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Contribution of the Aerospace Industry to the US Economy in 2023

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Executive summary

This report explores the economic contribution of the aerospace industry in the United States, examining its influence from three primary channels: direct, indirect, and induced effects. The direct effects arise from the employment and production activities within the aerospace industry. Indirect effects are generated as the industry procures intermediate and capital goods from a variety of other US industries. Induced effects stem from the personal purchases of employees and business owners both within the industry and its supply chain, and the personal spending by shareholders out of the dividends received from aerospace companies.[1]

PwC US Tax LLP ("PwC") was engaged by the Aerospace Industries Association ("AIA") to quantify the contribution of the aerospace industry to the US economy in 2023. The study provides a detailed assessment of the industry's economic contribution in terms of employment, labor income, output, gross domestic product ("GDP"), and tax payments, utilizing the most recent and comprehensive national-level data available for the year.[2]

Key findings

In 2023, including direct, indirect, and induced effects, the US aerospace industry supported:

- **1.6 million** US full- and part-time jobs, including **545,400** jobs directly provided by the industry
- **$157.2 billion** in labor income (including wages and salaries and benefits as well as proprietors' income), of which **$79.5 billion** was directly earned by industry employees
- **$545.2 billion** in economic output, including **$306.9 billion** of aerospace products
- **$284.1 billion** of national GDP, including **$151.1 billion** directly contributed by the industry.

[1] These economic effects represent the entire backward linkages of the aerospace industry to its suppliers. They do not capture forward linkages (i.e., the economic effect on sectors that are downstream to the aerospace industry).

[2] GDP is the sum of value added in all industries. Value added consists of employee compensation, proprietors' income, income to capital owners from property, and taxes on production and imports. Throughout this report, we refer to value added as contribution to GDP. By comparison, output represents the total value of sales, including the cost of intermediate goods. Value added excludes the value of intermediate inputs.

The industry also directly and indirectly contributed **$54.0 billion** of revenue to federal, state, and local governments.

Table E-1. – Total economic contribution of the aerospace industry to the US economy, 2023
[Dollar amounts in billions]

Item	Direct	Indirect and induced	Total	Total / Direct ("Multiplier")[4]
Employment (jobs)[1]	545,400	1,050,500	1,595,900	2.9
Labor income[2]	$79.5	$77.7	$157.2	2.0
Output	$306.9	$238.3	$545.2	1.8
Contribution to GDP	$151.1	$133.0	$284.1	1.9
Tax payments[3]	$25.1	$28.8	$54.0	2.1

Source: PwC calculations using the IMPLAN modeling system. Details may not add up to totals due to rounding.
(1) Employment is defined as the number of payroll and self-employed jobs, including part-time jobs.
(2) Labor income is defined as wages and salaries and benefits as well as proprietors' income.
(3) Taxes include federal, state and local income and nonincome taxes.
(4) Economic multiplier represents the overall contribution (including direct, indirect, and induced effects) relative to the direct contribution.

On a per capita basis, the aerospace industry's total GDP contribution equated to approximately $835 for every person in the United States in 2023. Notably, at the national level, each direct job within the aerospace industry was responsible for supporting an additional 1.9 jobs elsewhere in the US economy, emphasizing the multiplier effect and interconnectivity of this pivotal sector.

Overall, this report highlights the aerospace industry's vital role as an engine of economic growth and job creation, affirming its importance to the US economy and its contribution to national prosperity.

I. Introduction

The origins of the US aerospace industry trace back to the early 20th century, with pioneers like the Wright brothers laying the foundation for modern aviation. The sector grew rapidly during World War II as military demand surged and continued its expansion in the postwar era, driven by the rise of commercial aviation and the space race. Today, the aerospace industry encompasses a broad spectrum of activities, including the design, manufacturing, and maintenance of aircraft, spacecraft, and related systems. As a technologically advanced and capital-intensive sector, it operates across both civil and defense domains, supporting an extensive supply chain that spans manufacturing, engineering, software, and professional services.

The US aerospace industry stands as a global leader in innovation and technological progress, driving advancements in commercial aviation, defense systems, and space exploration. With robust investment in research and development ("R&D"), a highly skilled workforce, and strong collaboration between government and private sectors, it continues to pioneer cutting-edge technologies that shape the future of global mobility and security.

The aerospace industry is a major contributor to the US economy, generating substantial revenue and supporting a wide network of jobs across the country. Its strategic importance is underscored by its deep ties to national security, as it provides essential technologies and capabilities to the US military and allied forces.

PwC US Tax LLP ("PwC") was engaged by the Aerospace Industries Association ("AIA") to assess the aerospace industry's contribution to the US economy in 2023. By quantifying its economic contribution, this report underscores the aerospace industry's critical role as a driver of high-value employment, technological innovation, and long-term economic growth.

This report is organized as follows. **Section II** provides some background information on the aerospace industry in the United States. **Section III** presents estimates of the aerospace industry's total economic contributions at the national level in 2023. A description of the data sources and methodology is included in **Appendix A**.

II. Industry background

This section defines the aerospace industry as used in the study and offers insights into its production, workforce, supply chain, innovation, R&D, as well as its significant role in international trade.

Industry definition: The US aerospace industry encompasses multiple activities that span separate industry classifications in government economic data. For this study, PwC has defined the industry to include all activities of the industries listed in **Table 1**, below, which shows the composition of the industry as defined by PwC, followed by detailed descriptions based on the *North American Industry Classification System* ("NAICS").

