

2020

FORECAST:



RESTORING AEROSPACE GROWTH

Easing trade tensions, a rebound in commercial aircraft production, and military modernization can revitalize the aerospace and defense industry. **By Eric Brothers**

Despite Boeing's really bad 2019, there are reasons to believe aerospace in general will improve this year. Easing trade tensions between the U.S. and China, progress toward resolving Boeing's 737 MAX crisis, increased defense spending, a budding commercial space sector, and Airbus' robust sales and production portend well for 2020.

AIRBUS delivered 863 commercial aircraft to 99 customers in 2019, outpacing 2018's record output by 8%. Only the A380 declined. For the 17th year in a row, production increased, and

Airbus delivered 173 wide-body aircraft, its highest number in a single year.

Airbus had 1,131 new orders for the year, with net orders reaching 768, compared to 747 in 2018, taking Airbus' cumulative net orders higher than 20,000.

The single-aisle A320 family tallied 654 net orders, including an enthusiastic market for the A321XLR. Cancellations of 363 aircraft reflect specific airline situations in 2019 as well as the decision to end A380 production. At the turn of the year, Airbus' backlog stood at 7,482 aircraft.

Airbus 2019 commercial aircraft deliveries, net orders

Aircraft program	Deliveries	Net orders
A220 family	48	63
A320 family	642	654
A330 family	53	89
A350 family	112	32
A380	8	Cancelled
Total	863	838 (768 Airbus figures)

<https://www.airbus.com>

BOEING delivered only 380 planes in 2019, a 53% decrease compared to 2018. Its gross orders were 246, a 77% decrease compared to 2018. Boeing's net orders after cancellations and conversions were 54 planes, compared to 893 the previous year. Boeing's backlog now stands at 5,406 airplanes.

The company's efforts to return the single-aisle 737 MAX to service included more than 800 test and production flights through October, clocking more than 1,500 hours with new software.

Boeing commercial airplane deliveries, net orders 2018

Aircraft program	Deliveries
737	127
747	7
767	43
777	45
787	158
Total	380

<http://www.boeing.com>



Boeing hopes to get the 737 MAX 8 in service by mid-year.

Photos credit: Boeing & Airbus

Airbus' A220 should get rolling off the new U.S. assembly line in Mobile, Alabama, this year.



EMBRAER ended Q3 2019 (the latest figures available) with a firm order backlog of \$16.2 billion. Its commercial firm order backlog of 345 includes 181 E175 and 123 E195-E2 airliners. Embraer's contract with SkyWest Inc. for a firm order of seven E175 jets in a 70-seat configuration is worth \$340 million.

The most deliveries for the year were of the E175 model. Embraer also delivered its first E195-E2, the largest of the three members of the E-Jets E2 family of commercial aircraft. The recipients were aircraft leasing company AerCap and Azul Linhas Aéreas Brasileiras, the global launch customer for the E195-E2, which placed 51 firm orders.

Private jet company Flexjet ordered a fleet of Praetor 500, Praetor 600, and Phenom 300 jets valued at up to \$1.4 billion.

Embraer also delivered the first KC-390 airlifter to the Brazilian Air Force, and the Portuguese Air Force ordered five, the type's first international order.

Horizon Air, a subsidiary of Alaska Air Group, selected Embraer Aircraft Maintenance Services (EAMS) in Nashville, Tennessee, as the exclusive heavy maintenance provider for the company's fleet of 30 Embraer E175 aircraft. The multi-year agreement includes airframe maintenance, modifications, and repair services.

Embraer commercial aircraft deliveries through Q3 2019

Aircraft program	Deliveries
Commercial jets: (E175, E190, E195, E190-E2, E195-E2)	54
Executive aircraft: Phenom light jets	42
Executive aircraft: Legacy, Praetor large jets	21
Total	117

<https://embraer.com/global/en>



Bombardier Business Aircraft delivered its first Global 6500 in 2019.

Industry trends

In 2020, the aerospace and defense (A&D) industry is likely to return to growth, according to *Deloitte's Global Aerospace and Defense Industry Outlook*. Robin Lineberger, Deloitte Global's aerospace & defense leader, outlines a few trends to watch in the coming year.

