

\$14.95 AUGUST 11-31, 2025

AVIATIONWEEK

& SPACE TECHNOLOGY

Launch On Demand Gets Real

RICH MEDIA
EXCLUSIVE



Aeronautics
China Rises,
U.S. Pulls Back

RICH MEDIA
EXCLUSIVE



Grading Ortberg's
First Year at Boeing

D.C. Midair Collision
Troubling Truths

AviationWeek.com/AWST

AVIATION WEEK
NETWORK

WHAT WILL DEFINE THE FUTURE OF AEROSPACE AND DEFENSE?

Electrification. Advanced, secure networking. Next generation materials. Hypersonic flight. Artificial intelligence and machine learning. High-energy lasers. Autonomous, smart sensors. Sixth generation engine technologies. These are just some of the ways we're transforming how we connect and protect our world. Finding answers to the biggest questions is what defines us.

Learn more at [rtx.com](https://www.rtx.com)



COLLINS AEROSPACE | PRATT & WHITNEY | RAYTHEON

AVIATIONWEEK[®]

& SPACE TECHNOLOGY

56

An Alaska Airlines Boeing 737 MAX 8 with livery honoring U.S. military active-duty personnel, veterans and their families was among the aircraft on display at Boeing Plaza at EAA AirVenture Oshkosh.



BRETT SCHAUF



Access AW&ST Online

Go to: AviationWeek.com/AWST

TRADE

- 30** | EU-U.S. tariff deal reveals outlines of aerospace's trade future . . .
- 31** | . . . but relief over the deal is mixed with economic caution

COMMERCIAL AVIATION

- 34** | Uncertainty lifts for U.S. carriers as demand stabilizes
- 36** | FAA extension for flight deck barrier rule juggles mixed input

DEFENSE

- 44** | Turkey's Eurofighter procurement plans gain momentum
- 46** | Indonesia's Kaan commitment complicates its fighter ambitions
- 47** | European companies crank up their defense production plans
- 48** | Russia's next bomber, the PAK DA, is beginning to take shape
- 52** | Inside the Air National Guard unit bringing the F-15EX online
- 55** | The U.S. Air Force has unlocked a drone-killing rocket capability

FEATURES

- 16** | **China Rises as NASA Shrinks**
 Satellite images reveal growing wind tunnel test sites in China as NASA must mothball similar sites
- 22** | **Perilous Procedures**
 NTSB hearing into midair collision near Washington National Airport spotlights FAA and U.S. Army flaws
- 26** | **Walking the Talk**
 A year into the job, CEO Kelly Ortberg is solidifying his role as Boeing's turnaround-in-chief
- 38** | **High-Wire Act**
 Aerospace wiring suppliers face production and higher-voltage technology challenges
- 41** | **Need for Speed**
 The Pentagon is pushing the limits of responsive space missions to prepare for future conflict

DEPARTMENTS

- 5** | Feedback **14-15** | Leading Edge 
- 6** | Who's Where **62-63** | Tech Take
- 8-9** | First Take **64** | Marketplace
- 10** | Up Front **65** | Contact Us
- 11** | Going Concerns **65** | Aviation Week Events
- 12** | Airline Intel
- 13** | Quantum Leap

GENERAL AVIATION

- 56** | Finalized Mosaic rule will remake the light sport aircraft segment

ROTORCRAFT

- 59** | Robinson and MagniX partner on an electric R66 demonstrator

ADVANCED AIR MOBILITY

- 60** | Regent Craft launches a defense business for maritime missions

VIEWPOINT

- 66** | Model aviation can be a bridge to the future

ON THE COVER

As the U.S. pushes to launch satellites to space on more rapid timelines to counter increasing on-orbit threats, companies such as Firefly Aerospace, Rocket Lab and True Anomaly are answering the call by mass-producing satellites and rockets for faster integration and deployment. Military Space Editor Vivienne Machi's report begins on page 41. Rocket Lab concept image by Sam Taylor.

Aviation Week publishes a digital edition every week. Read it at AviationWeek.com/AWST



DIGITAL EXTRAS Access exclusive online features from articles accompanied by this icon.

AviationDaily⁷

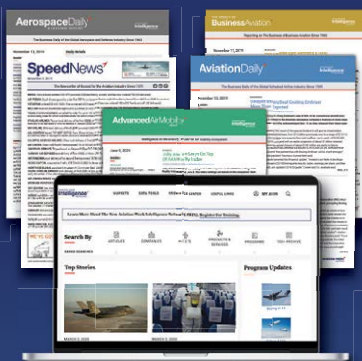
AerospaceDaily⁷
& DEFENSE REPORT

SpeedNews⁷

THE WEEKLY OF

BusinessAviation⁷

AdvancedAirMobility⁷
REPORT



Go beyond the
news of the day
with Aviation Week
Intelligence Network's
Market Briefings.

- Stay ahead of the market
- Identify new opportunities
- Drive revenue

Learn more:
[aviationweek.com/
marketbriefings](http://aviationweek.com/marketbriefings)

AVIATION
WEEK
NETWORK

AVIATIONWEEK⁷
& SPACE TECHNOLOGY

Editor-in-Chief Joseph C. Anselmo joe.anselmo@aviationweek.com

Executive Editors

Michael Bruno (Business) michael.bruno@aviationweek.com
Jens Flottau (Commercial Aviation) jens.flottau@aviationweek.co.uk
Lee Ann Shay (MRO and Business Aviation) leeann.shay@aviationweek.com
Robert Wall (Defense and Space) robert.wall@aviationweek.com
Graham Warwick (Technology) warwick@aviationweek.com

Editors Lindsay Bjerregaard, Christine Boynton, Sean Broderick, Bill Carey, Chen Chuanren, Thierry Dubois, Brian Everstine, Matthew Fulco, Ben Goldstein, Jeremy Kariuki, Irene Klotz, Vivienne Machi, Helen Massy-Beresford, Molly McMillin, Jefferson Morris, Mark Nensel, Guy Norris, Tony Osborne, James Pozzi, Lori Ranson, Garrett Reim, Adrian Schofield, Steve Trimble

Director, Editorial and Online Production Michael O. Lavitt

Managing Editor Andrea Hollowell

Art Director Lisa Caputo

Artists Thomas De Pierro, Vicki Hopewell, Rosa Pineda, Colin Throm

Senior Content Producer Audra Avizienis

Copy Editors Jack Freifelder, Cory Hitt, Peri Meyers, Natalia Pelayo, Andy Savoie

Production Editors Andrea Copley-Smith, Theresa Petruso

Podcast Editor Guy Ferneyhough

Contributing Photographer Joseph Pries

Content Marketing Operations Wes Charnock,
Elena Baxendale, Barbara Nichols

Data & Analytics

Senior Director, Forecasts and Aerospace Insights Brian Kough

Senior Director, Data Operations and Solutions Terra Deskins

Head, Defense Markets and Data Craig Gaffrey

Editorial Offices

2121 K Street, NW, Suite 210, Washington, D.C. 20037

605 Third Avenue, New York, N.Y. 10158

240 Blackfriars Road, London, SE1 8BF, UK

Bureau Chiefs

Atlanta

Jeremy Kariuki jeremy.kariuki@aviationweek.com

Auckland

Adrian Schofield adrian.schofield@aviationweek.com

Boston

Christine Boynton christine.boynton@aviationweek.com

Cape Canaveral

Irene Klotz irene.klotz@aviationweek.com

Chicago

Lindsay Bjerregaard lindsay.bjerregaard@aviationweek.com

Colorado Springs

Guy Norris guy.norris@aviationweek.com

Frankfurt

Jens Flottau jens.flottau@aviationweek.co.uk

Houston

Mark Carreau mark.carreau@gmail.com

London

Tony Osborne tony.osborne@aviationweek.co.uk

Los Angeles

Vivienne Machi vivienne.machi@aviationweek.com

Lyon

Thierry Dubois thierry.dubois@aviationweek.com

Paris

Helen Massy-Beresford helen.massy-beresford@aviationweek.co.uk

Seattle

Garrett Reim garrett.reim@aviationweek.com

Washington

Lee Ann Shay leeann.shay@aviationweek.com

Wichita

Molly McMillin molly.mcmillin@aviationweek.com

President, Aviation Week Network Gregory Hamilton

Senior Vice President, Data, Intelligence & Media Anne McMahon

Senior Vice President, Content Joseph C. Anselmo

Vice President, Sales of Data, Intelligence & Media Thom Clayton

Managing Director, Defense & Space Andrea Rossi Prudente

Senior Director, North American Media Rob Howlett

AVIATIONWEEK⁷
NETWORK
An Informa business

JETZERO



HOW TO DEICE A BWB?

I enjoyed your informative article on the JetZero blended wing body (BWB) (*"Blending Together," June 30-July 13, p. 48*). It is refreshing to see innovative revolutionary designs, as opposed to the incremental improvements of the last couple of decades.

One design issue that was not discussed was how this aircraft would be deiced and anti-iced. While the outer wings of the BWB can use the same techniques as all other airliners, the large and flat central body will require new techniques. The center body is also a lifting surface and will have to be deiced and anti-iced to the same standard as a conventional wing.

Will melted snow and ice drain off the flat center-body upper surface? Will standard deicing sprayers be able to push 8 in. of wet snow off the distant middle of the fuselage? Will the expansive center-body surface area require airports to stock more fluid than they would for a Boeing 737 or Airbus A320? Will it take significantly longer to deice a BWB than a conventional cylindrical fuselage? How will the ground deicing supervisor visually check the engine inlets to ensure there is no contamination? Will Type IV anti-icing fluid shear off the fuselage at 80 kt., as it does on the wings? When the fluid and slush do start to slide aft, will they be ingested by the engines?

Robert Steven, Southlake, Texas

Senior Editor Guy Norris replies: JetZero says it recognizes ground deicing as a significant factor and is discussing solutions with its airline advisory group. Although no details of proposed solutions have yet been disclosed, the company tells Aviation Week that the design will comply with FAR Part 25 regulations.

HOLLOWING OUT SCIENCE

I learned recently that NASA plans in fiscal 2026 to "zero-fund" the Scientific Balloon Program managed out of NASA's site on Wallops Island, Virginia. This relatively small program (\$50-60 million per year) supports the foundation of space science in several ways: economical testing of new instruments for space science, development of principal investigators (PI) through Ph.D. programs, data collection for space science research and comparatively short lead time to put instruments in near-space to meet U.S. scientific priorities.

If the program is eliminated, the U.S. will lose an important technology that has taken many years of development to support space science requirements reliably as well as a training ground for future space scientists. These balloons can carry payloads up to 6,000 lb. to 120,000-ft. altitude for short and long flights, routinely recovering the payloads. Several thousand balloon flights have been launched since the 1970s from Australia, Canada, New Zealand and Sweden as well as several sites within the U.S. Since the 1990s, NASA has flown balloons from McMurdo Station in Antarctica each year for several weeks' duration, including a record flight of 51 days. The success rate of zero-pressure balloon flights exceeds 90%. Super-pressure balloon technology was illustrated by the Chinese balloon that overflew the U.S. several years ago.

One important aspect of the NASA Balloon Program with little visibility is the development and training of PIs for the space science research community. A funded research program has a proven PI with a team of Ph.D.

candidates and engineers who work to develop instruments, meet scientific goals and gather data. I understand all of the scientists on the Cosmic Background Explorer satellite team, resulting in the 2006 Nobel Prize for George Smoot and John Mathers, had been involved with scientific ballooning payloads previously in their careers.

The current administration should continue to support this capability and technology to maintain U.S. dominance in space science and astrophysics. Elimination of scientific balloon programs is a step toward hollowing out this U.S. science community.

*Dwight Bawcom, manager of the NASA Columbia Scientific Balloon Facility, 1987-2000
Maryville, Tennessee*

GOLDEN DOME QUESTIONS

I cannot help but feel at a gut level the irony in your July 14-27 issue. On pages 16 and 17 (*"U.S. Golden Dome Details and Aggressive Schedule Come Together"*), you uncritically report the comments of self-interested officials associated with the Golden Dome for America. Essentially, technology and better systems management will make it overcome the failings of the Reagan-era Star Wars. On page 8 (*First Take*), you report that Israel, with its much-vaunted Iron Dome—protecting a small country the size of New Jersey—said it intercepted 86% of the rudimentary ballistic missiles Iran fired at it piecemeal over 12 days in June.

If the Golden Dome for America stops a similar percentage of a potential salvo of 1,000 advanced missiles launched by Russia and/or China, then "only" 140 nuclear warheads would strike the U.S. Depending on the cities targeted, that translates to 70-100 million dead Americans and likely the demise of the United States of America.

I trust that my beloved *AW&ST* will ask the administration and the associated contractors hard questions about the true viability of the Golden Dome for America.

Chris Mayrand, Beavercreek, Ohio

Address letters to the Editor-in-Chief, *Aviation Week & Space Technology*, 2121 K Street, NW, Suite 210, Washington, DC, 20037 or send via email to: awstletters@aviationweek.com Letters may be edited for length and clarity; a verifiable address and daytime telephone number are required.



David Broadbent has been appointed president and CEO of *SES Space & Defense*, the combined government and defense organization of SES and

Intelsat. He was president of government solutions at Intelsat. Before that, he spent more than 21 years at Raytheon, including as president of space systems.

Hanwha Defense has named **Ben Hudson** CEO of its Europe and UK business. He retains his role as CEO of Hanwha Defense Australia, which he assumed in May. Before joining the company, he held executive positions at BAE Systems and Rheinmetall and



worked in Australia, Germany and the UK.

Ariel Alon has been appointed CEO of *ParaZero*, a developer of safety systems for uncrewed aircraft systems. He

was chief sales officer of Aerodrome Group and CEO of its subsidiary Aerodrome LTD. Before that, he was vice president of sales and general manager for Israel at Voyager Labs.

Space startup *SpinLaunch* has tapped **Massimiliano Ladovaz** to be CEO, succeeding **David Wrenn**, who becomes chief innovation officer. Ladovaz was chief operating officer at Eutelsat OneWeb Group and before that was chief technology officer at OneWeb. Prior to that, he worked at Inmarsat and SES. Wrenn started at SpinLaunch as a mechanical engineer in 2015.

John Stevens has been named vice president and chief mergers and acquisitions and securities counsel at *Lockheed Martin*. He was vice president and associate general counsel for corporate and securities at the defense prime, where he has worked for more than 14 years. Before joining Lockheed, he was an associate at Arnold & Porter and O'Melveny & Myers.

Aerospace components provider *Alpha Metalcraft Group* has hired **Jennifer Brown** as chief financial officer. She spent 10 years at Triumph Group, where she was director of finance and prior to that, financial controller. Before joining Triumph,

she held senior finance positions at Goodrich and GE Security.

Drone developer *Unusual Machines* has appointed **Tim Manton** corporate controller and **Stacy Wright** executive vice president of revenue. Manton was director of finance and accounting at Sony Electronics, formerly known as KinaTrax, and prior to that worked at Blue Force Technologies and Ultra Electronics. Wright was president of Rotor Riot, which Unusual Machines



acquired in 2024, before which she was vice president.

Hector Huezo has been named chief operating officer of the *National Air Transportation Association*. He was most recently assistant general counsel in the airport division for the City of Los Angeles Office of the City Attorney. Before that, he worked at the U.S. Transportation Department, including in the Offices of General Counsel, Secretary and Under Secretary for Policy.

Greg Caicedo has been promoted at *Kratos Defense & Security Solutions* to senior vice president from vice president of space domain awareness and space superiority. He was director of U.S. Space Force business operations at Frontier Technology and before that worked at Raytheon Intelligence & Space and Kratos.

Oscar Torres has become an operating partner at *AE Industrial Partners*, a private equity company focusing on aerospace and defense. He was CEO and chief financial officer of Kellstrom Aerospace, which he had joined in 1999. Kellstrom was a portfolio company of AE Industrial Partners from 2015 until its sale to VSE in 2024.

MDA Space has hired **Rabindra Singh** as vice president of strategic solutions. He was co-founder and chief technology officer at Axta Space. Prior to that, he was chief technology officer of SpaceLink and held senior



positions at Maxar Technologies.

WestJet has promoted **Amanda Ierfino** to vice president of sales and cargo from director of sales. She worked at the carrier in 2014-21, after which she spent about a year at software company Symend.

Stephanie Willmann has joined *Northrop Grumman* as country lead executive for Germany. She was country director for Germany at Rolls-Royce and prior to that worked at Rheinmetall for 10 years, before which she worked with the Bundeswehr Transformation Center and at NATO's Supreme Headquarters Allied Powers Europe.

Deutsche Aircraft has hired **Markus Hahner** as sales director for multirole aircraft. He was senior manager of business development at Leonardo Germany, where he worked for more than seven years.

Andy Preston has been named director of strategic programs at *Essential Turbines*. He was director of programs for UK engines at Standard Aero and prior to that held positions at Signature Aviation and Dallas Airmotive.

Jetcraft has hired **Jeremi Austin** as sales director for Canada and **Ricky Gioconda** as sales director for the mid-Atlantic U.S. Austin was director of business development for Innotech-Execaire Aviation Group and prior to that worked at Jet It, Skyservice and Diamond Aircraft. Gioconda was senior director of aircraft acquisition and sales at FlyExclusive, before



which he was director of aircraft acquisition and sales.

Tiffany Norwood has joined the board of directors at *Sidus Space*. She is founder and CEO of professional training and coaching company Tribetan as well as co-founder of SimWin Sports and Next Generation Broadband. ☼

To submit information for the Who's Where column, send Word or attached text files (no PDFs) and photos to: whoswhere@aviationweek.com For additional information on companies and individuals listed in this column, please refer to the Aviation Week Intelligence Network at AviationWeek.com/awin For information on ordering, telephone U.S.:

+1 (866) 857-0148 or +1 (515) 237-3682 outside the U.S.

Where Aerospace Meets Innovation

Join the world's most forward-looking aerospace event and experience it all.



Vista: The start-up hub shaping the future of flight



Advanced Air Mobility (AAM): Unveiling the next chapter in urban mobility



Conferences: 250+ speakers driving dialogues in space, sustainability, tech & more



Delegations: High-level government & military engagement from across the globe



Space: An expanded pavilion exploring the commercial space frontier



Live Aircraft Display: 192+ aircraft on display and in the air, from commercial and military jets to private aircraft and helicopters



Networking Events: Two powerful opportunities, driving conversations long after the event closes - Party on the Runway & Airshow After Dark.



**Dubai
Airshow**

17 - 21 November 2025
DWC, Dubai Airshow Site
dubaiairshow.aero | [#DubaiAirshow](https://twitter.com/DubaiAirshow)

Get involved



FIRST TAKE

For the latest, go to
AVIATIONWEEK.COM

TURKISH AEROSPACE INDUSTRIES



DEFENSE

Indonesia has committed to purchasing 48 Turkish Aerospace Industries (TAI) Kaans, making the country the first export customer for the domestically developed fighter (page 46).

Spain has shelved plans to acquire the Lockheed Martin F-35, focusing funding on the Eurofighter and pan-European Future Combat Air System.

NATO countries Denmark, the Netherlands, Norway and Sweden have become the first contributors to a new initiative to arm Ukraine with U.S.-made defense equipment.

Machinists at Boeing's defense and space facilities in Missouri and Illinois went on strike after rejecting a proposed four-year labor agreement Aug. 3.

TAI received the first major Turkish government order for the Gokbey utility helicopter, with a deal for 57 from the country's military.

The Royal Thai Air Force has secured cabinet approval to acquire 12 Saab Gripen E/F fighters, clearing the way for contract signing.

Pakistan has formally inducted the Chinese-built Changhe Z-10ME attack helicopter, marking the first known export of the type.

Indonesian Aerospace's domestically designed Elang Hitam uncrewed aircraft system completed its first flight on July 28 after 10 years of development.

Anduril Industries has agreed to a partnership with Korean Air that could lead to production of its drones in South Korea.

The U.S. State Department has greenlit

a potential \$4.7 billion sale of RTX-Kongsberg Nasams air-defense systems to Egypt.

Joby Aviation and L3Harris Technologies plan to develop an optionally piloted hybrid-electric vertical-takeoff-and-landing (eVTOL) aircraft for defense applications (page 62).

TECHNOLOGY

The FAA has released the long-awaited draft Part 108 rule governing operation of beyond-visual-line-of-sight drones, key to commercial use of small uncrewed aircraft.

Capping a multiyear effort to revamp outdated light sport aircraft regulations, the FAA has issued its Modernization of Special Airworthiness Certification (page 56).

Joby is to buy urban helicopter service provider Blade Air Mobility's passenger business for up to \$125 million, gaining the clearest path to early revenues among the air taxi startups.

Archer Aviation has acquired intellectual property and employees from failed eVTOL developer Overair and a manufacturing facility from Mission Critical Composites.

MagniX has partnered with Robinson Helicopter to convert an R66 light turbine helicopter into an electric-powered demonstrator planned to fly in 2026 (page 59).

COMMERCIAL AVIATION

The EU and U.S. have agreed to return to zero tariffs on aircraft and components as part of a broader compromise trade deal struck July 27 (page 30).

Embraer has pledged to invest \$500 million in its U.S. facilities after the Trump administration reduced tariffs on aerospace imports from Brazil to 10% from 50%.

Boeing's second-quarter financial results reported positive operating cash flow for the first time in two years, due in part to higher airliner produc-

VIEW FROM LAS VEGAS

Boeing Hints at Airliner Drivers

Future airliner designs at Boeing will be driven by "dramatic" gains in efficiency and autonomy, says Brian Yutko, the new vice president of product development at Boeing Commercial Airplanes.

Yutko, formerly CEO of Boeing-owned autonomous air taxi startup Wisk Aero, was speaking at the recent American Institute of Aeronautics and Astronautics Aviation Forum in Las Vegas. Yutko identified two "megatrends" that will drive airliner design. One is "sustainability- or efficiency-related technologies, or energy transition," he said. "The other is automation for safety enhancements on crewed airplanes, or autonomy for flying uncrewed airplanes and all kinds of interesting solutions."

Yutko joined Boeing in 2017 with the airframer's acquisition of Aurora Flight Sciences, a specialist in uncrewed aircraft and rapid prototyping. He became vice president and chief engineer of sustainability and future mobility at Boeing before taking over at Wisk.

Although Wisk is targeting fully autonomous operations, Yutko acknowledged that the use of the technology will be limited as aircraft size increases. He sees advanced automation being applied to large crewed aircraft to enhance safety. "I don't think there's any world where we're going to have uncrewed aircraft at [large] scale, but I think certainly we're going to continue to advance the safety frontier," he said.

tion rates and deliveries (page 26).

Cathay Pacific has ordered 14 more Boeing 777-9s, boosting its backlog to 35 to complete the replacement of its large fleet of 777-300ERs.

Boeing added a fifth 777-9 to the twin-jet's long-running certification test program on Aug. 5, with the first flight of aircraft WH286.

The European Commission has approved state aid of €36 million (\$42 million) for a Danish measure to encourage the use of sustainable aviation fuel for domestic flights.

London Heathrow Airport has submitted a privately financed £49 billion (\$65 billion) plan to the UK government to build a long-discussed third runway and new terminal.

New Chinese air freight carrier Hubei International Cargo Airlines was incorporated on July 21, with plans to fly 20 widebody freighters within five years.

SPACE

SpaceX's Crew Dragon Endeavour, with three NASA and Japanese astronauts and a Russian cosmonaut onboard, docked to the International Space Station on Aug. 2.

Australian space startup Gilmour Space's first attempt to launch its Eris Block 1 rocket ended in failure when the vehicle crashed shortly after liftoff on July 29.

The first NASA-Indian Space Research Organization joint Earth science mission launched July 30 from India's Satish Dhawan Space Center to radar-map land and ice.

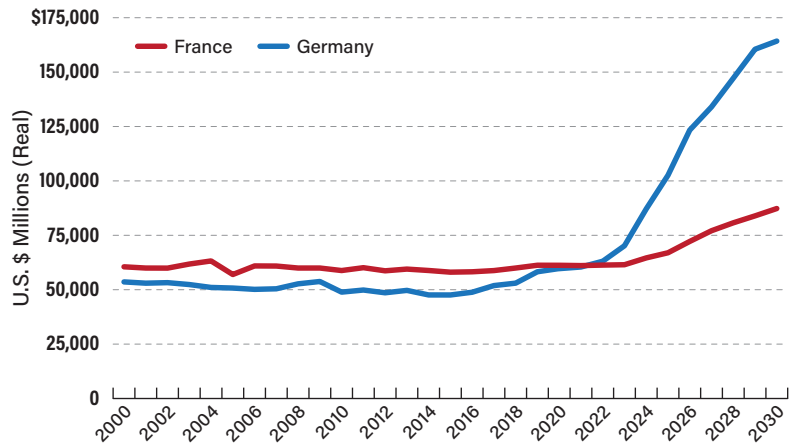
NASA plans to land a 100-kW nuclear fission reactor on the Moon by 2030, said acting Administrator Sean Duffy, as the U.S. races China to establish a base on the lunar surface.