Table 1.– Composition of the US aerospace industry

NAICS Code	Description
336411	Aircraft manufacturing
336412	Aircraft engine and engine parts manufacturing
336413	Other aircraft parts and auxiliary equipment manufacturing
336414	Guided missile and space vehicle manufacturing
336415	Guided missile and space vehicle propulsion unit and propulsion unit parts manufacturing
336419	Other guided missile and space vehicle parts and auxiliary equipment manufacturing

NAICS Code 336411. Aircraft manufacturing. Establishments in this subsector primarily engage in one or more of the following: (1) manufacturing or assembling complete aircraft; (2) developing and making aircraft prototypes; (3) aircraft conversion (i.e., major modifications to systems); and (4) complete aircraft overhaul and rebuilding (i.e., periodic restoration of aircraft to original design specifications).

NAICS Code 336412. Aircraft engine and engine parts manufacturing. This subsector comprises establishments primarily engaged in one or more of the following: (1) manufacturing aircraft engines and engine parts; (2) developing and making prototypes of aircraft engines and engine parts; (3) aircraft propulsion system conversion (i.e., major modifications to systems); and (4) aircraft propulsion systems overhaul and rebuilding (i.e., periodic restoration of aircraft propulsion system to original design specifications).

NAICS Code 336413. Other aircraft parts and auxiliary equipment manufacturing. This subsector comprises establishments primarily engaged in (1) manufacturing aircraft parts or auxiliary equipment (except engines and aircraft fluid power subassemblies) and/or (2) developing and making prototypes of aircraft parts and auxiliary equipment. Auxiliary equipment includes such items as crop dusting apparatus, armament racks, inflight refueling equipment, and external fuel tanks.

NAICS Code 336414. Guided missile and space vehicle manufacturing. This subsector comprises establishments primarily engaged in (1) manufacturing complete guided missiles and space vehicles and/or (2) developing and making prototypes of guided missiles or space vehicles.

NAICS Code 336415. Guided missile and space vehicle propulsion unit and propulsion unit parts manufacturing. This subsector comprises establishments primarily engaged in (1) manufacturing guided missile and/or space vehicle propulsion units and propulsion unit parts and/or (2) developing and making prototypes of guided missile and space vehicle propulsion units and propulsion unit parts.

NAICS Code 336419. Other guided missile and space vehicle parts and auxiliary equipment manufacturing. This subsector comprises establishments primarily engaged in (1) manufacturing guided missile and space vehicle parts and auxiliary equipment (except guided missile and space vehicle propulsion units and propulsion unit parts) and/or (2) developing and making prototypes of guided missile and space vehicle parts and auxiliary equipment.

Industry output: **Table 2**, below, provides estimates of gross output of the US aerospace industry by segment. Gross output is a measure of an industry's total sales or receipts, including sales to final consumers and sales to other businesses. Total sales of aerospace products amounted to $306.9 billion in 2023.

Table 2.– US aerospace industry output, 2023

Subsector	Output ($billion)
Aircraft manufacturing	$156.2
Aircraft engine and engine parts manufacturing	$57.3
Other aircraft parts and auxiliary equipment manufacturing	$33.2
Guided missile and space vehicle manufacturing	$49.8
Propulsion units and parts for space vehicles and guided missiles manufacturing	$10.4
US aerospace industry	**$306.9**

Source: PwC calculations using the IMPLAN modeling system.

Workforce: The US aerospace industry provides employment opportunities for individuals across a broad range of educational backgrounds. As shown in **Table 3** below, nationwide about 55 percent of the aerospace industry's workforce are high school graduates or have some post-secondary training or associate degree, but less than a bachelor's degree. Over 40 percent have a four-year college degree or higher

(including bachelor's degree and post-graduate degrees).[3] Comparatively, among workers across all US jobs, only about 29 percent have a bachelor's degree or higher. The aerospace industry employs workers with higher educational attainment than the US average in 2023.

Table 3.– Typical employee education: aerospace vs. all US jobs, 2023

	Percent of employees	
Education level	**Aerospace**	**All US jobs**
Less than a high school diploma	3.8%	9.8%
High school diploma or equivalent	26.9%	34.8%
Post-secondary certificate or some college courses	20.0%	17.9%
Associate degree (or other 2-year degree)	9.0%	7.7%
Bachelor's degree	32.1%	20.4%
Post-graduate	8.3%	9.3%
Total	**100.0%**	**100.0%**

Source: PwC calculations using the IMPLAN modeling system. Details may not add up to totals due to rounding.

Aerospace supports a range of occupations with growth opportunities for employees, as shown in **Table 4** below. The top three occupations within the industry comprise over 60 percent of direct employment: (1) production (29.7 percent), (2) architecture and engineering (19.8 percent), and (3) business and financial operations (14.5 percent). Production occupations include engine assemblers, structural metal fabricators and fitters, machinists, and more, making it particularly relevant to the aerospace manufacturing industry. The architecture and engineering occupation group includes surveyors, cartographers, photogrammetrists, engineers, drafters, and engineering technicians. The business and financial operations occupational group includes compliance officers, human resource workers, logisticians, market research analysts, accountants, and auditors.

[3] IMPLAN occupation database, which combines four government data sources: (1) BLS Occupational Employment and Wage Statistics (OEWS); (2) BLS Employment Projections national industry by occupation matrix; (3) Census Bureau American Community Survey (ACS) Public Use Microdata Sample (PUMS); and (4) The US Labor Department's O*NET database, which provides information on knowledge, skills, abilities, education, work experience, and on-the-job training by occupation.

