

2017 US aerospace and defense sector export and labor market study

Exports and employment experience
declining growth, with an outlook for
further challenges



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Executive summary

There are two parts of this report. The first part is a study of the trends in exports, and the second is a study on employment trends in the US commercial aerospace and defense (A&D) sector.

US A&D exports grew in 2016 by \$2.5 billion, but the pace of growth declined significantly from 4.0 to 1.7 percent, 2015 to 2016.¹ This likely results from the recent challenges that the US Export-Import (Ex-Im) Bank faces, the strengthening of the US dollar, and global competition. Exports of A&D products reached \$146.4 billion in 2016, compared to \$143.9 billion in 2015.² By contrast, exports grew \$10.1 and \$5.5 billion in 2014 and 2015.³ However, with global tensions on the rise, we could expect to see this trend change in the near future, with export growth possibly gaining momentum.

A&D sector exports remained a major contributor to overall US exports, adding approximately \$85 billion to the positive trade balance in 2016.⁴ The sector has been a major component to America's overall exports, creating significant employment, at approximately twice the national wage rate,⁵ which helps support the nation's overall growth. While not included in the US A&D export data, the US Foreign Military Sales program has increased \$5.8 billion or 21 percent from 2013 to 2016, but experienced a \$13 billion decline or 28 percent in 2016.⁶

Export growth has slowed for the US aerospace and defense sector likely due to a decline in export financing, a stronger US dollar, and increased global competition.

The US A&D sector is one of the top employers to the US economy, with 4.1 million workers directly and indirectly employed in 2016.⁷ Despite an increase in sector revenues over the last five years, total employment has decreased by 344,610 over the same period, with the decline slowly tapering off in the recent years.⁸ Much of this decline was in the defense subsector and was likely due to the effects of the Budget Control Act of 2011, the ongoing efforts to replace labor with process automation and robotics, and internal efficiency initiatives.

Total employment in the sector experienced a decrease of 0.4 and 0.3 percent in 2015 and 2016 after a 2.2 percent drop in the employment level in 2014.⁹ Of total A&D employment, exports supported nearly 1.42 million jobs in 2016 (34 percent of the total A&D jobs), slightly up from 1.40 million in 2015 and 1.37 in 2014.¹⁰ However, growth in export related jobs remained somewhat sluggish in 2016 at 1.1 percent, in line with the slow growth in A&D exports.¹¹

At a glance

US A&D export growth slowed to

1.7% in 2016

following 7.9% and 4.0% growth in 2014 and 2015



US Foreign Military Sales in 2016

declined \$13 billion or 28%



Direct and indirect jobs lost between 2011 and 2016 in the defense subsector totaled

165,044 lost jobs



US A&D exports directly supported

1.42 million jobs

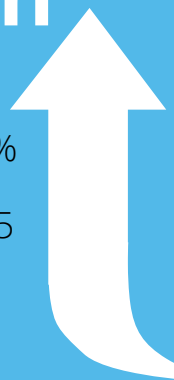
in 2016, and contributed 10.1% to overall US exports in 2016, up from 7.1% in 2010



Direct employment for A&D exports grew marginally by

1.1% in 2016

following a 1.7% growth in A&D exports in 2015



US A&D net commercial exports rose sharply in 2016 by

\$9 billion or 12%



Total employment in the US A&D sector in 2015 and 2016

decreased 0.4% and 0.3%



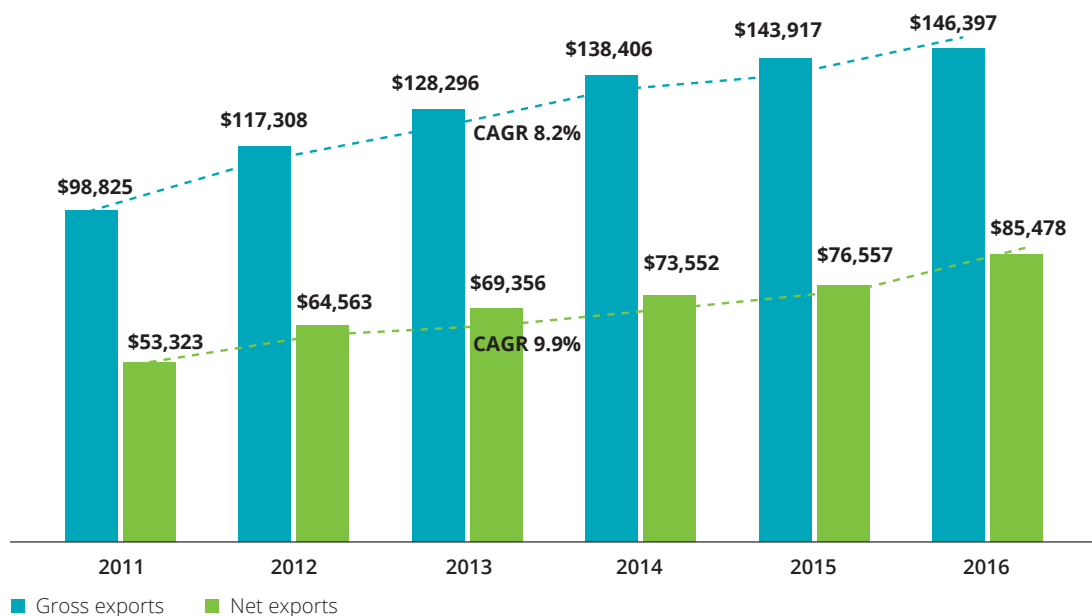
US A&D sector imports have declined by about \$4 billion or over 6 percent from 2014 to 2016, likely due to increased manufacturing activity in the US over the past few years.