The Korea Aerospace Research Institute is to transfer technology for the domestically developed KSLV-II Nuri launch vehicle to Hanwha Aerospace.

EchoStar has selected MDA Space to build more than 100 satellites for its low-Earth-orbit communications constellation in a \$1.3 billion deal. 🌐

DATA SPOTLIGHT

Europe's Big Guns Boost Spending



Source: Aviation Week Network Defense Market Analyzer

In June, NATO allies agreed to a new target for core defense spending: 3.5% of GDP. Hopes of reaching this higher level of investment rest disproportionately on France and Germany, the EU's largest economies. Both countries have responded to the renewed threat from Russia and plan to spend a combined \$211 billion on defense by 2027, a roughly 75% increase in real terms over spending before the full-scale invasion of Ukraine in 2022.



Find out more about the Defense Market Analyzer and other Aviation Week defense data products at [AviationWeek.com/awin-defense-data](https://www.aviationweek.com/awin-defense-data)

50 YEARS AGO IN AVIATION WEEK

The cover of our Sept. 8, 1975, issue featured a photo of the Soviet Union's Soyuz spacecraft, taken from a U.S. Apollo spacecraft above Argentina. After nearly two decades of rivalry in space, the two superpowers had embarked on the Apollo-Soyuz mission in July 1975, joining their spacecraft in orbit for about 47 hr., conducting joint experiments and taking congratulatory calls from Soviet Communist Party General Secretary Leonid Brezhnev and U.S. President Gerald Ford. It was too much to stomach for Aviation Week Editor-in-Chief Robert Hotz, a staunchly anti-communist cold warrior, who derided the joint mission as a costly stunt that would be more celebrated in speeches than laboratories. "Politics intruded so heavily into orbital activities that they badly upset the mission time for useful activities," Hotz wrote in a July 28 editorial. "It is a tragic blunder to try to convince the people on Earth that Apollo-Soyuz really represents



any progress in opening the benefits of space exploration to all mankind."

Subscribers can log in to access every edition of Aviation Week back to 1916 at: archive.aviationweek.com 🗨️

UP FRONT

STEPHEN PERRY



THE DEFENSE INDUSTRY IS FAST becoming more collaborative.

Russia's full-scale invasion of Ukraine, the second Trump administration's disposition and the use of drones on the modern battlefield have caused tectonic shifts in the global security landscape. They have also dramatically reset how Western defense companies think about their product strategies.

New threats, technologies and competitors are disrupting what was once the domain of a limited number of global defense prime contractors. In the words of Lockheed Martin CEO James Taiclet, "no one company—or even one industry—can meet today's global defense and security needs alone."

During the Cold War and the era of the "peace dividend" that followed, defense companies spent years developing products—sometimes with partners, sometimes not. Those lengthy development cycles seem misplaced in today's environment, in which technology needs can change within weeks. It is hard and painful to remake traditional companies that have tens of thousands of employees and often deeply embedded processes. But doing business the old way is likely a recipe for missed opportunity.

A new approach has thus emerged in the form of joint ventures, strategic partnerships and direct investments. These arrangements have paired legacy OEMs with new entrants, hardware with software/artificial intelligence, U.S. suppliers with European ones, public companies with private companies, sovereign nations with for-profit enterprises and the defense industry with nondefense-related sectors. The extent of these initiatives has been unprecedented, especially of late.

Joint ventures and partnerships offer such advantages as the ability of both partners to mitigate their weaknesses and pool their respective strengths. Legacy primes can gain access to cutting-edge technology while new entrants gain access to a robust production footprint, supply chain and market presence.

Moreover, the benefits of integration, scale and market access can be realized without one party incurring the cost and risk of a merger and acquisition (M&A) transaction and the other losing independence. Creating a joint venture is also faster than an M&A process, and regulatory hurdles tend to be lower.

Here is a snapshot of activities (ranked alphabetically) that illustrates how joint ventures have been established in short order to address emerging needs:

1. Airbus announced a partnership with Kratos to offer the XQ-58A Valkyrie drone to the German Air Force

after Anduril partnered with Rheinmetall on the same goal (see photo).

2. Anduril has partnered with Archer to develop a next-generation, hybrid, vertical-takeoff-and-landing aircraft and with Meta to design and build integrated extended-reality platforms designed to see, sense and integrate battlefield information. Anduril also expanded its partnership with Microsoft to support the U.S. Army Integrated Visual Augmentation System Next program.

3. BAE Systems recently partnered with ASC Pty. Ltd. to build nuclear-powered submarines under the SSN-AUKUS Program. It also partnered with General Dynamics to support development of the U.S. Army Armored Combat Vehicle and with Leonardo and Japan Aircraft Industrial Enhancement Co. in the Edgewing partnership to develop the trinational Global Combat Air Program.

4. Hanwha Aerospace and Poland's WB Group announced a joint venture to manufacture guided missiles.

5. Leonardo has established joint ventures with Baykar Technologies to design, build and sell uncrewed aircraft systems and with Thales to develop advanced radar systems for enhanced surveillance and threat detection.

6. Lockheed Martin announced joint ventures/partnerships with HavocAI to develop medium uncrewed surface vessels, with Raphael Advanced Defense Systems on an "Iron Dome" for the U.S. and with Tata Advanced Systems Ltd. to produce aircraft for the Indian Air Force Medium Transport Aircraft program.

7. Northrop Grumman invested \$50 million in Firefly to fund completion of the Eclipse rocket.

8. RTX has partnered with Blue Origin to develop advanced space-based defense and communication systems to enhance early warning and missile defense and with ShieldAI to gain access to Hivemind and ViDAR software on its existing weapon systems and sensors.

9. Ukraine has announced defense-related investment initiatives with key suppliers in nine countries.

10. The Pentagon acquired a 15% stake in MP Materials to assure supply of rare earth materials. Days later, Apple announced a \$500 million investment in the company.

Although some of these combinations might fizzle, downside risk is limited, since they are relatively easy to unwind and do not risk massive goodwill impairments. One thing is certain: More such arrangements will follow. 📌

.....

Investment banker Stephen Perry is Managing Director at Janes Capital Partners in Irvine, California.

Defense Disruptors

These 10 tie-ups are reshaping the industry



RHEINMETALL AG



GOING CONCERNS MATTHEW FULCO

THE DEFENSE SECTOR HAS LONG worried that China's escalating restrictions on the export of critical minerals could compromise supply chains vital for U.S. national security.

Beijing's two-year export control campaign has been laser-focused on the most important raw materials for the Pentagon. Yet defense contractors—wary of national security sensitivity and negative market perception—have been hesitant to disclose the impact of the restrictions publicly, leaving investors to wonder about their severity.

In its second-quarter earnings call on July 30, Leonardo DRS broke with precedent, revealing that China's ban on the export of the critical mineral germanium has disrupted its supply chain.

China, which produces about 60% of germanium globally, cut off exports of the mineral in December in response to U.S. sanctions on its semiconductor sector.

Germanium has many aerospace and defense applications, notably in infrared sensors and advanced semiconductor devices. Night vision goggles, thermal imaging and precision-guided weaponry all require it to function. Satellites and other space-based platforms also use the metal.

In Leonardo DRS' case, germanium is crucial for its infrared sensing capabilities. "We're a sensor house . . . so germanium stands out for us," CEO William Lynn said during the earnings call. Amid U.S.-China tensions, "the source of most of the germanium supply in the world has reduced to a trickle," he noted.

The supply crunch has driven germanium prices up 39% since Jan. 1 to \$5,670 per kilogram. Those increased costs caused Leonardo DRS to revise down its targeted 2025 earnings before income, tax, depreciation and amortization to +9-13% from +9-14%.

The financial impact could be more significant in the future if the company's germanium supply dwindles. Lynn said Leonardo DRS had built up a safety stockpile, anticipating that Beijing would cut off the export of the metal, but that only provides ephemeral relief. "In order to sustain timely product deliveries, material flow must improve in the second half," Lynn said.

The company is thus searching for an alternative germanium supply. One possibility is to source from other countries. Canada's Teck Resources, North Amer-

ica's largest germanium producer, said in June that it was weighing options to increase production. Canada proposed a joint U.S.-Canadian investment in Teck to the incoming Trump administration in January, but the offer has not been taken up.

Another option is to recycle from existing products. The Pentagon's Defense Logistics Agency introduced a program in 2022 for recycling optical-grade germanium used in military weapon systems and night vision equipment. The Defense Department said at the time that the program was expected to yield about 10% of the U.S.' annual germanium needs.

Regarding Leonardo DRS' exposure to rare earth minerals—on which China maintains tight restrictions for military-use exports—Lynn said that "the biggest other material we think about is permanent magnets." While the company has sufficient rare earth supply for its existing programs, it is focused on ensuring it has access to enough of the strategic metals for future programs. "We're looking at what steps we would need [to take] to do that," he said.

Analysts do not expect Beijing to relax its controls on military-use rare earths significantly. "They're very serious about keeping these materials out of the hands of military end users and defense contractors," Cory Combs, Trivium China's

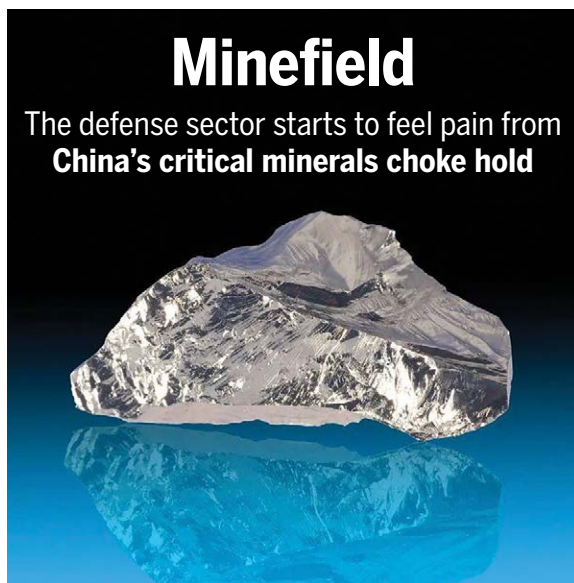
head of critical mineral and supply chain research, tells Aviation Week.

He notes that China has been asking companies that apply for rare-earth export licenses for detailed information about the metals' end use with an eye on preventing their involvement in military applications.

China also has intensified efforts against rare earth smuggling in recent months with the same objective. In July, the country's Ministry of State Security accused foreign intelligence agencies of trying to steal rare earths and asserted that it had thwarted an unnamed country's scheme to acquire the metals illegally for stockpiling. The smuggling attempts pose "a serious danger to our national security," the ministry said in a statement.

Given Beijing's choke hold on the rare-earth supply chain, diversification is key for the defense sector.

"Go to Mountain Pass; go to Lynas," Combs says, referring to the largest U.S. rare earth mine and the Australian company that is the top producer of the metals outside China. "Go to wherever you need to diversify." ☛



PHIL DEGGINGER/ALAMY STOCK PHOTO



AIRLINE INTEL

CHRISTINE BOYNTON

THIRTEEN WORDS FROM A DELTA

Air Lines executive on a July 10 earnings call garnered widespread attention, raising alarm bells and prompting lawmakers

to propose new legislation.

“Our goal is to have about 20% by the end of the year,” President Glen Hauenstein said, referring to Delta’s expanding use of artificial intelligence (AI) in pricing fares. Building on experiments that began in 2023, the carrier uses a generative AI (GenAI) system to price about 3% of its domestic network—up from 1% in late 2024.

The remarks quickly drew scrutiny from lawmakers. Sens. Mark R. Warner (D-Va.), Ruben Gallego (D-Ariz.) and Richard Blumenthal (D-Conn.) queried Delta on the data inputs it uses, which routes and passengers are affected and what steps it has taken to ensure compliance with applicable laws, rules and regulations. “Your company has not shared what those safeguards are or how you plan to protect American families against pricing discrimination in the evolving AI landscape,” their letter states. Additionally, Reps. Greg Casar (D-Texas) and Rashida Tlaib (D-Mich.) have introduced the Stop AI Price Gouging and Wage Fixing Act that would generally prohibit “surveillance-based” price-setting. The bill seeks to ban the use of automated systems to set different prices based on personalized data.

The swift legislative reaction reflects growing concerns about AI’s potential impact on consumer privacy and fairness. Airlines’ plans to harness the technology to price fares have already come under U.S. government scrutiny. During a U.S. Senate subcommittee hearing on ancillary fees in December, representatives from five U.S. airlines were questioned whether AI in pricing could be exploited. At the time, Delta countered that its use of AI in pricing was “more about the right offer at the right time, as opposed to a thousand different offers to a thousand different people,” Chief External Affairs Officer Peter Carter explained. “I can assure you that our focus is efficiency.”

The carrier is utilizing a GenAI-driven pricing engine developed by Israeli startup Fetcherr (see image). Delta is the company’s first publicly announced U.S. customer, but it is far from the only airline to experiment with the technology. By early 2025, eight airlines had begun tests with Fetcherr, which says that its platform can boost revenue by 6-9% once implemented. The

startup also argues that the consumer benefits from flatter prices throughout the booking calendar.

Fetcherr has stressed that it does not collect private customer data. “We don’t price customers—we price fares,” CEO and co-founder Roy Cohen told Aviation Week in late 2024. “We have zero private information. We only use public data.”

At the heart of Fetcherr’s offering is a large market model, an AI engine forecasting demand and market trends. The system assesses airline schedules and such information as weather and financial market data and

acts as a superanalyst to optimize the price until departure. Accelerating analysis and adjustments, the technology can forecast demand on specific routes and flights, adapt to new market conditions in real time and factor in thousands of variables simultaneously—while learning from each pricing decision to improve its future outcomes. Factors that influence pricing include the time and date of flights, routes, customer demand for seats and the price of jet fuel. Although the tool might eliminate certain manual

Fare Fairness

Delta seeks to set the record straight on “misinformation” about its AI pricing



FETCHERR

processes, its recommendations can also be overruled by internal teams overseeing the outputs.

When Delta first disclosed its tests with Fetcherr, Hauenstein described the initiative as “a full reengineering of how we price and how we will be pricing in the future.” He said during Delta’s Investor Day in November: “The initial results show amazingly favorable unit revenues versus the beta, and so we’re all-in on this.”

For airlines looking to manage high costs and improve revenue, programs that can save time and resources are appealing. Watchdogs and consumers, however, should continue to demand greater transparency and robust safeguards to protect customer privacy and ensure fair pricing practices now and in the future.

Following the comments about AI on its summer earnings call, Delta has worked to clarify what the technology brings to the table, pushing back against what it has termed “a lot of misinformation.”

“There is no fare product Delta has ever used, is testing or plans to use that targets customers with individualized offers based on personal information or otherwise,” an airline spokesperson said. “A variety of market forces drive the dynamic pricing model that’s been used in the global industry for decades, with new tech simply streamlining this process. Delta always complies with regulations around pricing and disclosures.”

QUANTUM LEAP

GARRETT REIM



CITING WONDROUS EFFICIENCIES

gained through artificial intelligence programs, Amazon, Alphabet, Microsoft and many other technology companies have

laid off thousands of workers in recent years. And they are not hiring at the pace they used to. Unemployment among recent college graduates, especially those with computer science degrees, is higher than the overall unemployment rate.

This sacrifice-the-young business strategy is being justified as a boost to profits (and share prices). However, the practice imperils a corporation's long-term success by depriving its future workforce of vital experience. This behavior has yet to spread to the aerospace industry, but it might soon.

A host of companies are developing artificial intelligence (AI) applications for aerospace, including several that say their programs can engineer an entire spacecraft using text prompts and voice commands. NASA sees great promise in trials with its Text-to-Spaceship program (AW&ST April 7-20, p. 46).

AI may bring a big productivity boost to aerospace, and that should be welcomed, but not without weighing the hidden costs and limitations.

Although AI is relatively effective at capturing, sharing and manipulating explicit information, such as documents, designs, code and recordings, that is only the tip of the iceberg of human knowledge within a business. Below the surface, inside employees' brains, exist massive amounts of tacit knowledge collected person by person and shared in informal conversations or absorbed through observation.

Consider a master machinist adjusting milling speeds when hearing certain chattering sounds while cutting a special alloy, or an engineer who designs a composite structure with a little extra strength, above regulatory guidance, because of experience with past failures. These best practices are often not written down but learned on the fly by individual employees and shared ad hoc between co-workers.

Such tacit knowledge can be immensely valuable. In fact, corporations often sue, citing trade secrets, to stop employees from using internal know-how at competitors. Allowing these prized skills, best practices and processes to fade away is foolish.

Maintaining and building tacit and tribal knowledge is not cheap. It requires continually hiring and training

new employees as well as keeping a close eye on what a company might lose when staff leave or are laid off. Paradoxically,

as AI levels the playing field for explicit knowledge, implicit human knowledge will become even more cherished for its ability to give a company an edge. Fortunately, implicit knowledge can be cultivated and transferred to new workers.

"You have to start investing more in your employees, the human aspects of the work," says Dana Daher, executive research leader with HFS Research, which is studying the workforce impact of AI. "Things like communication, collaboration [and] critical thinking" are at the core of human expertise, she says.

Returning employees to the office, formal mentorship programs and encouraging employees to constantly ask "why?" of corporate processes are key to building cognitive capital.

In the technology sector, some software developers are declaring "no-AI days," when they write code without assistance to strengthen their foundational programming skills, boost creativity and deepen their problem-solving abilities.

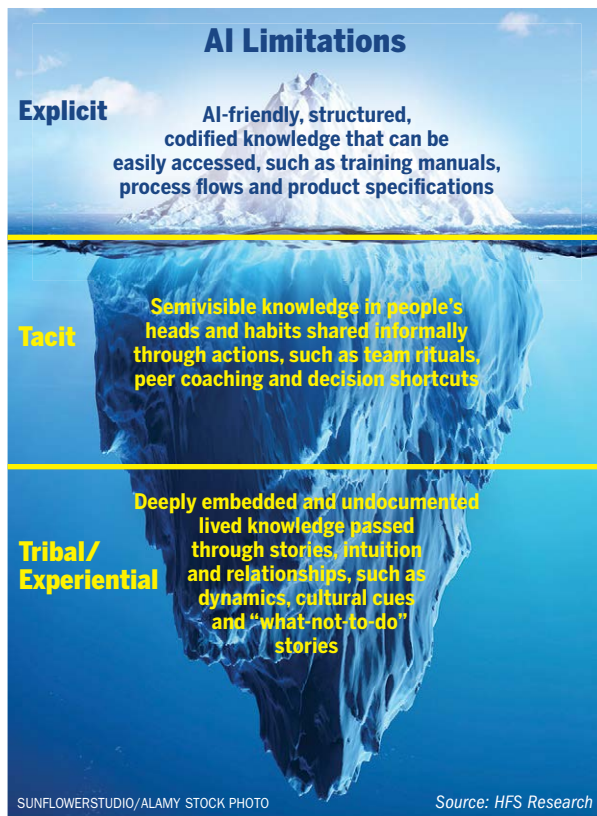
"Brainstorming, leadership discussions [and]

critical analysis should be deliberately AI-free to preserve and strengthen human reasoning," Daher adds.

Managers must be patient and deliberate with new employees, resisting the temptation to use the AI shortcuts that Wall Street rewards. "You have to remind people that they also started somewhere; you were also that person that was struggling to understand the tribal knowledge, the tools and everything else," Daher says. "It's just returning back to being human." 🧠

Hidden Knowledge

Tacit expertise can be immensely valuable





LEADING EDGE

GRAHAM WARWICK

LOSING THE COMPETITION TO develop the successor to its own F-22 presents Lockheed Martin with a challenge and an opportunity: retaining its dominant position in the combat aircraft industry and evolving the F-35 to fill the gap.

Lockheed Martin CEO James Taiclet has made clear his plan is to “create a best-value bridge” from today’s fifth-generation fighters to the sixth-generation Boeing F-47, winner of the U.S. Air Force’s Next-Generation Air Dominance (NGAD) program.

It will take at least five years—perhaps as long as a decade—for the F-47 to enter service, Taiclet told analysts on July 22. He sees a need and an opportunity to provide the capability to bridge that gap.

“How do we bridge capability there?” he said. “We’re going to port a lot of our own NGAD R&D over to the F-35, and potentially the F-22 as well, striving to get 80% of the effectiveness of sixth-generation in stealth and other aspects at 50% of the cost per unit.”

Darold Cummings, who was chief configurator for Northrop’s YF-23 fighter, has some ideas about how the F-35 could be evolved. Still an active aircraft designer, he this year helped Aviation Week analyze both the F-47 (*AW&ST* April 21-May 4, p. 13) and China’s latest combat aircraft (*AW&ST* Jan. 13-26, p. 14).

At Lockheed Martin Aeronautics in Fort Worth, engineers are looking back at the F-16 program for insights into how best to evolve the F-35, which is expected to remain in production for more than a decade, based on the current backlog.

In particular, they are looking at how the arrow-wing F-16XL was developed as a company-funded initiative to evolve the F-16 from its origins as a lightweight com-

bat aircraft into a long-range strike fighter. Cummings similarly takes the F-16XL as a starting point.

“I believe one way Lockheed Martin can meet its goals is by employing two strategies,” he says. One is stretching the airframe to add fuel and improve fineness ratio, as well as adding lifting area with a canard or more wing area. The second is to use thrust vectoring to eliminate the tail.

Starting in April, Cummings developed three conceptual designs for evolved F-35s based on past Lockheed experimental projects; the new designs offer short-, medium- and long-term improvements in performance and increased stealth.

In the near-term F-35EX concept, the fuselage is stretched 60 in., similar to the F-16XL, and vertical and horizontal tails are replaced by a canard foreplane and multi-axis thrust vectoring. The latter is based on the Low-Observable Axisymmetric Nozzle first flown on an F-16C in 1992 and the Axisymmetric Vectoring Exhaust Nozzle now fitted to the X-62A VISTA (Variable In-flight Stability Test Aircraft), a highly modified two-seat F-16D.

“The short length of the F-35, combined with the fuselage cross-sections necessary to contain weapon bays and landing gear, contribute to a poor fineness ratio,” Cummings says. “This is the main reason the F-35 cannot supercruise. The F-16XL solved this problem with a 56-in. fuselage stretch.” Stretching the

fuselage increases fineness ratio for higher lift-to-drag ratio in supersonic flight while adding volume for fuel and equipment.

Cummings’ F-35EX concept employs the maximum amount of F-35A and F-35C components, including using the larger F-35C wing with a canard for pitch control and maximum lift. The fuselage stretch adds 4,000

Designer’s View: Evolving the F-35

Looking to the F-16XL for inspiration



IMAGES: DAROLD CUMMINGS/FOZZAERO

The F-35GX (below) is one of three evolved F-35 concepts (above) developed by aircraft designer Darold Cummings.



lb. of fuel volume, he calculates. Another 1,500 lb. of fuel is housed in an external tank with the same outer mold line as the F-35C external gun pod. Together they increase fuel capacity by 30% over the baseline F-35C. Cummings sees the F-35EX as a near-term alternative to the U.S. Navy's F/A-XX.

The midterm F-35FX concept uses the core F-35EX fuselage but employs technologies from another past Lockheed experimental program, the conceptual X-44 MANTA (Multi-Axis No-Tail Aircraft). Derived from the F-22, the X-44 was intended to test the feasibility of full-authority pitch, roll and yaw control without a conventional empennage, relying purely on three-dimensional thrust vectoring.

The tailless F-35FX has a clipped-delta planform similar to the MANTA for lower radar cross-section and better supersonic area distribution, as well as an advanced, stealthy 3D vectoring nozzle. With the stretched fuselage and larger wing, total internal fuel volume is about 30,000 lb., Cummings calculates, 50% more than the F-35A.

The F-35GX is a long-term concept that maximizes low observability. This configuration starts with the F-35FX layout and modifies the forward fuselage shape to a straight 70-deg. chine. The inlets are moved under the chine.