- Global defense budgets up 3% to 4%, reaching an estimated \$1.9 trillion
- U.S. foreign military sales (FMS) likely to remain steady as global threats persist
- Commercial aerospace sector should recover in 2020, grow in deliveries after the recent downturn; long-term commercial aircraft demand remains robust, with 14,000-aircraft commercial order backlog
- Regional jet market remains strong; forecasts anticipate more than 5,000 units required during next 20 years

Scott Walker

Chairman, Mitsui Seiki (USA) Inc.

Mitsui Seiki sees strong demand for large, hard-metal trunnion 5-axis machines going into 2021 as companies are still tooling up for hard metal parts for landing gear, helicopter components, and aero structural components that manage large stress loads during flight operations.

Skills-based manufacturing remains an issue, and the tighter the tolerances, the bigger the impact. An area where

the shortage of qualified operators is particularly evident is jig grinding. In the U.S., the average age of jig grinder operators is 60 years old. Jig grinding is a small niche where 1µm tolerances are typical. In addition to its current jig grinder portfolio, Mitsui Seiki has added the Vertex G (combination 5-axis HMC and grinding) to its lineup to further automate ultra-precision hard milling and grinding.

This automated platform provides a repetitive process in micron applica-

tion environments, permitting users to develop ultra-precision processes and move skilled operators to this machine to produce repeatable jig grinder tolerances. The more-skilled setup person can dial in the machine then pass production to an operator. Segregating duties allows users to focus highly skilled people on process development on several machines instead of dedicating such limited resources to one machine. This trend will continue in the coming years. <http://www.mitsuseiki.com>

Gediminas Ziemelis

Founder and Chairman, Avia Solutions Group

Rising customer expectations along with innovative technology implementation set 2020 to be a transformational year for aviation. It is forecast for the sector to have net profit growth again this year; however, it's essential that market players are prepared to adapt to evolve and achieve that goal.

Sustainability

To reduce aviation's carbon footprint, original equipment manufacturers (OEMs) are testing lighter airframe components and electrified aircraft taxiing. OEMs are also investing in methods to reduce aircraft fuel consumption.

Monitors installed in aircraft will show passengers in real-time the amount of carbon dioxide (CO₂) emissions and the improvements being made.

A greener tomorrow requires reviewing all business processes from rethinking aircraft design and airframes to their operation and in-flight services. Governments and industry leaders are ready to prioritize environmental impact and waste reduction.

Blockchain

This technology allows companies to stop using paper for information processing needed to track aircraft spares and parts, as well as conduct an aircraft parts census.

<http://www.gediminasziemelis.com>

- Increasing aerospace electric propulsion system development to reduce carbon emissions, make flights quieter, decrease costs
- Commercial space sector investment in new and existing space technologies, services should remain steady, funded primarily from governments, venture capital
- Urban air mobility (UAM) vehicle development to accelerate during the next decade; challenges remain in regulations, energy management, collision avoidance, infrastructure needs, air traffic management, overcoming passenger anxiety
- Mega-mergers may decrease; further industry consolidation possible as smaller companies may not meet increased financial, program management, skills,

risk-taking, investment requirements

- Consolidation of components, aero-structures, electronics, interiors expected to continue as companies focus on gaining economies of scale

In 2020, the Deloitte analysts expect the A&D industry to get back to its growth trajectory with the commercial aerospace sector recovering from its decline in 2019 and the defense sector continuing to soar.

“To meet the increased demand and improve production yields, A&D companies should leverage highly agile production that adapts to changes in demand, including digital technologies,” Lineberger writes. “As A&D customers become more demanding in terms of customization, industry players could be at the forefront

of manufacturing, enhancing productivity and efficiency by investing in areas such as smart factory initiatives.”

Lineberger tells *AM&D* readers to be prepared for market disruptions, such as fallout from Brexit – the United Kingdom quitting the European Union.

“Inventory your supply chain, understand where they are and what’s at risk, and ensure you have material on hand to buffer any delays at the border until things get sorted out.”

He adds that the era of just-in-time supply chains is over, that companies must manage in a different way.

“Be cautionary, have supplies on hand” to get through any unexpected production bumps. <https://www.deloitte.com>

Helping engineers find the *right* adhesive system

✓ EPOXIES

✓ SILICONES

✓ UV/LED CURING SYSTEMS

MASTERBOND
ADHESIVES | SEALANTS | COATINGS

154 Hobart St., Hackensack, NJ 07601, USA
+1.201.343.8983 • main@masterbond.com

www.masterbond.com

NT

PHC-A PHC-H

PHC-SA PHC-SA-C PHC-SA-NC

See for yourself why leading Auto-makers are choosing NT TOOL!