After peaking to \$1.62 trillion in 2014, gross US exports (in all sectors) have fallen to \$1.45 trillion in 2016, a decline of 10.3 percent over the 2014–2016 period. However, the decline in exports slowed to 3.3 percent in 2016 as compared to a 7.3 percent drop in exports in 2015.¹²

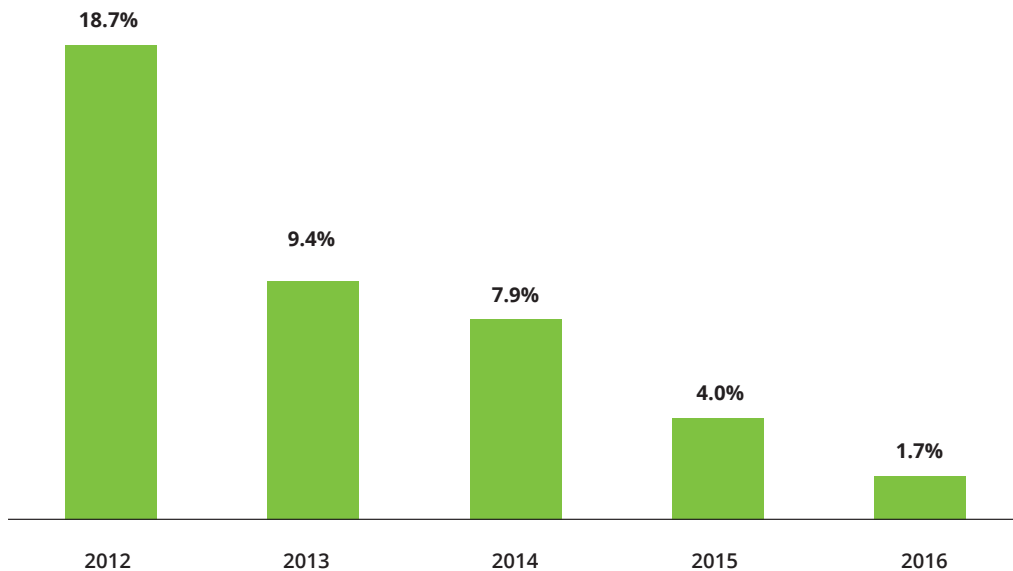
As shown in Figure 1, US aerospace and defense exports experienced growth in 2016, albeit at a lower rate, with exports reaching \$146.4 billion, adding \$2.5 billion to last year's total.¹³ However, the pace of year-over-year growth of US A&D exports has weakened over the last five years—18.7 percent in 2012, 9.4 percent in 2013, 7.9 percent in 2014, 4.0 percent in 2015, and 1.7 percent in 2016¹⁴ (see Figure 2).



Figure 1. US aerospace and defense sector gross and net exports: 2011–2016 (USD millions)

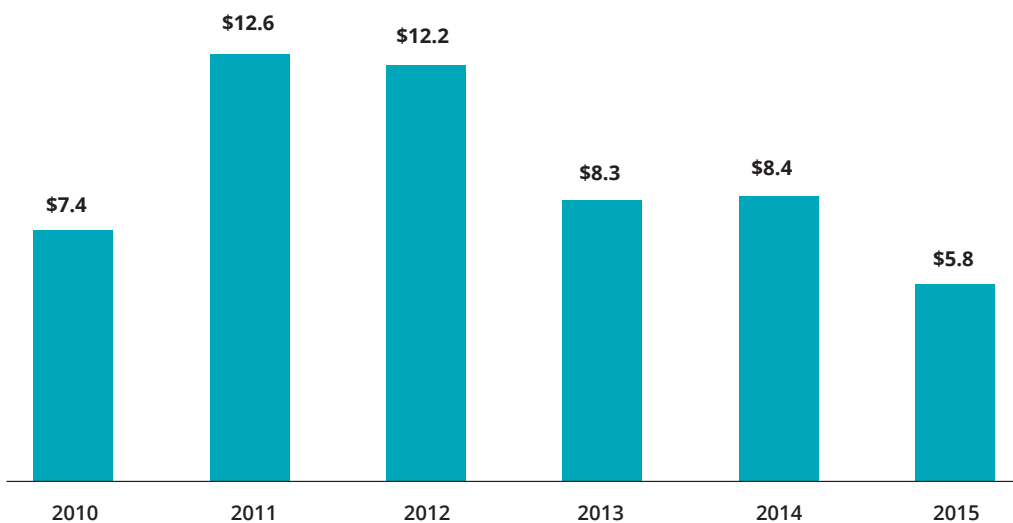


Source: Deloitte analysis based on data from United States Census Bureau

Figure 2. US aerospace and defense export growth, year over year: 2012–2016

Source: Deloitte analysis based on data from United States Census Bureau

As indicated by the declining growth rates illustrated in Figure 2, total gross exports in the US A&D sector seemed to remain under pressure in 2016, likely due in part to limitations placed on the US export credit agency, the US Ex-Im Bank. Due to a lack of a board quorum, the US Ex-Im Bank reduced its financing authorization by \$2.6 billion for exports related to aircraft and avionics (Figure 3). This was due to the restrictions on approving transactions above \$10 million. (The impact of the Ex-Im Bank is further discussed in a subsequent section of this report.)

Figure 3. US Ex-Im Bank's financing authorization for aircraft and avionics (USD billions)

Source: Export-import Bank of the United States, annual reports (2010–2016)

Other likely contributing factors are the strengthening of the US dollar which continues to make US exports more costly in the international market and increased competition from global competitors, especially Russia and China.

US-manufactured A&D products seem to have remained attractive to foreign customers, likely due to the capability and pricing balance. Although less so recently, imports of A&D products into the US have gained in popularity as the sector has globalized and foreign markets have become proficient in manufacturing A&D products. As illustrated in Figure 1, A&D imports had been growing faster than US A&D exports until 2016 when the US experienced a significant increase of \$9 billion or nearly 12 percent. With the increasing competitiveness of the British Pound and Euro, and lower-cost labor markets in Mexico, Asia Pacific, North Africa and Eastern Europe, there may be further pressure on US A&D export growth in the coming years. To that end, over the last five years, A&D sector imports into the US have increased 33.9 percent.¹⁵

Civilian aircraft, engines, equipment and parts contributed the most to total exports (82.5 percent in 2016) and the overall growth in total sector exports was primarily driven by this segment, which grew 50.3 percent over the 2011–2016 period.¹⁶ Exports of military aircraft, engines, equipment and parts experienced a 44.1 percent jump in 2016 compared to 2011 and missiles, space vehicles, propulsion units and parts witnessed substantial growth, with exports up from \$347 million (2011) to \$3.0 billion (2016).¹⁷ Small arms, ammunition, and other ordnance and accessories was the only product category which experienced a decline in exports in the last five years, down 29.6 percent.¹⁸ Figure 4 illustrates gross exports by product category as well as the trend over the 2011–2016 period.