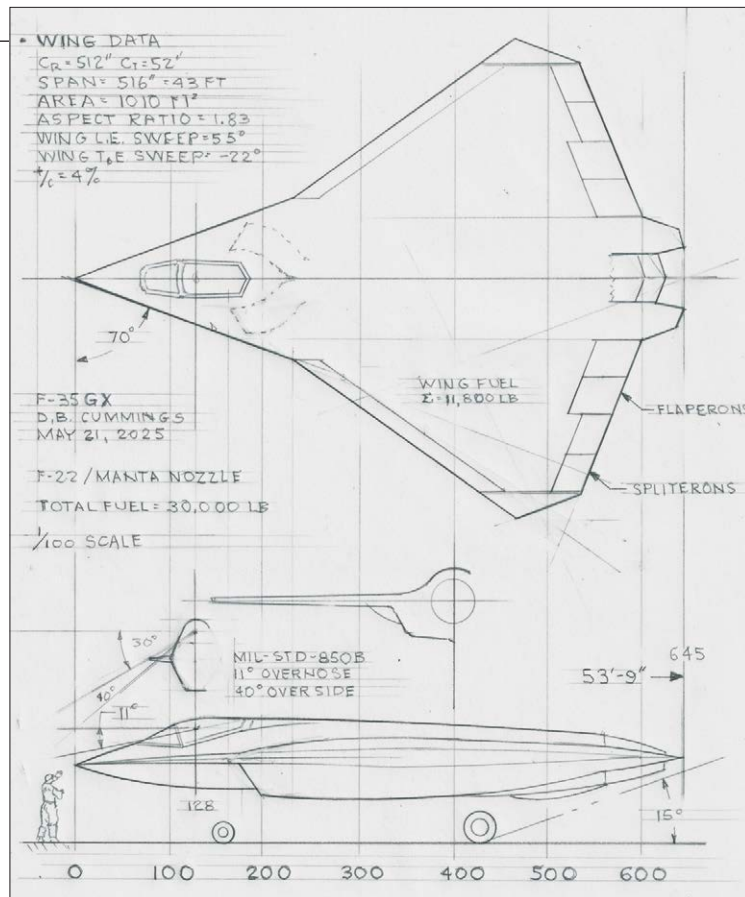
The wing tips are clipped to match the 70-deg. chine angle, and all aft edges—wing, fairing and nozzles—are aligned to reduce radar signature.

The spirit of the F-16XL is evident in Cummings' concepts, but evolving the F-35 may not be as easy as it was for the F-16, for technical and financial reasons.

In December 1980, General Dynamics CEO David Lewis gave the Fort Worth division \$53 million in company funds (more than \$200 million today) to build two F-16XL flight-test prototypes. "We aren't about to sit on our laurels and risk the F-16 becoming obsolescent," Lewis said in an article in *The Wall Street Journal* cited by Albert Piccirillo in his book on the F-16XL, *Elegance in Flight*.

The Air Force provided two F-16A development aircraft for modification into F-16XLs, one of which had been damaged when its nose landing gear failed. Component manufacturing began in January 1981, and the first aircraft flew on July 3, 1982—19 months after Lewis greenlit the program.

That speed of execution was due in part to the F-16's design, as the wing attached to the side of the body, making it relatively straightforward structurally to change the wing. This was done with the F-16XL as well as with Japan's F-16-based Mitsubishi



Cummings' original pencil drawing of the F-35GX concepts shows the proposed changes to the baseline F-35.

F-2, which has a bigger wing and longer fuselage.

In the F-35, the wing and fuselage structure are integrated to reduce weight. This could make it more complicated to stretch the fuselage and replace the wing. For this reason, Cummings located the rear wing spar on all three concepts with the rear wing-spar fuselage carry-through structure.

"When we did the YF-23, three of the most labor-intensive, painful things were the crew station and canopy, the weapon bay and the landing gear—and especially the landing gear relationship to the weapon bay," Cummings says. "These things are all done on the F-35. Compared to those three things, implementation of new wings and other components are much less complex. So the F-35 has a running start."

Ultimately, the F-16XL lost to Boeing's F-15E in the Air Force's Dual-Role Fighter competition, but the F-16 continued to evolve, culminating in the Block 70 variant still in production today.

Whether Lockheed decides that evolving the F-35 justifies a similarly substantial investment of company R&D funding will become clear in the months ahead. ☼

Digital Extra See Cummings' concepts for the F-35EX and FX at: AviationWeek.com/Evolving-the-F-35

CHINA RISING . . .

- > SATELLITE IMAGES REVEAL CHINA'S NEW WIDEBODY TRANSONIC TEST SITE
- > FIVE WIND TUNNELS AT MIANYANG
- > NEW SITE MIMICS EUROPEAN ETW

Guy Norris Colorado Springs and
Graham Warwick Washington

In its most recent commercial market outlook, Boeing forecasts China will need approximately 9,000 new airliners by 2044 to support projected growth, 1,550 of which will be widebody aircraft.

However, while China is on track to have the world's largest widebody fleet, the big question is: Who will provide them? Although Airbus and Boeing—the only Western manufacturers of twin-aisle aircraft—will necessarily share the spoils for the next decade, Chinese civil aircraft developer Comac has other ideas. It plans to challenge the duopoly starting in the 2030s with new widebodies of its own, the C929 and C939.

To make this giant leap in airliner development capability, China first must fill critical gaps in its test infrastructure—particularly with sophisticated wind tunnels. Although

modern aircraft aerodynamic design relies increasingly on advances in simulation tools like computational fluid dynamics (CFD), wind tunnels remain fundamental and have taken on new importance in validating results from simulations.

Satellite images of a vast new wind tunnel complex in Sichuan province in southwest China appear to reveal the existence of a nearly complete cryogenic facility able to test large, transonic transport aircraft at close to flight conditions. Dubbed the China Transonic Wind Tunnel (CTW), the facility is part of the world's largest wind tunnel complex, built by the China Aerodynamics Research and Development Center (CARD C) in Mianyang to support the country's commercial aircraft industry.

Developed in secrecy since 2007, the Mianyang complex was officially acknowledged in 2013. But the addition of the CTW, only noticed by Western observers in recent months, is a clear sign of China's growing investment in facilities supporting development of indigenously designed widebody airliners as well as other large aircraft, potentially including blended wing body (BWB) transports.

Ironically, the expansion of China's advanced test facility comes as NASA prepares to mothball several sites because of budget issues. The Trump administration's 2026 budget calls for five of NASA's 12 wind tunnels to be put into standby mode, an unprecedented number, says Robert Pearce, associate administrator for the agency's Aeronautics Research Mission Directorate.

"The reason cryogenic tunnels came into being is because airliners started to get bigger, and so the gap grew between

. . . NASA SHRINKING

- > RETIREMENTS RISK HOLLOWING OUT THE AGENCY'S AERONAUTICS EXPERTISE
- > PROJECTS BEING TERMINATED AND CONSOLIDATED

Graham Warwick Washington

NASA expects to lose research capabilities as it reshapes its aeronautics portfolio to cope with a massive budget cut imposed by the Trump administration and is wrestling with the likely loss of expertise as it slashes its workforce.

"This next year is going to be challenging as we rebalance the workforce, rebalance the portfolio and continue to add value through our partnerships [with industry and academia]," Robert Pearce, associate administrator for NASA's Aeronautics Research Mission

Directorate, told a July 23 meeting of the National Academies' Aeronautics and Space Engineering Board (ASEB).

As outlined to the ASEB, that rebalancing includes mothballing wind tunnels, scaling back flight research and consolidating projects even as NASA

has been charged with "strengthening U.S. technology leadership in aviation to ensure a competitive advantage over China and Europe."

The impact of the budget cuts was apparent at the American Institute of Aeronautics and Astronautics' Aviation and Ascend conferences in Las Vegas on July 21-25, where the usual turnout of some 400 NASA experts was reduced to just 50, dramatically curtailing the opportunities for networking and technical interchange with industry and academia.

Several senior NASA experts are retiring, sources tell Aviation Week, while many of the midcareer researchers intended to replace them are leaving the agency, raising concerns that the budget cuts risk hollowing out NASA's aeronautics capabilities and causing long-term repercussions.

what you could test in a conventional tunnel and what you began to see in flight test,” a NASA expert says. “At that stage, CFD was virtually nonexistent, so you had a lot more surprises when you got to first flight.”

The CTW appears to be similar to the European Transonic Wind Tunnel (ETW) in Cologne, Germany, notes the NASA specialist, who is familiar with U.S. and European transonic test capabilities. Operational since 1994, the ETW is more modern than the world’s first cryogenic wind tunnel, NASA’s National Transonic Facility (NTF) in Langley, Virginia. The NTF was completed in 1982 and has been used to test the development of the Boeing 777 and 787 as well as the space shuttle orbiter, Northrop Grumman B-2 and several other research configurations, including BWB transports and supersonic airliners.

The NTF and ETW both use high-pressure, cold-temperature nitrogen as a test gas to enable evaluation of aircraft models at Reynolds numbers close to those encountered in flight. A scaling factor that measures the ratio between inertial and viscous



Built rapidly over the last 15 years, the Mianyang facility in southwest China includes a newly completed transonic wind tunnel (inset) for tests of large-scale aircraft.

President Donald Trump’s fiscal 2026 budget request cuts funding for NASA aeronautics to less than \$589 million from \$935 million in fiscal 2025, a drop of 37%. “That’s a \$350 million reduction. But on top of that is \$50 million or so for workforce reshaping,” Pearce said. “So it’s really almost a \$400 million reduction in the portfolio going in 2026.”

The largest year-over-year funding cut ever is forcing NASA to rejig aeronautics research, including putting five of its 12 large wind tunnels on standby status to save money. Budget markups working their way through Congress may restore some of the cuts, but any additional funding could be impounded by the Trump administration, which wants to hold aeronautics funding at \$589 million for the next five years.

“The vision we have going forward is an evolution. It’s not a complete remake,” Pearce said, outlining planned portfolio changes to the ASEB, which

provides recommendations on how to tackle aerospace issues of national importance. “Everything we do, we do for value. It’s about how we look differently at our portfolio to continue to drive value with our partners.”

NASA’s Advanced Air Vehicles Program is most affected by the changes, with its budget halved and six projects consolidated into three. Subsonic aircraft, vertical lift and turbine engine research are combined into one project “to create a larger trade space” in a bid to gain efficiencies, Pearce said.

Commercial supersonic and hypersonic research is consolidated into a new High-Speed Flight project for the same reason. The HiCAM high-rate composites manufacturing project, which enjoys strong congressional support, continues as a separate effort.

As these surviving projects targeting next-generation commercial aircraft are completed, NASA plans to begin looking to the generation after next, with a focus on revolutionary propul-

sion—and propulsion-airframe integration—for future ultraefficient airliners.

“There is a lot of opportunity to drive innovation in propulsion concepts and cycles forward,” Pearce said. “There’s a lot of innovation on the energy side,” he added, citing as an example the Cheeta concept for a cryogenic-hydrogen, distributed-electric-propulsion airliner developed by a team led by the University of Illinois.

“We’re going to start doing that again, to explore that trade space with industry,” he said. “As we understand things better, we’ll choose the ones that have the highest promise and start bringing those to a higher [technology readiness level (TRL)].”

Also deeply cut is the Integrated Aviation Systems Program, responsible for NASA flight research. The X-59 Low-Boom Flight Demonstrator project continues, but the Electrified Powertrain Flight Demonstration project is being terminated before GE Aero-

forces in fluid flow, the flight Reynolds number can approach 50 million or more in cruise for large subsonic aircraft, but most conventional wind tunnels only operate at 10-20 million. The ETW provides test conditions equal to around 50 million for full-span models and 90 million for half-span models.

The use of cryogenic nitrogen gas as the working fluid increases the available Reynolds number by 5-6 times compared with a conventional wind tunnel. Nitrogen also reduces the power required to drive the wind tunnel fan by more than 40%, as its higher density requires less energy to move the same amount of gas.

An Airbus test specialist says the start of development of the CTW in 2007-08 coincides with Comac's use of the closely aligned German-Dutch DNW wind tunnel organization to conduct tests of the C919 single-aisle aircraft. The Airbus expert adds that the internal layout and configuration of at least one of the DNW sites was later altered to improve security, after the Chinese test team was seen taking photographs of the facility and engineering documents.

A paper published in the Chinese journal *Acta Aerodynamica Sinica* in December 2023, authored by researchers from CARDC and the AVIC Aerodynamics Research Insti-

tute in Shenyang, included the CTW among a list of wind tunnels built since China launched its large civil aircraft program in 2007. Satellite imagery indicates work began in 2010 to clear the greenfield site south of Mianyang. The first major wind tunnel then took shape on the facility's western boundary in 2013. Additional test areas and infrastructure quickly followed, and clearing of ground for the CTW and two other very large wind tunnels began in 2018.

Specialists note the "giveaways" that help identify the cryogenic tunnel include the presence of a tall vent stack and two large nitrogen storage tanks close to the facility. NASA's NTF also has two nitrogen tanks, while the ETW has one. Described as a "low-temperature, continuous type" wind tunnel—the same description given to the NTF and ETW in the paper—the CTW is listed as having a 2.6 X 2.2-m (8.5 X 7.2-ft.) working section, Mach 0.2-1.6 speed range and a Reynolds number capability similar to that of the ETW.

"When the large aircraft special project was officially launched in 2007, China's aerodynamic test equipment foundation, test simulation capabilities and test data correction technology were significantly behind those of developed aviation countries in the U.S. and Europe," the paper states.

"Compared with the well-equipped transonic test equip-

space and MagniX can fly planned hybrid-electric testbeds.

The Subsonic Flight Demonstrator project is being reworked after Boeing decided not to proceed with the X-66 transonic truss-braced wing testbed. "The focus remains the same, but the approach to achieving it has pivoted," Pearce said.

Flight research takes higher budgets, more disciplined program management and carries more overhead. "We are going to move away from large-scale flight demonstrations . . . and into more modest, more rapid and more focused flight demonstrations that support our transformations going forward," he said.

Also taking a hit is the Transformative Aeronautics Concepts Program, which supports lower TRL research into new concepts for the future of aeronautics. Despite being highly successful, the Convergent Aeronautics Solution (CAS) project is being terminated to save money.

Created in fiscal 2016 to enable

Check 6 *Aviation Week* editors discuss how the NASA cuts could affect U.S. competitiveness in commercial aviation and space: [AviationWeek.com/Check6](https://www.aviationweek.com/Check6)

in-house researchers to explore the feasibility of innovative concepts rapidly, CAS was successful in creating ideas that transitioned to other NASA projects, Pearce said, citing the ongo-



NASA has been directed to pivot to advanced propulsion and integration concepts for generation-after-next airliners, exemplified by the University of Illinois' Cheeta concept.

ing ACERO project to enable remotely piloted aircraft to fight wildfires 24 hr. a day.

"We do have a small initiative in the spirit of CAS trying to drive innovation into our other projects," he said. "CAS will be stopped, but as we transform our portfolio, we hope to get back into some more in-house, lower-TRL work.

We will drive CAS-like things back into the portfolio."

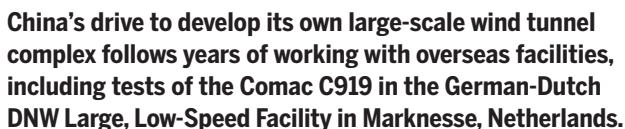
Two other projects under the Transformative Aeronautics Concepts Program will continue. The University Innovation project, under which NASA supports academic research, will be scaled back in line with the overall budget cut, while the Transformational Tools and Technologies project will be refocused on the task of revolutionizing aerospace engineering methods.

While startups such as Luminary Cloud have seized the initiative in bringing cloud access to massive computing power and physics-based artificial intelligence (AI) for engineering simulation, there is still a role for NASA, Pearce said.

"There is an opportunity for NASA to do those canonical experiments in our wind tunnels and in flight that bring focus to the difficult physics that underlie these methods," he said. "The more we can . . . bring those databases to the community, the faster we can validate those engineering methods."

The Airspace Operations and Safety Program has been reduced from four projects to two. One focuses on NASA's existing partnership with the FAA as it modernizes the U.S. air

The Mianyang site's immediate focus is expected to be on supporting the development of the C929 widebody, which is similar in size to the A350 and 787. Comac revealed at June's Paris Air Show that detailed design of the C929 is underway, type certification is targeted for 2032 and service entry for 2035—significantly behind the initial plans when it was still a joint project with Russia. As with hopes for a stretched C919, Comac still needs government approval to unlock funding.



Designed to carry 282 passengers in a standard layout over a maximum of 6,500 nm (7,480 mi.), the C929 is planned to be followed by the C939, which is to be positioned as a competitor to the 777X. A service entry date and further technical details have not yet been made public. 🌐

Major changes are planned for the Aerosciences Evaluation and Test Capabilities Program, which operates NASA's wind tunnels. "We have 12 large wind tunnels," Pearce said. "They're unique, they're highly capa-

The biggest challenge is the specialist workforce that each facility requires. "The idea is to cross-train the workforce to operate more than one

As NASA adapts to the drastically reduced funding for aeronautics research that lies ahead, it faces difficult choices. "We will not be able to sustain every capability that we have today, but we will do the best we can to both keep the critical capabilities and advance them where we can," Pearce said. ☐



SEOUL INTERNATIONAL AEROSPACE & DEFENSE EXHIBITION

Public Day Oct.17(Fri) – 19(Sun), 2025 / Seoul Airport

Business Day Oct.20(Mon) – 24(Fri), 2025 / KINTEX

*Oct. 24th : Integrated with the Future's Day

am City



Richard Butler
Aerospace Industry Leader
at Rockwell Automation



Glenn Reis
Federal/Aerospace &
Defense Leader at Rockwell
Automation

Learn How Rockwell Automation Powers Commercial Space Launch Success

As today's space launches grow more frequent and diverse, companies are using advanced manufacturing, automation, and digital tools to launch faster, cheaper, and more reliably. Aviation Week spoke with Rockwell Automation experts about the tech driving these changes.

Q Aviation Week: What are today's space industry business drivers?

A Richard Butler: Demand is surging as space launch companies race to deploy satellite constellations. Launch providers must deliver more frequent, safer, and cost-effective missions which forces them to rethink everything, from rocket system design and manufacture to launch operations. Behind every successful launch lies a complex network of industrial architectures and data systems, simulation environments, and data-driven platforms that enable speed, precision, and resilience.

Glenn Reis: Government-led space programs have given way to a full-fledged commercial market, and Wall Street is watching. An Aviation Week study projects the global space economy will reach \$994 billion by 2033, fueled by heavier and more diverse payloads and associated launch capacity. To reassure investors, providers must prove they can consistently deliver on-time, on-budget capabilities. The accelerated adoption of digital technologies is essential to compress design-to-production cycles for vehicles, infrastructures, and payloads.

Q AW: How is automation advancing the space industry and helping companies meet these challenges?

A GR: Digital transformation and automation means IT/OT convergence—bringing together information systems and operational technologies. That convergence happens through container-

based IoT platforms, PLM applications, and industrial control systems. Add AI and machine learning, and you get a smarter, more agile digital enterprise that supports today's launch demands.

Kalypso, Rockwell's digital-solutions arm, delivers scalable architectures that improve visibility, safety, and repeatability from fueling and payload prep to ground system control.

RB: It starts on the factory floor. To launch faster, you must build engines, boosters, and payload systems faster without sacrificing precision or quality. Automation makes that possible by focusing on safety and quality that carries through to the launch pad.

Launch pads operate like factories, too. Delays are costly. Automation enables rapid, safe responses to weather, system alerts, or mission-profile changes. It also uses real-time alarm management and predictive analytics to prevent delays across factories, assembly bays, or launch pads.

Q AW: How does the data you collect translate into predictive insights and Digital Engineering benefits?

A GR: This is where automation and data science meet. Prediction starts with understanding situational awareness which requires a robust enterprise data model—organizing data close to its source, at the edge, contextualizing it with data across the enterprise. Then, it uses AI and machine learning to identify patterns and anomalies that enable actionable insights and rapid decisions.

Digital twins and virtual test environments also

harness large volumes of contextualized data to help de-risk vehicle and infrastructure designs before they're produced and placed into service. This alignment between design and manufacturing helps you go faster, reduce rework, and deliver higher-quality systems.

RB: With all that data flowing through control systems, cybersecurity becomes critical. Years ago, these systems were isolated functions—high security but business limiting since data wasn't reaching the right people. Now, to be competitive, data must be captured, requiring network expansion to the edge. Rockwell Automation leads in securing operational technology—those control layers at the heart of manufacturing and launch operations.

Q AW: What strategic insights do Rockwell Automation and Kalypso offer?

A RB: The industry is shifting toward modular, repeatable launch architectures, and automation is the enabler. Far from being a bolt-on, industrial automation is a foundational enabler of cost-effective operations, resilience, and launch readiness.

The future depends on smart integration of OT/IT, edge computing, and AI-driven insights. What we do for space launch providers is like what we do for commercial aircraft—safety requirements are comparable for producing quality, safe and reliable rockets, payloads and satellites.

GR: Kalypso provides consulting and systems integration expertise for a broad range of digital solutions. We tackle the toughest operational challenges for our clients and apply deep domain expertise to solve them. We start with business strategy, then build operational and data security components and processes. We integrate and address multiple challenges simultaneously in one of the most heavily regulated technological environments.

Rockwell Automation and Kalypso help clients develop end-to-end digital strategy and solutions that link supply chain, production, and launch systems into a common framework. We don't just deliver hardware and software—we deliver digital capabilities to power growth in commercial launch services.

Digital Engineering & Manufacturing Driving Commercial Growth in Space



Photo courtesy of Richard Butler

PERILOUS PROCEDURES

➤ NTSB HEARING SPOTLIGHTS OPERATIONAL WEAKNESSES IN WASHINGTON AREA

➤ HELICOPTER AND WASHINGTON NATIONAL PROTOCOL CHANGES ARE LIKELY JUST THE START

Sean Broderick Washington

Nothing that led up to the Jan. 29 midair collision between an American Eagle regional jet and a U.S. Army helicopter near Washington was out of the ordinary.

Sikorsky UH-60Ls with no collision avoidance systems or onboard traffic displays are common in the airspace around Ronald Reagan Washington National Airport (DCA).

The Bombardier/MHIRJ CRJ-700's Runway 33 approach, which intersected the charted Route 4 helicopter airway, is used regularly. Controllers often use that approach to relieve congestion for other aircraft arriving on DCA's primary runway, 1/19. Sometimes, pilots request it.

controller to both aircraft involved—or something else.

But the accident's legacy will be lessons learned from the consequences of unchecked procedures. The ones in place on the night of Jan. 29 did not provide pilots or controllers with adequate safety margins, and the procedures on which the FAA relies for correcting such problems too often fail to mitigate risks proactively.

Years of accident-free operations masked what should have been clear warning signs. Helicopter routes in Washington airspace have been in use for decades. Route 4, established in 1988, was unique in that it crossed the Runway 33 glideslope with about 75 ft. of vertical separation. Despite the potential for conflict between helicopters and arriving aircraft, no special procedures were developed to deconflict traffic.

Instead, controllers and pilots relied on a patchwork of optional protocols alongside standard Class B airspace procedures. A common training practice taught controllers to hold helicopters at certain points along Route 4 when the runway departure and approach paths it crosses—notably Runway 33—were in use.

But Clark Allen, FAA air traffic control (ATC) training support manager and former DCA control tower operations manager, testified that the training was not backed by formal requirements or guidance. "There's no defined procedure whatsoever with it," Allen said on July 31, the second day of the hearings. "It is merely technique."

That technique also was not taught regularly, investigators learned. Some controllers swore by the de facto deconfliction strategy, while others did not use it, NTSB investigator Brian Soper said.

Helicopter pilots faced similar inconsistencies.

Published helicopter routes show minimum or maximum altitudes but no defined lateral boundaries. While helicopter pilots interviewed by investigators indicated that ATC instructions always take priority, some believed helicopter routes were established with procedures to ensure separation from nearby traffic. This included the Route 4/Runway 33 arrivals intersection.

"If there's traffic that's landing and the tower has them, and we're on Route 4, the way I understand it is . . . we should be fine; it shouldn't be an issue," a pilot from the Army's 12th Aviation Battalion (12th AB), the accident helicopter's unit, told investigators in a pre-hearing interview. That pilot added: "Maybe I just have too much trust in [the air route chart] printed in front of me, because I generally think that this is going to keep us safe."



Investigators determined the helicopter crew was flying higher than their route's 200-ft. maximum, likely due to a faulty altimeter reading.

Route 4, which crossed the Runway 33 glideslope about 100 ft. below where arriving aircraft pass, was used often as well.

One tower controller often is assigned double duty of managing arrivals and departures as well as helicopters moving through the airspace. That work often includes granting helicopter pilots' requests to maintain visual separation, putting the primary responsibility on those crews to see and avoid anything else flying.

UNCHECKED PROCEDURES

While the final NTSB report and accompanying probable cause are not expected until 2026, a three-day investigative hearing on the midair collision established an irrefutable fact: The accident sequence's operational elements were routine, but their safety margins were unacceptably thin.

The board's final report will pinpoint specifics of the collision's most direct contributors. These may include the UH-60L crew not maintaining the visual separation they were granted, insufficient communications from the

FLIGHTPATH CHANGE

On the night of the accident, the 12th AB UH-60L Black Hawk, call sign PAT-25, was flying south on a training mission along Route 4, which passed just east of DCA. American Eagle Flight 5342, operated by American Airlines subsidiary PSA Airlines, was approaching from the south and preparing for an arrival on Runway 1.