FROM HEAVY MILLING TO TIGHT SPACE APPLICATIONS, NT TOOL HYDRAULIC CHUCKS COVER THEM ALL!!

TIGHT SPACE APPLICATIONS HEAVY MILLING

NT USA CORPORATION www.nttoolusa.com

318 Seaboard Lane, Suite 301. Franklin, TN 37067
Tel.1-615-771-1899 Fax.1-615-771-0121 E-mail:sales@nttoolusa.com

Richard Aboulafia

Vice President of Analysis, Teal Group

The world aviation market has slowed in recent years. The civil market has enjoyed a respectable 4.1% compound annual growth rate (CAGR) in deliveries by value during the last 10 years. But this growth story is complicated by the divergent fortunes of the various civil segments; jetliners have enjoyed 10 great years, but all the others are weak. The military aviation segment, by contrast, has been flat for some time, although it is poised for renewed growth. At the start of the year, single-aisle jetliners and fighter aircraft were the only two aviation segments driving aircraft market growth. Every other industry segment was either flat or down.

U.S. primes' share has remained relatively steady at about 50% by value of deliveries for the last two decades. As the industry top line has grown, so

has output. U.S. industry continues to do very well at the subcontractor level, exceeding 50% in key segments of engines, avionics, etc., and equaling 50% in aerostructures, control systems, and the like.

The U.S. has enjoyed a roughly 2.5:1 aerospace trade advantage by value with the rest of the world for decades. This export ratio reflects U.S. success at the subcontractor level, along with success in space systems, missiles, and other markets.

Large commercial jets are now about 60% of total industry output by value, not just at the final delivery level, but through most of the component and structures supply chain, too.

Airbus' acquisition of Bombardier's CSeries, now known as the Airbus A220 family, gives Airbus a new line of 110- to 130-seat jets. Meanwhile, Embraer and Boeing are moving toward creating

a joint venture – to be controlled by Boeing – covering Embraer's E-Jet series, spanning 75-to-120 seats.

In a year, the jet transport industry will be controlled by only two companies. Barriers to entry remain extremely high, as evidenced by China's multi-decade effort to break into the market and Russia trying to re-enter the market.

Our Top 20 Aviation Programs Chart shows revenue from deliveries throughout the past 10 years and Teal Group's forecast for the next 10. The two major single-aisle programs – Airbus's A320 series and Boeing's 737 family – constitute 25% of industry revenue.

Jetliners comprise eight of the top 10 aviation manufacturing programs. Of the top five programs (which represent half the aircraft industry in revenue), just one, Lockheed Martin's F-35 Joint Strike Fighter, is not a jetliner.

