2022 edition

Global aerospace and defense

Annual industry performance and outlook

How are aerospace and defense companies performing today?
What challenges and opportunities do they face?
PwC takes a look.

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Contents

Executive summary **3**

Aerospace and defense **4**

A&D performance 2021 overview 5
A&D deals 8

Commercial aviation and aerospace **10**

Commercial aviation and aerospace performance 2021 overview 10
Notable developments: passenger aviation and cargo 12
Notable space developments 17
Commercial aviation outlook 18

Defense **19**

Defense performance 2021 overview 19
Notable developments: defense 20
Defense outlook 22

The state of A&D: the big picture **23**

Appendix **26**

Methodology 26
A&D top 100 companies 27
Additional resources 30
Contact 31

Executive summary

The 2022 edition of PwC's *Global Aerospace and Defense: Annual Industry Performance and Outlook* presents and analyzes key performance metrics of the global commercial aerospace and defense (A&D) industry. Our data are drawn from financial reports on fiscal year (FY) 2021 and include financial results for the largest 100 A&D companies by revenue (see the complete list in the appendix).

We also highlight notable industry developments and express PwC's point of view on topics affecting the industry now, developed through interactions with our clients and other industry leaders and analysts.

This edition arrives in the wake of a rollercoaster year for the commercial aviation industry. Passenger demand has fluctuated dramatically due to pandemic-related pressures, as new waves of infection have been met by continually evolving travel restrictions that govern testing and vaccination documentation and post-travel quarantine. As in 2021, developing an industry outlook continues to be unusually challenging given the uncertain future course of the COVID-19 crisis.

The overall story in commercial freight aviation continues to be one of rapid growth as the sector adapts to — and takes advantage of — supply networks stalled and scrambled by the pandemic. By contrast, the defense industry in 2021 remained somewhat insulated, as defense is an essential industry and spending remained robust, **topping $2 trillion** for the first time. However, the defense industry has been affected by the pandemic due to absenteeism and supply chain challenges caused by the pandemic, which has negatively impacted production and services.

Russia's invasion of Ukraine on February 24, 2022 has already profoundly affected both the civilian and military aviation industries, upending many expectations and making an already uncertain future even more so. We explore the current situation and prospects below.

Aerospace and defense

2021 was a partial recovery year for the A&D industry, following the most challenging year ever resulting from the collapse of commercial aviation amidst the COVID-19 pandemic. Prior to the pandemic, the industry experienced more than a decade of stratospheric growth. COVID-19 has been more persistent than originally expected. Many had expected a return to unrestricted travel by the summer of 2021, which did not occur. Travel restrictions and onerous COVID testing requirements continued throughout 2021, and the Omicron variant persisted into 2022.

Despite these headwinds, domestic travel partially recovered, allowing the commercial aviation sector to report significant improvement over 2020. Revenue passenger kilometers (RPKs) for the year were still less than half of pre-pandemic levels, yet they steadily improved and trended higher by the end of 2021. Additionally, **M&A deals** (in value) in the sector set a new record, surpassing $100 billion for the first time and more than doubling over 2020, with SPAC transactions contributing to much of this activity.

Meanwhile, the defense sector was steady, reporting modest growth in the US and significant growth in Europe, with global military expenditures hitting an all-time high of $2.1 trillion in 2021, according to the Stockholm International Peace Research Institute. Unlike commercial aviation, the defense end markets were unaffected by the pandemic. However, the defense industry was still impacted by worker absenteeism linked to the pandemic, as well as supply chain shortages which affected all industries, resulting in some constraints on production. In February of 2022, Russia's invasion of Ukraine reverberated throughout the defense sector. The full implications of this event are still unfolding but are already influencing future defense budgets globally in terms of funding and priorities. Specifically, defense priorities accelerated a shift from counter-terrorism equipment back toward Cold War-style priorities.

A&D performance 2021 overview

Operating profit more than doubles. According to PwC analysis, the aerospace and defense industry reported $712 billion of revenue in 2021 (up 4% over 2020), and $62 billion of operating profit, up 136%. However, industry performance remains well below pre-pandemic record levels. Industry revenue was 6% below the 2019 record of $754 billion and industry operating profit was 24% below the 2018 record of $82 billion.

Figure 1: Key industry metrics

	2021	2020	Change
Revenue	US$ 712b	$681b	4%
Operating profit	$62b	$25b	136%
Operating margin	8.8%	3.9%	490 bps

Source: PwC analysis

Partial industry recovery led by Boeing, Airbus and Raytheon Technologies. A PwC analysis of the A&D industry's 2021 financial performance shows that Lockheed Martin remained the industry's largest company, reporting revenue of $67 billion, up 3% from 2020. It was also the most profitable, reporting operating profit of $9.1 billion, up 6%. This is the second largest profit reported in industry history, after Boeing's 2018 operating profit of $12 billion. Raytheon Technologies reported a revenue increase of $7.8 billion, or 13%. However, this is primarily due to the reporting impacts of the merger of United Technologies (UTC) and Raytheon in the second quarter of 2020. After adjusting for the estimated impact of Raytheon's first quarter 2020 revenue, Raytheon Technologies' 2021 revenue was roughly flat.

Our analysis also shows that Boeing, Airbus and Raytheon Technologies, in aggregate, contributed about two-thirds of the overall industry profit improvement, together reporting combined profit increases of nearly $24 billion of the $36 billion increase for the entire industry. Boeing reported a loss from operations of $2.9 billion, but this was nearly a $10 billion improvement over 2020's loss of $12.8 billion — due to a combination of pandemic impacts as well as the 737 Max grounding. Airbus returned to profitability of $6.3 billion after reporting a loss of $582 million in 2020. Raytheon Technologies also rebounded, reporting a profit of $5 billion compared to a $11.9 billion loss in the prior year, with an estimated $600 million of that improvement attributed to reporting impacts of its merger with UTC.

There were other noteworthy performances as well, according to our analysis. BAE Systems reported a nearly $5 billion increase in revenue (up 18% over 2020) and a $550 million increase in profit (22%). Thales and Leonardo each reported a 9% increase in revenue and more significant improvements in profit. And Dassault reported a $2.3 billion increase in revenue (37%), and a $350 million increase in profit (130%).

Based on our analysis, Japanese A&D companies — including Mitsubishi, Kawasaki and IHI — reported sharp decreases in revenue and profits. This is largely due to the fact that their fiscal years end on March 31, with fiscal 2021 results based on the first year of the pandemic.