But ATC requested that Flight 5342 accept a circle-to-land approach on Runway 33. The reason? The distance between arrivals on Runway 1 was tightening up, which threatened to delay outbound flights.

"We had some departures waiting to depart Runway 1," the tower controller told the NTSB in an interview. "We really [weren't] getting spacing on final at the time. And so that's why I asked [Flight 5342] if they could take [Runway 33]."

The runway change required the CRJ to turn northeast and then back northwest to acquire the new approach path. That also changed its flightpath from one that paralleled Route 4 to one that crossed the helicopter's path.

At this point, PAT-25 was about 5 nm north, heading south down the Potomac River just to the airport's east. The controller cleared PAT-25 to proceed down Route 4, calling out Flight 5342 and its pending circle-to-land approach as traffic. A PAT-25 crew member radioed that they had the CRJ in sight and requested visual separation. The controller granted the request.

He did not give a similar traffic advisory to the CRJ.

"I can't explain why someone would omit that portion," Allen said. "Traffic should be exchanged to both aircraft."

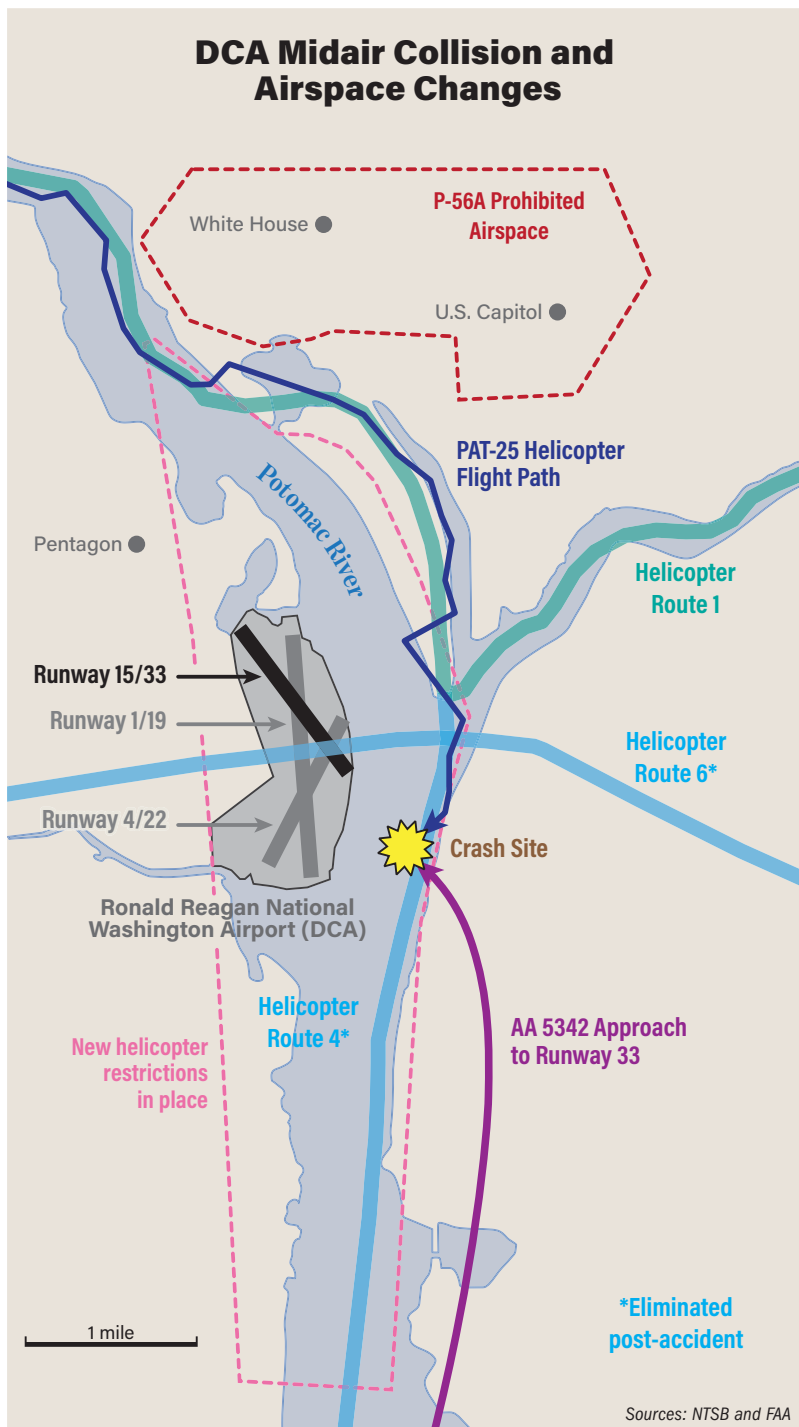
The controller alluded to workload as a factor.

"There were other priority duties at the time," he told investigators. "We're taught to work yourself in [from the airport] and then go out. So I issued a traffic call early on for [PAT-25] to know about that traffic, and then my next step is I would clear that aircraft for Runway 1 for takeoff, and I was going back to let the [CRJ] know, but I saw at the time there was conflict."

The controller was juggling multiple arrivals and departures, plus two other helicopters. He communicated with four aircraft in the 90 sec. after granting PAT-25's visual separation request. He then looked out and saw the Black Hawk flying too close to the airport.

"I wasn't looking at radar," he said. "I was just looking outside the window and could see that something wasn't right."

"Do you have the CRJ in sight?" the controller asked PAT-25. "Pass behind the CRJ."



PAT-25 flew Helicopter Route 1 down the Potomac River and joined Route 4. American Eagle Flight 5342 (AA 5342) was cleared to land on Runway 15/33. PAT-25 twice asked for and was granted visual separation, giving it primary responsibility for avoiding traffic. Despite being told the approach on which AA 5342 was flying, the helicopter crew seemingly never saw the Bombardier/MHJR CRJ-700 closing in from its left side as it proceeded down the Potomac's east bank and into the runway's approach path. Following the Jan. 29 collision, Helicopter Routes 4 and 6 were closed, and other helicopter flights around the airport were significantly restricted. More changes are expected.



The NTSB is working to complete its investigation and final report on the midair collision at DCA by early 2026.

A conflict alert warning controllers of a possible collision was audible in the background, the ATC transcript notes.

"PAT-25 has aircraft in sight—request visual separation," one of the helicopter pilots responded. The controller again granted the request.

The transcript from the Black Hawk's cockpit voice recorder shows the instructor pilot telling the pilot flying to move left, away from the airfield and closer to the Potomac's east bank. "I think that's why he's asking," the instructor said. "We're kinda out toward the middle [of the river]."

There was no discussion of the CRJ approaching from the helicopter's left side. The two aircraft collided about 12 sec. later, at 8:48 p.m. local time.

The tower controller was handling both the local controller arrivals and departures position and helicopter traffic due to a decision earlier in the day to combine the positions and assign them to one person.

Allen testified that the move to combine the positions, made possible following a 2023 change in standard operating procedures, is common and based on many factors, including controller comfort levels.

"I may be able to control five helicopters and it [is] no volume for me, and maybe you could only manage two, or vice versa," he said. "It's subjective to each controller as to what volume is to them."

On the day of the accident, the local controller and helicopter positions had been combined for all but about 80 min.

"There are many variables that go into making those decisions," Allen said, citing unanticipated staffing shortages due to sick days as an example. "Multiple factors can occur at any time, and we have to adjust our priorities in order to continue to provide a safe and efficient operation."

The on-duty controller said traffic was "a little bit heavier than normal" and "a little complex" at the time of the accident, but "manageable for me."

Adding to the complexity was the need to move some arrivals to Runway 33 to minimize delays to and from Runway 1. Controllers dealt with it, but they were not necessarily comfortable with it—and FAA managers knew that.

"Current flight schedules have created a consistent over-

lap in arriving [and] departing traffic, which does not allow for reduced separation," Bryan Lehman, ATC manager for the Potomac Consolidated Terminal Radar Approach Control (PCT) in charge of Washington-area airspace, wrote in a 2023 memo. "Without the ability to meter traffic at DCA, we will continue to have issues with compacted demand and airborne holding. PCT routinely solicits programs from [Air Traffic Control System Command Center] to support our need to control the influx of traffic that creates a compacted demand, only to be denied."

Lehman lobbied to reduce maximum hourly arrivals and departures at DCA, telling the three NTSB board members conducting the hearing that the matter was a safety issue. His request was denied.

Rates were cut after the accident, but still not to Lehman's suggested levels. Runway 1/19 remains the busiest single commercial runway in the U.S.

"With the lower rate that we're currently operating, or potentially the rates that were discussed in the memo of 2023, obviously, if you reduce the volume, you reduce risk, and you reduce the need to utilize additional runways," Allen testified.

CONCERNS ABOUT HELICOPTER OPERATIONS

Concerns about helicopter risks also were not prioritized. An air traffic working group representing the agency and airspace users looked into moving Route 4 as recently as 2021, Allen told investigators on the hearing's opening day. The idea never got past the discussion stage, however.

A suggestion to add warning language to the helicopter charts that included advising "pilots use caution for fixed-wing arrivals" to Runways 1 and 33 when the airport is in a "north configuration" also was not accepted.

Allen said that clearing aircraft to land on Runway 33 while helicopters were on Route 4 was "common." Despite this, the FAA had no special procedures for helicopters to follow beyond basic visual or instrument flight rules.

The 12th AB pilot told investigators that his "personal preference" is to hold until the arriving aircraft is clear. "Knowing that procedure, knowing . . . that commercial airliners are flying into DCA," he said. "But again, that's preference. That's not procedure, and that's not required anywhere."

Another experienced Army pilot expressed surprise that any helicopters were cleared up and down Route 4 when Runway 33 was in use.

"Every single time that I saw traffic landing on 15/33, I was told to hold at the two locations," north or south of the Route 4/approach path intersection, David Van Vechten, a chief warrant officer and UH-60 instructor pilot, said on the first day of hearings. "Based on the hundreds and hundreds of hours I flew in this area, . . . I did not think that was allowed, for a helicopter to be on that route while [a commercial flight was] landing."

Van Vechten is not alone.

"Pilots who had encountered fixed-wing traffic landing on Runway 33 reported that they had been instructed by ATC to hold until the traffic had landed, regardless of whether they had the traffic in sight," the NTSB helicopter operations group report states.

The FAA received plenty of reports of close calls with helicopters that triggered commercial aircraft onboard traffic avoidance system alerts and, in many cases, warnings to take evasive action. But FAA analysis of the incidents turned up few near-midair collisions (NMAC), defined by the agency as aircraft within 500 ft. of each other, or otherwise at risk of collision as determined by pilots.

For instance, the FAA Air Traffic Organization's (ATO) Aviation Risk Identification and Assessment (ARIA) tool flagged 874 incidents, or preliminary ARIA reports (PAR), for analysis, NTSB documents show. PARs are reviewed and classified by ATO safety experts. Classifications range from pilot deviations—such as not maintaining an assigned altitude—to NMACs.

"Of the 874 PARs reported at DCA during the three-year time frame noted in your request, there were no PARs classified as an NMAC," Dale McNeal, acting vice president of safety and technical training at the ATO, wrote in a July 11 response to investigators' queries.

The FAA tapped Mitre Corp. to develop ARIA, which processes radar data and flags events and then assigns each an index number based on an algorithm. Those index numbers help the agency determine which issues warrant closer examination and potential corrective action plans.

The FAA's explanation of its ARIA data analysis helps explain why steps taken after the accident were not taken sooner. ARIA is one of several sources of data the agency uses to evaluate airspace conflicts. Others include reports filed directly by pilots and air traffic controllers, but those failed to trigger much more concern (*AW&ST* Feb. 10-23, p. 16).

From February 2020 through October 2024, the voluntary Aviation Safety Action Program received 85 pilot reports "on close calls between helicopters and commercial aircraft near DCA," an NTSB working group report states. Event review committees analyze those reports and recommend actions if warranted.

The Army does not collect aircraft-level safety data. A service review of the voluntary Army Safety Management Information System "found no on-file reports of mishaps or near-misses for DCA," the NTSB report stated.

LACK OF AWARENESS

Given the lack of red flags from organizations with the data to make informed risk assessments, commercial operators did little to emphasize the risks of helicopter operations in and around the airport. While carriers provided pilots with special, DCA-specific information covering airspace restrictions and the airport's constraining configuration, they did not discuss helicopter operations or routes.

The Air Line Pilots Association "did not report or have any knowledge, based on safety data, of midair collision risk at DCA before this accident," the NTSB report stated. "Until this midair collision, to the union's knowledge, operators did not publish helicopter route information to its pilots. If there was knowledge of the routes, it would have been based on an individual pilot's previous military or professional experience operating in the DCA airspace."

Investigators' interviews with four Washington-based PSA pilots underscore the union's stance. While DCA was "on [the airline's] radar" for issues such as runway incursion risk, PSA "did not see a heightened risk of midair collision," the NTSB report stated.

Only one of the PSA pilots interviewed—a former mili-

tary helicopter pilot based in the Washington region—had detailed knowledge of area helicopter routes. A second was familiar with the published routes. The two others did not know they existed. Knowing that information would have been "really helpful for us to have . . . more awareness," one of those pilots told the NTSB.

Several technical issues also pierced already-thin safety margins.

Route 4's published maximum altitude at the collision point was 200 ft.; arriving aircraft usually cross the route at about 300 ft. While the routes provide 100 ft. of vertical separation, they were not designed to manage intersecting traffic and do not have defined lateral boundaries.

The helicopter was flying above the route's 200-ft. limit, NTSB investigators determined, seemingly due in part to the inaccuracy of its barometric altimeter, particularly at lower altitudes. Sikorsky warned the Army about the issue years ago, but pilots were never told. The service is evaluating the problem's ramifications for the entire UH-60L fleet and plans an official update for pilots. NTSB Chair Jennifer Homendy said the board is considering an urgent safety recommendation.

Even in functioning order, the UH-60L was arguably out of place in such busy airspace. The Black Hawk did not have any onboard traffic display, detection or collision warning system. Its pilots had tablets that can provide situational awareness of nearby traffic, but Army policy prohibits their use as a primary traffic deconfliction tool, Van Vechten testified.

"If I were king for a day, I would replace them" with newer, more advanced variants, said Scott Rosengren, chief engineer of the Army Utility Helicopter Project Office.

The helicopter was equipped with ADS-B Out but was not transmitting—a common military practice. Several witnesses testified that while this added risk, it likely did not play a direct role in the collision, due in part to the lack of an ADS-B In mandate and related flight-deck application that may have helped the Flight 5342 crew.

That appears destined to change. After years of opposition, the FAA now supports both forward-fit and retrofit mandates for aircraft operating in airspace where ADS-B Out is required today, testified Franklin McIntosh, acting chief operating officer of the ATO.

The collision killed all 63 on the regional jet and four on the helicopter. It also triggered immediate, drastic changes to DCA-area helicopter operations. Routes 4 and 6, which flew directly over the airport, no longer appear on published charts. Nonessential helicopter flights around the airport are prohibited, and new ATC procedures are in place for when helicopters must fly, such as when moving the president. The Army has modified its operational and training protocol.

The changes made post-accident have one common theme: They decrease risk by aggressively increasing safety margins. Still unclear is whether they represent a knee-jerk response or key stakeholders' changing mindsets.

"I think there were some things that we missed, to be quite honest with you," McIntosh said of the pre-accident days, citing dependence on helicopters using visual separation as one example.

"It's not illegal," he added. "But based on the complexity of the airspace and close proximity, I think those are some things that we definitely take a look at now [and say] we would have definitely shined a bigger magnifying glass onto that if we could go back in time." 🌀

Walking the

- > KELLY ORTBERG SOLIDIFIES HIS ROLE AS BOEING'S TURNAROUND-IN-CHIEF
- > OBSERVERS CREDIT ORTBERG WITH KICK-STARTING BOEING'S RECOVERY
- > HARD CHALLENGES REMAIN, INCLUDING CERTIFICATIONS AND CASH FLOW



Aviation Week editors spoke with Boeing CEO Ortberg in a Seattle factory during a visit in early May.

Michael Bruno and **Sean Broderick** Washington and **Guy Norris** Colorado Springs

Kelly Ortberg has had the kind of first year on the job that would make many people glad not to be in his position. Weeks after he became CEO of Boeing on Aug. 8, 2024, the company's central corps of factory workers in Seattle launched a heated 53-day strike. The disasters piled up: prominent management changes, a round of company-wide layoffs, President Donald Trump's tariffs, federal contract upheaval, the first 787 widebody crash and, above all, Boeing's worsening finances.

Ortberg began his tenure by relocating his main office to Boeing Commercial Airplanes (BCA) near Seattle, effectively reversing predecessors' decisions to move headquarters to Chicago and then to the Boeing Defense, Space and Security (BDS) site in Arlington, Virginia.

That was just the first of many re-

versals that Ortberg has initiated at Boeing. A year into his tenure, analysts acknowledge that while the company still faces considerable challenges before it can reclaim its precrises prowess and industry leadership, at least the company is making progress.

"It's clear our recovery plan is taking hold," Ortberg declared on July 29 while

delivering second-quarter 2025 results. "We're making steady progress to stabilize our business, strengthen development program execution and change our culture to set up for the future."

"I still have some work to do," he told a teleconference of financial analysts later, "but I'm pretty pleased with where we are through the first half and through my first year."

Others are pleased as well. "Today, Boeing's relationships with regulators, employees, suppliers and customers are on the mend," Melius Research analyst Scott Mikus affirmed to his clients after hearing Ortberg speak. "Customers are expressing increased confidence in Boeing's delivery projections, and suppliers note that Boeing is now more collaborative and recognizes the importance of taking a long-term view in an industry where aircraft programs span decades."

Talk

at \$227 million in the latest three-month period compared with a \$3.92 billion cash burn in the same 2024 period.

What is more, while Boeing still has not provided formal 2025 financial guidance, retiring Chief Financial Officer Brian West told financial analysts during a teleconference that they can expect the aerospace and defense giant to burn only \$3 billion or so in cash this year. That compares with previous—albeit similarly unofficial—guidance of \$4-5 billion used in all of 2025.

“The first-half free cash flow usage of \$2.5 billion exceeded our expectations, and the second quarter use of \$200 million was quite a bit better,” West said. Results were driven primarily by better commercial aircraft delivery numbers as well as timing of some financial issues.

Ryan O’Loughlin, a director at credit agency Fitch Ratings, said the improved performance further positions Boeing to cut its gross debt “significantly” in 2026. That debt stood at \$53.3 billion at the end of the latest quarter, while cash on hand and marketable equivalents totaled \$23 billion.

Overall, the airframer and defense prime’s combined work backlog has grown to \$619 billion, up about 14% sequentially from \$545 billion at the end of the first quarter of 2025. The backlog now includes more than 5,900 aircraft.

First-half deliveries totaled 280 aircraft, the most since 2018’s 378, which came amid the last full year in which no major production-related interruptions or delivery pauses occurred linked to safety or quality shortcomings. Monthly rates on its two key programs, the 737 MAX and 787, are climbing steadily and, crucially, with the stability needed to sustain growth.

Leading the charge is the 737 program. Boeing is settling in at a production rate of 38 aircraft per month. The next step is securing the FAA’s approval to go beyond 38, the maximum rate set after the Alaska Airlines 737-9 door-plug blowout in January 2024 kick-started a company-wide safety and quality revamp. “I expect to be going to the FAA soon to start . . . discussions on the rate increases,” Ortberg said.

The 787 widebody program is following a similar trajectory. Monthly output recently stepped up to seven of the twin-aisles from five, and Boeing has laid the groundwork to increase production to its previous high of 14 jets per month or more.

Ortberg nonetheless insists that every rate increase will be methodical, in part to ensure stability in the supply chain but also to secure customer confidence. This disciplined approach is occurring in the company’s defense and space division, too. Boeing this year won the landmark contract to build the F-47 combat aircraft for the U.S. Air Force, and BDS finances appear to be stabilizing.

The finalized April-June results show that Boeing has avoided a second sequential quarter of charges against some of its troubled programs. Ortberg reiterated that the company will no longer sign contracts with challenging conditions—firm, fixed-price development—that caused trouble on the loss-making KC-46 tanker, T-7A trainer and MQ-25 refueling drone. Both the F-47 and another win, the Evolved Strategic Satcom program, are cost-plus development with less risk.

But Boeing is making progress with the most problematic of its BDS programs also, Ortberg said. For instance, Boeing has advanced the MQ-25 closer to first flight for the U.S. Navy. The program has started ground tests and moved production to a new facility. Boeing also has achieved five milestones as part of an agreement with the Air Force on adjusting the T-7A plan. In addition, the company received a morale boost when the Air Force said it would pursue a sole-source award for the next program of tankers.

Company management expressed confidence that the defense business can reach the target of high-single-digit earnings margins. BDS delivered a 1.7% operating margin in the second quarter, up from a negative 15.2% in the prior-year period.

The latest quarter also was the second consecutive period with positive pretax earnings for BDS, JP Morgan analysts Seth M. Seifman, Rocco Barbero and Alexander Ladd noted. “There is still a lot of work to do under Steve Parker, who recently took over the segment on a permanent basis after being named interim leader last year, but we are seeing early progress,” they said.

Mikus of Melius said that looking back, Boeing’s recent pivot has been phenomenal considering the litany of challenges facing it and Ortberg. “In that vein, the turnaround at Boeing has been nothing short of remarkable,” Mikus said.

MARIAN LOCKHART/BOEING

“In an organization of 170,000 people, culture changes aren’t easy, and they don’t happen overnight,” Mikus continued. “However, we believe Boeing is heading in the right direction and that progress is showing up in the quarterly results.”

Indeed, the latest quarterly results beat consensus forecasts on Wall Street, and analysts already had heightened expectations. Boeing reported a core loss per share of \$1.24 compared with a consensus vision of \$1.40. Revenue in the second quarter of 2025 was up 35% year over year, to \$22.7 billion, and \$500 million above expectations. Better yet, cash burn of \$200 million in the latest quarter paled in comparison with forecasts of around \$1.6 billion. Stripping out other costs and looking at only operations, the second-quarter 2025 performance also included the first positive operating cash flow report since 2023,

As if to punctuate for effect, Ortberg told analysts that he sees no reason why Boeing cannot hit the November 2022 prediction of then-CEO David Calhoun that the company would generate \$10 billion in free cash flow a year—although Calhoun promised as much by 2027 while Ortberg explicitly declined to forecast a date.

Therein lies the rub—the OEM must still overcome substantial hurdles to reach the \$10 billion mark, which is critical to Boeing's long-term viability, since it must pay down \$30 billion of accumulated net debt. Boeing shares closed down more than 4% in regular trading on July 29. While it is hard to ascertain stock traders' motivations, comment-

that subsequent rate increases will occur in increments of five no sooner than every six months. In a best-case scenario that sees Boeing transition to 42 by year-end, it would move to 47 in mid-2026 and then 52 sometime around late 2026 or early 2027.

While possible, such a path is far from assured, as Boeing managers know. "As we go to the new rate, [we will] ensure we're stable and can prove that the production system has the right metrics before we go request an increase in rate," Ortberg said. "And if they aren't, then we'll stay at that rate until we get the stability to where we want it."

Meanwhile, BDS union workers in

billions of dollars to fix the smaller parts of Spirit that it is buying as part of the carve-up, leaving Boeing's ultimate integration costs uncertain.

To be sure, Ortberg has not been without criticism in his first year as Boeing CEO. During the Seattle strike, several industry observers wondered aloud why Ortberg was not more prominent in trying to resolve the situation sooner. A few openly questioned whether he was fully informed or had complete control of Boeing's bureaucracy.

Ortberg also has been questioned about the rate of change in Boeing management and about making then-BDS chief Ted Colbert his first apparent ouster last September. By contrast, top BCA leadership was left untouched, although Ortberg later removed corporate chief operating officer duties from BCA head Stephanie Pope to let her focus on the commercial division. He also announced a 10% reduction in force (RIF) last year and was criticized for risking the loss of necessary expertise and institutional knowledge.

Certainly, Ortberg has since made more management changes, including recruiting well-regarded veteran finance leader Jesus "Jay" Malave to become Boeing chief financial officer starting Aug. 15. Boeing could also face future RIFs regardless, especially as it integrates the majority of Spirit.