Table 4.– US aerospace industry: types of occupation, 2023

Occupation	Percent of employees
Production occupations	29.8%
Architecture and engineering occupations	19.8%
Business and financial operations occupations	14.5%
Computer and mathematical occupations	9.1%
Installation, maintenance, and repair occupations	8.7%
Management occupations	8.3%
Office and administrative support occupations	5.1%
Transportation and material moving occupations	2.1%
Sales and related occupations	0.7%
Construction and extraction occupations	0.5%
Life, physical, and social science occupations	0.4%
Arts, design, entertainment, sports, and media occupations	0.4%
Building and grounds cleaning and maintenance occupations	0.3%
Protective service occupations	0.2%
Legal occupations	0.1%
Healthcare practitioners and technical occupations	*
Food preparation and serving related occupations	*
Total	**100.0%**

Source: BLS Occupational Employment and Wage Statistics May 2023, NAICS 336400 - Aerospace Product and Parts Manufacturing.
*Less than 0.05%.

Supply chain: The US aerospace industry's supply chain spans high-value materials and critical services. In 2023, the industry's non-labor operating expenditures are estimated to be $145 billion, supporting a wide range of nonaerospace industries. Its top supplying sectors are:

1. Engineering & technical services (e.g., R&D, design outsourcing)
2. Electronics & avionics components (semiconductors, sensors, flight controls)
3. Metals (aluminum, titanium, steel alloys)
4. Composite materials (carbon fiber, composites)
5. Logistics & transportation services (freight, warehousing for aerospace parts)
6. Software & IT services (design software, simulation, IT support)

The industry is estimated to have spent $2.9 billion in 2023 on the construction or major renovation of physical facilities that support aerospace manufacturing, testing, research, and logistics, including:

- Aircraft manufacturing facilities

- R&D centers

- Maintenance, repair, and overhaul ("MRO") facilities

- Launch pads and spaceport infrastructure

- Logistics and warehousing facilities

- Office complexes for design and program management.

In addition, the industry spent another $8.4 billion in 2023 on new equipment critical for enhancing production capacity, quality, and innovation, such as:

- Advanced Computer Numerical Control ("CNC") machines and robotics

- Additive manufacturing (3D printing) equipment

- Autoclaves and composite processing equipment

- Nondestructive testing ("NDT") equipment

- Simulation and avionics testing systems

- Cleanroom and assembly line equipment

- Ground support equipment ("GSE").

Innovation and R&D: The US aerospace industry is a powerhouse of R&D, driving innovation across both commercial and defense sectors. With sustained investment in cutting-edge technologies ranging from advanced materials to autonomous systems, it plays a key role in shaping the future of global transportation, security, and space exploration.

Based on National Science Foundation data, aerospace manufacturers spent $35.4 billion on R&D in 2022, the most recent data year available. Aerospace manufacturers increased spending on R&D at an average

annual rate of 3.3 percent over an eleven-year period from 2012 to 2022 (see **Table 5**, below). In comparison, all manufacturers increased R&D spending by only 1.9 percent per year over the same period.

The increase in R&D spending within the aerospace manufacturing industry is driven by the guided missile, space vehicle, and related parts manufacturing subsector, covering NAICS code 336414–15 and 336419. A few key factors likely drove this increase: the shift toward commercial space activities, and significant contracts from government agencies like the National Aeronautics and Space Administration ("NASA") and the Department of Defense.

Table 5.– R&D spending, 2012-2022

	2012	2022	Average annual growth rate, 2012-2022
Manufacturing total	**$302.3**	**$372.5**	**1.9%**
Aerospace products and parts manufacturing	**$24.8**	**$35.4**	**3.3%**
Aircraft, aircraft engine, and aircraft parts manufacturing	$23.4	$24.6	0.4%
Guided missile, space vehicle, and related parts manufacturing	$1.4	$10.8	20.2%
Aerospace as a percentage of total manufacturing	8.21%	9.49%	