Figure 2: Top 100 additions and deletions

Added to the list	
Exchange Income	#56
Hanwha Defense	#69
RBC Bearings	#89
Heroux Devtek	#94
Barnes Aerospace	#100
Deleted from the list	
Perspecta	Acquired by Peraton
PAE	Acquired by Amentum
FLIR	Acquired by Teledyne Technologies
Signature Aviation	Acquired by Blackstone
Cubic	Acquired by Veritas / Evergreen

Source: PwC analysis

Figure 3: Analysis highlights

Largest increase in revenue (dollars)	Raytheon Technologies	+$7,800m
Largest increase in revenue (percentage)	Exchange Income Corporation	+43%
Largest increase in profit (dollars)	Boeing	+$9,865m
Largest increase in profit (percentage)	Airbus	+1,186%
Highest operating margin	Aselsan	46.8%
Largest rise in top 100 list	Vectrus	+12
Largest decrease in revenue (dollars)	IHI Aero Engines	–$2,266m
Largest decrease in revenue (percentage)	IHI Aero Engines	–50%
Largest decrease in profit (dollars)	Bombardier	–$671m
Largest decrease in profit (percentage)	Axon Enterprise	–1,100%
Largest drop in top 100 list	IHI Aero Engines	–17

Source: PwC analysis

Figure 4: Companies with operating margins exceeding 20% rose from five in 2020 to 10 in 2021:

Top 100 rank	Company	Operating margin
15	Honeywell Aerospace	27.7%
31	TransDigm	35.2%
37	Trimble	40.3%
42	Eaton Aerospace	21.9%
47	Aselsan	46.8%
53	SES	26.3%
57	Bharat Electronics	20.9%
59	Heico	21.1%
83	Exchange Income Corporation	23.0%
84	Garmin	25.0%

Source: PwC analysis

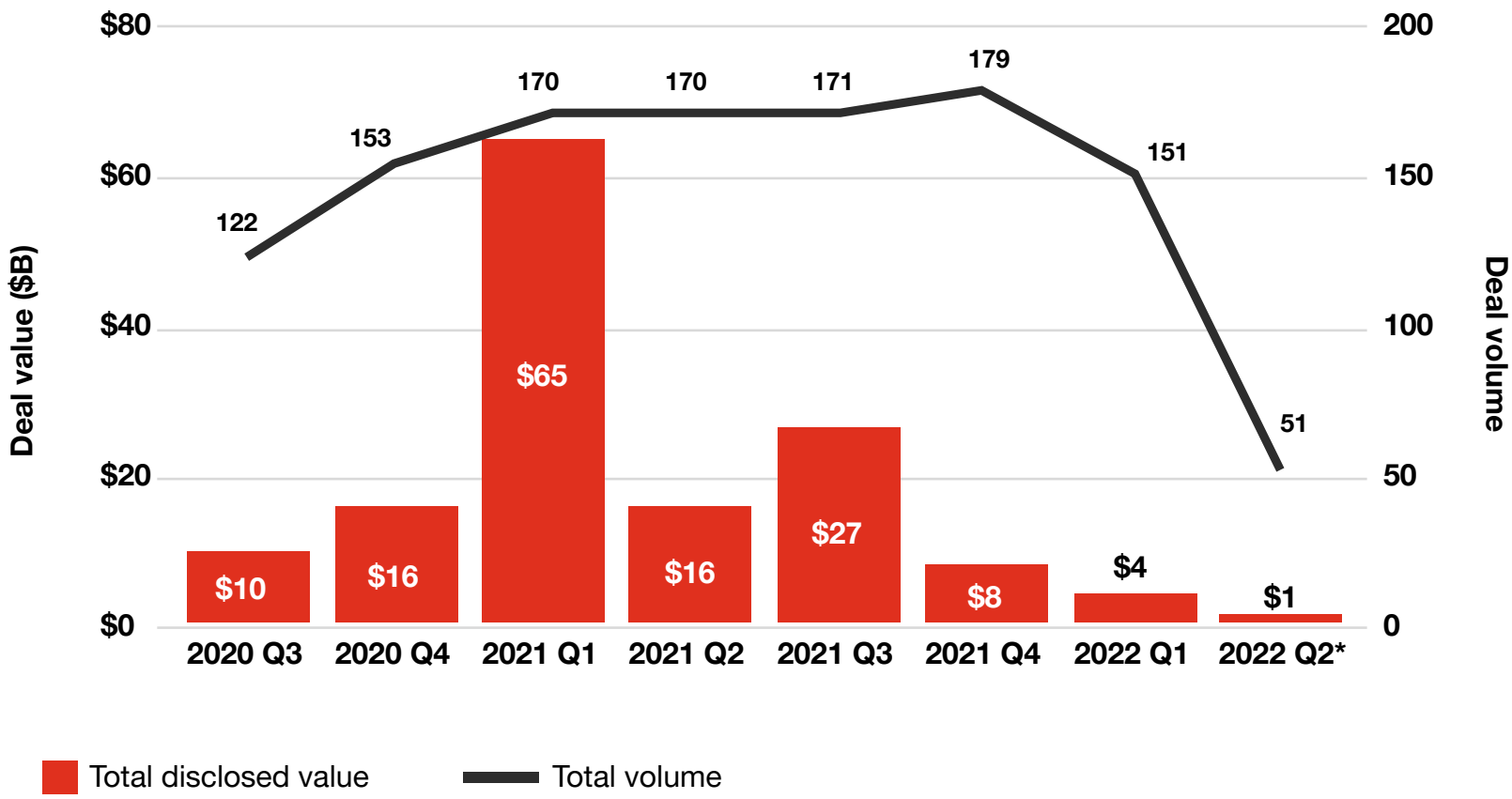
A&D deals activity sets record, soaring over $100 billion in value

The A&D sector's M&A deal activity went on a torrid streak in 2021 with deals valued at $104 billion, up from $46 billion in 2020. Deal volume rose to 555 deals in 2021 from 377 the previous year. The record level was largely driven by special purpose acquisition company (SPAC) activity. However, A&D dealmaking slowed in the first half of 2022. (For more information on M&A activity and the outlook for 2022, please refer to PwC's **Aerospace and Defense: Deals 2022 Outlook**.)

Notable 2021 (and early 2022) deals:

- Notable 2021 A&D SPAC mergers included Vector Acquisition's merger with Rocket Lab (for a $4.1 billion valuation); NextGen Acquisition Corp.'s merger with Virgin Orbit ($3.2 billion valuation); and dMY Technology Group's merger with Planet Labs, Inc. ($2.8 billion valuation).
- Northrop Grumman agreed to sell its federal IT and mission support services business to Peraton — provider of space, cyber, defense and communications services — in a cash deal worth $3.4 billion.
- Perspecta agreed to be acquired by Peraton in an all-cash $7.1 billion deal.
- Power management company Eaton agreed to acquire Cobham Mission Systems from Cobham (a UK-based portfolio company of Advent International) in a deal worth $2.8 billion (n.b., Advent had acquired Cobham, a specialist in aviation technology, in 2020 for about $5.5 billion).
- Cubic, a defense and transportation technology services provider, was acquired by Veritas Capital and Evergreen Coast Capital for $3 billion in May 2021.
- PAE agreed to be acquired by Amentum in October 2021.
- Teledyne Technologies, a maker of electronic sensor technology, agreed to buy FLIR Systems, a developer of thermal image technology, in a cash-and-stock deal valued at about $8 billion.
- Lockheed Martin's planned acquisition of Aerojet Rocketdyne Holdings $4.4 billion was denied by the Federal Trade Commission in January of 2022.