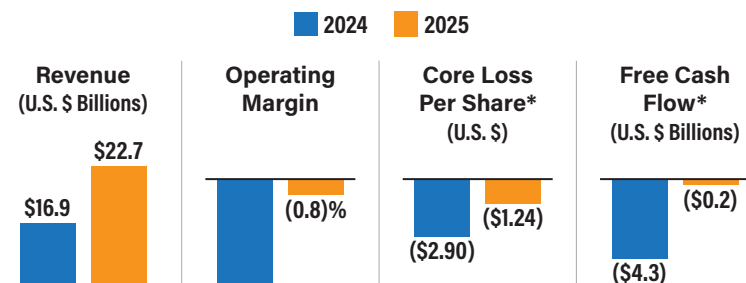
Ortberg is the first to admit he and Boeing have much more to do. When an analyst asked him on July 29 to reflect on his first year as Boeing CEO, Ortberg exuded the same Midwestern evenness that had helped establish him as a reputable leader last decade (*AW&ST* Aug. 12-Sept. 1, 2014, p. 14).

"As you know, I spent a lot of my career working very closely with Boeing," Ortberg responded, alluding to his days running erstwhile Rockwell Collins. "So not a lot of surprises with what we're dealing with. It's just one day at a time. Improve our performance; address the issues that we have; restore trust and build confidence with our customer base and our end-users of our products. And I think you're seeing that." ☞

—With Brian Everstine in Washington

Check 6 *Melius Research analyst Scott Mikus and Aviation Week editors discuss Ortberg's performance as Boeing CEO: [AviationWeek.com/Check6](https://aviationweek.com/Check6)*

Boeing Second-Quarter Financial Results Compared



*Non-GAAP measure.

Source: Boeing

ers on Yahoo Finance and Reddit cited a bevy of reasons, beginning with the now-confirmed delay of 737-7 and -10 FAA certifications into 2026.

A recent uptick in flight-test activity through June indicated that Boeing was closing in on a preferred configuration to address the long-running redesign of the 737-7/10 engine anti-ice system and associated nacelle inlet structure, but Ortberg acknowledged, "we just haven't closed the design."

Some investors might have been disappointed that Boeing's 737 ramp-up is not as aggressive, analysts also noted. Ortberg has been adamant that stability means multiple months of green key performance indicators (KPI). One of the metrics—rework during final assembly—still is "below the threshold," he said. "So we're working that down, and once we get that KPI where we need it, then we'll be having those discussions with the FAA."

After reaching the rate of 42 aircraft per month, Ortberg reiterated

Missouri and Illinois went on strike on Aug. 4 after rejecting a proposed four-year labor agreement, a reminder of the trouble Boeing had with its Puget Sound workforce last fall. The labor action involved approximately 3,200 workers, a fraction of the BCA workers who walked off the job near Seattle. The strike affects facilities that build Boeing's F-15EX and F/A-18 fighters as well as missiles, defense systems and the new MQ-25 Stingray. It also comes as Boeing looks to begin work on its new sixth-generation F-47 jet for the U.S. Air Force.

Another watchpoint is closing the acquisition of Wichita-based Spirit AeroSystems and then integrating the world's largest aerostructures provider into Boeing. The deal, worth more than \$8 billion up front before integration costs, was initially projected to close by midyear but now will not be consummated until the third quarter of 2025, at the earliest. Rival Airbus has suggested it could spend

Defense Market Analyzer

Easily Navigate the Global
Defense Landscape.

Access data covering
the key political,
economic, budgetary,
and strategic trends
driving defense
markets to identify new
opportunities.



International
Procurement Data



Detailed Spending
Projections



In-Depth Analysis by
Country



Learn More:

aviationweek.com/

DefenseMarketAnalyzer

or call Melissa Crum at +1 913 284-2951

melissa.crum@aviationweek.com

EU-U.S. Tariffs Deal Reveals Aerospace Trade Future Outlines . . .

- > IT IS NOT CLEAR IF THE AGREEMENT WILL COVER ROTORCRAFT
- > INDUSTRY PLAYERS AWAIT OUTCOME OF OTHER TRADE TALKS

Helen Massy-Beresford Paris and **Robert Wall** London

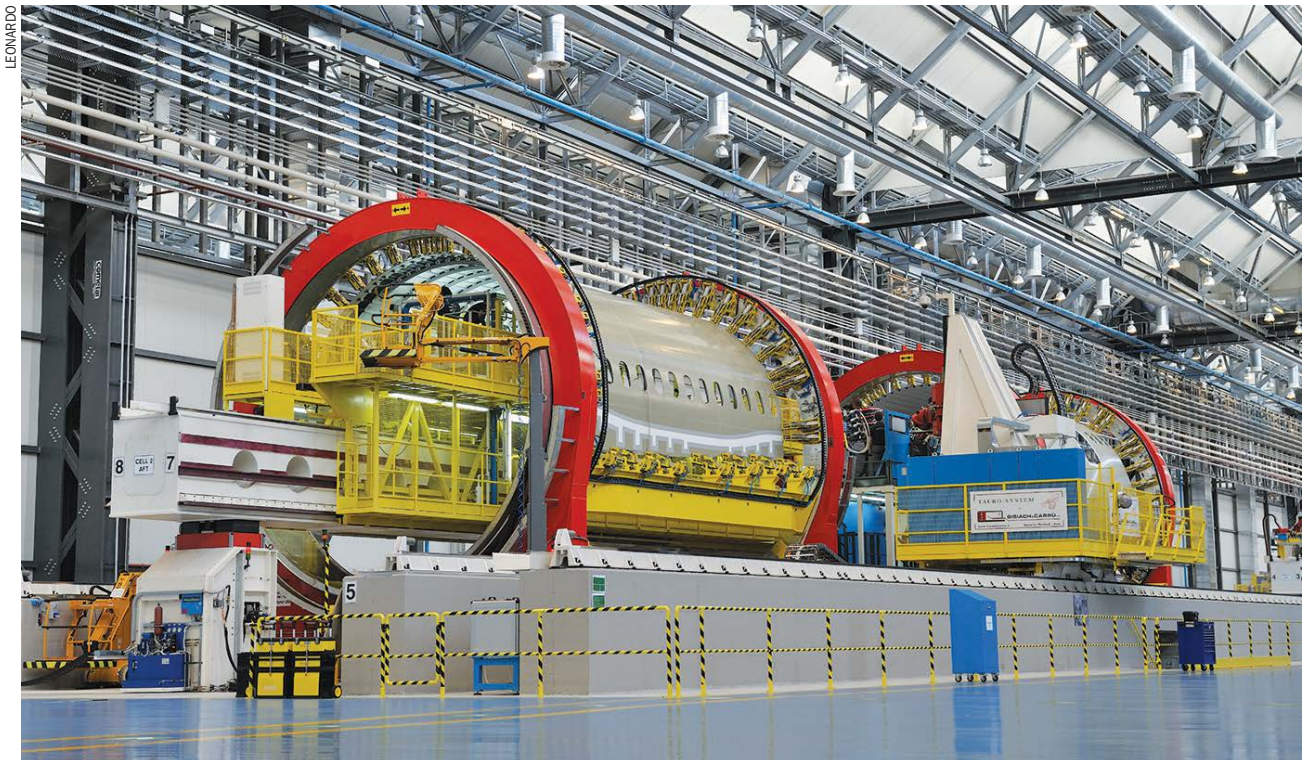
The biggest cloud hanging over the aerospace industry is breaking up with trade deals emerging that could leave companies largely tariff-free. But after months of trade turmoil, industry officials want to see finalized terms before they can breathe easier.

input costs, softening demand and other disruptions.

The latest deal, reached July 27 following talks between European Commission President Ursula von der Leyen and U.S. President Donald Trump in Scotland, sets a tariff rate for most EU exports of 15%. For air-

manage through this dynamic environment,” Boeing CEO Kelly Ortberg said on the company’s second-quarter earnings call, signaling not all potential areas of disruption are out of Boeing imports 787 parts from Europe, with Leonardo as a big supplier, and imports other parts from Mexico. China this year temporarily suspended importing Boeing airliners because of trade tensions with Washington. On the earnings call, Ortberg still expressed concern about retaliatory tariffs with China and talks with Canada and Mexico.

Leonardo CEO Roberto Cingolani noted on the company’s quarterly earnings call some uncertainty about



Under the U.S.-EU trade deal, Boeing would dodge tariffs on importing 787 sections made by Leonardo in Italy.

The U.S. and European Union agreed to return to zero tariffs on aircraft and components as part of a broader preliminary trade deal. Japan and the UK struck similar deals, and a White House executive order to place high levies on Brazilian goods excludes civil aircraft and related items. The U.S. and China also have restarted their contentious trade talks.

The handshake agreements reached so far could end almost six months of anxiety for airframers and suppliers around the globe about higher

craft and components, this marks a return to zero tariffs.

The deal follows months of uncertainty and tense negotiations aimed at averting a trade war. The Trump administration had threatened 30% tariffs on EU goods, before agreeing to the 15% level. The deal “creates certainty in uncertain times,” von der Leyen said.

Von der Leyen listed several strategic products to come under the so-called zero-for-zero tariff umbrella.

“We’re probably feeling better today, but we still need to actively

the tariff details. Despite talk about a zero-for-zero tariff environment in aviation, it is not clear if that will cover rotorcraft. Leonardo produces some helicopters in the U.S. “We still don’t know,” he said, with about \$10-20 million at stake.

“This is obviously a welcome development for our industry,” Airbus CEO Guillaume Faury said, adding that “we remain very cautious.” Details of the agreements still need to be finalized and then implemented with pace, he said. But while deals such as that between Washington and Brus-

sels—and a similar arrangement with London—are positive, Faury echoed his Boeing counterpart in noting that other trade relations remain an issue. Airbus, which makes some aircraft in the U.S., draws on supplier input from Mexico.

There are other reasons for caution, too. Many European Union member states are unhappy with the deal von der Leyen struck. “It is a dark day when an alliance of free peoples, gathered to affirm their values and defend their interests, resolves to submit,” French Prime Minister François Bayrou wrote on social media.

Lobbying group Airlines for Europe also noted that the wider implications of the deal are worrying. “We believe that the 15% tariffs that remain in place for other sectors will weaken international trade and damage competitiveness on both sides of the Atlantic,” the organization said, while welcoming the aerospace-specific elements of the proposed arrangement.

Embraer stated that even though it will escape the sharp tariffs Washing-

ton plans for Brazil, it still faces baseline 10% levies on imports to the U.S. under the April 2 announcement. “We continue to believe in, and advocate firmly for, a return to the zero-tariff rule for the global aerospace industry,” the company said in a statement.

In announcing the deal with the EU, Trump said the European side also agreed to buy “a vast amount” of defense equipment on the order of “hundreds of billions.”

That assertion seems hard to believe, argues Byron Callan, defense analyst at Capital Alpha Partners. A rough calculation of military expenditures by EU member states in NATO suggested those countries may spend about \$175 billion on U.S. hardware through the rest of the decade. Much of that money would likely have flown even before the trade deal.

There are likely going to be some quick benefits for U.S. companies from the announced framework if it is enacted. General Dynamics, for instance, should see a 2% margin boost this year alone on the Gulfstream G700 and

G800 business jet programs, Jefferies analysts say, because the deal removes tariffs on the Rolls-Royce Pearl 700 engines made in Germany.

If the agreement falls through, companies would be better prepared to minimize the effect of higher costs after spending recent months scrambling to determine how to operate in a tariffed environment. Before the EU agreement was announced, GE Aerospace managers exuded confidence that they could overcome a roughly \$500 million hit this year from the tariffs announced in April, but now they do not have to do so.

Safran CEO Olivier Andriès on July 31 said the trade deal was “a positive step for the industry,” but he added that the company would continue to work on mitigation actions to handle any potential fallout from tariffs.

Both Safran and Rolls-Royce, which upgraded their full-year guidance in their July 31 earnings reports, said they are holding off on adjusting mid-term targets, in part reflecting uncertainty about tariffs. ☼

... But Relief Over the Deal Is Mixed With Economic Caution

- INVESTORS DO NOT HAVE A FAVORABLE VIEW OF THE AGREEMENT
- BROADER TARIFF AGREEMENTS COULD HARM ECONOMIES AND HIT TRAVEL DEMAND

Helen Massy-Beresford Paris, **Christine Boynton** Boston and **Sean Broderick** Washington

Airlines are relieved that the U.S. and the European Union have agreed to zero levies on aircraft amid a tariff compromise, but the potential global macroeconomic effects of the new trade reality mapped out in broader deals could harm travel demand in the longer term.

The agreement, reached July 27 following talks between European Commission President Ursula von der Leyen and U.S. President Donald Trump in Scotland, sets a single tariff rate of 15% for most EU exports.

For aircraft and components, the deal marks a return to zero-for-zero tariffs. However, while that 15% is better than the 30% the U.S. administration had threatened, it is likely to have

a considerable effect on trade—when it eventually comes into force.

The agreement is not yet finalized, and the European Commission has said it will delay countermeasures for six months while the details are ironed out.

Greater certainty is a good thing, but the longer-term implications are not yet fully clear. In an Aug. 4 research note, economists at consultancy Oxford Economics noted a decline in the August Sentix index, a monthly survey of more than 4,000 private and institutional financial market investors on their assessment of the current economic situation and their expectations over the next six months.

“Today’s August Sentix index... provides a first indication that investors do not perceive the new EU-U.S. trade deal as favorable,” Oxford wrote. “The reduction in uncertainty for the Eurozone from the trade deal and the stronger-than-expected second-quarter GDP outturn were not enough to contain the decline in investor sentiment.”

The U.S. also recently reached a deal with Japan involving 15% tariffs, and it carved out an exemption for aircraft and parts, sparing Embraer from the 50% tariff imposed on many exports from Brazil. Talks between the U.S. and China are ongoing ahead of an Aug. 12 deadline.

On recent earnings calls, the Big Three U.S. airlines all voiced hopes that progress on trade negotiations would support continued improvement in demand. Their comments came on the heels of a difficult first half of the year during which economic uncertainty weighed on consumer confidence.

“In terms of the drivers of the reduction in uncertainty, I think that comes from more stability,” American Airlines CEO Robert Isom said on July 24, before the U.S. and the

EU announced their high-profile deal. “I think it comes from tariff deals being done with the UK, recently announced Japan, hopefully something with the EU soon. So all of that bodes well for the consumer.”

The carrier has since commended the trade deal, hopeful that the precedent will be followed in future bilateral agreements. “This agreement with the EU, alongside the U.S.-UK agreement, shows the administration rightfully understand the importance of zero tariffs in aviation,” American said in a statement.

United Airlines CEO Scott Kirby told investors in mid-July that tariffs were not yet certain, but he believed most businesses had a better read on how they could manage in a “narrow array of outcomes” and that the level of uncertainty had declined. “And encouragingly, that higher level of certainty has translated into a meaningful inflection point in demand,” Kirby said on July 17. “As uncertainty has declined, we’ve seen an improvement in booked revenue, including a double-digit acceleration in business demand.”

Delta Air Lines CEO Ed Bastian also expected a deal to have a positive effect. “With continued progress on trade negotiations, we expect both consumer and corporate confidence to improve in the second half of the year, creating the environment for travel demand to accelerate,” he said on July 10.



Lufthansa says demand is still strong on U.S.-Europe routes.

“The fundamentals of the U.S. economy are solid,” he told investors and analysts. “Our core consumer is in good shape and continues to prioritize travel.”

While airline executives carefully monitor consumer spending trends, aftermarket service providers are keeping a similar eye on their customers. So far, there is hardly any evidence of tariffs prompting change.

Parts manufacturers and distributors reported little to no extra purchasing to protect against potential tariffs on spares.

“We did not see significant activity that would indicate any kind of stocking up for distribution,” AAR President and CEO John Holmes said on a mid-July earnings call.

Even more encouraging, aftermarket spending remains strong, indicating business as usual despite global economic uncertainty. AAR’s heavy maintenance hangars are full, and capacity being added at the company’s Miami and Oklahoma City facilities is spoken for.

RTX, parent company of Pratt & Whitney and Collins Aerospace, recognizes a similar pattern. “We haven’t seen it at this stage bleed through into

demand,” RTX CEO Chris Calio said on a late-July earnings call. “We’ve seen increased shop visits in the [Pratt] platforms. . . . If you look at Collins . . . [there are] some very strong demand on mods and upgrades.”

As the International Air Transport Association (IATA) published global air cargo figures for June, including a 0.8% year-over-year increase in demand, it highlighted the close relationship between international trade developments and flows of goods.

“There are very differing stories behind that number for the industry’s major players,” IATA Director General Willie Walsh said. “Trade tensions saw North American traffic fall by 8.3% and European growth stagnate at 0.8%. But Asia-Pacific bucked the trend to report a 9.0% expansion.”

“The June air cargo data made it very clear that stability and predictability are essential supports for trade,” Walsh added. “Emerging clarity on U.S. tariffs allows businesses greater confidence in planning. But we cannot overlook the fact that the ‘deals’ being struck are resulting in significantly higher tariffs on goods imported into the U.S. than we had just a few months ago. The economic damage of these cost barriers to trade remains to be seen.”

In Europe, the deal has been welcomed—but with reservations. “The exclusion of aircraft and spare parts from the tariff regime is a positive outcome, as it will help protect jobs, safeguard connectivity and support shared climate goals while providing long-term certainty for one of the world’s most integrated industrial partnerships,” lobby group Airlines for Europe said. “At the same time, we believe that the 15% tariffs that remain in place for other sectors will weaken international trade and damage competitiveness on both sides of the Atlantic.”

Europe’s three major legacy airline groups all

U.S. carriers are upbeat about demand for the rest of the year.



sounded a similar note of industry-specific relief about the aircraft and components exemption. In the weeks leading up to the deal, they pointed to slight dips in transatlantic demand that highlight those routes' sensitivity to macroeconomic developments that fuel greater uncertainty.

Lufthansa CEO Carsten Spohr said July 31 that load factors were strong and revenues stable, driven by premium sales with strong bookings in the U.S.-to-Europe market but more restrained bookings from Germany to the U.S.

International Airlines Group (IAG), parent company of Aer Lingus, British Airways, Iberia, Level and Vueling, published its first-half results Aug. 1. IAG predicted that robust demand would continue in the second half of the year and noted strong North and South Atlantic routes.

IAG Chief Financial and Sustainability Officer Nicholas Cadbury men-

tioned some weakness in U.S.-originating economy-class traffic, particularly in the leisure sector, but said that this had been offset by continued strong performance in premium cabins.

Air France-KLM CEO Ben Smith welcomed the U.S.-EU deal. "What was really important for us was that

so we're pleased that aerospace seems to be exempted."

The group has seen signs of slowing demand on routes to and from the U.S., Chief Financial Officer Steven Zaat said. He added that the effects have been stronger than what was seen a



European airlines are closely watching transatlantic activity.

aircraft, engines and aerospace [were] not impacted, and that seems to be the case," Smith said on a July 31 webcast as the company presented first-half financial results. "We still do have a few airplanes on order, yet to be delivered by Boeing, and that could have put additional cost on those airplanes [if tariffs were] applicable, . . .

year ago, noting that the same time frame in 2024 was affected by the Olympic and Paralympic Games in Paris.

"On the U.S., I think we had a very strong second quarter," Zaat said "I think there were a lot of bookings already in before the U.S. discussions fully started. We see a little bit of weakening over there. If you look at our long-haul network in the first 25 days of July, the rest of the long-haul is keeping stronger than the U.S. part." 📺

AVIATION WEEK

AeroEngines

EUROPE

September 9-10, 2025
CCH Congress Center, Hamburg, Germany

Hear from industry executives:

Olivier Boina
VP Engine Fleet Engineering
Air France

Georg Fanta
VP Commercial Engines
Lufthansa Technik

Jeremy Goossens
Managing Director, Engines Parts
Revima

Barak Hendelman
Director, Procurement and Logistics
IAI Bedek Aero

Mehmet Nane
Vice-Chairperson of the Board & Managing Director
Pegasus Airlines

John Savvides
CEO
UAMCO

Derrick Siebert
VP Engine Services Operations
Lufthansa Technik

Manoj Singh
Chief Customer Service Officer
Ramco Systems

Connecting the leaders of the aero engine industry

MORE INFORMATION AND REGISTRATION: [AEROENGINECONFERENCE.COM](https://aeroengineconference.com)

HOST SPONSOR



PREMIUM SPONSORS



SPONSORS



PURPOSEFUL PARTNERSHIPS



aeroengineconference.com

AVIATION WEEK
NETWORK

Uncertainty Lifts for U.S. Carriers

- > THE MAJOR U.S. AIRLINES VOICE OPTIMISM FOR 2025 SECOND HALF
- > ECONOMIC INSTABILITY COMPLICATED THE FIRST HALF OF 2025 AND PRESSURED MAIN CABIN DEMAND

Christine Boynton Boston and **Lori Ranson** Washington

After a choppy start this year due to unpredictable fluctuations in U.S. trade policy, the general consensus among the country's airlines seems to be that demand has stabilized, albeit at lower levels than originally anticipated.

Although booking curves remain shorter than usual, Delta Air Lines

Many airlines, including Delta, have cited a favorable capacity backdrop as carriers strive to align supply with demand. For the period spanning May to September, "it appears as though the industry has taken four points of capacity out, and by the time we hit September, domestic seats are actually down close to 1%," Hauenstein said.

The carrier's first quarter was challenged by operations at New Jersey's Newark Liberty International Airport, where a combination of air traffic control technology outages, runway construction and FAA staffing shortages resulted in widespread cancellations and delays. Its booking volumes at the New York-area hub returned to normalized levels in July.

United noted a sequential six-point acceleration in overall demand beginning in early July. With three weeks' worth of data in hand, the airline also observed double-digit growth in business demand compared with the second quarter.

"As uncertainty has declined, we've seen an improvement in booked revenue," Kirby said. "Supply has adjusted once again, just like it did last year. Demand feels to us like it is inflected upward and is returning toward the normal trend line we expected at the start of the year."

Alaska Air Group is also seeing positive supply trends in its markets. Chief Financial Officer Shane Tackett noted during the airline's second-quarter earnings call that the "[third quarter] in our markets looks better than last year, and I think [the fourth quarter] could be improved."

Alaska Chief Commercial Officer Andrew Harrison said that demand has stabilized "following the abrupt pullback we experienced earlier this year." Since late June, the company's "traffic, yield and total revenue intakes have moved from negative to positive," he added.



Delta hopes domestic revenue will "inflate back to positive" in the second half of the year, and United's CEO is confident of a strong finish to 2025.

leaders see signs of elongations. President Glen Hauenstein said during a July earnings call that he hopes domestic revenue will "inflate back to positive" and that "all forward booking trends indicate that it is moving in the right direction."

At some point during the fall season, he said, "I would believe that we would inflect back into positive."

Delta's main-cabin ticket revenue fell 5% in the second quarter, while premium revenue grew 5%. JP Morgan analyst Jamie Baker states in a research report dated July 10 that it was the highest quarterly spread for premium revenue growth post-COVID-19. He calls it "an ominous read-through to domestic-leisure carriers this earnings season."

"I've never really seen that amount of capacity come out in a nonrecessionary environment." He cautioned that more adjustments likely need to occur between October and December.

United Airlines, meanwhile, described the world going into the year's second half as "less uncertain today than it was during the first six months of 2025." Reporting better-than-expected summer-quarter results, CEO Scott Kirby expressed confidence for a strong finish to the year.

"From a supply perspective, it's déjà vu all over again," Kirby said during a July 17 earnings call. He said United has "almost the exact same setup that we had a year ago at this time," when summer domestic oversupply led to capacity moderation in the fall.

"THE WORST IS BEHIND US"

After describing a tough start to July, American Airlines projected year-over-year revenue to improve each month during the third quarter and says it is well positioned to gain some ground against competitors.

"We believe the worst is behind us," Chief Financial Officer Devon May said. The carrier is "proud to be forecasting a profit in a year [when] we have faced the challenges of a tragic accident, significant and continued [air traffic control] delays, unprecedented weather, the full financial cost of new collective bargaining agreements and a material drop in demand in the domestic market where we produce over 70% of our revenue," he added.

Although margins at American continue to lag those of its largest rivals,

JOE PRESERVATION/NET PHOTOS

the carrier is confident it can close that gap and sees no structural impediments to that. “At the end of last year, we had a two-point [earnings before interest, taxes, depreciation, amortization and restructuring (Ebitdar)] margin gap to United; inclusive of Delta’s third-party business, we had about a two-point Ebitdar margin gap to them as well,” May said during a July 24 earnings call. “We do expect to close it heading into 2026.”

American says investments in premium products will help move the needle. It unveiled a new premium-heavy layout for Boeing 787-9s in May—its first significant long-haul cabin update in more than a decade. By 2030, other planned investments and adjustments will give American the ability to serve almost 50% more premium customers, CEO Robert Isom said.