Figure 4. US aerospace and defense sector exports by product category, 2011 and 2016 (USD millions)

Product category	Exports		% of total A&D	5-year growth	5-year CAGR
	2011	2016			
Civilian aircraft, engines, equipment, and parts	\$80,353	\$120,784	82.5%	50.3%	8.5%
Military aircraft, engines, equipment, and parts	\$8,877	\$12,795	8.7%	44.1%	7.6%
Search, detection, and navigation instruments	\$3,843	\$3,950	2.7%	2.8%	0.6%
Missiles, space vehicles, propulsion units, equipment, and parts	\$347	\$3,031	2.1%	774.4%	54.3%
Small arms, ammunition, and other ordnance and accessories	\$3,898	\$2,745	1.9%	-29.6%	-6.8%
Military armored vehicle, tanks, and tank components	\$1,003	\$1,730	1.2%	72.6%	11.5%
Ships	\$504	\$1,362	0.9%	170.0%	22.0%
Total	\$98,825	\$146,397	100.0%	48.1%	8.2%

Source: Deloitte analysis based on data from United States Census Bureau

Figure 5 illustrates gross imports by product category as well as the trend over the 2011–2016 period.

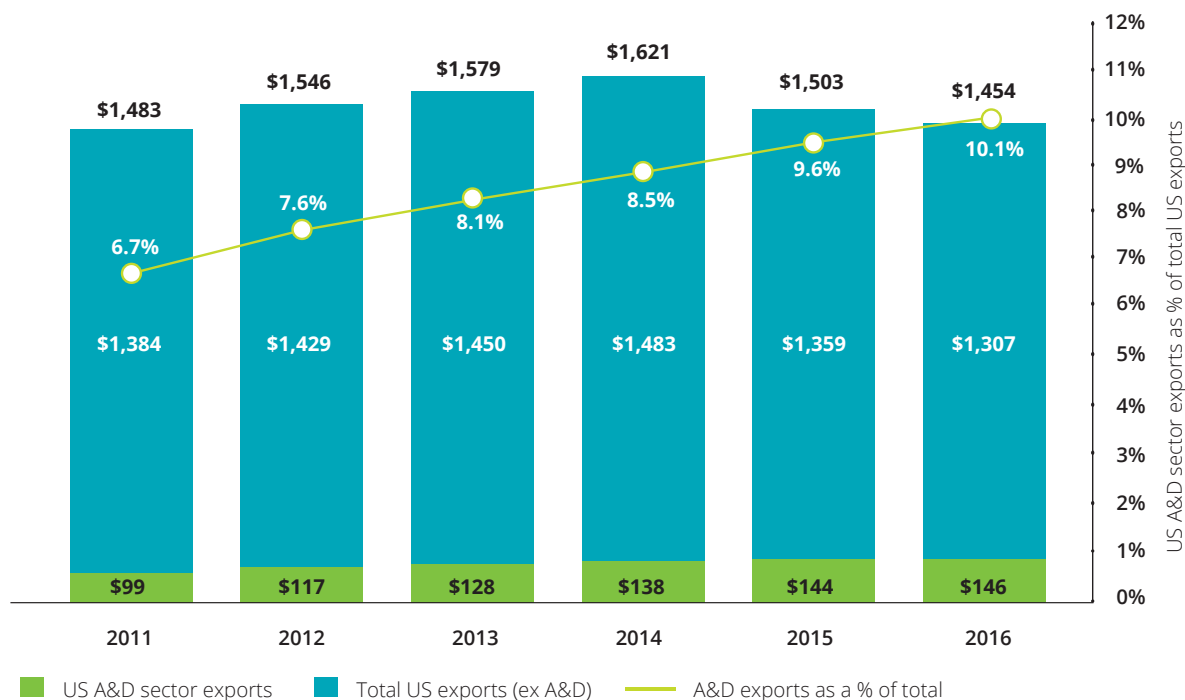
Figure 5. US aerospace and defense sector imports by product category, 2011 and 2016 (USD millions)

Product category	Imports		% of total A&D	5-year growth	5-year CAGR
	2011	2016			
Civilian aircraft, engines, equipment, and parts	-	-	-	n/a	n/a
Military aircraft, engines, equipment, and parts	\$35,797	\$49,782	81.7%	39.1%	6.8%
Search, detection, and navigation instruments	\$5,716	\$7,646	12.6%	33.8%	6.0%
Missiles, space vehicles, propulsion units, equipment, and parts	\$279	\$581	1.0%	108.3%	15.8%
Small arms, ammunition, and other ordnance and accessories	\$2,664	\$2,131	3.5%	-20.0%	-4.4%
Military armored vehicle, tanks, and tank components	\$932	\$279	0.5%	-70.1%	-21.4%
Ships	\$114	\$501	0.8%	338.6%	34.4%
Total	\$45,502	\$60,919	100.0%	33.9%	6.0%

Source: Deloitte analysis based on data from United States Census Bureau

Growth in US A&D exports led to a steady increase in its contribution and possibly even, importance to overall US exports. In 2016, US A&D exports accounted for 10.1 percent of the total, (see Figure 6) increasing from 7.1 percent in 2010, even though growth has gradually slowed in recent years.¹⁹ As a net exporter, the sector reduced the US trade deficit by \$85.5 billion²⁰ and was the top contributor to the US trade balance amongst some of the major sectors—agricultural products, food manufacturing, petroleum and coal products manufacturing, chemical manufacturing, machinery manufacturing, computer and electronic product manufacturing, electrical equipment, appliance and component manufacturing, and transport equipment manufacturing.

Figure 6. US aerospace and defense sector contribution to total US exports, 2011 and 2016 (USD billions)