<https://www.tealgroup.com>

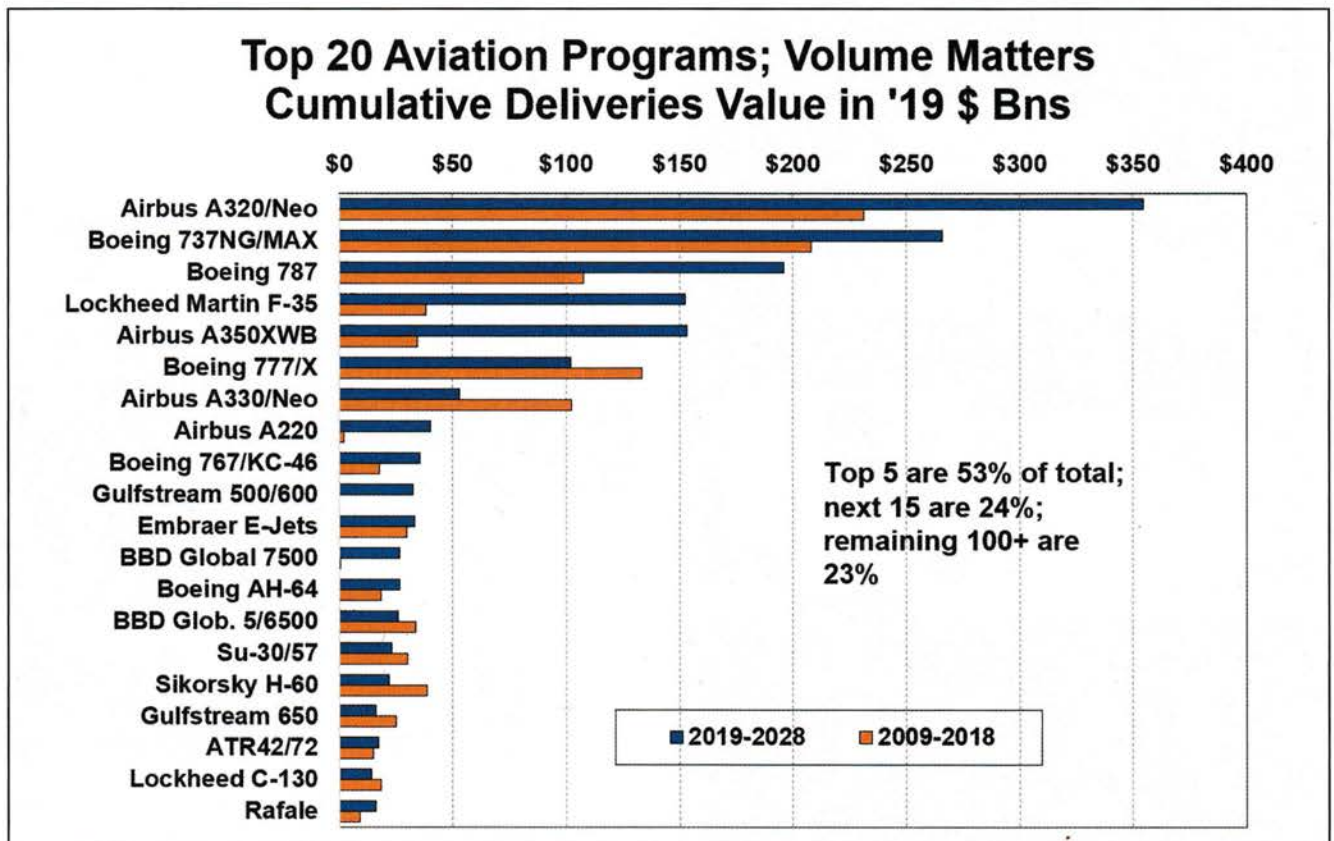


Chart courtesy of: Teal Group

Lockheed Martin is ramping up F35 production.



Dhiren Marjadi

VP of Global Aerospace Business, Altair | 2020 predictions:

- *Certification by analysis* – Aircraft manufacturers and suppliers hope to replace physical testing in aircraft certification, but certification by analysis efforts are constrained by tools and processes with roots dating back to the Apollo program. Recent advancements such as intuitive user experience, integrated solution workflows, and optimization-driven simulation tools are increasing efficiency of certification by analysis.
- *Simulation and optimization tools* – To reduce product development time, aerospace organizations are using digital tools to drive designs rather than simply validate them. Empowering design engineers to apply simulation and optimization up-front in the design cycle supports fast design iterations and decision making. New digital tools provide an environment for analysis, optimization, manufacturing checks, and geometry editing.
- *Data analytics to shape early program decisions* – Applying statistical methods such as dimensionality reduction to the huge number of design variables considered during a program will help identify a subset of critical performance criteria. Measures considered during early studies using advanced physics simulations can identify the most promising design concepts.
- *Increased number of aircraft and satellites* – Flying systems will be supported by many on-ground systems. Ensuring the safe and reliable operation of these systems will require efficient management of a system of connected systems. The fields of data acquisition, data analytics, and machine learning are converging to address this need.

<https://www.altair.com> **A**

About the author: Eric Brothers is AM&D's senior editor. He can be reached at 216.393.0228 or ebrothers@gie.net

Photo credit: U.S. Air Force

Change the **TOOL** Not the **Holder**

The revolutionary Carmex **CIM** toolholder delivers new "quick change" capability for Swiss-style applications



The Carmex **CIM** toolholder allows for fast and easy set-up to precisely define the tool position. Once set, tool change is quickly accomplished by loosening the retaining nut and replacing only the tool.

The Carmex **CIM**

- Saves money by eliminating multiple toolholders
- Delivers coolant through the holder and tool to the tool tip
- Maintains the initial setting for maximum accuracy and repeatability.

Change to the new Carmex **CIM** and save tool change time, trouble, and money.

Contact your Carmex representative
or visit www.carmexusa.com



The optimal tools for your industry™