“If you take a look at our results today, the primary differentiator between us and some of our competitors is largely two things,” Isom said. “One, we’re paying our team members at market wages [while] others are benefiting from not doing that. I’m sure that will catch up over the long run. The second thing is, we do have a network that we’re proud to say is more oriented to the domestic network.” Anticipating improvements, “we think that’s going to be a tailwind for us,” he added.

For its part, Alaska is taking major steps to broaden its network reach as its merger integration with Hawaiian Airlines continues. New service from Seattle to Tokyo’s Narita International Airport operated by Hawaiian with Airbus A330s debuted in May, and by June it had “achieved a load factor of greater than 80%, and stage-length-adjusted [revenue per available seat mile] was 18% higher than our discontinued Honolulu-Narita service for the same period last year,” Harrison said.

After inheriting Hawaiian’s 787-9s, Alaska announced during the second quarter that it was adding five aircraft to that subfleet and creating a 787-9 widebody base at its hub in Seattle, which is transforming into a global gateway for the company.

Alaska marked a milestone in the second quarter as Hawaiian recorded its first profitable quarter since 2019. Alaska CEO Ben Minicucci underscored Hawaiian’s achievement of profitability and “the power of connecting these two networks.” The re-

positioning of some Hawaiian wide-body aircraft maximized the assets in a way that improves the bottom line, he said. “We have [Airbus A]330s flying to Anchorage,” Minicucci noted. “We repositioned more [A]330s flowing from Seattle to Hawaii.”

IN TRANSITION

Southwest Airlines is working through its own transformation, making significant changes to its brand and traditional playbook in pursuit of new customers and improved profits. Revenue from new checked bag fees has so far surpassed its expectations.

“At this early stage, we’re already trending at the higher end of the bag-revenue-per-passenger rate of our

proximately 25% of its fleet is now modified with the extra-legroom seating. Southwest has realized approximately one-third of its \$1.8 billion initiative earnings target for 2025 in the first six months of the year. It expects to achieve the remaining two-thirds before year-end and continues to target a \$4.3 billion earnings contribution from its initiatives in 2026.

At the same time, citing the “precipitous decline in the macro environment that is being felt by the industry,” Southwest lowered its full-year EBIT expectations to \$600-800 million from previous guidance of \$1.7 billion.

TD Cowen analysts said Southwest’s wording around its EBIT initiatives is “concerning.” “Southwest claims it cap-



American is betting on premium products to close margin gaps with peers. Alaska cites positive results from repositioning Hawaiian widebodies.

larger peers, which is in excess of our estimates,” Southwest Chief Operating Officer Andrew Watterson said. The new fees represented a major shift from Southwest’s longtime hallmark policy of “bags fly free.” CEO Bob Jordan attributed a “temporary decline in bookings, primarily in Basic Economy,” after launch to “more about how we were selling it.”

Refinements to the booking flow and product descriptions have since returned them to expected levels, the carrier said. It estimates the bag fees will result in more than \$350 million of earnings before interest and taxes (EBIT) for the full year 2025.

Other deviations from its traditional playbook include assigned and premium seating, offerings planned to become available at the end of July for flights beginning in late January. Ap-

tured one-third of its \$1.8 billion in [the first half of 2025], a period in which the airline only generated \$117 million in EBIT,” analyst Tom Fitzgerald writes. “This implies the core business lost [approximately] \$483 million in [the first half of the year].”

The company told investors that an improving demand environment, moderated capacity and the continued ramp of initiatives would provide a constructive backdrop for the rest of 2025. Moving into the third quarter, bookings are showing signs of improvement, Southwest said.

“What feels really different overall is that it was just tough to get volume,” Jordan said of the last several months. Pointing to recent weeks, “we’re starting to see the volume return,” he said. “I think that’s a strong sign that it’s a broad-based recovery.”

FAA Extension for Flight Deck Barrier Rule Juggles Mixed Input

➤ SECONDARY BARRIERS ARE INTENDED TO SAFEGUARD FLIGHT DECK

➤ AIRLINES REQUESTED MORE TIME TO COMPLY, BUT PILOT AND FLIGHT ATTENDANT UNIONS PUSHED BACK

Christine Boynton Boston

The FAA has granted airlines a one-year exemption to install and use additional flight deck barriers on new commercial aircraft, citing the need for more time for certification and training.

Installed Physical Secondary Barriers (IPSB) were mandated by the FAA Reauthorization Act of 2018. The agency adopted the Secondary Barriers Final Rule in June 2023 (*Inside MRO* July 2023, p. MRO5), which was set to require U.S. carriers to install the barriers on all newly manufactured aircraft delivered after Aug. 25, 2025.

Roughly three months before that deadline, trade association Airlines for America (A4A) raised a cautionary flag: The IPSB had yet to receive FAA certification. “No manuals or procedures have been released, and no training recommendation for flight deck and cabin crew members (flight crew) has been submitted for review,” it wrote in a May 5 petition seeking relief for its members. While it expected FAA certification in June or July, A4A said the impending deadline created “an impossible timeline” for operators to complete the necessary training for IPSB.

Acknowledging the required training timelines, the FAA agreed that it was “not feasible for A4A member airlines to provide flight and cabin crews with initial IPSB training” by the approaching deadline. Aircraft manufacturers were still “in the process of certifying secondary barriers to amend their respective [type certificates]” and “in different stages of certification,” the agency said in its July 17 exemption notice. Once the barriers are certified, carriers need to develop, obtain FAA approval of and provide training to flight crews, the FAA explained.

“This one-year time frame will be sufficient to address the current lack of IPSB certification, the expected availability of [type certificate] holders’ reference materials for development and approval of air carrier train-

ing and the training of flight crews,” the FAA determined.

Several unions pushed back against a delay, asserting that carriers had ample time to prepare. The Association of Flight Attendants-CWA (AFA) and the Association of Professional Flight Attendants were among those to contest A4A’s petition, stating that flight attendant training could be accomplished prior to departure on an

ply with the regulation,” A4A said.

In reaction to the FAA’s decision, the Air Line Pilots Association (ALPA) expressed disappointment.

“The FAA’s decision to grant airlines yet another delay on the secondary barrier rule is deeply disappointing and undermines our nation’s aviation security,” ALPA President Jason Ambrosi said. “This pattern of endless delays must stop. Airlines have had ample time—two full years—to comply with this congressionally mandated safety requirement.”

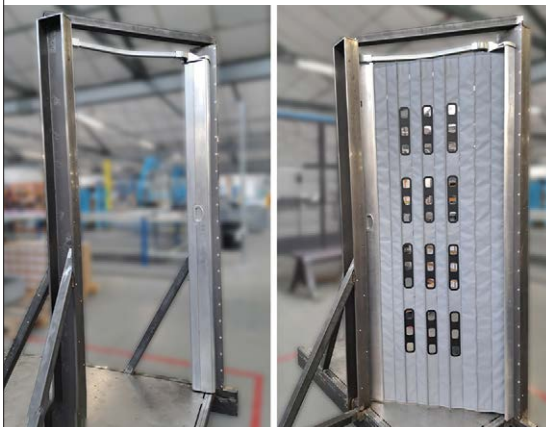
As mandated under the final rule, Part 121 operators will be required to close and lock installed IPSB whenever the flight deck door is temporarily open while in flight—including during lavatory breaks, meal service or crew changes. The additional barriers are intended to slow a would-be disruptor long enough to close an

open flight deck door before it can be breached. In the meantime, airlines will continue to use improvised noninstalled secondary barrier (INSB) methods, which utilize crew and/or galley carts to monitor and block the area in front of the flight deck during a door transition.

IPSB have been developed by suppliers including Schroth Safety Products and AmSafe Bridport. Airbus chose Schroth’s IPSB for the A320, A330 and A350, and it selected AmSafe to supply secondary barriers for all newly man-

ufactured A220s. AmSafe says it has completed a range of tests including flammability, structural loading, cyclic and functional assessments as well as environmental exposure trials, abuse loading and inertia testing.

“We are working with the FAA and Transport Canada Civil Aviation to finalize additional certification requirements and support upcoming deliveries for the Airbus A220,” a company spokesperson said. “These deliveries will comply with the new FAA regulation 14 CFR 25.795(a)(4) and will be certified by [Transport Canada Civil Aviation] authorities. Additionally, we are engaging directly with airlines that will soon receive the new product to assist with their upcoming crew training programs.”



AmSafe’s IPSB can be stowed when not in use (left) and features a locking mechanism with a minimum 5-sec. delay.

IPSB-equipped aircraft as a “manageable” number of such aircraft joined airline fleets. The AFA estimated that an average of 29 new IPSB-equipped aircraft per month—spread across eight U.S. airlines—might be delivered between Aug. 25 and Feb. 28, 2027.

The FAA’s exemption was a compromise of sorts, as A4A had sought a two-year exemption to comply with the rule. The association counts the four largest U.S. airlines among its members. Its request “was simply a reflection of the practical fact that there is a current lack of FAA certification of secondary barriers, which has resulted in a circumstance that temporarily prevents airlines from developing the required FAA-approved regulatory requirements to com-

AVIATION WEEK
MRO
EUROPE

October 14-16, 2025
London, UK • #MROE



LONDON CALLING

Join the aviation aftermarket for 3 days of unbeatable networking in London

500+
Exhibitors

10,000+
Attendees

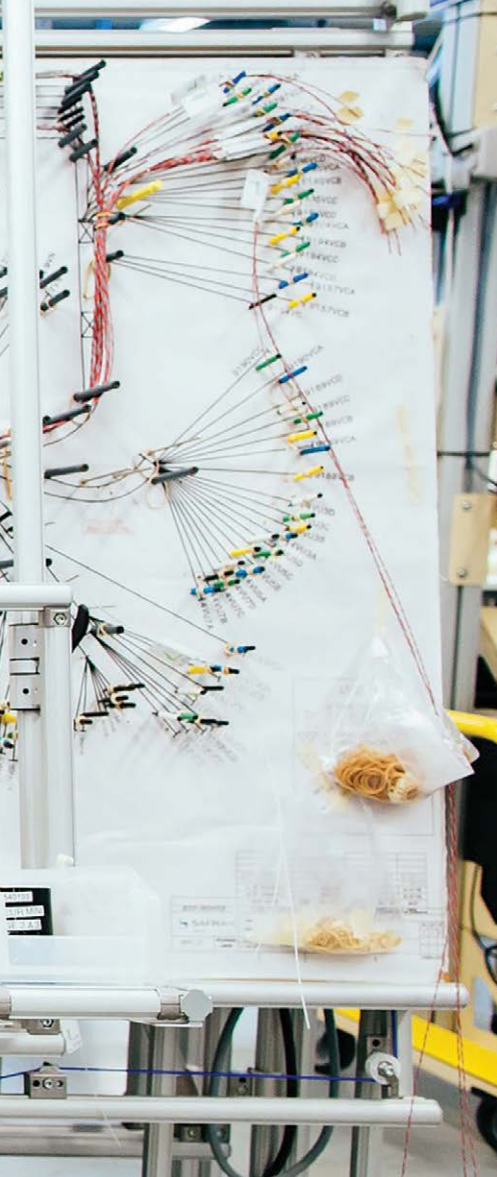
3 days
of Content



REGISTRATION NOW OPEN!

Scan the QR code or visit mroeurope.aviationweek.com

AVIATION WEEK
NETWORK 



CYRIL ABAD/CAPA PICTURES/SAFRAN

of electrical wiring interconnection systems (EWIS)—such as GKN Aerospace, Latecoere and Safran—will have to design innovative and more reliable equipment that can transmit more power and data.

Meanwhile, those companies have to plan for higher production rates and change the largely manual nature of EWIS manufacturing. Airbus is planning to produce its next-generation single-aisle, which may replace the A320 starting in 2037-38, at a rate of 80-100 per month.

Higher voltages in power transmission that will enable the change create their own challenges, says Jérôme Martin, technical and innovation director for Safran Electrical & Power's Interconnection Systems Eurasia division. "The point of high voltage is to increase power without increasing intensity, and therefore without enlarging the section of conductive wire," he explains. "Higher

voltages will enable us to offer more innovation and product features."

A standard for high voltage has yet to emerge, but players seem to be converging toward 800 volts. However, some are expecting even more demanding specifications. Do iT Platinum, a five-year-old company in Toulouse, specializes in EWIS design, engineering, harness manufacturing and installation support on final assembly lines. "With the electrification of aircraft systems, EWIS will have to support voltages growing gradually to 1,000 volts," CEO Fabien Terrassoux says. "That will involve an evolution in the materials we use."

EWIS manufacturing has been manual so far to enable precision and customization.

Do iT Platinum has supported hybrid-electric and electric aircraft developers Ascendace and Heart Aerospace in the design of their high-voltage electric systems and has manufactured harnesses for their prototypes and testbeds.

Suppliers would like a clearer view of future voltage standards. "We depend on the definition of standards for higher-voltage components," says Enrique Alatorre, GKN's senior vice president of EWIS. "Those standards will drive EWIS design and the associated value stream."

EcoPulse, a joint research and technology program by Airbus, Daher and Safran, has flight-tested distributed hybrid-electric propulsion on a modified TBM 900 business turboprop. Safran supplied all the high-voltage harnesses—the cables and their protective layers—and the program provided a considerably better understanding of the technology.

"Among the challenges we faced was that we had to install [the high-voltage harnesses] on a small platform and had to ensure protection against arcing, including in the vicinity of fuel lines," Martin says. The team had to work with other design and installation rules, too, such as segregating data wiring from power cables.

Given its increasing use in the automotive sector, high voltage may seem like an issue that has been mastered, but flight altitude creates a unique environment. "Up to 10,000-15,000 ft., conventional technology is fine if used with caution," Martin says. "Above

that, adverse physical phenomena appear, and you need specific technologies for regional aircraft and even more for large commercial aircraft flying at up to 43,000 ft. Among other phenomena, we have to prevent arcing and partial discharge, as cables become more sensitive to insulation defects."

High voltage also increases the risk of electromagnetic coupling between cables, hence the use of dedicated protection. "Integration is then an issue because of the greater section of the cables [due to the thicker insulation]," Martin says. "Their geometry has to be factored in, just like for a piece of equipment."

Thermal management is another difficulty. "As the wiring system dissipates heat, we must ensure the cables do not go beyond a temperature limit," Martin explains. That may require ventilation to keep within the insulation's limits.

"It is also about preventing a harness from heating connected systems by conduction," Martin adds. "Such excessive heating can accelerate aging." Installing high-voltage cables requires a thorough knowledge of their environment. Safran Electrical & Power works with sister company Safran Aircraft Engines to model the thermal behavior of harnesses.

For more conventional aircraft layouts at the higher voltage level, GKN Aerospace delivered its first high-voltage wire harnesses to Collins Aerospace in June. They are intended to be integrated into a powertrain for testing on an experimental hybrid-electric version of the Pratt & Whitney PW1100G geared turbofan.

Developed under the European Clean Aviation Switch (Sustainable Water-Injecting Turbofan Comprising Hybrid-electrics) program, the EWIS was built at GKN Aerospace's site in Papendrecht, Netherlands. It will undergo system integration testing this year at Collins Aerospace's advanced electric power systems lab, The Grid, in Rockford, Illinois.

"In the next generation of aircraft, EWIS integration will be a challenge—for instance, integration with batteries," Alatorre notes.

OEMs are looking at replacing copper with aluminum as a way of reducing weight, Alatorre says. Aluminum would thus make a comeback, having last been used on Airbus' A380.

In addition to satisfying fundamen-

tal aviation design drivers such as safety and weight, EWIS increasingly must accommodate larger data flows. “Fiber optics increase the rate of data transmission and reduce weight,” Alatorre says. “We expect to supply more optical fibers for the A220 in the future. The technology is just as robust as metal-based wiring and is now well proven.” So far, GKN has provided fiber optics for the A220’s head-up display, which benefits from better signal quality.

EWIS suppliers have been busy keeping up with demand from airframers that want to ramp up pro-

manpower accordingly,” Alatorre says.

That also mitigates geopolitical and macroeconomic risks. GKN Aerospace’s Chihuahua plant contributes to multiple programs, including the A220. Its facility in Langfang, China, is essentially meant for the A320 final assembly line in the country; Izmir, Turkey, is chiefly a supplier for European OEMs.

What makes EWIS experts’ situation special is the high level of customization they provide, as opposed to the serial manufacturing of standardized components. That is impeding efforts to automate production, which will

Ever-changing specifications compound the challenges of complexity and quantity. While an airframer regularly improves an aircraft’s design, leading to frequent modifications at the EWIS level, customers can choose multiple options. On the Airbus A350, about 150 pieces of EWIS equipment can vary. For example, the buyer can choose whether or not to include a refueling lamp. As a result of the customization and design updates, a harness’ configuration may change every three weeks, Lainé says.

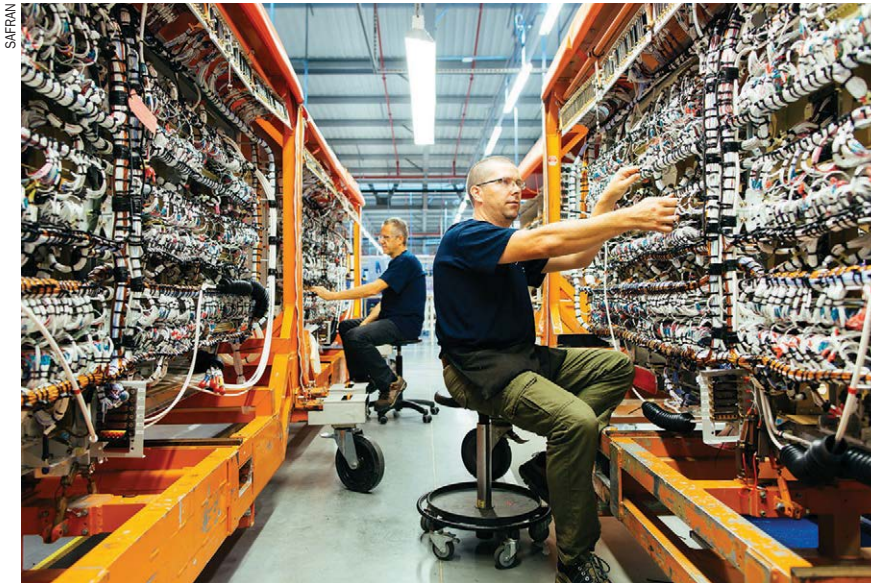
Production cycles can be relatively short—five days for a cabin harness—but large racks comprising several harnesses may require 3-4 months, he explains. Due to precision and customization, manufacturing operations have remained entirely manual. Workers successively strip, crimp, insert and cut at length, Lainé says. EWIS suppliers have devised methods to make last-minute adjustments.

With higher production rate targets, how can manufacturers shorten those cycles? Safran is considering greater process digitalization to ensure workers receive exactly what they need to put the harness together, step by step. Moreover, the company intends to improve manufacturing inspections, such as by using artificial intelligence to assist visual checks.

Latecoere is identifying those long tasks that have little added value, says Jeremy Lopes, head of the company’s advanced EWIS engineering department. Robotic arms could partly automate them. In addition to shortening cycles, automation can further curb errors and make quality consistent across production sites, Lopes says.

One of Latecoere’s machines has been in service for two years, contributing to production at one airframer. While its high speed is useful, it can perform only a single task; Latecoere’s engineers are looking for versatility instead. They aim to design a machine that can work with any type of connection, cable length or harness to support the production of next-generation narrowbodies in the 2030s.

Increased safety and functionality requirements for high-voltage systems also call for more automation in manufacturing, Alatorre says. For instance, production, inspection and testing of testing of crimping could be robotized, and GKN Aerospace may automate some steps of final assembly. ☐



The annual output at Safran’s Interconnection Systems Eurasia division adds up to 60,000 km of wires.

duction, and they have to prepare for significantly higher rates in the early years of the next narrowbody programs. GKN started operations at its expanded site in Chihuahua, Mexico, in November. The factory is supporting the production ramp-up of the A220—a priority for GKN Aerospace, as it is the only civil aircraft for which it is responsible for the entire EWIS design and production. GKN Aerospace also provides the EWIS for the A320. “We are ahead of Airbus’ production ramp-up needs on the A220 and A320 programs,” Alatorre says.

Having A220 EWIS production with identical capabilities in China, Mexico and Turkey gives GKN Aerospace a robust supply chain. “We allocate production between the three factories depending on supply chain performance, increasing or decreasing local

be required for the next generation of narrowbodies, meaning the low capital expenditure requirement of the EWIS business may increase.

Electric wires and harnesses can be complex assemblies that require large quantities of material—such as copper—and subcomponents. An electric harness can be made of wires measuring a combined 40 m (131 ft.), enabling 19,000 electrical links and weighing up to 300 kg (661 lb.), says Alexandre Lainé, Latecoere vice president of interconnection systems sales and programs for Europe, the Middle East, Africa and Asia. The annual output at Safran’s Interconnection Systems Eurasia division adds up to 60,000 km (37,000 mi.) of wiring. The division is planning on 42% growth in its wiring activity in 2024-28 with current programs.

NEED FOR SPEED



True Anomaly is providing its Jackal autonomous space vehicle for the Space Force's Victus Haze mission.

- > PENTAGON IS PUSHING RESPONSIVE SPACE MISSION LIMITS
- > UPCOMING MISSION TO FEATURE ON-ORBIT MANEUVERING AND DOMAIN AWARENESS
- > SPACE FORCE PLANS AT LEAST THREE MORE "VICTUS" INITIATIVES

TRUE ANOMALY

Vivienne Machi Los Angeles

With space as the ultimate high ground, the U.S. is honing its ability to launch with little warning and adapt quickly to deter threats before they materialize.

The U.S. military has realized that patience is no virtue as it prepares for future conflict in space. To address the urgency to be able to respond to threats quickly, the Pentagon has launched the Tactically Responsive Space (TacRS), an ambitious effort to make launch on demand a normal part of U.S. Space Force operations.

For decades, the Pentagon treated space systems built for intelligence-gathering and satellite communications as largely safe from attack as they enabled other service operations. In that environment, multiyear contracts to build new spacecraft and lengthy launch campaigns were deemed acceptable.

But in an era when potential threats can move at orbital speeds, the service is feeling pressured to respond quickly and flexibly when an adversary launches a novel space object, or when a malfunctioning or disabled satellite needs replacement.

The Space Force achieved what many considered an improbable goal on Sept. 14, 2023: taking a commercially built satellite from contract to launch-ready in less than a year, followed by liftoff within 27 hr. of a call-up. The mission, called Victus Nox—Latin for “conquer the night”—improved on the results of a 2021 effort in which the service deployed a space domain awareness satellite to low Earth orbit (LEO) in a then-unprecedented 21 days.

Chief of Space Operations Gen. Chance Saltzman has likened the success of Victus Nox to Chuck Yeager's breaking of the sound barrier in 1947 and says the achievement has significant implications for how the Space Force responds to future threats. “Now the question is: ‘How do we take advantage of that?’” he said during a virtual event in October 2023.

The service is planning several TacRS missions over the next two years

to provide real-world data for responsive launch concepts, focusing heavily on space domain awareness to avoid on-orbit surprises (see graphic on facing page). While Victus Nox sought to compress the typical multiyear process to launch and deploy a spacecraft into a matter of months, the next mission will incorporate the high-stakes capability of maneuvering satellites near others for inspection or surveillance.

Victus Haze is slated to take place between the end of 2025 and early 2026. The Space Force has tasked two industry groups to perform red and blue team demonstrations of rendezvous and proximity operations (RPO) and space domain awareness.

As part of one team, space defense technology company True Anomaly is building its Jackal autonomous orbital vehicle and an undisclosed payload to be launched on a Firefly Aerospace Alpha small-lift launch vehicle from Vandenberg SFB, California. In parallel, Rocket Lab is supplying a spacecraft from its Pioneer production line as well as its Electron small-lift rocket to launch from the company's facilities



Rocket Lab, which launched two missions in 48 hr. in June, is building a spacecraft based on its Pioneer line for Victus Haze.

in Mahia, New Zealand, carrying a multi-aperture optical telescope built by Lawrence Livermore National Laboratory (LLNL).

With Victus Haze, the Space Force wants to take the lessons learned from the 2023 mission and see what happens when the whole technology stack is commercialized, Col. Bryon McClain, program executive officer for space domain awareness and combat power, said at the annual Space Symposium in Colorado Springs in April.

The ability to launch on demand rests on the innovation that companies such as Firefly, Rocket Lab and True Anomaly have brought to the space ecosystem by mass-producing satellites and rockets for faster integration and deployment.

Firefly is scaling up its Alpha rocket production and has eight launches on its 2026 manifest. The company has also invested in a dedicated payload processing facility to streamline bottlenecks exposed during Victus Nox,

in which it launched a satellite built by Boeing subsidiary Millennium Space Systems from Vandenberg SFB.