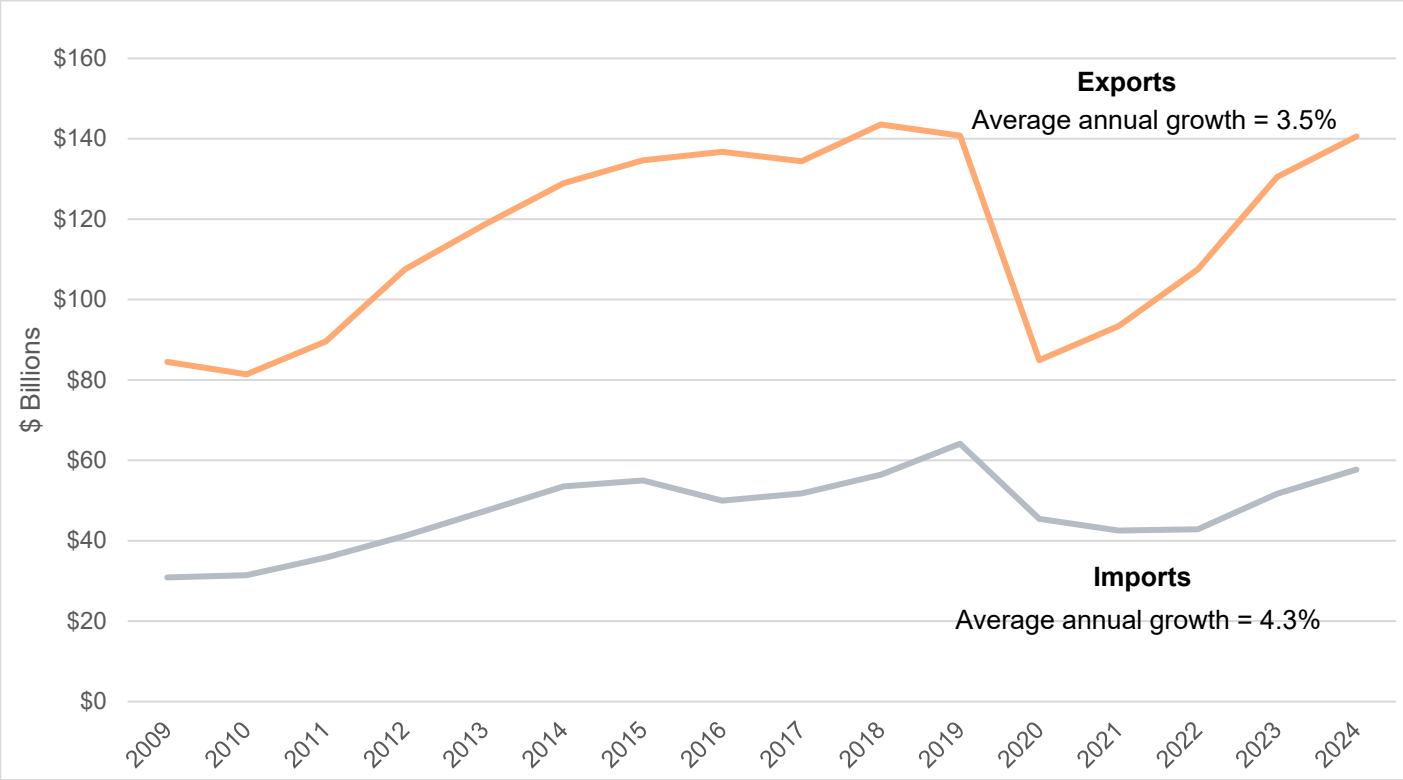
Source: National Science Foundation, Business R&D and Innovation Survey, 2012, Business Enterprise Research and Development (BERD) Survey, various years, and PwC calculations. Aerospace products and parts manufacturing includes all of NAICS code 3364.

International trade: The US aerospace industry plays a vital role in international trade, consistently ranking as one of the nation's top exporters. Aerospace products, such as aircraft, engines, and space systems, generate a substantial trade surplus, helping to offset trade deficits in other areas of manufactured goods.

According to the International Trade Administration ("ITA"), between 2009 and 2019, the value of aerospace product exports increased from $84.5 billion to $140.8 billion, an average annual growth rate of 5.2 percent (see **Figure 1a**, below). After falling to $84.9 billion in 2020 due to the pandemic, exports grew to $140.6 billion in 2024, equaling the pre-pandemic high reached in 2019. Over the 15-year period between 2009 and 2024, the value of aerospace product exports grew at an average annual rate of 3.5 percent. Over the same period, the value of imported aerospace products grew at an average annual rate of 4.3 percent, from $30.9 billion in 2009 to $57.7 billion in 2024. Aerospace products generated a trade surplus every year between 2009 and 2024, with a surplus of $82.8 billion in 2024. For comparison, total merchandise

generated a trade deficit each year in the same period. In 2024, the total US merchandising trade had a deficit of about $1.2 trillion (see **Figure 1b**, below).[4]

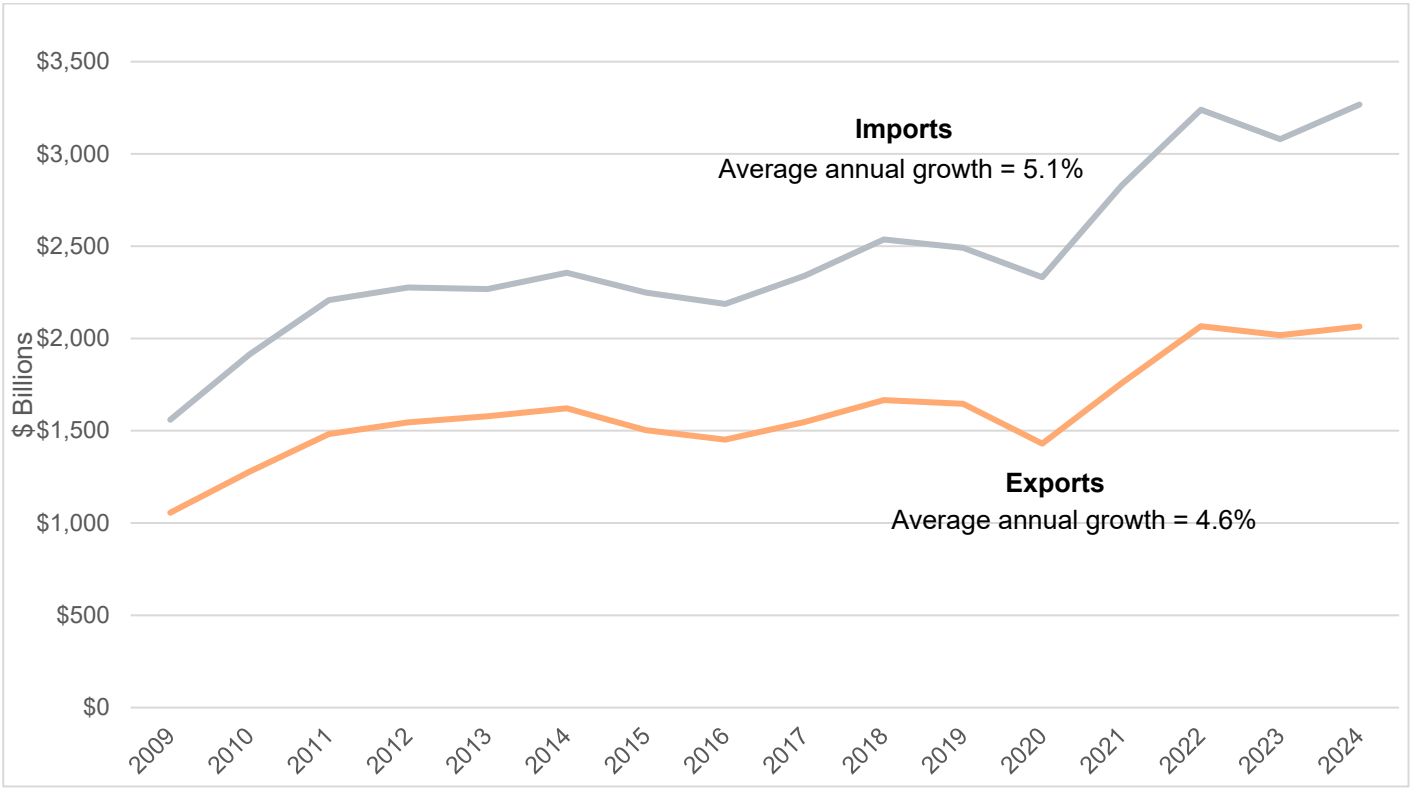
Figure 1a. US aerospace industry: imports and exports, 2009-2024