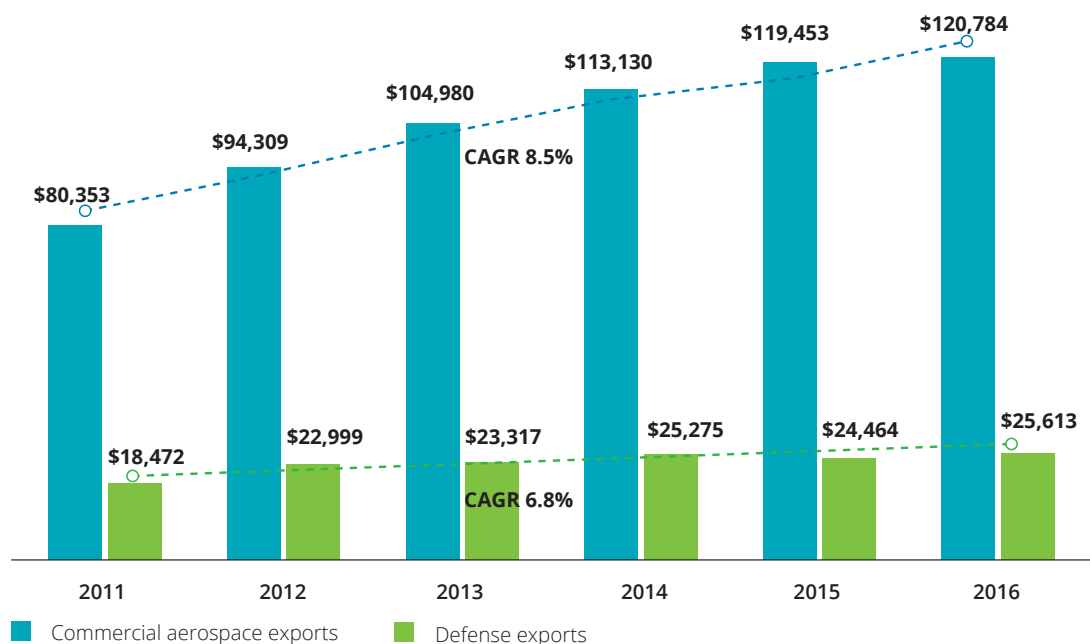


Source: Deloitte analysis based on data from United States Census Bureau

Defense exports returned to growth while commercial aerospace export growth weakened in 2016

US commercial aerospace subsector exports experienced a strong surge in the 2010–2015 period, growing by 66.1 percent (Figure 7).²¹

Figure 7. US commercial aerospace versus defense gross exports: 2011–2016 (USD millions)

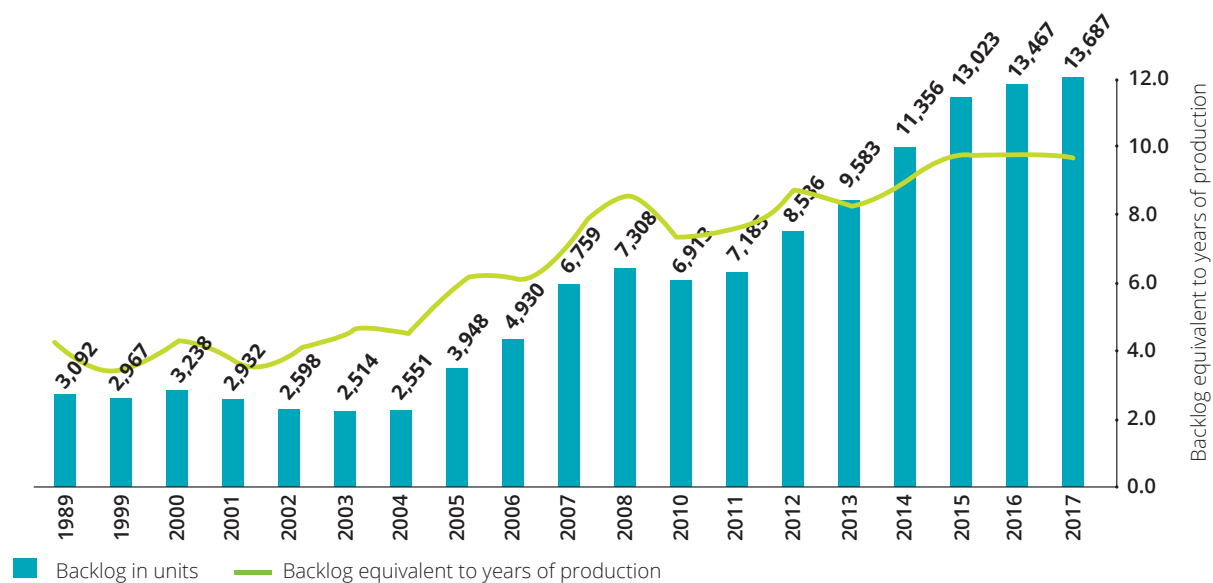


Source: Deloitte analysis based on data from United States Census Bureau

Aerospace and defense sector exports increased from 6.7% of all US exports in 2011 to 10.1% in 2016. US exports remained stagnant during this period while US A&D sector exports grew by 48%.

This was primarily due to strong international demand for commercial aircraft manufactured by the US, reflected in robust industry backlogs, which were at a high of approximately 13,700 at the end of 2016 (see Figure 8).²² The growth rate in commercial aerospace exports declined in 2016, with exports rising merely 1.1 percent.²³ However, the contribution of the commercial aerospace subsector accounted for 82.5 percent of total A&D sector gross exports in 2016, up from 79.8 percent in 2010, reflecting the trend of increased global air travel demand.²⁴

Figure 8. Global commercial aircraft order backlog (units): 1998–2016

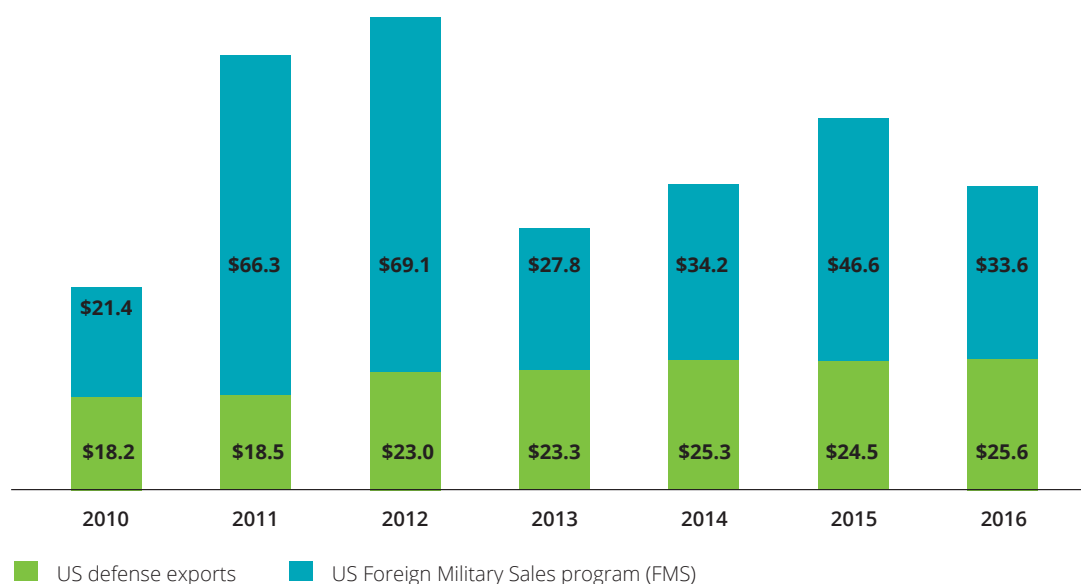


Source: Deloitte analysis based on data from Airbus, Boeing, Bombardier, FlightGlobal