The challenges during that mission were bureaucratic rather than technical, says Jason Kim, who was CEO of Millennium during Victus Nox and left to lead Firefly less than one year later. Streamlining processes like cybersecurity approvals proved just as important as launch readiness, he says.

The Space Force has incorporated lessons from Victus Nox to boost its

U.S. Space Force Tactically Responsive Space Missions

TacRL-2

- **Mission Objective**
To prepare and launch a spacecraft within 21 days of notice
- **Launched**
June 13
- **Spacecraft Provider**
Not disclosed
- **Launch Vehicle**
Northrop Grumman Pegasus XL

Victus Nox

- **Mission Objective**
To prepare and launch a spacecraft within 24 hr. of notice
- **Launched**
Sept. 14
- **Spacecraft Provider**
Millennium Space Systems
- **Launch Vehicle**
Firefly Aerospace Alpha

Victus Haze

- **Mission Objective**
To demonstrate rendezvous and proximity operations and space domain awareness capabilities in orbit
- **Operational time frame**
2025 4th quarter/
2026 1st quarter
- **Spacecraft Provider**
True Anomaly and Rocket Lab
- **Launch Vehicle**
Firefly Aerospace Alpha and Rocket Lab Electron

Victus Surgo/ Salo

- **Mission Objective**
To demonstrate how pre-positioned on-orbit assets can complement responsive launch efforts and reduce response times
- **Time Frame**
By 3rd quarter 2026
- **Spacecraft Provider**
Impulse Space
- **Launch Vehicle**
SpaceX Falcon 9 (commercial rideshare)

Victus Sol

- **Mission Objective**
To demonstrate the rapid launch capability for an operational TacRS mission
- **Time Frame**
2026 2nd quarter
- **Spacecraft Provider**
TBA
- **Launch Vehicle**
Firefly Aerospace Alpha

2021

2023

2025-26

Future

Sources: U.S. Defense Department and Space Force

launch tempo at Vandenberg SFB. Space Launch Delta (SLD) 30, the unit responsible for launch operations from the Western Range, oversaw 51 launches in 2024—up from just six in 2023—and is on track to beat that record this year.

While a surge in SpaceX flights last year drove the increase, the TacRS mission was a critical exercise in “cutting fat” from regular activities, leading to more launch opportunities, Col. Mark Shoemaker, then-SLD 30 commander, told reporters in January at a conference in Orlando, Florida.

“What Victus Nox allowed us to do is go, ‘Well, we can do that. Why don’t we just do that every day?’” he said. Shoemaker retired on July 3.

Rocket Lab has already shown that it can launch on tight timelines. The company launched two missions within 48 hr. in June from its facilities in New Zealand. It pulled off two launches in less than 24 hr. from two separate sites last year.

The company has built its business model around an integrated space offering, from satellite systems and payloads to launch and ground stations. This makes the Victus Haze mission an easy fit, says Richard French, vice president of business development and strategy for space systems. Bringing the company’s New Zealand launchpad into the TacRS mix offers “multidimensional resilience,” he adds.

Supply chain changes are key to the pace of operations, too. Space telescopes used to be tailor-made and delicate to assemble. LLNL has refined its optics technology to build shelf-stable telescopes that are well-suited for responsive space missions. In addition, the facility has partnered with telescope manufacturer Staris: Optimax Space Systems to commercialize and scale its patented technology specifically for space domain awareness missions. LLNL has flown monolith telescope imaging missions on five different satellites in the past five years, including the 2021 responsive demonstration.

While TacRS seeks to address the modern space threat environment, the idea of rapidly deployable space assets is not new. LLNL traces its responsive space mission heritage to the Strategic Defense Initiative, when it built interceptor vehicles and their sensor systems under the Brilliant Pebbles program (*AW&ST* June 13, 1988, p. 151). When NASA’s Clementine

mission launched in 1994—the first U.S. spacecraft launched to the Moon in more than 20 years—it carried optical sensors developed for Brilliant Pebbles, which provided the first complete look at the lunar surface, including the poles (*AW&ST* July 18, 1994, p. 68).

In the wake of the Sept. 11, 2001, terrorist attacks, the U.S. began to recognize that traditional space systems were too slow and inflexible to respond to increasingly dynamic situations. But a tactically responsive capability was “a concept ahead of its time,” says Stephen Kitay, a former Pentagon official who is now senior vice president of space defense at True Anomaly.

That has changed. The big shift is a “full-stack technology approach” coming out of commercial space companies, Kitay says. The approach incorporates launch vehicles designed to integrate and deploy payloads into orbit very quickly, satellites that are mass-produced at lower costs and flexible ground systems.

The ability to loft a new spacecraft to replace a malfunctioning system—or one taken offline by an adversary—has obvious benefits. But the Pentagon is particularly keen to use a rapid-launch capability to improve its knowledge of what is going on in space.

The growing sophistication of foreign systems, particularly from China and Russia, has rendered the space domain awareness mission essential for the U.S. military. When adversaries launch new systems, it is “fundamentally hard to know what is what,” LLNL Space Program Leader Ben Bahney says. Responsive imaging missions “allow us to go and find out,” he adds, calling space domain awareness the ideal mission set for TacRS.

At least three more missions are in the pipeline. Two follow-ons, Victus Surgo and Victus Salo, will explore

how maneuverable satellites and prepositioned assets can reduce the need for last-minute launches. McClain likened the missions’ goals to placing a sophisticated traffic camera above a highway overpass.

The Space Force awarded orbital transportation startup Impulse Space a \$34.5 million contract in October to build two maneuverable satellites and procure commercial rideshare slots, with expected launches in the fall of 2026. Under Victus Surgo, the spacecraft are to carry an Optimum Technologies optical payload into a geosynchronous transfer orbit, while Victus Salo is to deploy a sensor built by the Massachusetts Institute of Technology’s Lincoln Laboratory to LEO, a service spokesperson says.

The Space Force hopes to achieve that “next evolution” of an operationalized TacRS mission by next spring, Lt. Gen. DeAnna Burt, deputy chief of space operations for operations, cyber and nuclear capabilities, said in an August webinar. Once that happens, combatant commanders can trust that, when the need arises, they can call up a pre-staged satellite for launch “as they see fit,” she said.

The Space Force is preparing to take the TacRS capability beyond the trial phase. With Victus Sol, the service will use a Firefly Alpha rocket to launch an undisclosed spacecraft for an operational mission. Like Victus Nox, it will launch only upon senior leadership call-up.

It will not be the last. The Space Force is considering additional RPO and pre-positioned missions.

For McClain, TacRS is no longer just a technology demonstration, but a blueprint for the Space Force’s future. In the long term, “absolutely, this is an operational capability,” he said at the conference in April. 🌟

A Firefly Aerospace Alpha rocket launched 27 hr. after call-up during the Victus Nox mission in 2023.



FIREFLY AEROSPACE

Turkey's Eurofighter Procurement Plans Gain Momentum

- > ANKARA SEEKS EUROFIGHTERS EQUIPPED WITH METEOR MISSILES
- > TURKISH DEVELOPMENT OF THE HURJET FOR SPAIN PROGRESSES WITH AIRBUS AGREEMENT



MARK WRIGHT/BAE SYSTEMS

Tony Osborne Istanbul

Istanbul's International Defense Industry Fair may be the glittering showcase for Turkey's defense industry capability, but it was the government's interest in the procurement of a European combat aircraft that made waves.

After decades of buying first- and secondhand U.S.-made combat aircraft, including McDonnell Douglas F-4 Phantoms and Lockheed Martin F-16s, Ankara has set in motion a plan to acquire the Eurofighter Typhoon. It signed a long-awaited memorandum of understanding with the UK government that could pave the way to a multibillion-dollar contract agreement before year-end. That would be the first Eurofighter export deal since the sale of 24 aircraft to Qatar in 2017.

While the Turkish and UK defense ministries described the memorandum of understanding as reflective of

the "growing ties" between the two nations in terms of the defense industry and security, the agreement is tightly focused on the procurement of the Eurofighter and associated weapons package, including the MBDA-developed Meteor beyond-visual-range air-to-air missile. Turkish commanders have long sought a longer-range air-to-air missile, not least to give the air force parity or improvement over the Aegean Sea against Greece's Meteor-armed Rafales.

Turkey would acquire new-build Tranche 4-standard Eurofighters, similar to those being built for Germany, Italy and Spain but assembled in the UK by BAE Systems, since the UK has the lead for the export campaign. BAE Systems and UK government officials declined to comment on the number of aircraft that Turkey is seeking, but Eurofighter GmbH, the

company that manages the program, has previously said Ankara is seeking about 40 aircraft that would likely replace the air force's F-4 Phantoms (AW&ST June 16-29, p. 70).

Industry officials expect a level of offset and Turkish industrial involvement, but the level of such involvement remains subject to a series of implementation agreements between BAE Systems and the Turkish government. One option discussed among bazaars at the International Defense Industry Fair (IDEF) was to generate a local capacity to overhaul the Eurofighter's Eurojet EJ200 engine in Eskisehir, home to the Turkish Air Force's engine maintenance, repair and overhaul cen-

Turkey would purchase Tranche 4-model Eurofighters built on the BAE Systems assembly line in the UK, ensuring final assembly work would continue into the 2030s.

ter. Another option would enable Turkish industry to support the wider Eurofighter supply chain.

Industry officials say the UK has enjoyed the unexpected sales support of Qatar, which has close ties with Turkey and regularly deploys its aircraft to the country on joint exercises, including the most recent edition of the Anatolian Eagle drills. Several high-ranking Turkish Air Force commanders have ridden in the aircraft's back seat to build up knowledge about and experience with the Qatari-operated aircraft.

Turkey could also benefit from a similar government-to-government agreement that Qatar had as part of its Eurofighter buy; that included the creation of a joint UK Royal Air Force and Qatar Emiri Air Force unit to help accelerate pilot training for Doha.

"This is a fantastic signal of intent from the two governments [to] deepen the relationship between [them], and we are pleased that Eurofighter and [MBDA] Meteor and the weapons that equip Eurofighter are at the centerpiece of this [memorandum of understanding]," Simon Barnes, head of BAE Systems' air business, told Aviation Week at IDEF. "Turkey and the UK are non-EU but key NATO members, and Eurofighter is the backbone of European and NATO air defense," he added. "It can do the same thing here."

Ankara's acquisition of the Typhoon has been able to move forward because of the lifting of opposition from

Germany. Berlin had been concerned about the arrest of Istanbul's mayor, Ekrem İmamoğlu, who is seen as a serious presidential rival to President Recep Tayyip Erdoğan; however, the new Merz administration has indicated that it is more open to the transaction, in part because of the benefit to German industry.

For the UK, a Turkish order will help continue Eurofighter final assembly in the UK, which has been on pause since the completion of the last aircraft for Qatar. Workers unions had urged the British government to acquire additional aircraft for the UK Royal Air Force to bridge the gap in final assembly, but the UK government and BAE said export contracts would provide that bridge instead.

Officials also note that the Eurofighter supply chain is already spun up to produce major unit components for new-build aircraft destined for Germany, Italy and Spain, a process that is accelerating as the partner nations target increased production rates. These factors could speed deliveries to Turkey, but much will depend on Ankara's requested aircraft configuration—notably, which of the three active, electronically scanned array radar variants, already developed or being designed for the Eurofighter, the Turkish Air Force selects.

The plans for the Eurofighter appear to provide some shape to Turkey's future fighter fleet ambitions. But critics question the Eurofighter's affordability, particularly since Ankara is also negotiating to acquire new-build Block 70-standard Lockheed Martin F-16s. Meanwhile, Turkish Aerospace Industries (TAI) is leading the development of the Kaan indigenous combat aircraft. Ankara's decision to opt for a European fighter likely was driven by the need to diversify sources of supply after it faced sanctions from the U.S. due to its purchase of a Russian air defense system and banishment from the F-35 Joint Strike Fighter program. Turkish think tank SETA states that the Eurofighter will provide breathing room for national industry by filling a capability gap in the air superiority mission until such platforms as the Kaan are ready.

The first of the next batch of three

Kaan prototypes is set to make its initial flight in April 2026, TAI General Manager Mehmet Demiroğlu said at IDEF, while a second aircraft is planned to fly some three months later, representing a small delay in the flight-test program compared with what Aviation Week reported about the ambitious program previously (*AW&ST* May 5-18, p. 40).

TAI's other programs appear to be progressing. The company is collaborating with Airbus Defense and Space to develop a variant of TAI's Hurjet advanced jet trainer for Spain as a replacement for the country's Northrop F-5 lead-in fighter trainers.

Roketsan's Gokbora (pictured) has emerged as one of two ramjet-powered air-to-air missile projects from Turkey; both were unveiled at the IDEF event.



Demiroğlu said he expects that TAI will be on contract this fall for Madrid's €1.4 billion (\$1.6 billion) Integrated Training System-Combat (ITS-C) program to acquire 30 aircraft equipped with subsystems developed by Spanish industry. A batch of six aircraft will be delivered in the similar configuration as those Hurjets destined for the Turkish Air Force, allowing the F-5s to be phased out, while the second batch of aircraft will be equipped with the Spanish systems and then certified. One challenge in this plan, however, could be a potential overlap between completing the Hurjet for its advanced training role and introducing the Spanish customization. Development of the Hurjet advanced trainer is due to be completed in late 2027 or early 2028, Demiroğlu said.

TAI says the two Hurjet prototypes have logged 210 test flights and achieved supersonic speeds of up to Mach 1.4.

The airframer was also buoyed by a government order for 57 T-625 Gokbey twin-engine utility rotorcraft to equip the Turkish Air Force, Navy, Land Forces, Coast Guard, Gendarmerie and General Directorate of Security. Perhaps most important, the aircraft will use the indigenous TS1400 turboshaft engine produced by TAI subsidiary TUSAS Engine Industries. Some 83 Gokbey helicopters have been ordered, three of which have been delivered to Turkey's Gendarmerie.

Elsewhere at IDEF, Turkey showcased its push toward self-sufficiency with advanced sensors, including radars and electro-optical systems, and new weapons.

A highlight was the development of a domestically produced equivalent to the Meteor; two separate projects were unveiled at the show. The first, Gokhan, led by national research and development agency Tubitak Sage; the other, Gokbora, is being developed by national missile manufacturer Roketsan. Tubitak Sage had already worked on two domestic air-to-air missiles, Gokdogan and Bozdogan, analogs of the Raytheon AIM-120 Amraam and AIM-9 Sidewinder, while Gokbora represents Roketsan's first venture into air-to-air missile development.

The industrial links between the two missile programs are unclear. Tubitak Sage has traditionally developed weapon prototypes and then passed them on to national industry for further development and production, as it did with the SOM family of standoff missiles, for example.

Both the Gokhan and Gokbora are expected to employ technology similar to the Meteor, using a solid-fuel rocket motor that transitions to create a combustion chamber for the ramjet's ignition. The resulting weapon has longer range and improved kinematics in the endgame since the missile remains powered rather than coasting to its target. Roketsan officials said their weapon would use an active, electronically scanned array radio frequency seeker and that development is running in parallel with the TAI Kaan fighter jet and Baykar Kizilelma uncrewed combat air vehicle. ☛

Indonesia's Kaan Commitment Complicates Its Fighter Plans

> INDONESIA'S AIR FORCE MODERNIZATION PUSH LAGS

> JAKARTA HAS YET TO FUND THE KAAAN COMMITMENT

Chen Chuanren Singapore

Indonesia's confusing fighter procurement strategy has become even more of a hodgepodge.

Jakarta has signed a contract for 48 Turkish Aerospace Industries (TAI) Kaan fighters, deepening bilateral defense ties with Turkey and further diversifying its airpower acquisitions. The deal, signed on July 26, follows a June commitment and includes extensive industrial cooperation and technology transfer provisions.

entered a development partnership with South Korea for the KF-21.

Driving much of the activity is Jakarta's ambition to revamp its armed forces under its long-standing but slow-moving Minimum Essential Force (MEF) road map. When it was launched more than 15 years ago, the MEF called for the Indonesian Air Force to operate 344 aircraft by 2024. By that year, the air force had reached only around half that target—the low-

though. If Indonesia actually buys the Kaan, it would be Turkey's largest-ever defense export.

Indonesia's involvement in a new combat aircraft raises new questions about its KF-21 partnership with South Korea. At the height of the COVID-19 pandemic, under then-Defense Minister Prabowo Subianto, Jakarta defaulted on its KF-21 payments. The country eventually negotiated a reduced financial contribution in exchange for a diminished level of technology transfer. The episode signaled Indonesia's fading interest in the KF-21 program and its wandering eye.

Prabowo also strengthened ties with Ankara, purchasing TAI's Anka, Bayraktar TB3 and Akinci drones as well as a suite of Roketsan missiles for the three services. The deepening bilateral relationship followed his ascension to president in 2024, putting the country on a path to build a defense industrial base modeled on Turkey's.

Indonesia has historically relied on creative financing to support its defense ambitions. The country funded its 2003 Sukhoi Su-27/30 procurement partially through a barter arrangement, providing Russia with commodities such as agricultural products and rubber. Its more recent Rafale deal with France came with export credit guarantees.

Even if Jakarta finds a way to fund the Kaan acquisition, sustaining high operational availability across its expanding and diverse fleet presents a longer-term challenge. The current Indonesian defense budget is unlikely to support the operational tempo or logistical infrastructure required for such a mixed inventory.

The country's 2025 defense budget is reportedly around 139.2-165.2 trillion rupiah (\$8.5-10.1 billion). This puts it well behind Singapore, which continues to outspend its neighbors and plans a projected allocation of S\$23.4 billion (\$17.4 billion) for fiscal 2025. As Indonesia broadens its fleet and commits to complex multinational platforms, the gap between its MEF ambition and sustainment capability may widen further.

Although fighters have been at the heart of the air force's MEF modernization drive, the service is discussing buys of tanker and airborne early warning aircraft, too. Those would come on top of the country's two Airbus A400M transport aircraft, the first of which is due for delivery before year-end. 🇮🇩



Indonesian officials used the International Defense Industry Fair in Istanbul to celebrate their partnership with Turkey on the Kaan fighter.

Indonesia has now either negotiated or agreed to deals to acquire Sukhoi Su-35s, Boeing F-15EXs, Korea Aerospace Industries KF-21s and Dassault Aviation Rafales. Of those, only 42 Rafales are on contract. Jakarta's commitment to buy 24 F-15EXs, for instance, remains a nonbinding agreement almost two years after signing.

That scattershot approach reflects not only operational ambitions but also political realities and industrial objectives. Indonesia's earlier flirtations with Russia's Su-35 fell through amid geopolitical pressures, including U.S. sanctions risks. Then in 2022, Jakarta agreed to buy the first batch of Rafales while turning to the U.S. for the F-15EX as well as upgrades to its Lockheed Martin F-16s. In parallel, the country

est among the three services. The COVID-19 pandemic compounded delays and prompted an extension of the MEF timeline.

As part of the Kaan agreement, Turkey is offering generous offset packages, including potential domestic drone assembly and aircraft component manufacturing. This gives Jakarta a hedge against overreliance on traditional suppliers and a possible catalyst for building sovereign aerospace capabilities.

Despite the signing, Indonesia has yet to allocate funding from its defense budget for the Kaan program, and it is not clear how the country intends to finance the acquisition.

The deal bolsters Ankara's prestige as an emerging defense exporter;



European Companies Crank Up Defense Production Plans

➤ GERMANY OUTLINES A RECORD DEFENSE SPENDING PLAN

➤ SAFRAN RAMPS UP AASM AIR-TO-GROUND WEAPON PRODUCTION

Robert Wall London

To boost output or not to boost output is no longer the question for many European defense companies, since they have booming backlogs amid surging military spending. The question now is how to boost output cost-effectively.

Across Europe, production is increasing for everything from combat aircraft to missiles to air surveillance equipment. NATO members' commitment to higher spending targets at the alliance's June summit has only fueled companies' confidence that government pledges will turn into contracts.

"What we have seen in recent months, particularly the step-up in the NATO numbers and the success of the recent NATO summit, is our confidence around the durability of those sort of growth rates continuing," BAE Systems CEO Charles Woodburn said on the midyear earnings call.

Cranking up output is not straightforward and can take time. Leonardo CEO Roberto Cingolani said addressing the demand could require 30-40% more engineering hours, 10-15% more manufacturing work and 10-20% more strategic suppliers—and that would come with huge costs.

Leonardo suffered financially after investing heavily in commercial air-

craft production capacity, only for it to be underutilized for a prolonged period. Now the company seeks to avoid similar missteps. "We want to be lean, clean and agile," Cingolani said on the second-quarter earnings call.

Leonardo has set up more than 170 projects to enable growth at lower cost. Those include the goal of increasing efficiency of helicopter manufacturing by 40% and fixed-wing aircraft production by about 35%. The company detailed plans to overhaul production sites, such as increasing automation and quintupling capacity at some locations. Leonardo will only pursue investments once those changes are made.

Defense electronics provider Hensoldt has been scaling up since 2022 and is similarly looking ahead. "With the German defense budget rising and visibility on future orders improving, we are preparing a step change in our operations," CEO Oliver Dörre said on the second-quarter earnings call. "Our focus as management at the moment is to really set the prerequisite that we can digest these massive orders that we expect from the market."

Hensoldt reported a record order backlog and plans to spend the next several months assessing how to set the stage for having additional pro-

duction capacity ready in 2027-28.

The past few weeks have only added urgency to those efforts. Germany, Hensoldt's home market, plans to boost defense spending for 2026 to more than €108 billion (\$125 billion)—a record—with additional increases through 2029.

BAE Systems sees strong appetite for its APKWS laser-guided rocket.

Moreover, several countries have agreed to acquire the Diehl IRIS-T SLM air defense system, which uses Hensoldt's TRML-4D surveillance and targeting radar. Denmark, Sweden and Switzerland are among the IRIS-T's new customers, and Slovenia is looking to buy more. Hensoldt sees €2 billion in European potential for the radar.

Demand is so strong for defense equipment that Safran CEO Olivier Andriès expects the company's sales from those activities as well as space to double by decade-end. Safran generates about 20% of total revenue through its defense and space business, which includes landing gear and wiring.

Safran makes engines for Dassault Aviation Rafale fighters and various military helicopters, as well as the AASM guided air-to-ground weapon, for which demand is increasing. AASM production has risen by a factor of four, and Safran has boosted output of turbojets for guided missiles about threefold. Missile engine output could swell higher, Andriès said.

Missiles are also hot items for BAE, which is a major shareholder of European missile joint venture MBDA. Woodburn said as the company lifted its full-year sales outlook. The Pentagon has been using BAE's APKWS laser-guided rocket in counterdrone operations (page 55). "We're literally selling them as fast as we can make them," he added.

Saab, having enjoyed overseas sales success for its Gripen fighter, is similarly looking to raise output. "We will aim for at least a production rate of 20 aircraft a year," CEO Micael Johansson said on the second-quarter call.

The Swedish defense company is working with Thailand to finalize that country's purchase of 12 additional Gripens by year-end. Contract talks are underway with Colombia, which aims to replace its Israel Aircraft Industries Kfir with 16-24 Gripens. Saab is pursuing deals in the Philippines and Peru, where a selection may come soon. 🌐

Russia's Next Bomber Slowly Takes Shape

- > THE PAK DA IS DESIGNED TO CARRY NEW, LONG-RANGE CRUISE MISSILES
- > THE BOMBER IS PLANNED TO BE ABLE TO FIRE AIR-TO-AIR WEAPONS

Piotr Butowski Gdansk, Poland

Ukraine's extraordinary June 1 attack on Russian air bases in Operation Spiderweb destroyed several of the country's bombers—and raised the stakes for Moscow on what comes next.

The strikes used dozens of drones smuggled into various locations in Russia to attack the facilities from relatively short distances. The uncrewed air vehicles damaged or destroyed roughly eight of about 55 Russian Tupolev Tu-95MS strategic bombers, four Tupolev Tu-22M3 medium bombers and other aircraft types, satellite imagery shows.

Moscow has said little about how it plans to replace the bombers, which are a key element of its conventional and nuclear strike force. But the attack raises critical questions about Russia's long-held ambition to develop a new bomber, the Tupolev PAK DA, the Russian name of which means Future Air Complex of Long-Range Aviation.

Plans for the PAK DA date back almost two decades—initial research efforts at aircraft design house Tupolev kicked off in 2007. But the project for a long time played second fiddle to Moscow's desire to build up its bomber inventory more quickly by modernizing and expanding its Tu-160M fleet.

The future bomber gained momentum about a decade later, when Tupolev received a contract from the Russian Defense Ministry for research and development on what was codenamed Poslannik-1 and covered design, building and testing of three prototypes. Tupolev internally refers to the project as Product 80; the Tu-160 was Product 70.