Source: International Trade Administration, TradeStats Express – US Trade by Product. Downloaded in May 2025.

[4] Trade surplus figures (including imports and exports) from the International Trade Administration. Aerospace manufacturers are represented by NAICS code 3364.

Figure 1b. Total US merchandise imports and exports, 2009-2024

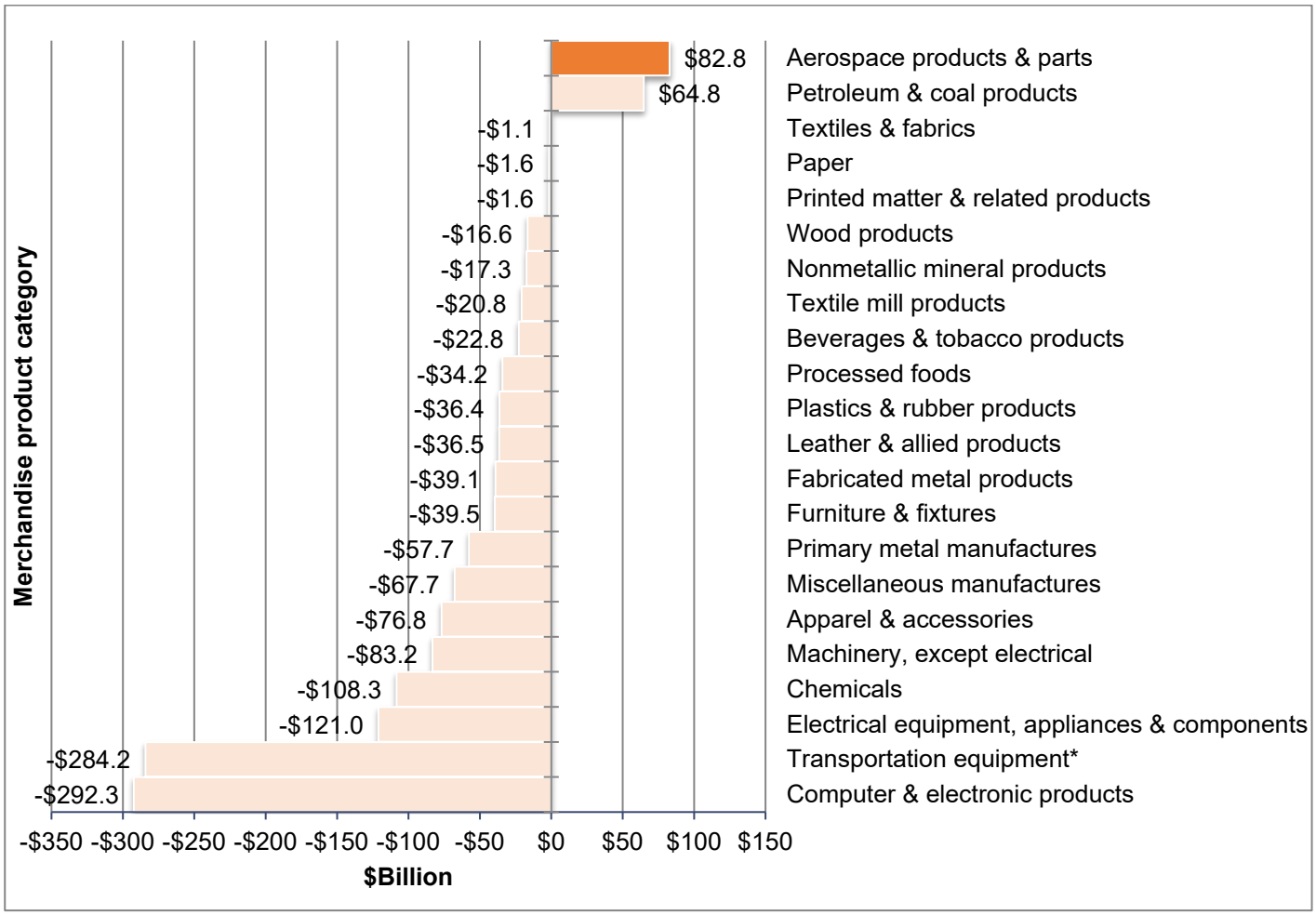


Source: International Trade Administration, TradeStats Express – US Trade by Product. Downloaded in May 2025.