After a decline of 3.2 percent in 2015²⁵ defense exports returned to growth in 2016 posting a gain of \$1.15 billion or 4.7 percent (see Figure 7). This return to growth can be attributed to an increased demand for weapon system platforms as global tensions exist and several countries have taken actions to improve their defense posture. However, the US's share of global defense subsector exports in total A&D exports dropped from 20.2 percent in 2010 to just 17.5 percent in 2016.²⁶

Foreign Military Sales have been significant to US defense subsector revenue

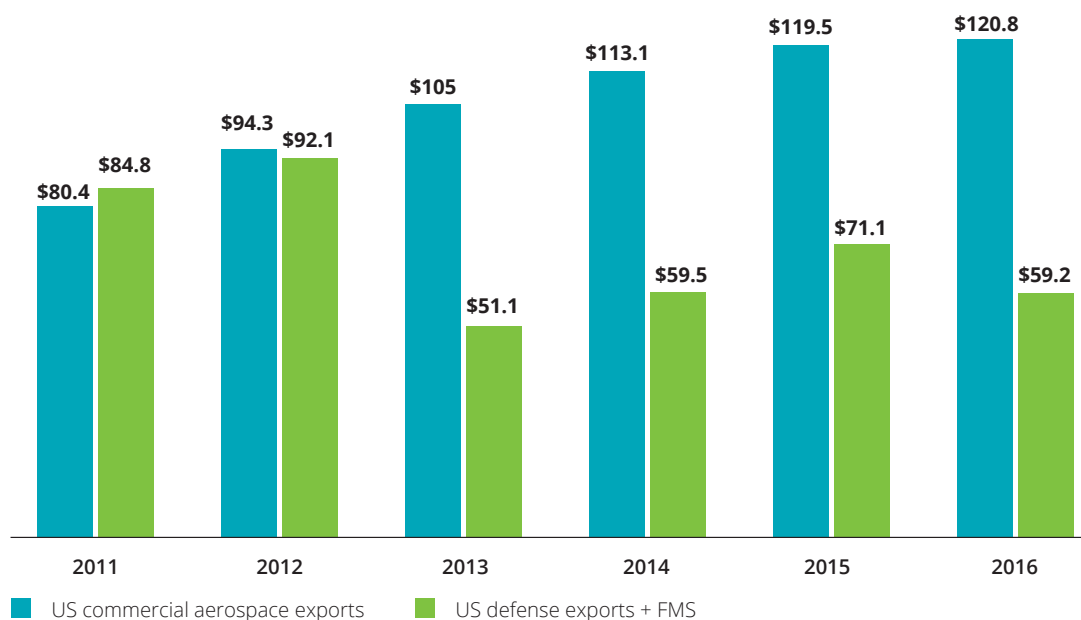
The US Foreign Military Sales (FMS) program significantly declined in 2016 by 28 percent or \$13.0 billion breaking a 3-year growth trend (see Figure 9). Major US defense companies focused on expanding their international sales portfolios to offset declines in US defense spending. The US DoD executed FMS, a US government sponsored and administered process, over the 2010–2015 period and more than doubled its sales, increasing from \$21.4 billion to \$46.4 billion.²⁷ Though US FMS in 2011 and 2012 were much higher, these were likely anomalous years, where Saudi Arabia, the UAE and Oman purchased weapons at record levels, a predominant one being the F-15 fighter jet purchases by Saudi Arabia.

Figure 9. US defense gross exports and Foreign Military Sales: 2011–2016 (USD billions)

Source: Deloitte analysis based on data from United States Census Bureau, Defense Security Cooperation Agency (DSCA), *New York Times*, "U.S. Arms Sales Make Up Most of Global Market," August 2012

There were pending deals announced in 2016 that are likely to be accounted for in the next fiscal year. As a result, 2017 is anticipated to be a significant growth year for US FMS, driven by helicopter, missile, and other military sales to the Middle East, which have already been cleared by the US State Department. In 2017, US fighter manufacturers are likely to sell approximately \$36 billion only in military aircraft, with recent announcements including the sale of F-16s to Bahrain, F-15s to Qatar and F/A-18s to Kuwait.²⁸ Foreign military sales by the US are expected to remain robust for 2017 and 2018, driven by increases in defense spending globally, especially in the Asia Pacific and the Middle East regions.

While commercial aerospace exports have outpaced both direct commercial defense exports and FMS, on a combined basis, defense exports and FMS have represented a significant portion of overall US A&D exports (see Figure 10). In 2014 to 2016, they accounted for 35 percent, 37 percent, and 33 percent of the total exports.²⁹ With the anticipated growth in defense related exports, their contribution could exceed 40 percent of the total in the next two years.

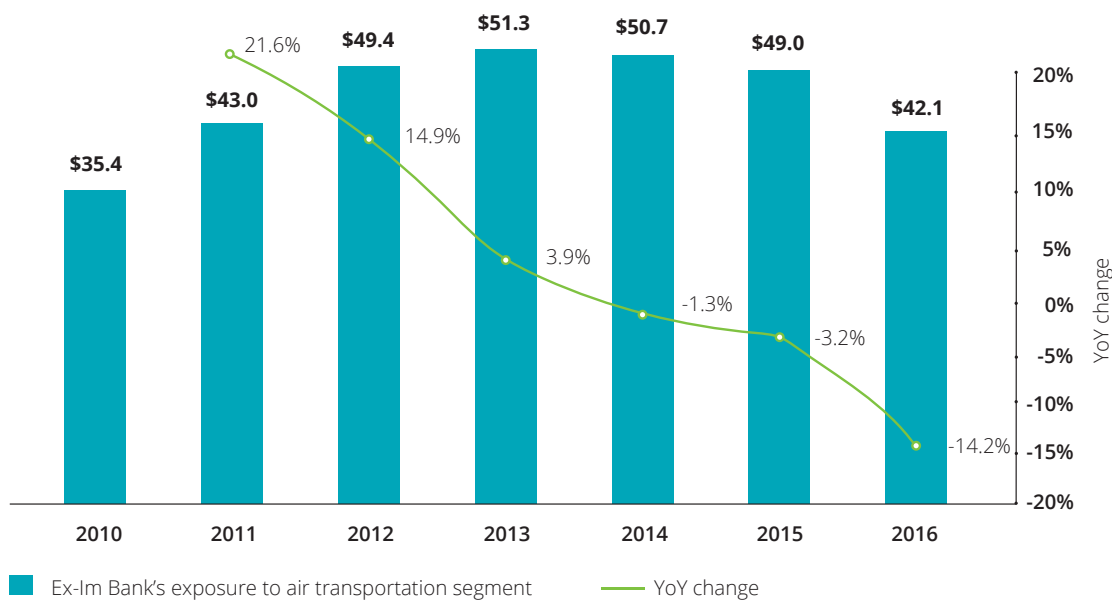
Figure 10. US commercial aerospace versus defense exports with Foreign Military Sales: 2011–2016 (USD billions)