Disclosed deal value and total volume, last eight quarters



*Information cutoff for Q2 2022 data is May 15, 2022
**Deals included in this graphic are total announced deals (including disclosed and undisclosed).

There have been 90 deals so far in H1 2022, with disclosed values totaling $5.3 billion

Source: Refinitiv

Commercial aviation and aerospace

Commercial aviation and aerospace performance 2021 overview

On the heels of the tumult in 2020, 2021 was a year of partial recovery for aviation manufacturers, even though there is a significant way to go before returning to pre-pandemic levels of output.

Boeing's deliveries more than double, backlog strong. Boeing delivered 340 commercial aircraft in 2021, a substantial improvement over 2020's total of 157 but far below the company's 2018 record of 806. As of December 31, 2021, Boeing reported a backlog of 4,250 commercial airplanes (3,414 of them 737s).[1]

Airbus deliveries inch up by 8%, but backlog strong. Airbus deliveries rose 8% to 609 aircraft (vs. 566 in 2020, but well below the company's record of 863 in 2019), led by 483 A320-family craft. The total 2021 year-end order backlog stood at 7,082 commercial units (vs. 7,184 at end 2020).[2]

Adjusted net orders soar. Perhaps the most important prospective figure for both companies is adjusted net orders (i.e., with past orders unlikely to be delivered filtered out due to buyers' poor financial condition, this year only for Boeing). Airbus experienced an 89% rise in adjusted net orders — from 268 in 2020 to 507 in 2021 — while Boeing's figures leapt from –1,194 in 2020 to 535 in 2021.

In commercial passenger aviation, RPKs are recovering. International passenger demand in 2021 was 75.5% below 2019 levels, and US domestic demand in 2021 down by 28.2%. However, despite suppression of holiday travel due to the Omicron variant (with total traffic for December 2021 45.1% below December 2019), demand in early 2022 has surged.[3] The recovery in passenger travel is gathering momentum:

- Total traffic in February 2022 (measured in RPKs) rose year-on-year by 115.9%, yet still down by 45.5% from two years previously.
- February 2022 US domestic traffic was up 60.7% compared to the same month in 2021, but still 21.8% below the volumes of February 2019.
- International RPKs in all regions rose 256.8% versus February 2021, shooting up from a 165.5% year-over-year increase in January 2022 versus the year earlier period. February 2022 international RPKs were down 59.6% compared to the same month in 2019.[4]

While it would be premature to say that the recovery cannot be dented by future COVID-19 variants, all signs suggest a rising trajectory toward pre-pandemic levels.

Figure 5: Aircraft backlog ($US billions)

	12/31/21	12/31/20	12/31/19	12/31/18
Boeing	$297b	$282b	$377b	$412b
Airbus*	$345b	$325b	$475b	$486b

Source: The Boeing Co. 2021 annual report; Airbus Group 2021 annual report

Figure 6: Aircraft backlog (units)

Index	Boeing	Airbus	Total
Net orders	535	507	1,042
Deliveries	340	609	949
Backlog at Dec. 31, 2021	4,250	7,082	11,332

Notable developments: passenger aviation and cargo

Passenger aviation

Boeing's 777X deliveries pushed to 2025, 787 deliveries to resume in 2H 2022. Boeing reportedly is delaying its 777X program, pushing initial deliveries by at least one year into early 2025, with a certificate target of late 2024.The new 777s, which upgrades the existing fuselage with new engine and composite-wing technology, will have the largest product launch in commercial jetliner history. Boeing also expects 787 Dreamliner deliveries to resume in the second half of 2022.[5]

Business aviation activity surges. April 2022 saw North American business flight activity reach its highest year-on-year increase, up 16.7%, and a 24.5% jump in global business aircraft activity over the previous year, according to Argus International. April's flight gains were largely powered by large-cabin in both North America (31.5%) and Europe (155.8%).[6]

Fuel prices, reduced flights propel airfares higher. Russia's invasion of Ukraine on February 24, 2022, sent jet fuel prices skyrocketing higher than in any other category of transportation fuel, and to the highest level since 2008.[7] Prices subsequently moderated but have remained — and are likely to remain — both elevated and volatile. Supply, both in the US and globally, is severely constrained. The US Department of Energy reported that inventory on the East Coast, where prices spiked fourfold in March, lay at the lowest level since 1990, when the agency first began tracking such indicators. Ticket prices rose 40% from January through early April 2022 and are expected to rise 10% before a summer price drop.[8] Surging airfares are partly attributable to normal seasonal patterns and to suppressed demand, especially during the Omicron variant's spread in December 2021 to January 2022.

Some airlines have also cut flights as a way to cope with persistent staff shortfalls, further driving up fares. JetBlue, for example, announced in March 2022 plans to cut or suspend 27 routes through the summer of 2022,[9] then pulled another nine routes in April.[10] Alaska Air plans to trim its offerings to catch up on pilot training.[11] High demand and a pandemic-inspired shift in consumer purchasing behavior toward ticket buying closer to departure date have enabled airlines to pass on part of increased fuel costs much more quickly than in the past, almost in real time.

Russian-Ukraine war effects. As a consequence to Russia's invasion of Ukraine, rerouted international flights are taking longer and therefore adding costs to many international flights.[12] The longer the war persists, the greater the likelihood that Chinese and other Asian carriers, which Russia has not banned, may seek to take over many profitable routes. Meanwhile, the long-term effects of Russia's expropriation of leased aircraft appears likely to be limited. While Russia announced that all foreign-leased aircraft still in Russia whose contracts have been terminated will be expropriated, 78 such jets have been seized abroad, leaving more than 400 (estimated at a worth of at least $10 billion) in Russia.[13] There are over 13,000 commercial jets leased to the global airline industry.

The long-term effects will likely be increased insurance costs, especially for war-related risks, and a reluctance to lease to Russian entities, perhaps for decades to come.[14] Going forward, some lessors may reconsider their relationships with lease-holders in other non-democratic countries where the rule of law is respected only opportunistically.

