form 10-K for the year ended October 27, 2000 [Commission File Number 1-6357].)
10.32	Lease Amendment #2 between Glacier Partners and Advanced Input Devices, Inc., dated July 2, 2002, and Lease Amendment #3 between Glacier Partners and Advanced Input Devices, Inc., dated September 18, 2009. (Incorporated by reference to Exhibit 10.14 to the Company's Annual Report on Form 10-K for the year ended October 30, 2009 [Commission File Number 1-6357].)
10.33	Lease Agreement, dated as of August 6, 2003, by and between the Prudential Insurance Company of America and Mason Electric Co., relating to premises located at Sylmar, California. (Incorporated by reference to Exhibit 10.34 to the Company's Annual Report on Form 10-K for the year ended October 31, 2003 [Commission File Number 1-6357].)
10.34	Occupation Lease of Buildings known as Phases 3 and 4 on the Solartron Site at Victoria Road, Farnborough, Hampshire between J Sainsbury Developments Limited and Weston Aerospace Limited, dated July 21, 2000. (Incorporated by reference to Exhibit 10.35 to the Company's Annual Report on Form 10-K for the year ended October 31, 2003 [Commission File Number 1-6357].)
10.35	Lease Agreement dated as of March 19, 1969, as amended, between Leach Corporation and Gin Gor Ju, Trustee of Ju Family Trust, relating to premises located in Orange County. (Incorporated by reference to Exhibit 10.37 to the Company's Annual Report on Form 10-K for the year ended October 29, 2004 [Commission File Number 1-6357].)
10.36	Lease Agreement, dated November 29, 2005, between Lordbay Investments Limited, Darchem Engineering Limited and Darchem Holdings Limited relating to premises located at Units 4 and 5 Eastbrook Road, London Borough of Gloucestershire Gloucester. (Incorporated by reference to Exhibit 10.38 to the Company's Quarterly Report on Form 10-Q for the quarter ended April 28, 2006 [Commission File Number 1-6357].)