Uncertainty remains with respect to US A&D exports in the near future largely due to issues in financing from US Ex-Im, a strong dollar, and competition from other countries. However, it is unlikely that US A&D exports will experience a decline in 2017. Moreover, given the expected growth in commercial aircraft sales and production volumes, coupled with growth in military products and weapons systems, contribution of US A&D exports will likely remain substantial in the global A&D marketplace, with the US currently accounting for 33.0 percent of global military exports and 39.0 percent of commercial aerospace exports.³⁰

Challenges faced by the US Ex-Im Bank adversely impacted US aerospace and defense exports

US Ex-Im Bank provides export credit financing to the customers of various US manufacturers. The bank has been considered critical to supporting trade transactions of US-made aerospace and defense products and its exposure to the “Air Transportation” segment remains the highest, accounting for 48.2 percent of the total.³¹ However, the bank’s overall exposure to the “Air Transportation” segment has dipped over the last two years (see Figure 11). In 2014, Ex-Im Bank’s exposure to the segment was \$50.7 billion, which fell to \$49.0 billion in 2015 and further to \$42.1 billion in 2016.³²

Figure 11. US Ex-Im Bank exposure to air transportation segment: 2010–2016 (USD billions)



Source: Export-Import Bank of the United States

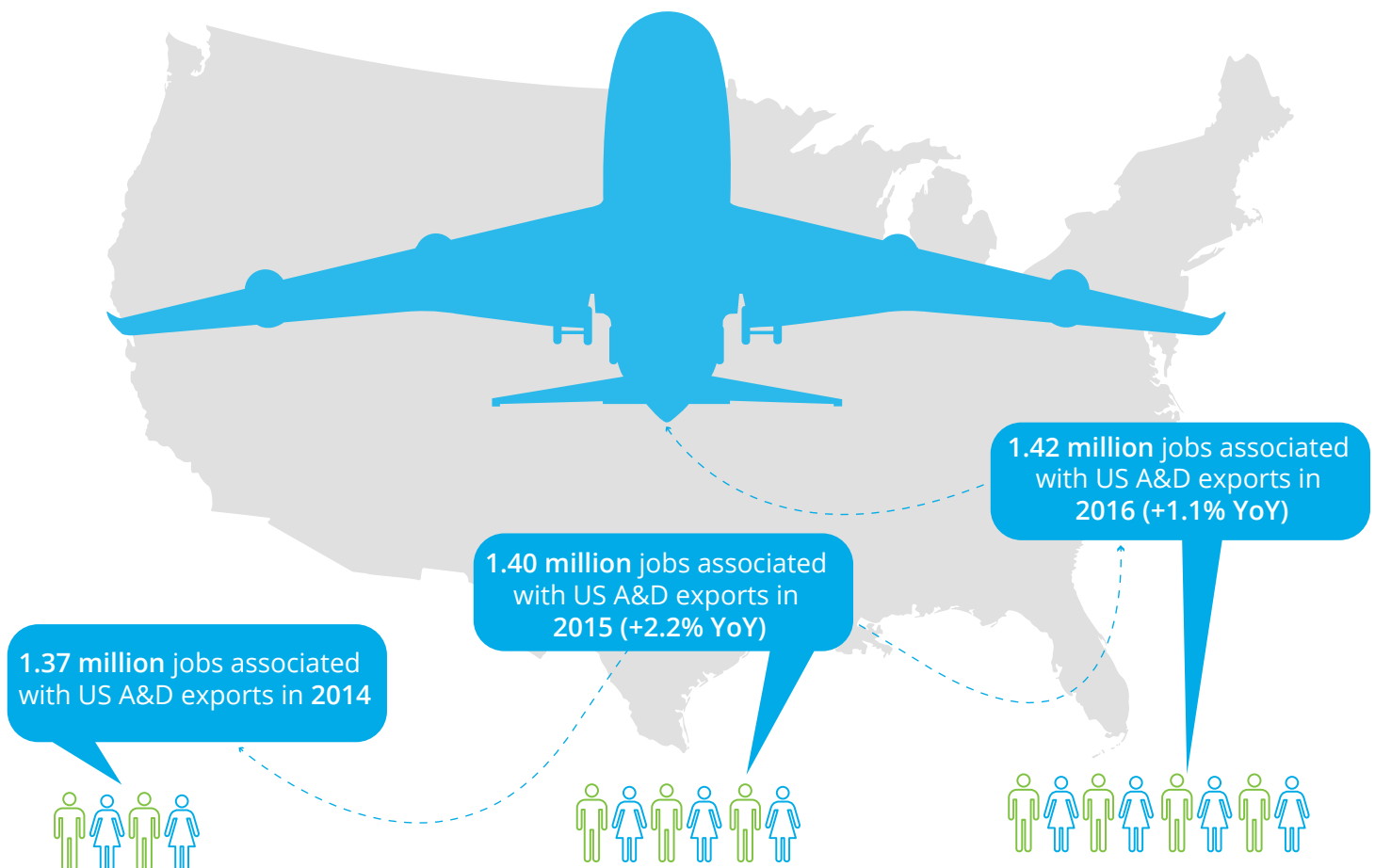
Since late 2015, the inability of the Ex-Im Bank Board to authorize transactions above \$10 million, due to a lack of a voting quorum has impacted financing for US A&D exports. In 2016, the bank could only authorize \$5.8 billion in total financing, which was just 25 percent of what it authorized in 2014, when the bank was fully operational.³³ Recently, in December 2016, the US Congress declined to permit a waiver for the Ex-Im Bank to approve higher value transactions, possibly leading to further limitation for the bank to support financing for US exports. At time of publishing, the new US administration has put forward two Ex-Im board nominees.