Travelers want to fly and are willing to pay higher ticket prices. After grinding to a near standstill for most of 2020, mid-2021 seemed to promise passenger travel recovery as restrictions eased and vaccination rates rose. Recovery was derailed, however, by the rise of COVID-19 variants in late 2021. US domestic flights earned $56 billion in online spending in 2021, 57% higher than in 2020 — yet still 26% lower than in 2019. Consumers may have turned a corner for good in early 2002, as February saw US domestic bookings surpass 2019 levels for the first time since the pandemic's onset.[15] The trend has even been dubbed "revenge travel" (travelers' revenge upon the virus itself) — a sentiment that is fueling rising demand.[16]

International COVID-19 travel restrictions remain complicated, yet easing rapidly. Numerous international travel restrictions and protocols related to limiting the spread of COVID-19 infections have been gradually relaxing. For example, the CDC in April 2022 dropped all countries from its highest-risk category of COVID infection, overhauling its advisory system to reserve Level 4 ("Do not travel") only for extreme conditions.[17] Meanwhile, entry rules continue to vary across Europe, as some have abolished all COVID-19 measures altogether for everyone, while others have decided to impose less stringent rules or ease restrictions only for certain categories of travelers.[18]

Cargo

Cargo keeps buoying commercial aviation. After bottoming out in April 2020, the world's three main air cargo corridors (North America–Europe, North America–Asia, Asia–Europe), which together constituted nearly 50% of global cargo traffic in 2019,[19] led the way to a V-shaped recovery in global air freight. Cargo has outperformed passenger traffic since the pandemic's outbreak, providing a cash-flow lifeline to some airlines. In 2021 overall, air cargo volumes rose by 18.7% year-on-year (and 6.9% compared to 2019), the second-best yearly performance since 1990.[20] A tight market entailed exceptionally high load factors and air cargo rates. However, growth was likely muted due to inadequate or suboptimally located capacity and airport congestion.

Passenger aircraft are being converted to cargo at a record pace. With global ocean shipping in a crisis since the pandemic's outbreak and afflicted now with new complications triggered by the war in Ukraine, airlines are converting passenger jets to cargo at an unprecedented rate. For 30 years, about 50 to 70 conversions have taken place annually.[21] But AeroDynamic Advisory expects that level to rise to as much as 180 per year by 2025, relying on 30 new conversion lines expected to open by then compared to 2020. Younger aircraft are being converted too, as witnessed by DHL's acquisition of two 767s less than a decade old (compared to an age of 15 to 20 years for typical freighter conversion stock). While a return to pre-pandemic passenger belly-hold cargo levels is expected by 2023 that may blunt the growth in air freight somewhat, the reconfiguration of the air cargo sector looks very durable.[22]

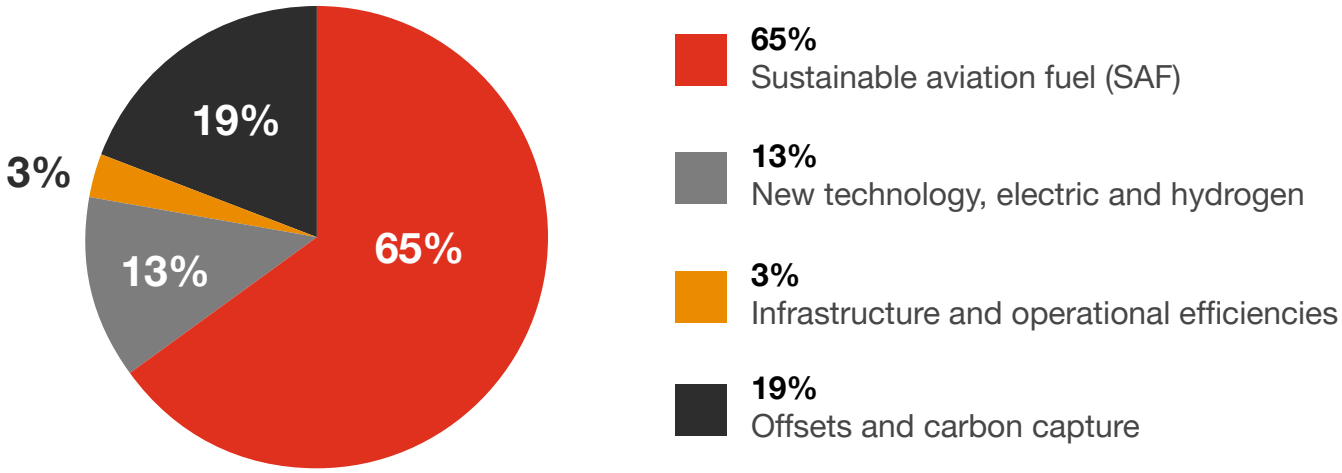
Spiking jet fuel prices raise the already high costs of global shipping. One factor that will likely affect near-term prospects for the air cargo industry — at least as much as it affects passenger traffic — is the rising cost of fuel. In April 2022, Amazon announced plans to impose its first-ever "fuel and inflation surcharge" for sellers whose goods it warehouses and delivers to customers.[23] FedEx and UPS both already had fuel surcharges pegged to fuel cost indexes.

The war in Ukraine impacts air cargo, too. Banned from trans-Siberian flight paths, air cargo between Europe and East Asian factories has had to fly routes a thousand miles longer or more than usual. The regimes of sanctions and counter-sanctions could push soaring cargo rates still higher, perhaps for years to come. Nonetheless, with supply networks still clogged, higher rates may not dent demand much.[24]

IATA targets net zero emissions by 2050. In October 2021, members of the International Air Transport Association released a target to achieve net-zero greenhouse gas emissions by 2050. The goal would require collaboration by all industry stakeholders, including airlines, airports, air navigation service providers, manufacturers and public sector support. Emissions reductions are expected to be attained through the shift to sustainable aviation fuel, new electric and hydrogen technologies, industry efficiencies, carbon capture technology and carbon offsets.

Our strategy towards net zero

Achieving net zero by 2050 will require a combination of maximum elimination of emissions at the source, offsetting and carbon capture technologies.