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Exhibit Number	Exhibit Index
10.37	Amendment No. 1 dated as of November 23, 2005, to Lease Agreement dated as of March 1, 1994, between Highland Industrial Park, Inc. and Armtec Countermeasures Company. (Incorporated by reference to Exhibit 10.41 to the Company's Quarterly Report on Form 10-Q for the quarter ended April 28, 2006 [Commission File Number 1-6357].)
10.38	Lease Agreement between Capstone PF LLC and Korry Electronics Co. dated as of March 26, 2008. (Incorporated by reference to Exhibit 10.1 to the Company's Quarterly Report on Form 10-Q for the quarter ended May 2, 2008 [Commission File Number 1-6357].)
10.39	Exhibit C to Lease Agreement between Capstone PF LLC and Korry Electronics Co. dated as of March 26, 2008. (Incorporated by reference to Exhibit 10.2 to the Company's Quarterly Report on Form 10-Q for the quarter ended August 1, 2008 [Commission File Number 1-6357].)
10.40	Second Amendment to Building Lease and Sublease, dated July 30, 2008, between Capstone PF LLC and Korry Electronics Co. (Incorporated by reference to Exhibit 10.4 to the Company's Quarterly Report on Form 10-Q for the quarter ended August 1, 2008 [Commission File Number 1-6357].)
10.41	Subordination, Nondisturbance and Attornment Agreement and Estoppel Certificate, dated July 30, 2008, between Keybank National Association and Korry Electronics Co. (Incorporated by reference to Exhibit 10.5 to the Company's Quarterly Report on Form 10-Q for the quarter ended August 1, 2008 [Commission File Number 1-6357].)
10.42	Lease Extension Agreement between Weir Redevelopment Company and Kirkhill TA dated October 30, 2009. (Incorporated by reference to Exhibit 10.4 to the Company's Quarterly Report on Form 10-Q for the quarter ended January 29, 2010 [Commission File Number 1-6357].)
10.43	First and Second Amendment to Office Lease Agreement between City Center Bellevue Property LLC, a Delaware limited partnership, and Esterline Technologies Corporation, a Delaware corporation, dated April 14, 2011, and May 4, 2011. (Incorporated by reference to Exhibit 10.2 to the Company's Quarterly Report on Form 10-Q for the quarter ended July 29, 2011 [Commission File Number 1-6357].)
10.44	First Amendment to Lease between The Prudential Insurance Company of America and Mason Electric, Co. dated July 29, 2004. (Incorporated by reference to Exhibit 10.1 to the Company's Quarterly Report on Form 10-Q for the quarter ended July 26, 2013 [Commission File Number 1-6357].)
10.45	Second Amendment to Lease between Sylmar Cascades Properties, L.P. and Mason Electric, Co. dated January 19, 2007. (Incorporated by reference to Exhibit 10.2 to the Company's Quarterly Report on Form 10-Q for the quarter ended July 26, 2013 [Commission File Number 1-6357].)
10.46	Third Amendment to Lease between Sylmar Cascades Properties, L.P. and Mason Electric, Co. dated January 1, 2013. (Incorporated by reference to Exhibit 10.3 to the Company's Quarterly Report on Form 10-Q for the quarter ended July 26, 2013 [Commission File Number 1-6357].)
10.47	Third Amendment to Office Lease Agreement between City Center Bellevue Property LLC, a Delaware limited partnership, and Esterline Technologies Corporation, a Delaware corporation, dated August 19, 2013. (Incorporated by reference to Exhibit 10.49 to the Company's Annual Report on Form 10-K for the year ended October 2, 2015 [Commission File Number 1-6357].)
10.48	Lease Agreement between Industrias Asociados Maquiladoras, S.A. de C.V. and Sunbank de Mexico, S. de R.L. de C.V. dated as of September 1, 2015, as amended by the First Addendum dated September 19, 2015, the Second Addendum dated May 5, 2016, and the Third Addendum dated May 23, 2016. (Incorporated by reference to Exhibit 10.57 to the Company's Annual Report on Form 10-K for the year ended September 30, 2016 [Commission File Number 1-6357].)
10.49	Lease Agreement between Mex-Industrial Assets, S. de R.L. de C.V. and Esterline Mexico, S. de R.L. de C.V. dated June 4, 2014, as amended by the Amendment dated December 2, 2015, the Second Amendment dated June 1, 2016, and the Third Amendment dated November 3, 2016. (Incorporated by reference to Exhibit 10.58 to the Company's Annual Report on Form 10-K for the year ended September 30, 2016 [Commission File Number 1-6357].)