US aerospace and defense exports support over 1.4 million jobs

According to Deloitte estimates, US A&D exports supported 1.42 million jobs in 2016, and although substantial, it experienced a small 1.1 percent increase, subsequent to a 2.2 percent growth experienced in 2015.³⁴

The decline in the growth rate in job creation associated with A&D exports can primarily be attributed to a slowdown in A&D exports growth, increased process automation and efficiency initiatives, and lower overhead costs brought about from economies of scale gained through M&A activity and internal company efficiency initiatives. Export related jobs accounted for nearly 34 percent of the total A&D jobs in the US in 2016, up from 33.9 percent in 2015 and 33.1 percent in 2014.³⁵

Figure 12. Employment associated with US aerospace and defense exports



Source: Deloitte analysis based on data from Bureau of Labor Statistics, US Office of Personnel Management, and US Census Bureau

Since 2011, US aerospace and defense sector employment has experienced a significant decline, much of it due to budget sequestration

Despite the increase in sector revenues over the last five years, total employment has decreased by 344,610 personnel. The decline slowly has tapered off with a majority of the reduction realized in the 2011–2013 period.³⁶ Much of the cutbacks were likely triggered by US Department of Defense (DoD) spending cuts related to the Budget Control Act of 2011, coupled with a drawdown of military forces (see Figure 13).

We estimate that the A&D sector supported 4.11 million jobs directly and indirectly in the US in 2016, down only marginally, from 4.13 million in 2015 and 4.14 million in 2014 (see Figure 13).³⁷ In addition, we found that the US A&D sector directly employed 1.22 million workers in 2016, a decline of 7.7 percent since 2011 or a reduction of 102,562 employees over the same period.³⁸

Figure 13. Total direct and indirect aerospace and defense sector employment (2011 and 2016)

Aerospace and defense sector employment metrics	2011	2016	% change	Trend
Direct commercial aerospace subsector employment	322,336	384,818	19.4%	↑↑
Direct defense subsector employment	1,004,215	839,171	-16.4%	↓↓
Total direct employment	1,326,551	1,223,989	-7.7%	↓↓
Total indirect employment	3,130,661	2,888,614		
Total direct and indirect employment	4,457,213	4,112,603	-7.7%	↓↓

Sources: Deloitte analysis based on data from Bureau of Labor Statistics, US Office of Personnel Management, US Census Bureau, and Bureau of Economic Analysis

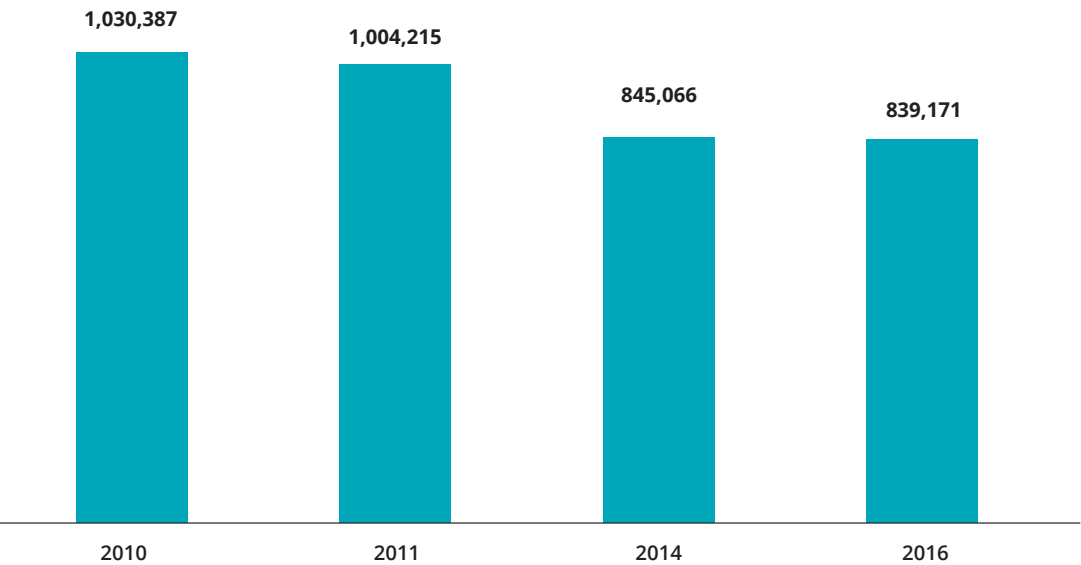
Direct employment includes employees at aerospace and defense companies which sell products and services to commercial airlines and government agencies (e.g., DoD, FAA, and NASA). Direct employment also includes employees that are support personnel for direct-to-home television broadcast providers, data and voice communication providers, National Oceanic and Atmospheric Administration, Department of Homeland Security, and individuals or companies purchasing private general aviation aircraft. These metrics include all such employees working in the US, regardless of the employer's country of origin.³⁹

In the US defense subsector, direct and indirect jobs lost since 2011 total 165,044. If it were not for the increase in employment in the commercial aerospace subsector, total employment declines in the sector may likely have been much more severe. Figure 14 illustrates the employment levels in the defense sub segment over the last four years.

The A&D sector direct employment is supported by indirect jobs in other sectors, such as, energy, professional services, health care, food service, grocery, and consumer retail. In other words, many A&D jobs create a cascading effect of additional indirect jobs that can be ultimately traced back to the A&D sector. Indirect employment associated with the A&D sector is estimated to be 2.89 million in 2016, a reduction of 242,047 personnel since 2011.⁴⁰ Although the workforce reduction in the A&D sector is substantial over the 2011 to 2016 period, it is much lower than the employment cuts from 2008 to 2013 (a reduction of 171,772 personnel).⁴¹

The top three segments generating majority of the employment in the A&D sector were aerospace products and parts manufacturing, A&D related services, and manufacturing of search, detection, navigation, guidance, aeronautical and nautical systems and instruments.