Source: IATA

The trajectory of electrified aviation is evolving quickly. E-aviation's emerging sweet spot is small craft, carrying 10 to 40 passengers for short-haul flights (up to 500 miles), powered by lithium-ion or hydrogen batteries (including some electric-jet fuel hybrids). Such electric short take-off-and-landing (eSTOL) aircraft could cross the threshold to mainstream acceptance in as little as three years. The adoption of such "flying battery" aircraft, especially models capable of vertical takeoff and landing, could revolutionize the US domestic short-haul sector by connecting the country's vast network of small, regional airports, decentralizing the existing hub-and-spoke system, and even "democratizing" air travel. The space saw promising developments in 2021, including the FAA's announcement of special conditions for airworthiness standards of electric propulsion systems in commercial aircraft.[26] Some developments include:

- Airflow, a maker of both passenger and freight eSTOLs, announced in October 2021 that it will expand into small hydrogen-fueled aircraft.[27]

- Ampaire, which retrofits small planes with hybrid electric propulsion systems, announced an expected FAA supplemental certificate in 2023, with new craft going into passenger service in 2024.[28]

- Embraer announced plans in November 2021 to develop an array of four small aircraft as part of its push for net-zero emissions by 2050.[29]

- Boeing announced in January 2022 a $450 million investment to develop an autonomous e-taxi.[30]

- Airbus has targeted large jetliners, planning to fit a hydrogen-powered engine on a modified A380, with test flights to begin as early as 2026.[31]

Electric aircraft manufacturers can look forward to an unexpected source of support from the federal government. In March 2022, President Biden invoked the Cold War-era Defense Production Act to bolster domestic production of metals and minerals critical to electric vehicles of all kinds, aiming to help reduce American reliance on foreign suppliers, especially Russia and China. And in other alternative-fuel news, Airbus announced in February 2022 plans to test a hydrogen engine on an A380 jumbo jet scheduled to fly by 2026.[32]

The end of private airlines in Russia? Not even Russia's homegrown Sukhoi passenger fleet is immune to repair and maintenance challenges caused by the sanctions regime. The Sukhoi Superjet 100's SaM146 turbofan engine was developed via a joint venture with French aerospace leader Safran, which is solely responsible for certifying not only the engines but systems connected to them. Without Safran's support, the jets, flown by Aeroflot, its subsidiary Rossiya, and at least seven regional Russian carriers, cannot be maintained, and potentially will likely not be flown.[33] The longer the Ukraine war continues, the more intense will likely be the pressure on Russian airlines to become self-sufficient. Sukhoi merged with MiG in late 2021 to create a joint airplane manufacturing venture called UAC.[34] More such mergers are possible. Speculation is growing that the Putin regime might even eventually nationalize most or even all of Russia's remaining privately owned commercial airlines, perhaps amalgamating them with Aeroflot.

Notable space developments

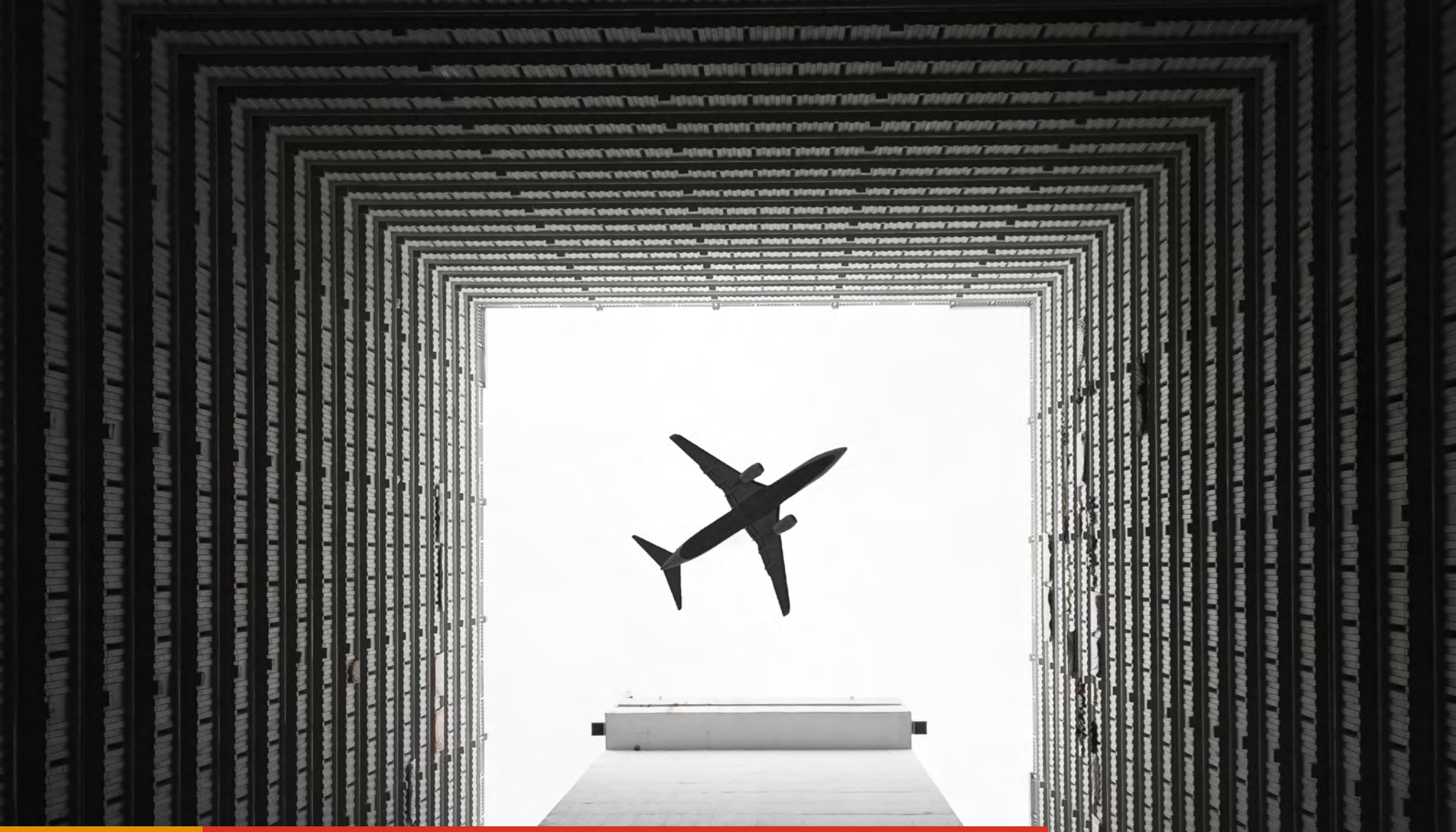
The space industry is booming. Led by the evolution of small satellites and internet satellite service, some forecasts see the commercial space sector tripling in size to $1.4 trillion over the next decade.[35] Much of the SPAC activity driving record deal value has been focused on space. For much of the Space Age, launches have been one or two per month. Now we are forecasting launches to occur weekly and even daily.