US aerospace industry products and parts trade generated the largest surplus when compared to all other manufactured merchandise trade by sector. The aerospace products and parts sector is one of only three manufacturing categories that produced a trade surplus in 2023 (see **Figure 2**, below).[5]

[5] Comparisons provided in **Figure 2** are based on International Trade Administration data, 3-digit NAICS sectors within the manufacturing industry.

Figure 2. Manufacturing trade balance by sector, 2024



Source: International Trade Administration, TradeStats Express – US Trade by Product. Downloaded in May 2025.
*Excludes aerospace products and parts merchandise product category.

Trade balance as a percent of sales within the manufacturing industry gives insight to the number of exports or imports relative to the total amount of products sold. Net exports as a percent of total sales of aerospace products and parts were 27.4 percent in 2021 (the latest year for which consistent sales data are available from the US Census Bureau). This percentage is by far the highest positive percentage of all manufacturing merchandise sector categories (see **Table 6**, below).

Table 6. Balance of trade as a percent of total sales by sector, 2021
(Dollar amounts in billions)

NAICS code	Sector	Balance of trade	Total sales	Balance as a percentage of sales
3364	Aerospace products & parts	51	185	27.4%
324	Petroleum & coal products	27	610	4.4%
322	Paper	2	198	1.2%
323	Printed matter & related products	(1)	78	-0.9%
311	Processed foods	(9)	904	-1.0%
313	Textiles & fabrics	(1)	27	-3.7%
325	Chemicals	(60)	832	-7.2%
332	Fabricated metal products	(41)	393	-10.3%
327	Nonmetallic mineral products	(16)	144	-10.8%
326	Plastics & rubber products	(37)	273	-13.4%
312	Beverages & tobacco products	(22)	166	-13.5%
333	Machinery, except electrical	(61)	397	-15.4%
321	Wood products	(26)	155	-16.7%
331	Primary metal manufactures	(58)	281	-20.8%
336*	Transportation equipment*	(189)	693	-27.3%
339	Miscellaneous manufactures	(89)	161	-55.0%
337	Furniture & fixtures	(47)	76	-61.5%
335	Electrical equipment, appliances & components	(95)	143	-66.6%
334	Computer & electronic products	(241)	324	-74.4%
314	Textile mill products	(26)	24	-111.8%
316	Leather & allied products	(36)	5	-755.0%
315	Apparel & accessories	(81)	9	-860.2%
Total	**All manufacturing**	**(1,055)**	**6,080**	**-17.4%**

Source: PwC calculations based on data from ITA TradeStats Express and the US Census Bureau Annual Survey of Manufacturers, 2021.
*Excludes NAICS code 3364, aerospace products and parts.

III. Contribution of the aerospace industry to the US economy

The economic contribution of the aerospace industry is measured in terms of employment, labor income, output, gross domestic product ("GDP"), and tax payments for 2023, the most recent year for which a full, consistent set of national and state-level data is available.[6]

In this report, we explore the aerospace industry's economic effects through three distinct channels—direct, indirect, and induced contributions—that together encapsulate the industry's total economic contribution:

1. **Direct contribution** This pertains to the economic activities taking place within the aerospace industry itself, including jobs and production.

2. **Indirect contribution** This encompasses the economic activities generated throughout the supply chain as the aerospace industry procures goods and services from a wide array of supporting industries.

3. **Induced contribution** This refers to the economic activities spurred by household spending of incomes earned directly or indirectly through aerospace-related activities.

Direct contribution is the starting point of the industry's total contribution. Nationwide the aerospace industry directly provided 545,400 full- and part-time jobs to American workers in 2023 (see **Table 7**, below). They earned $79.5 billion in labor income (including wages and salaries and benefits as well as proprietors' income), averaging $145,800 per job. This was almost twice the national average ($74,900). The industry's manufacturing output in 2023 was $306.9 billion, resulting in $151.1 billion direct contribution to the national GDP. In addition, the industry directly contributed $25.1 billion of tax revenues to federal, state, and local governments in 2023.

[6] GDP is the sum of value added in all industries. Value added consists of employee compensation, proprietors' income, income to capital owners from property, and taxes on production and imports. Throughout this report, we refer to value added as contribution to GDP. By comparison, output represents the total value of sales, including the cost of intermediate inputs. Value added excludes the value of intermediate inputs.

Table 7. – Direct economic contribution of the aerospace industry to the US economy, 2023
[Dollar amounts in billions]

Item	Direct	Percent of US economy
Employment (jobs)[1]	545,400	0.3%
Labor income[2]	$79.5	0.5%
Output	$306.9	0.6%
Contribution to GDP	$151.1	0.5%
Tax payments[3]	$25.1	0.4%

Source: PwC calculations using the IMPLAN modeling system. Details may not add up to totals due to rounding.
(1) Employment is defined as the number of payroll and self-employed jobs, including part-time jobs.
(2) Labor income is defined as wages and salaries and benefits as well as proprietors' income.
(3) Taxes include federal, state and local income and nonincome taxes.