Figure 14. Employment associated with US defense subsector



Sources: Deloitte analysis based on data from Bureau of Labor Statistics, US Office of Personnel Management, and US Census Bureau



Figure 15. Direct employment by aerospace and defense sector classification (2011–2016)

Subsector	2011	2012	2013	2014	2015	2016	Changes in employment from 2011 to 2016	Changes in employment from 2013 to 2016
Aerospace products and parts manufacturing	668,357	657,846	645,030	621,757	619,384	617,420	(50,937)	(27,610)
Aerospace and defense related services	325,695	317,329	316,149	303,409	302,251	301,293	(24,402)	(14,856)
Manufacture of search, detection, navigation, guidance, aeronautical and nautical systems and instruments	189,541	176,541	164,428	173,866	173,202	172,653	(16,888)	8,225
Establishments engaged in operating a shipyard	89,909	91,867	90,519	85,906	85,578	85,307	(4,602)	(5,212)
Military land vehicles manufacturing	21,717	19,535	15,304	18,602	18,531	18,472	(3,245)	3,168
Ammunition manufacturing except small arms	13,690	13,073	12,399	12,580	12,532	12,493	(1,197)	94
Radio and television broadcast and wireless communication equipment	9,227	8,532	7,840	8,311	8,279	8,253	(974)	412
Ordnance manufacturing	7,945	7,671	7,483	7,719	7,690	7,666	(279)	183
Small firearms manufacturing	256	268	308	245	244	243	(13)	(65)
Small arms ammunition manufacturing	216	194	194	192	191	190	(26)	(4)
Grand total	1,326,551	1,292,857	1,259,653	1,232,587	1,227,882	1,223,989	(102,562)	(35,664)

Sources: Deloitte analysis based on data from Bureau of Labor Statistics, US Office of Personnel Management, and US Census Bureau

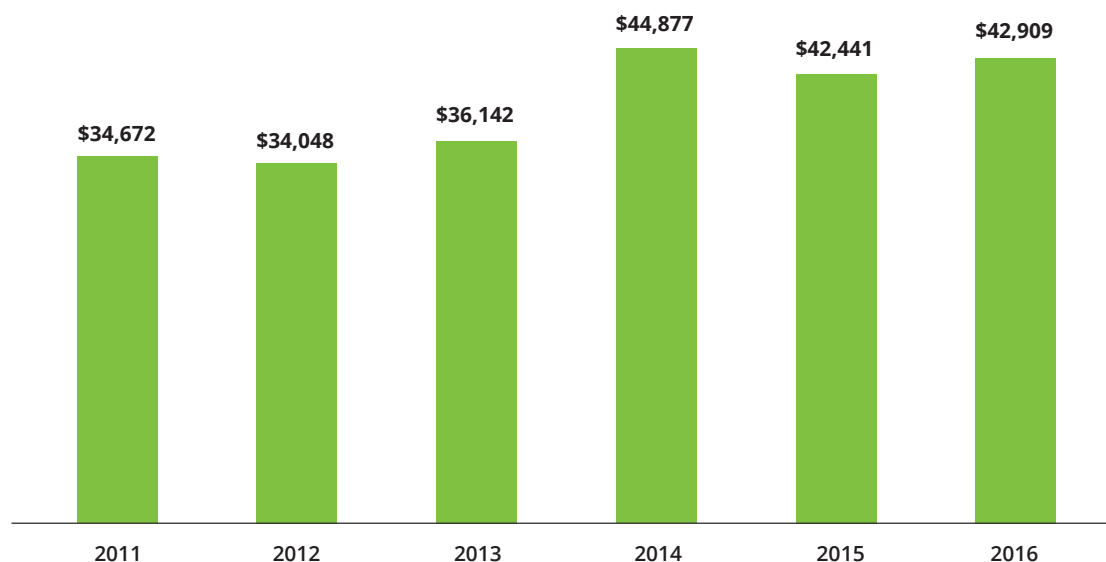
Figure 16. Direct employment growth by aerospace and defense sector classification

Subsector	% CAGR 2011–2016	% CAGR 2013–2016
Aerospace products and parts manufacturing	-1.57%	-1.45%
Aerospace and defense related services	-1.55%	-1.59%
Manufacture of search, detection, navigation, guidance, aeronautical and nautical systems and instruments	-1.85%	1.64%
Establishments engaged in operating a shipyard	-1.05%	-1.96%
Military land vehicles manufacturing	-3.18%	6.47%
Ammunition manufacturing except small arms	-1.81%	0.25%
Radio and television broadcast and wireless communication equipment	-2.21%	1.72%
Ordnance manufacturing	-0.71%	0.81%
Small firearms manufacturing	-1.05%	-7.56%
Small arms ammunition manufacturing	-2.52%	-0.63%
Total	-1.60%	-0.95%

Sources: Deloitte analysis based on data from Bureau of Labor Statistics, US Office of Personnel Management, and US Census Bureau

Though the employment levels in the A&D sector have declined over the last five years, revenue and profitability continued to grow, implying perhaps that the sector has become more efficient and less labor intensive. Process automation and robotics have increasingly taken the place of labor. Productivity in the sector has improved, largely due to increase in efficiency initiatives and lower overhead costs brought about from economies of scale, mostly gained from industry consolidation and merger and acquisition activity. Efficiency, defined as operating earnings per employee among US A&D companies, improved 23.8 percent to \$42,909 in 2016 compared to \$34,672 in 2011.⁴²

Figure 17. US aerospace and defense sector's operating profit per employee



Source: Deloitte analysis of aerospace and defense company annual reports for 2010–2015, 2016 quarterly reports, and Deloitte's Global aerospace and defense sector financial performance study, years 2011–2016

Scope and methodology

The scope of this study includes commercial and military aircrafts, as traditionally viewed, as well as naval platforms, military land vehicles, arms, armaments, defense-contracting services, and several other categories of employment. The following US-based categories were specifically included in our study:

- Military, civil passenger, freight, and general aviation aircrafts, spacecraft, launch vehicles, military land and naval platforms, missiles, munitions, arms, and armaments
- Command, control, communications, computing, intelligence, surveillance, reconnaissance (C4ISR), security, mission software, and government contracting services
- Other related supply chain portions of the sector

It is important to note that the activities included within the scope of this study primarily focus on the sector that serves the US government defense subsector, as well as the commercial aircraft, general aviation, and commercial space subsectors. Airlines data was excluded from the scope of this study.

The analysis in this study is based on inputs from various sources, including the US Census Bureau, the US Bureau of Labor Statistics, the US Bureau of Economic Analysis, USA Trade Online, and UN Comtrade Database. The data was assessed for the years 2011 through 2016.

The foreign trade division of the US Census Bureau reports export and import trade statistics by NAICS code at a national level. Total values were identified for exports and imports for each A&D-related six-digit NAICS code.

For estimating indirect employment, we used an employment multiplier of 2.36, based on studies from Brookings Institution and Milken Institute.⁴³

Approximation and extrapolation procedures and methodologies were applied to develop estimates for various metrics. As mentioned previously, metrics calculated to assess the economic impact of the A&D sector include employment, exports, imports, and economic multiplier data.

Sources

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