In April 2022, Amazon signed a deal with Jeff Bezos's Blue Origin, United Launch Alliance (ULA) and Arianespace for up to 83 launches of its Project Kuiper internet satellites. The contracts, which Amazon claims amount to the largest rocket launch deal in the commercial space industry's history, is ultimately a small part of the company's ambitious plan to send a network of 3,236 satellites into low Earth orbit to provide high-speed internet service everywhere on the planet, which was authorized by the Federal Communications Commission in 2020. Prototypes are set to launch before the end of the year.[36]

Project Kuiper is clearly intended to compete directly against Elon Musk's SpaceX Starlink satellite program, which has a lead over the upstart venture, with about 2,000 units in orbit so far, as does OneWeb, which has launched two-thirds of its first-generation satellites. It's going to get crowded up there. Down on Earth, however, with at least 37% of the global population lacking internet access, there is plenty of room for expanded service.[37]

NASA confirmed in November 2021 its selection of SpaceX to develop a new human lunar landing module for the Artemis moon mission program.[38] In March 2022, NASA reopened competition to seek a second company to back up the Artemis program, giving Blue Origin a second shot after losing out to SpaceX before.[39] Given the scope of NASA's plans — ten crewed missions to the Moon, a permanent Moon space base, and ultimately a crewed mission to Mars — the American space sector is likely to see many more such public-private collaborative partnerships in coming years.[40]

SpaceX completed its first space tourism flight to the International Space Station (ISS) in April 2022, the first such all-private mission ever.[41] Another milestone to look forward to in the fall of 2022: the first orbital flight of Sierra Nevada Corp. (SNC) Space Systems' Dream Chaser to the ISS for NASA. SNC's announcement in April 2021 that it was spinning off the Space Systems division as an independent subsidiary has led to speculation that the new Sierra Space intends to go public. SNC also announced that its plans include an inflatable space station.[42]



Commercial aviation outlook

Commercial aviation could soar again by 2024. As international flight restrictions are being loosened, we are seeing exceptionally strong, pent-up demand for air travel. RPKs could return to pre-pandemic levels, or at least near pre-pandemic levels, in 2023. Forecast International projects that Boeing and Airbus will deliver 483 and 694 commercial jets in 2022, respectively, a 42.1% increase for Boeing and a 22.6% increase for Airbus over 2021 levels. Boeing is on track to return to its 2018 level of deliveries by 2024–25 while Airbus is likely to outdeliver its rival for several years to come.[43] Therefore, we expect 2022 to be another year of significant recovery with full recovery happening in 2023 or 2024.

Air cargo: Is the sky the limit? At this point in the global pandemic, it is unlikely we will see a return to the pre-COVID 19 status quo ante for air cargo. The White House, for example, announced in April 2022 that the Biden administration's economic advisors foresee many years of serious supply chain challenges ahead. The year 2022 could well be a year in which a burgeoning global air cargo industry seeks above all to consolidate and build upon its ad hoc adaptations of 2020–21.[44]

Defense

Defense performance 2021 overview

Global military spending rose for the seventh year in a row in 2021, surpassing $2 trillion for the first time, led by the US, China, India and the UK. Total military expenditures in Europe, which have risen steeply since Russia's annexation of Crimea in 2014, reached $418 billion.[45]

The top six US defense contractors reported increased revenue of 5%, but only 1% after adjusting for the reporting anomalies of the merger of UTC and Raytheon in the second quarter in 2020. Revenue was also affected by divestitures at Northrop Grumman and L3Harris in 2021. After these adjustments, revenue was up about 2%, which is in line with the FY 2022 defense budget increase. For FY 2023, the White House has proposed a Department of Defense budget of $773 billion, subject to congressional approval.[46]

These six companies reported a 16% improvement in operating profit, 13% after adjusting for Raytheon's merger with UTC. The increased operating margin was driven primarily by Raytheon's defense businesses due to a combination of productivity and changes in contract adjustments. Beginning in the third quarter of 2021 and into the first quarter of 2022, supply chain challenges had a negative impact on defense production, revenues, operating profit and cash flow.

The top five European defense companies reported an 8% increase in revenue and 34% increase in operating profit. BAE Systems reported an 18% increase in revenue while Thales and Leonardo each reported 9% growth, substantially organic. All five leading European defense companies, including Airbus' defense businesses and Rolls-Royce Defence, reported significantly higher operating profit, resulting from a combination of higher volumes and improved program performance.

Notable developments: defense

The Department of Defense (DoD) modernization strategy took an important step in November 2021 with the announcement of a strategic software modernization program whose goal is "transforming software delivery times from years to minutes" over the next five years, while enhancing resiliency. The program will leave no aspect of DoD operations untouched, very much including the Air Force. The strategy places great stress on an "enterprise first" approach focusing on cost efficiency and collaboration that appears likely to offer multiple opportunities to technology providers, including newer, smaller players.[47]

The Space Force continues to grow. With its ranks expected to reach 15,000 by the end of 2022, the Space Force announced a new approach to acquisitions to fix a "broken" procurement system that will seek to bring potential providers into the branch's planning cycle much earlier than normal and speed the entire procurement process. The branch's Space Warfighting Analysis Center held its first business fair in October 2021 and plans to hold many more. In 2021 the force also set up SpaceWerx to acquire new technology, selecting 19 startups and small businesses to stimulate new tech development. The force also absorbed the former Space Development Agency in October, which will continue to focus on leveraging the commercial space sector to improve the Pentagon's satellite architecture. Plans include launching satellites through 2024–25 to provide the military with a low-latency data transport layer worldwide. The force has requested $17.4 billion for 2022, a 13.1% increase in funding over 2021.[48]

As expected, the Air Force announced in September 2021 the awarding of contracts to Boeing, Lockheed Martin and Raytheon to develop a solid-rocket, air-breathing hypersonic cruise missile that can be launched from fighter or bomber aircraft. Boeing won a $39.7 million contract, Lockheed $27.2 million and Raytheon $27.9 million to advance to a preliminary design review stage by August–September 2022. The program is part of the Southern Cross Integrated Flight Research Experiment (SCIFiRE), in collaboration with the Australian Department of Defense.[49]

The Air Force awarded a contract to Rolls-Royce, Indianapolis, for 608 new engines for its fleet of B-52H Stratofortress bombers, in a contract to extend up to 17 years and possibly reach $2.6 billion for as many as 650 engines total. Initial delivery is set for March 2022.[50]

Skyborg advances. The Air Force announced in August 2021 contracts worth a combined $20.2 million to Kratos and General Atomics for development of the Autonomous Core System of the Skyborg unmanned aircraft control system, keeping the initiative on target to become a program of record on time in 2023. Skyborg is one of the Air Force's "**Vanguard**" innovative tech programs, seeking an AI-enabled system for a future manned-unmanned aircraft teaming concept.[51]