Including direct, indirect, and induced effects, the US aerospace industry supported 1.6 million jobs, generated $157.2 billion in labor income, produced $545.2 billion in output, contributed $284.1 billion to GDP, and added $54.0 billion to government revenues at the federal, state, and local levels.

On a per capita basis, the aerospace industry's total GDP contribution equated to approximately $835 for every person in the United States in 2023. Notably, at the national level, each direct job within the aerospace industry was responsible for supporting an additional 1.9 jobs elsewhere in the economy, emphasizing the multiplier effect and interconnectivity of this pivotal sector.

Table 8. – Total economic contribution of the aerospace industry to the US economy, 2023
[Dollar amounts in billions]

Item	Direct	Indirect and induced	Total	Total / Direct ("Multiplier")[4]
Employment (jobs)[1]	545,400	1,050,500	1,595,900	2.9
Labor income[2]	$79.5	$77.7	$157.2	2.0
Output	$306.9	$238.3	$545.2	1.8
Contribution to GDP	$151.1	$133.0	$284.1	1.9
Tax payments[3]	$25.1	$28.8	$54.0	2.1

Source: PwC calculations using the IMPLAN modeling system. Details may not add up to totals due to rounding.
(1) Employment is defined as the number of payroll and self-employed jobs, including part-time jobs.
(2) Labor income is defined as wages and salaries and benefits as well as proprietors' income.
(3) Taxes include federal, state, and local income and nonincome taxes.
(4) Economic multiplier represents the overall contribution (including direct, indirect, and induced effects) relative to the direct contribution.

Table 9 provides additional detail on the indirect and induced contributions associated with the aerospace industry.

Table 9. – Indirect and induced economic contributions of the aerospace industry in 2023
[Dollar amounts in billions]

Item	Total	Percent of US economy
Indirect contribution		
Employment (jobs)(1)	351,300	0.2%
Labor income (2)	$32.3	0.2%
Output	$98.7	0.2%
Contribution to GDP	$51.2	0.2%
Tax payments(3)	$10.6	0.2%
Induced contribution		
Employment (jobs)(1)	699,200	0.3%
Labor income (2)	$45.4	0.3%
Output	$139.6	0.3%
Contribution to GDP	$81.8	0.3%
Tax payments(3)	$18.2	0.3%
Total indirect and induced contributions		
Employment (jobs)(1)	1,050,500	0.5%
Labor income (2)	$77.7	0.5%
Output	$238.3	0.5%
Contribution to GDP	$133.0	0.5%
Tax payments(3)	$28.8	0.4%

Source: PwC calculations using the IMPLAN modeling system. Details may not add up to totals due to rounding.
(1) Employment is defined as the number of payroll and self-employed jobs, including part-time jobs.
(2) Labor income is defined as wages and salaries and benefits as well as proprietors' income.
(3) Taxes include federal, state, and local income and nonincome taxes.

Table 10 provides detail by industry of the indirect and induced contributions of the aerospace industry. It supported 560,000 jobs and $48.2 billion of GDP in the service sector, 146,100 jobs and $21.4 billion of GDP in the wholesale and retail trade sector, and 120,300 jobs and $26.3 billion of GDP in the finance and insurance sector .

Table 10. – The aerospace industry's indirect and induced contributions by receiving industry, 2023
[Dollar amounts in billions]

Industry supported	Employment (jobs)[1]	Labor income[2]	Output	Contribution to GDP
Agriculture, forestry and fishing	12,500	$0.6	$2.1	$1.0
Mining	2,500	$0.4	$1.9	$1.0
Utilities	4,000	$0.9	$5.2	$2.7
Construction	11,900	$0.9	$2.2	$1.2
Manufacturing	82,400	$8.3	$46.8	$14.8
Wholesale and retail trade	146,100	$10.5	$34.5	$21.4
Transportation and warehousing	71,200	$4.1	$9.5	$5.6
Information	29,300	$4.6	$16.2	$9.5
Finance, insurance, real estate, rental and leasing	120,300	$7.8	$42.5	$26.3
Services	560,000	$38.7	$74.6	$48.2
Other	10,400	$1.1	$2.9	$1.3
Total	**1,050,500**	**$77.7**	**$238.3**	**$133.0**

Source: PwC calculations using the IMPLAN modeling system.

(1) Employment is defined as the number of payroll and self-employed jobs, including part-time jobs.

(2) Labor income is defined as wages and salaries and benefits as well as proprietors' income.

Appendix: Data sources and methodology

This appendix describes the data sources and methodology used to derive the results for the study.

Estimating the Direct Jobs, Labor Income and Value Added

PwC's employment estimates for the aerospace industry include both full-time and part-time workers as well as self-employed business owners. The *State Annual Personal Income and Employment* data set published by the US Bureau of Economic Analysis ("BEA") is the only source on total employment including self-employed individuals by industry. Given that the subsectors of the aerospace industry are more disaggregated compared to the BEA data, PwC obtained each subsector's paid employment from the US Bureau of Labor Statistics ("BLS"). PwC then estimated total self-employment for the more aggregated industry using the BEA data and allocated across the subsectors according to each subsector's share of paid employment. A similar methodology was used to estimate labor income and GDP for each aerospace subsector.

Estimating Capital Investment Effect

PwC obtained the aerospace industry's capital expenditures for 2022 from the Census Bureau and projected it to 2023 based on data from the BEA. For the contribution analysis, the industry's capital spending was translated into purchases of capital assets by type through the use of the so-called "capital flow matrix" from the BEA.