Exhibit Number	Exhibit Index
10.50	Lease Agreement between Industrias Asociados Maquiladoras, S.A. de C.V. and Esterline Mexico, S. de R.L. de C.V. dated October 8, 2007, as amended by the First Amendment dated December 1, 2012. (Incorporated by reference to Exhibit 10.59 to the Company's Annual Report on Form 10-K for the year ended September 30, 2016 [Commission File Number 1-6357].)
10.51	Lease Agreement between Inmobiliaria Promotora S.A. de C.V. (f/k/a Promotora Industrial Tijuana, S.A. de C.V.) and Leach International de Mexico, S. de R.L. de C.V. dated June 1, 2000, as amended by the First Addendum dated April 17, 2001, the Second Addendum dated March 23, 2005, and the Third Addendum dated October 8, 2014. (Incorporated by reference to Exhibit 10.60 to the Company's Annual Report on Form 10-K for the year ended September 30, 2016 [Commission File Number 1-6357].)
10.52	Fourth Amendment to Lease Agreement between Cibanco, S.A., I.B.M. Como Fiduciario del Fideicomiso E Finsa-WSC CIB/2504 (formerly Mex-Industrial Assets, S. de R.L. de C.V.) and Esterline Mexico, S. de R.L. de C.V. dated May 15, 2017. (Incorporated by reference to Exhibit 10.57 to the Company's Annual Report on Form 10-K for the year ended September 29, 2017 [Commission File Number 1-6357].)
10.53	Eighth Amendment dated as of October 9, 2018, among Esterline Technologies Corporation, the foreign borrowers party thereto, the subsidiary guarantors party thereto, Wells Fargo Bank, National Association, as Administrative Agent, and the lenders partied thereto. (Incorporated by reference to Exhibit 10.1 to the Company's Form 8-K filed April 13, 2015 [Commission File Number 1-6357].)
10.54	Seventh Amendment dated as of April 9, 2015, among Esterline Technologies Corporation, the foreign borrowers party thereto, the subsidiary guarantors party thereto, Wells Fargo Bank, National Association, as Administrative Agent, and the lenders partied thereto including the restated Credit Agreement attached as Exhibit A. (Incorporated by reference to Exhibit 10.1 to the Company's Form 8-K filed April 13, 2015 [Commission File Number 1-6357].)
11.1	Schedule setting forth computation of earnings per share for the five fiscal years ended September 28, 2018.
12.1	Statement of Computation of Ratio of Earnings to Fixed Charges.
21.1	List of subsidiaries.
23.1	Consent of Independent Registered Public Accounting Firm.
31.1	Certification of Chief Executive Officer.
31.2	Certification of Chief Financial Officer.
32.1	Certification (of Curtis C. Reusser) pursuant to 18 U.S.C. Section 1350, as adopted pursuant to Section 906 of the Sarbanes-Oxley Act of 2002.
32.2	Certification (of Stephen M. Nolan) pursuant to 18 U.S.C. Section 1350, as adopted pursuant to Section 906 of the Sarbanes-Oxley Act of 2002.
101.INS	XBRL Instance Document
101.SCH	XBRL Taxonomy Extension Schema
101.CAL	XBRL Taxonomy Extension Calculation Linkbase
101.DEF	XBRL Taxonomy Extension Definition Linkbase
101.LAB	XBRL Taxonomy Extension Label Linkbase
101.PRE	XBRL Taxonomy Extension Presentation Linkbase

* Indicates management contract or compensatory plan or arrangement.

SIGNATURES

Pursuant to the requirements of Section 13 or 15(d) of the Securities Exchange Act of 1934, the Company has duly caused this report to be signed on its behalf by the undersigned, thereunto duly authorized.

ESTERLINE TECHNOLOGIES CORPORATION
(Registrant)

By /s/ Stephen M. Nolan
Stephen M. Nolan
Executive Vice President and
Chief Financial Officer
(Principal Financial Officer)

Dated: November 21, 2018

Pursuant to the requirements of the Securities Exchange Act of 1934, this Report has been signed below by the following persons on behalf of the Registrant and in the capacities and on the dates indicated.

/s/ Curtis C. Reusser (Curtis C. Reusser)	Chairman, President and Chief Executive Officer (Principal Executive Officer)	November 21, 2018 Date
/s/ Stephen M. Nolan (Stephen M. Nolan)	Executive Vice President and Chief Financial Officer (Principal Financial Officer)	November 21, 2018 Date
/s/ Brian D. Reid (Brian D. Reid)	Corporate Controller and Chief Accounting Officer (Principal Accounting Officer)	November 21, 2018 Date
/s/ Michael J. Cave (Michael J. Cave)	Director	November 21, 2018 Date
/s/ Michael J. Covey (Michael J. Covey)	Director	November 21, 2018 Date
/s/ Delores M. Etter (Delores M. Etter)	Director	November 21, 2018 Date
/s/ Anthony P. Franceschini (Anthony P. Franceschini)	Director	November 21, 2018 Date

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/s/ Paul V. Haack	Director	November 21, 2018
(Paul V. Haack)		Date
/s/ Mary L. Howell	Director	November 21, 2018
(Mary L. Howell)		Date
/s/ Scott E. Kuechle	Director	November 21, 2018
(Scott E. Kuechle)		Date
/s/ Nils E. Larsen	Director	November 21, 2018
(Nils E. Larsen)		Date