The Pentagon cut its request for Lockheed's F-35s by 35%, announcing in March 2022 a reduction to 61 from 94 of the fighters in its next budget.[52] At the same time, demand for the F-35 is increasing among international allies. For instance, Finland plans to acquire 64 F-35s by 2028, with initial aircraft arriving as early as 2025.[53]

Boeing and Sikorsky selected Honeywell to power the Defiant-X helicopter with its HTS7500 turboshaft engine, the newest and most advanced model of military engine made by the company. The stealthy new copter is a leading contender to win the U.S. Army's Future Long-Range Assault Aircraft (FLRAA) competition.[54] The program also announced the selection of ATI Forged Products, Collins Aerospace, Elbit Systems of America, Parker Aerospace, Magnaghi Aeronautica and Marotta Controls to provide other important components of the aircraft.[55]

The Air Force announced an acceleration of its highly classified new B-21 Raider program, which will overlap development and production to begin delivering the planes in 2025–26. Air Force Global Strike Command officials also said that procurement will likely rise to about 145 aircraft, up from prior estimates of 100.[56]

The war in Ukraine is likely to stimulate faster adoption of and advances in military drone technology. With its forces outnumbered and outgunned by Russia, Ukraine has nevertheless successfully leveraged armed drones to provide its army with an asymmetrical battlefield advantage. Turkey's Bayraktar TB2 drones and American "kamikaze" Switchblade drones — the Pentagon has sent at least 700 to Ukraine — have proven particularly lethal to Russian armor. A top-secret new drone, the Phoenix Ghost, developed by California-based Aevex Aerospace and dispatched under wraps to the front lines in April 2022, could prove even more effective.[57] Serious security concerns aroused by malfunctioning Chinese-made drones are already providing important opportunities for US drone startups, including Seattle-based BRINC Drones, Inc. and Silicon Valley's Skydio, Inc.[58] In multiple ways, the Ukrainian battlefield is functioning as a testing ground for emerging drone technologies. The world may look back upon the war as the beginning of a new era in multimodal tactics.

In May 2022, the Biden administration announced it will sign a directive that would place the National Quantum Initiative Advisory Committee under the authority of the White House in a bid to enhance the nation's competitiveness in quantum information science and technology. This directive underscores the importance of quantum computing to the country's competitiveness in many industries, including the A&D sector, and will likely drive advances in other technologies including artificial intelligence.

Defense outlook

The president's FY 2023 defense budget request of $872 billion represents more than an 8% increase. Some in Congress are arguing for an even higher increase, given the high level of inflation and war in Ukraine. Multiple European countries, including Germany, are vowing to boost military spending to 2% of GDP or even more in response to the war in Ukraine, and Sweden and Finland are expected to join NATO. Additionally, defense spending among Pacific allies was already trending higher in response to China's military modernization. Much of these increases won't be reflected until 2023. Accordingly, we expect modest growth in the defense sector for 2022, with the potential that lingering supply chain challenges could even result in flat to declining performance. However, we expect high single digit growth for 2023.

We expect defense priorities to be on near-peer threats and the following stated areas of modernization: hypersonics; small satellites; unmanned systems; directed energy; 5G; artificial intelligence.

International military exports typically amount to some 20% of US contractors' revenue. In the first quarter of 2022, foreign military sales notifications for US defense manufacturers (indications of interest approved by the State Department and submitted by the DoD to Congress for review) hit three times the five-year historical average. With nearly 70% of the expected exports being aircraft (both fixed and rotary), this is a sign that the US defense aviation manufacturing sector can anticipate a jump in sales in 2023–24.[59]

The state of A&D: the big picture

Commercial aviation is experiencing strong growth from pent-up demand. As international travel restrictions ease, we expect to see RPKs recover to near pre-pandemic levels toward the end of the year, with a full recovery happening by the end of 2023. There is still some uncertainty, however, as China, the world's second largest and fastest growing aviation market, continues with lockdowns. Some health officials are forecasting another wave of COVID infections this fall which could impact travel, depending on the severity of the variant. However, full recovery for the industry is not a matter of "if," but "when." At the same time, the industry is evolving to focus on Net Zero carbon emissions, through the scaling of sustainable aviation fuels and development of electric aircraft. The long-term growth for aviation is extremely bullish. Consider that approximately 82% of the global population has never experienced an aircraft flight. And with the global middle class projected to grow to 60% by 2030, that's billions of new potential customers.

The defense industry should experience a year of modest growth in 2022, followed by a year of high single-digit growth in 2023. We expect that supply chain challenges will continue to restrict performance in 2022. We also expect that the industry will be focused on military modernization priorities in its product development and M&A strategies. However, the geopolitical environment is complex and unpredictable. Developments in the Ukraine War or the Pacific could rapidly change the priorities.

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Appendix

Methodology

Our data are drawn from financial reports on FY 2021 results for the largest 100 A&D companies by revenue (see below) and other publicly available information, such as company websites and press releases. Our cutoff date for publication was April 1, 2022.

A&D companies include those that generate the majority of revenue from aerospace or defense activities or, for diversified companies, those reportable segments that derive a majority of their revenue from A&D activities. The results are reported in US dollars. Foreign currencies were translated, for the top 100 list, at average exchange rates for years ended December 31, 2021, and December 31, 2020, respectively.

Our report also expresses PwC's point of view on topics affecting the industry, developed through interactions with our clients and other industry leaders and analysts.

A&D top 100 companies (ranked by 2021 revenue)

#	Company	Revenue (US$ millions) 2021	2020	Change	Operating Profit (US$ millions) 2021	2020	Change
1	Lockheed Martin	67,044	65,398	3%	9,123	8,644	6%
2	Raytheon Technologies	64,388	56,587	14%	4,958	(1,889)	362%
3	Boeing	62,286	58,158	7%	(2,902)	(12,767)	340%
4	Airbus	61,642	56,912	8%	6,314	(582)	1186%
5	General Dynamics	38,469	37,925	1%	4,163	4,133	1%
6	Northrop Grumman	35,667	36,799	-3%	5,651	4,188	35%
7	BAE Systems	29,312	24,746	18%	3,033	2,478	22%
8	GE Aviation	21,310	22,042	-3%	2,882	1,229	134%
9	Thales	19,139	17,527	9%	1,949	1,423	37%
10	Safran	17,888	18,812	-5%	1,655	1,391	19%
11	L3Harris	17,814	18,194	-2%	1,889	1,124	68%
12	Leonardo	16,708	15,291	9%	1,077	590	83%
13	Rolls Royce	15,431	14,751	5%	706	(2,531)	128%
14	Leidos	13,737	12,297	12%	1,152	998	15%
15	Honeywell Aerospace	11,026	11,544	-4%	3,051	2,904	5%
16	Huntington Ingalls	9,524	9,361	2%	513	799	-36%
17	Textron	9,203	8,596	7%	975	630	55%
18	Dassault Aviation	8,550	6,262	37%	644	281	130%
19	Booz Allen Hamilton	7,859	7,464	5%	754	669	13%
20	SAIC	7,056	6,379	11%	390	370	5%
21	Mitsubishi Aircraft, Defense and Space	6,393	6,605	-3%	(863)	(1,955)	56%
22	Serco	6,087	4,987	22%	315	209	51%
23	Bombardier Aviation	6,085	6,487	-6%	241	912	-74%
24	CACI	6,044	5,720	6%	540	458	18%
25	Babcock International Group	5,754	5,712	1%	(39)	485	-108%
26	Singapore Technologies	5,724	5,191	10%	481	413	16%
27	Elbit Systems	5,279	4,663	13%	419	326	29%
28	AVIC Aircraft Company	5,070	4,853	4%	129	142	-10%
29	Howmet Aerospace	4,971	5,259	-5%	748	626	19%
30	MTU Aero Engines	4,950	4,535	9%	553	474	17%
31	TransDigm Group	4,798	5,103	-6%	1,691	1,751	-3%
32	Rheinmetall Defence	4,785	4,245	13%	580	472	23%
33	Saab	4,561	3,849	19%	336	143	136%
34	Israel Aerospace Industries	4,477	4,184	7%	217	195	11%
35	Embraer	4,197	3,771	11%	201	(323)	162%