Estimating Dividend Effect

PwC obtained data on common stock dividend payments by publicly traded companies in the US aerospace industry.[7] Dividend payments were allocated among (1) US households, (2) foreign shareholders, (3) retirement plans, (4) governments, and (5) other businesses using data from the Federal Reserve Board's *Financial Accounts of the United States*.

[7] The measure of dividends used includes cash dividends from all classes of common stock out of income from US operations by publicly traded US corporations in the aerospace industry. It also includes dividends paid to US shareholders out of income from US operations by foreign corporations in the industry. It does not include the dollar value of stock dividends or dividends paid or accrued on preferred stock.

For the purpose of estimating the industry's dividend effect, only dividends paid by publicly traded companies in the aerospace industry to US households and retirement plans are considered. Dividends paid to US households were allocated by income group using tax return data published by the Internal Revenue Service (IRS)'s Statistics of Income Division.

Dividends paid to pension plans and other retirement accounts were allocated across income groups based on data on retirement assets by income quintile obtained from the 2022 *Survey of Consumer Finances*, conducted by the Federal Reserve. These data were combined with the data on dividends paid directly to US households by publicly traded companies in the aerospace industry to derive our estimates of total dividends paid by publicly traded companies in the industry to residents in the United States.

To quantify the economic effect resulting from these dividend payments, PwC first converted them into additional household consumption expenditures. For dividends paid directly to households, after-tax dividend income was estimated by income class based on average tax rates on dividend income. The additional consumption from dividends paid directly to households was estimated using published estimates of the marginal propensity to consume out of after-tax dividend income.[8] Similarly, the additional consumption resulting from dividends paid to retirement accounts was estimated based on published estimates of the marginal propensity to consume out of wealth.[9]

Estimating the Indirect and Induced Economic Contributions

The initial round of output, income, and employment generated by the operations of the aerospace industry leads to successive rounds of re-spending in the chain of production and through the personal consumption spending of industry and supplier employees. Such indirect and induced economic effects can be measured using various approaches. The most common is multiplier analysis. In broad terms, a multiplier is an index that indicates the overall change in the level of economic activity that results from a given initial change. It

[8] The marginal propensity to consume out of dividend income is a measure of the additional consumption resulting from the last dollar of dividend income earned. The MPCs used for this study were based on Malcolm Baker, Stefan Nagel, and Jeffrey Wurgler, "The Effects of Dividends on Consumption" Brookings Papers on Economic Activity, 2007, pgs. 213-291. Using two micro data sets the authors estimated pre-tax MPCs ranging from 0.25 to 0.77. Using the authors' midpoint estimate of 0.4, PwC estimated the after-tax MPC for each income group as the pre-tax MPC divided by one minus the marginal effective tax rate on dividend income.

[9] A review of the literature suggests that each additional dollar of financial wealth increases consumption between two and six cents. To be conservative we have assumed an MPC out of wealth of 0.028 for all income groups (based on Gabriel Chodorow-Reich, Plamen T. Nenov, and Alp Simsek, "Stock Market Wealth and the Real Economy: A Local Labor Market Approach," working paper, June 7, 2019).

effectively adds up all the successive rounds of re-spending, based on a number of assumptions that are embedded in the method of estimation.

There are different methods available for calculating multipliers. The method used in this report is input-output analysis. It is the most commonly used approach in regional economic studies. An input-output model is built around an "input-output" table that relates the purchases that each industry has made from other industries to the value of the output of each industry. To meet the demand for goods and services from an industry, purchases are made in other industries according to the patterns recorded in the input-output table. These purchases in turn spark still more purchases by the industry's suppliers, and so on. Additionally, employees and business owners make personal purchases out of the additional income that is generated by this process, sending new demands rippling through the economy. Multipliers describe these iterations. The Type I multiplier measures the direct and indirect effects of a change in economic activity. It captures the inter-industry effects only, i.e., industries buying from local industries. The Type II (Social Accounting Matrix or SAM) multiplier captures the direct and indirect effects, and, in addition, it also reflects induced effects (i.e., changes in spending from households as income increases or decreases due to the changes in production). The indirect and induced effects by the aerospace industry on other sectors of the economy in terms of employment, labor income (including wages and salaries and benefits as well as proprietors' income), and value added were calculated through the multiplier process built into the model.

For this study, PwC used a third-party modelling tool to build a customized input-output model for the national economy to calculate the US aerospace industry's indirect and induced economic contribution to each study area in terms of employment, labor income, output, GDP, and tax payments.

Limitations

A study using input-output models with fixed coefficients has certain limitations.

Firstly, the assumption of fixed coefficients implies that the technology and production processes remain constant over time. However, this may not reflect real-world dynamics, such as technological advancements or changes in production methods in the study period.

Secondly, IO models assume linear relationships between inputs and outputs, whereas in reality, these relationships are often nonlinear and can vary depending on specific circumstances. This can result in less precise model outputs. Additionally, these models do not account for changes in relative prices, substitution effects, or shifts in consumer demand, all of which can significantly influence economic outcomes.

Thirdly, IO models assume rational behaviors of economic agents. However, the behavior of consumers and firms are influenced by various social, psychological, and cultural factors that may not be fully accounted in these models. As a result, the accuracy of estimates may be affected.

Considering these limitations, it is important to interpret the estimates from IO models with caution. While they can provide valuable insights, actual effects may diverge from the model's estimates due to the complexity and variability of real-world economies.

Thank you.

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