#	Company	Revenue (US$ millions) 2021	2020	Change	Operating Profit (US$ millions) 2021	2020	Change
36	Spirit AeroSystems	3,953	3,405	16%	(459)	(813)	44%
37	Trimble	3,659	3,148	16%	1,474	420	251%
38	Kawasaki Aerospace Systems	3,509	5,038	-30%	(288)	400	-172%
39	Melrose / GKN Aerospace	3,498	3,599	-3%	154	18	757%
40	Hindustan Aeronautics Limited (HAL)	3,078	2,894	6%	577	515	12%
41	MOOG	2,852	2,885	-1%	238	44	441%
42	Eaton Aerospace	2,648	2,223	19%	580	414	40%
43	ManTech International	2,554	2,518	1%	187	158	18%
44	Oshkosh Defense	2,526	2,311	9%	198	188	5%
45	Curtiss-Wright	2,506	2,391	5%	383	289	33%
46	Parker Hannifin Aerospace	2,387	2,735	-13%	403	477	-16%
47	Aselsan	2,262	2,292	-1%	1,058	751	41%
48	ViaSat	2,256	2,309	-2%	58	38	53%
49	Korea Aerospace Industries	2,236	2,638	-15%	51	234	-78%
50	IHI Aero Engines and Space Operations	2,227	4,493	-50%	(368)	377	-198%
51	Aerojet Rocketdyne	2,188	2,073	6%	257	241	7%
52	BWXT	2,124	2,124	0%	346	359	-4%
53	SES	2,106	2,139	-2%	553	94	492%
54	CAE Aviation Defense and Security	2,097	2,609	-20%	18	431	-96%
55	Meggitt	2,048	2,162	-5%	243	245	-1%
56	Ball Aerospace	1,911	1,741	10%	169	153	10%
57	Bharat Electronics	1,898	1,701	12%	396	335	18%
58	Triumph Group	1,870	2,900	-36%	(326)	58	-662%
59	Heico Corporation	1,866	1,787	4%	393	377	4%
60	Vectrus	1,784	1,396	28%	62	43	44%
61	Maxar Technologies	1,770	1,723	3%	46	-46	200%
62	Qinetiq	1,758	1,377	28%	154	151	2%
63	AAR	1,652	2,072	-20%	85	41	107%
64	Austal	1,572	2,086	-25%	114	130	-12%
65	Swire Pacific / HAECO	1,475	1,480	0%	51	(12)	510%
66	Woodward Aerospace	1,404	1,591	-12%	234	310	-25%
67	RUAG	1,357	1,258	8%	77	239	-68%
68	Constellium Aerospace & Transport	1,350	1,169	15%	131	121	9%
69	Hexcel	1,325	1,502	-12%	52	14	271%
70	Hanwha Systems Defense	1,322	981	35%	81	59	36%
71	Kongsberg Gruppen Defense and Aerospace	1,186	903	31%	230	123	87%
72	Ultra Electronics	1,171	1,104	6%	179	162	11%
73	Allegheny Technologies High Performance Metals	1,155	1,165	-1%	85	52	63%
74	OHB Technology	1,070	1,003	7%	56	48	16%
75	Teledyne A&D Electronics and Engineered Systems	1,035	1,005	3%	182	131	39%
76	Smiths Detection	992	1,035	-4%	106	73	45%
77	Mercury Systems	924	797	16%	81	91	-11%
78	Axon Enterprise	863	681	27%	-168	(14)	-1100%
79	Kratos Defense & Security Solutions	812	748	9%	28	29	-3%
80	Subaru Aerospace	799	1,332	-40%	(89)	47	-288%

#	Company	Revenue (US$ millions) 2021	2020	Change	Operating Profit (US$ millions) 2021	2020	Change
81	Indra Security & Defense	752	594	27%	37	29	-202%
82	VSE Corporation	751	662	13%	22	14	57%
83	Exchange income Corporation	731	513	43%	168	105	60%
84	Garmin Aviation	712	623	14%	178	131	36%
85	Kaman Aerospace	709	784	-10%	44	(70)	163%
86	Ducommun	645	628	3%	49	46	7%
87	Crane Aerospace & Electronics	638	651	-2%	110	101	9%
88	RBC Bearings	609	727	-16%	111	157	-29%
89	Senior Aerospace	604	639	-6%	11	8	43%
90	FACC	588	601	-2%	(30)	(84)	65%
91	Magellan Aerospace Corp Aerospace & Aviation	549	555	-1%	4	14	-72%
92	Chemring	541	517	4%	69	59	16%
93	Larson & Toubro Defence Engineering	460	499	-8%	83	74	13%
94	Heroux Devtek	457	457	0%	27	(22)	222%
95	Jamco Corp	456	858	-47%	(107)	17	-732%
96	Latecoere	449	471	-5%	(84)	(197)	58%
97	Astronics	445	503	-12%	-29	-101	71%
98	SIA Engineering	443	994	-55%	-25	68	-137%
99	Aeroviroment	395	367	8%	43	47	-9%
100	Barnes Aerospace	362	354	2%	52	57	-9%
	Total	711,556	682,731	4%	62,331	26,454	136%

Additional resources

2021 Aerospace manufacturing attractiveness rankings

Our analysis considers how various countries and American states compare in terms of their attractiveness as locations for all sectors of aerospace manufacturing.

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