The new bomber is supposed to be a twin-engine, subsonic, stealthy flying wing with a takeoff weight of 145,000 kg (320,000 lb.) and a declared unrefueled range of 15,000 km (9,000 nm). To minimize development risk, Russia is forgoing breakthrough technologies and plans to employ mostly systems and weapons that were already developed for the Tu-160M.

A contract awarded last year for a full-scale mockup of the PAK DA's cockpit shows a design that accommodates four crew members, with pilot and co-pilot in the front seats and two navigators in the rear. An earlier ejection seat contract similarly suggested a four-person crew. The PAK DA cockpit compartment is intended to measure 4.75 m (15.6 ft.) long, 2.2-2.76 m wide and 1.8 m high. Russian bombers traditionally have a large crew; the Tu-160 and Tu-22M3 each have four and the Tu-95MS has seven personnel onboard.

Information is to be displayed on large 43-in. main front displays, 24- and 32-in. auxiliary displays and control panels.

Another milestone occurred in 2018, when construction began at the Kazan Aviation Plant for a 591 X 1,017-ft. production hall that would accommodate the PAK DA alongside the Tu-160M bomber and Tu-214 airliner. Last year, work began on a smaller adjacent facility. Construction of the buildings is nearing completion, according to informa-



Ukraine's Operation Spiderweb has dented Russia's bomber inventory.

tion and satellite imagery from umbrella company United Aircraft Corp.

In parallel, Russia is ramping up supply chain activity around the project, signaling its intent to move the bomber from paper to reality. Beriev is on contract to produce the bomber's armament bay covers, landing gear covers, elevons and ailerons, corporate records show. In 2022, the airframer placed an order with a specialist company to produce rigging for production of these items. The order also reveals that the aircraft has one central weapon bay and two side bays, which are most likely smaller.

While the pace of development has increased, the project remains behind schedule. In 2017, the Russian Defense Ministry targeted 2023 for the PAK DA's first flight, which has yet to occur. The bomber was due for state acceptance trials in 2027, which is no longer feasible. During a high-level meeting at Tupolev in May to discuss the status of various Kazan Aviation Plant programs, only the supplier schedule for the PAK DA's static-test aircraft was on the agenda, suggesting flight tests may remain some time away.

Nevertheless, details about the PAK DA have emerged through program records. Documents associated with the KPM-800 avionics and weapon integration system disclosed at least some weapons Moscow plans to mate with the bomber.

Among the most surprising features is a plan for firing a new long-range air-to-air missile. The Vympel Product 810 has a range of more than 200 km and was designed for



MAXAR

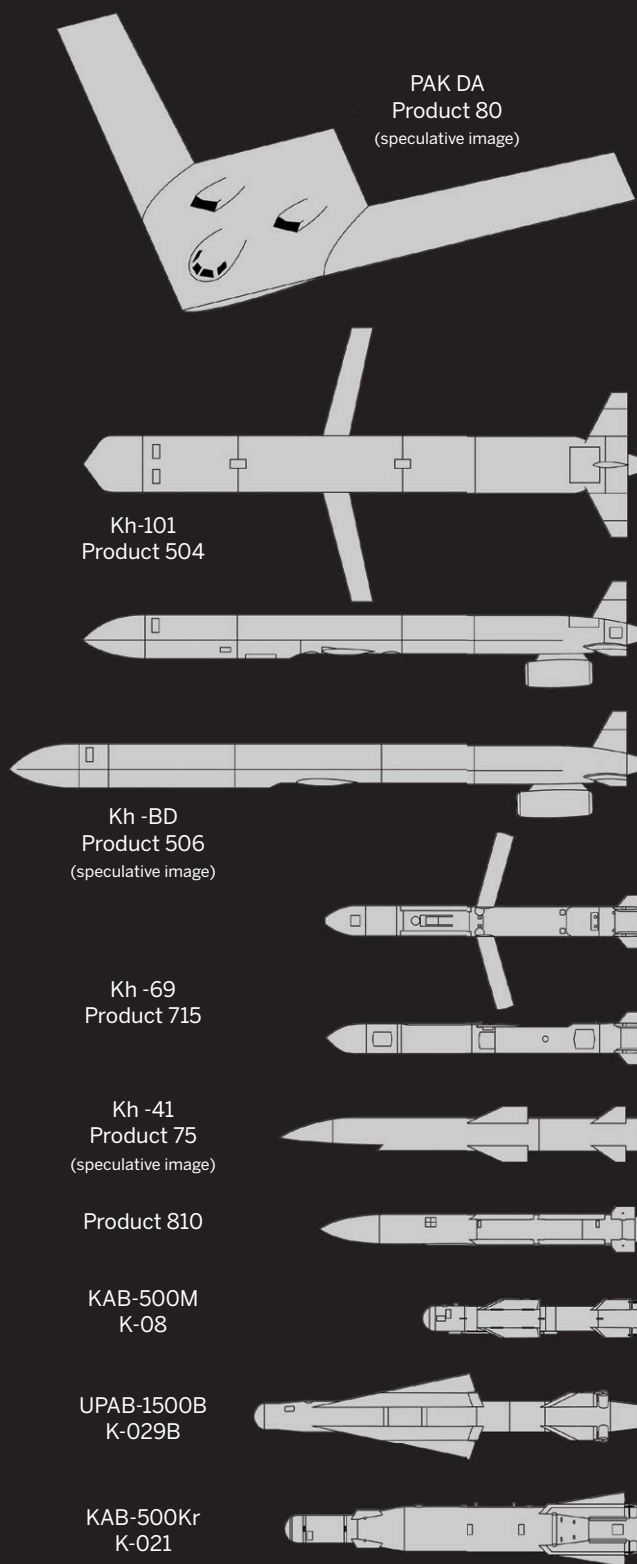
internal carriage by the Sukhoi Su-57. The inclusion of the weapon in the PAK DA's armaments loadout underscores that Moscow intends for the bomber to play a secondary role as a long-range platform to attack high-value targets such as an adversary's airborne early warning or electronic warfare aircraft.

The PAK DA also is set to carry two types of strategic subsonic cruise missiles: the nuclear-tipped Kh-102 and the conventional Kh-101. Russia has employed the Kh-101 heavily in Ukraine; its maximum range is about 3,500 km. The Kh-102 has a longer range.

Russia is also working on a new long-range missile, designated Kh-BD, intended for the PAK DA and the Tu-160M. Missile design company Raduga received a development contract in 2013 and expected to test it by 2020, but progress has been slow, and no evidence has emerged of it being in trials. Little is known about the missile, but it may be 2-4 ft. longer than the Kh-101 to increase its range. In 2023, Gen. Sergei Kobylash, then commander of the long-range aviation branch of the Russian Aerospace Forces, described the weapon as having a range of over 6,500 km.

In addition to carrying the long-range cruise missiles in its central bay, the PAK DA's side bays can accommodate the Tactical Missile Corp.'s ramjet-powered Kh-41 medium-range air-to-ground missile, which is poised for series production. The bomber also is slated to carry the

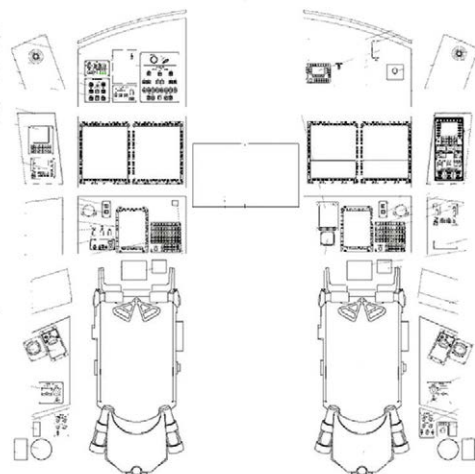
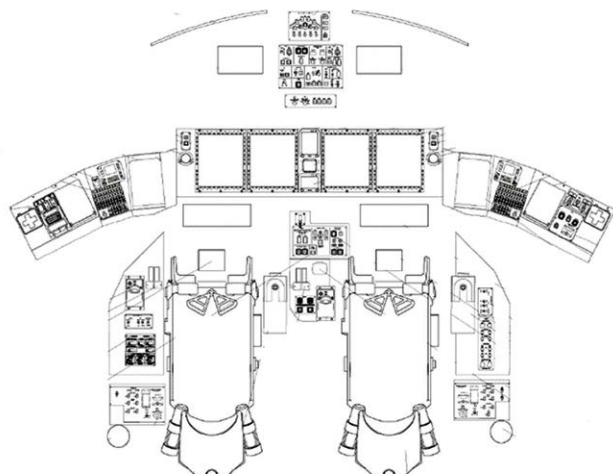
PAK DA To Pack a Punch



PIOTR BUDOWSKI

The likely configuration and ordnance package for the Russian PAK DA bomber is emerging.

PAK DA's Cockpit Takes Shape



GOSNIAS IMAGES

The four-person cockpit is arranged with two pilots at the front (left) and two positions in the rear (right), each provided with large multifunction displays.

stealthy Raduga Kh-69 subsonic, medium-range, land-attack cruise missile, which Russia has been firing from the Su-57 against targets in Ukraine.

The PAK DA is set to carry a range of guided bombs on which Russia has relied heavily in Ukraine, too. Among

those is the 1,525-kg UPAB-1500B, Russia's largest standoff glide bomb, which can reach targets as far as 50 km. The documents also identify the 505-kg KAB-500M as well as the "K-21A," which may refer to the KAB-1500Kr guided bomb that has been in Russia's inventory for decades. ⑦

AVIATION WEEK
MRO
ASIA-PACIFIC

25
YEARS

SEPTEMBER 16-18, 2025
SINGAPORE

We look forward to celebrating MRO Asia-Pacific's
25th anniversary with you!



300+

Solution providers
featured on a SOLD
OUT exhibition floor



6,000+

attendees from
around the world



50+

industry leading
speakers across paid
and free content



3 days

of unrivalled
networking
opportunities

Register Your Place Today!

mroasia.aviationweek.com | #MROAP

AVIATION WEEK
NETWORK

WHAT'S NEXT?

BE THE FIRST TO FIND OUT WHAT
THE NEXT 10-YEARS HOLDS

2026 Fleet & MRO
Forecast **COMING SOON!**



For more information, visit
aviationweek.com/forecasts

or call Melissa Crum at +1 913 284-2951
melissa.crum@aviationweek.com

EXtra EFFORT



Brian Everstine Portland, Oregon

The critical mission of bringing online the U.S. Air Force's newest fighter variant, the Boeing F-15EX Eagle II, rests on the shoulders of a relatively small Air National Guard unit in the Pacific Northwest. The group is working to establish operational standards for the entire service and pressing through newly uncovered issues with the aircraft, all with minimal outside support.

The Redhawks of the 142nd Wing at Portland ANGB in Oregon received the service's initial two operational F-15EXs last summer, and the group has used a yearlong lull to ramp up their pace. The unit's initial focus of a direct transition from aging F-15Cs to F-15EXs has proved to be mostly smooth, despite a few bumps along the way.

"It's certainly a challenge" says Lt. Col. Jonathan Friedman, commander of the 123rd Fighter Sqdn., which is

- > **USAF'S FIRST F-15EX UNIT PUSHES THROUGH VARIANT'S GROWING PAINS**
- > **ISSUES WITH PYLONS AND FUEL SYSTEM IMPEDE EARLY OPS**
- > **THE F-15EX's MULTI-ROLE FUTURE IS AN OPEN QUESTION**

After a gap of almost a year, the 142nd Wing received its third and fourth F-15EXs in May and June.

leading the work. "[The F-15EX] was billed as a plug-and-play, easy swap over for a unit like ours.

"The idea was that we would be able to continue without taking a full conversion . . . for us," Friedman continues. "One of the biggest challenges is we got two jets up front, then basically waited a year before anything else showed up. That's kind of a blessing and a curse, where you have to maintain and operate those two EXs but

the majority of your fleet is C models."

Aviation Week visited the installation in early July, as the Portland ANGB was awaiting a slightly delayed delivery of its fifth F-15EX. The air base was hosting personnel from Kadena AB, Japan, who are training to stand up the first active-duty squadron of the aircraft in the spring of 2026.

At the time, half of Portland's F-15EXs were grounded because of a previously unannounced issue facing the fleet. The Eagle IIs have a problem with venting fuel when they are being refueled on the ground: As gas is loaded into the aircraft, it sporadically leaks out the back. The squadron, the Air Force's F-15EX program office and Boeing are investigating the issue; no specific fix had been identified as of late July.

Rob Novotny, Boeing's executive director of F-15 business development, tells Aviation Week that the company has dedicated a team of both Eagle engineers and weapon engineers from other units to investigate the issue. "I think we found the solution," he says.

F-15 maintainers say the grounding of half the fleet has not been a showstopper, although it has affected the squadron's ability to fly lengthier operations.

"When they don't vent fuel, they've been super reliable, just like you would hope a new aircraft would be," Friedman says.

The first F-15EXs delivered to the Air Force were originally planned to be F-15QAs for the Qatar Emiri Air Force, and that introduced another unique issue for the aircraft. Because the F-15QAs use different pylons—ones dedicated to Foreign Military Sales (FMS) cases, as opposed to Tier II pylons for U.S. Air Force use—the FMS pylons did not have specific wiring for the service's unique systems, such as the Eagle Passive/Active Warning and Survivability System (Epawss) and the AN/ALE-58 countermeasures dispenser, nor were they compatible with military-standard 1760 smart weapons.

As an interim fix, the service is modifying pylons at the F-15 depot at Warner Robins AFB, Georgia. The first pylons were delivered to Portland in mid-July; once cleared, they were expected to unlock additional capability for the fighter.

Epawss has been billed as a game changer for the F-15 fleet, providing fifth-generation-like survivability. It has been fielded on F-15E Strike Ea-

gles, which have come off the line wired for it. So far at Portland, the unit has not been able to conduct its full range of mission sets because of the pylon issue. The unit is prioritizing C model air superiority missions, aligning with the variant's primary mission of homeland defense, before transitioning to more multirole sets. The squadron has brought on three Strike Eagle weapons officers to help with that pivot.

"Epawss, certainly as we dabble into more multirole types of missions, unlocks a totally new mission set with regard to air-to-ground things," Friedman says. "Air-to-air, I don't know if we've truly seen what Epawss can do just yet. . . . Until you've [been] in combat or flown it in big events, . . . the jury is still out a little bit from what we've seen."

On paper, however, the presumption is that the Epawss upgrade could make a major difference for the Redhawks.

"We've kind of always assumed that everyone can see us all the time, since we're a flying tennis court out there, but now finally, some relevant [electronic attack] potentially unlocks some great capabilities for us," he says.

A big question at Portland is whether the unit's F-15EXs will eventually receive conformal fuel tanks (CFT). The first two test aircraft have them, but Portland's do not. CFTs will provide more multirole capability with additional weapon stations and fuel.

Another major question about the F-15EXs is what to do with the back seat. The aircraft is built with the capability for a weapon systems officer (WSO) to fly in the back, although the Air National Guard has no plan to bring them on. This would be a culture shift for units such as Portland's, whose pilots have for decades operated single-seat C models unaccompanied.

Friedman says he recently flew with a weapons school instructor in the back seat of an F-15EX at Nellis AFB, Nevada, for an offensive counter-air mission that demonstrated how much more capable the jet could be. A WSO can operate Epawss to jam surface-to-air missiles as the pilot focuses on air-to-air threats or troubleshoots systems, such as radios. "I think there's tremendous combat capability with WSOs in the back seat," Friedman adds. "It unlocks all the things the Strike Eagle does so well."

Portland would be happy to have WSOs operating in tandem with pi-

lots, but it is a question of funding. There have been discussions about the possibility; it is initially more likely to be done at active-duty units, such as Kadena. A small complement of WSOs also could be placed with specific units, one flying in a flight lead or in a four-ship flying formation. But for the next couple of years, Portland is focused on operating F-15EXs with a single pilot.

Due to the small number of EXs in Portland, pilots go back and forth between C and EX models. Typically, more experienced pilots, such as instructors, spin up in the EX first.

Pilots have reported that the new GE Aerospace F110 engines give the EX “phenomenal” power and provide the sought-after performance that a C model never really achieved. The F-15EX is a fully digital fly-by-wire design, which has taken some getting used to, Friedman says. Flying basic fighter maneuvers (BFM) with the C model requires finesse. The EX is still being optimized for those operations. It is not clear if the Air Force will invest in perfecting the F-15EX’s optimization for BFM, but that is a lower priority than connectivity and sensors.

“There are some disappointments with how it maneuvers once it’s at high alpha,” Friedman says. The F-15EX can give 9g turns in some configurations, he adds, but “the pilot has to be on exact parameters and executing a perfect brake turn at the same time. . . . It’s kind of rare to achieve peak G.”

The EX can fly smoothly, making the pilot “think you’re just killing it with a hard turn,” Friedman says. That comes at a cost—losing energy and altitude, however. In the C model, these maneuvers would lead toward wing rock, providing more feedback, as opposed to sinking.

“The EX can lull you into a sense you’re doing really well, but you’re also giving up all this energy,” he says. “So while you can point at a lot of things, you’re also falling through the sky, versus the C model, [which] would be in a heavy wing rock in those types of scenarios.”

The Air Force is revising how its pilots are training for F-15s. The F-15C/D schoolhouse in Klamath Falls, Oregon, is shifting to the F-35, and the service will merge F-15E and EX training at Seymour Johnson AFB, North Carolina. While the merge has raised some questions—combining Air National

Guard air superiority training with F-15E strike training—Friedman says it is actually an improvement. The Strike Eagle’s cockpit systems and capabilities are a better surrogate for the EX than the older C model’s.

to an individual pilot’s or maintainer’s preferences, a standardized step-by-step technical order is not practical. As Burdette notes: “Everybody has a preference.”

But the configurations are close



The Air Force plans for a second F-15EX base to be operational in 2026.

BRIAN EVERSHINE/AN&ST

The 142nd Wing has helped Seymour Johnson AFB modify its syllabus—for instance, adding more solo rides to prepare F-15EX pilots better. It is similar to F-16 training: Pilots who go to Block 40 units have different mission sets than Block 50 units, Friedman says. “In terms of commonality, the [hands-on throttle and stick] menu structure will be an easier transition E to EX than C to EX,” he notes.

Maintainers have also faced a bit of a steep learning curve standing up F-15EX operations. Technical orders and maintenance manuals have to be tweaked as airmen actually work on and operate the jets. Currently, technical orders are at a point where they require more experienced craftsmen to operate, since the orders are more of a guide than a full checklist.

The unit recently met with the Combined Test Force and Air Force Operational Test and Evaluation Center to work through these manuals. By the time Kadena begins its operations, less experienced journeymen-level personnel should be able to work through operational checks without a lot of hiccups, says Master Sgt. Sean Burdette, aircraft weapons training manager.

The base is learning how to work with the F-15EX’s highly customizable cockpit displays, which can make full checks more difficult. Since displays might be set up differently, according

enough that personnel can go from a C to an EX relatively interchangeably, with some small improvements needed, says Staff Sgt. Max Larson, a dedicated F-15EX crew chief.

The biggest issue facing maintenance preparations for EX operations has been staffing levels. The unit received aircraft as well as additional equipment, responsibilities and priorities before a personnel study was completed. This led to guardsmen doing two and three full-time jobs, Burdette says.

“In order to do this effectively, with the additional equipment and mission set, we’re going to need the personnel,” he says. “The biggest question is: ‘Is there a plan for personnel in Portland to support the EX and give it the attention that it needs?’”

These issues aside, however, the unit is confident the EX can serve the homeland defense role. “When the time comes, they’ll be ready,” Larson says. This will require six aircraft and operational pylons, among other steps.

“I love working on the EX; it’s just really cool,” says Tech. Sgt. Isaiah Harsh, an avionics maintainer with the squadron. “For a long time, since I’ve been brand-new out here, I was saying to myself: ‘Why does the Air Force keep trying to reinvent these new jets? Why don’t they take what we’re working on now, the F-15, and make a newer, cooler, badder one?’ And they finally did.”

How the U.S. Air Force Unlocked a Drone-Killing Rocket Capability

> A QUICK SOFTWARE CHANGE ENABLED FIGHTER AIRCRAFT TO ADOPT THE NEW MISSION

> IMPROVEMENTS ARE NEEDED TO FIGHT AT A LARGER SCALE

Brian Everstine Washington

The prevalence of slow-moving uncrewed aircraft systems targeting U.S. interests in the Middle East prompted a back-of-the-napkin idea—and then a software update—to take them down using cheaper, laser-guided drones.

That update, using Northrop Grumman's Litening pod to target BAE Systems Advanced Precision Kill Weapon System (APKWS) II rockets,

A Lockheed Martin F-16 outfitted with six laser-guided rocket pods is now the U.S. Air Force system of choice for drone defense.

has allowed fighter aircraft to take down the threats at a much lower cost. However, the method has turned out to be more strenuous for pilots.

In early 2024, U.S. Air Force Boeing F-15s and Lockheed Martin F-16s deployed to the Middle East were tasked with taking down Iranian Shahed drones that Houthi forces in Yemen were using to strike ships in the Red Sea. Soon after, Iran itself used large numbers of the drones in waves of attacks against Israel.

The use of the BAE \$35,000-per-round system, designated AGR-20F, went from idea to fruition over a "handful of months," says Cyrus Dhalla, vice president and general manager for navigation, targeting and survivability at Northrop Grumman. The company makes rolling updates to the Litening system and is working to provide a larger aperture within the next couple years.

Using the rockets means "this is a place where we can get real symmetry in the low-end fight," Dhalla tells Aviation Week.

The 121st Fighter Sqdn. of the District of Columbia Air National Guard was among those deployed to the re-

gion at the time. The squadron's F-16 Block 30 Vipers have long been "hyper fixed" on the cruise missile threat because of its capital region alert mission, said 121st Fighter Sqdn. commander Lt. Col. Nathan Skavdal. "Our baseline knowledge of the mission set is a little bit higher," he noted.



ARMAN IST CLASS (NANADA WALKER/PTTS)/U.S. AIR FORCE

At the beginning of the deployment, the F-15s and F-16s "slung a ton of AIM-9Xs, a ton of Amraams, and the cost-per-kill ratio is pretty out of balance," Skavdal said. "So how do we fix that cost?"

Using the APKWS II pods dramatically increases the magazine depth of the aircraft, he noted.

The current method is tricky because of the nature of the targeting pod and laser-guided rockets. Pilots of the fast-moving fighter aircraft need to fly more slowly and steadily to keep the laser designator on the small drone.

"In this one, I have to support all the way in because it's laser-guided into [the] projectile—cruise missile or drone—so it is more challenging there," Skavdal said.

In addition, the APKWS is designed as an air-to-ground rocket, so the aircraft's targeting system defaults to air-to-ground mode as the pilot pre-

pares for the air-to-air engagement, he explained.

Two fighter aircraft typically "buddy-laze" the strike, providing laser designation. But in an attack on a much larger scale, it is expensive to have two fighters on that task.

The prevalence of APKWS has grown rapidly across the Air Force; fighter aircraft of most types are carrying the pods. Air Force Chief of Staff Gen. David Allvin highlighted the mission in a March social media post focusing on the cost of the APKWS compared with the Amraam (about \$1 million per round) and AIM-9X (about \$500,000). "More savings. More lethality," Allvin wrote.

Aviation Week spoke with Skavdal

on July 27, during the large-scale Resolute Force Pacific exercise, during which the squadron's F-16s focused on cruise missile threats and other missions. In the long term, new systems might come online, but until then, the service is investing in drone and cruise missile defense and keeping the tactic within the F-16's Designated Operational Capability (DOC), he said.

"I don't see it coming off the DOC statement," Skavdal remarked.

The Air Force's newest aircraft are taking on the AGR-20F. The service's test F-15EX Eagle IIs are practicing with the system at Eglin AFB in Florida before other units install it, Master Sgt. Sean Burdette, aircraft weapons training manager with the 142nd Wing of the Oregon Air National Guard, told Aviation Week during a visit to the base. The wing is the first operational unit for the F-15EX.

"That's coming our way because of drone warfare," he said. ☪



The Bristell B23 EnerGic was displayed at EAA AirVenture Oshkosh with the H55 electric propulsion system that has an energy cost of \$7 per flight hour.

H55

Final Mosaic Rule Will Remake Light Sport Market

- > EXPANDED ACCESS TO GENERAL AVIATION FLEET SHOULD LOWER THE COST OF FLIGHT TRAINING
- > THE REVISED RULE ALSO OPENS OPPORTUNITIES FOR AIRCRAFT-MAKERS

Molly McMillin Oshkosh

An FAA rule that makes sweeping changes to the light sport aircraft segment has been finalized and signed, U.S. Transportation Secretary Sean Duffy announced on July 22, the second day of the Experimental Aircraft Association's AirVenture Oshkosh fly-in convention.

Duffy made the long-awaited announcement regarding

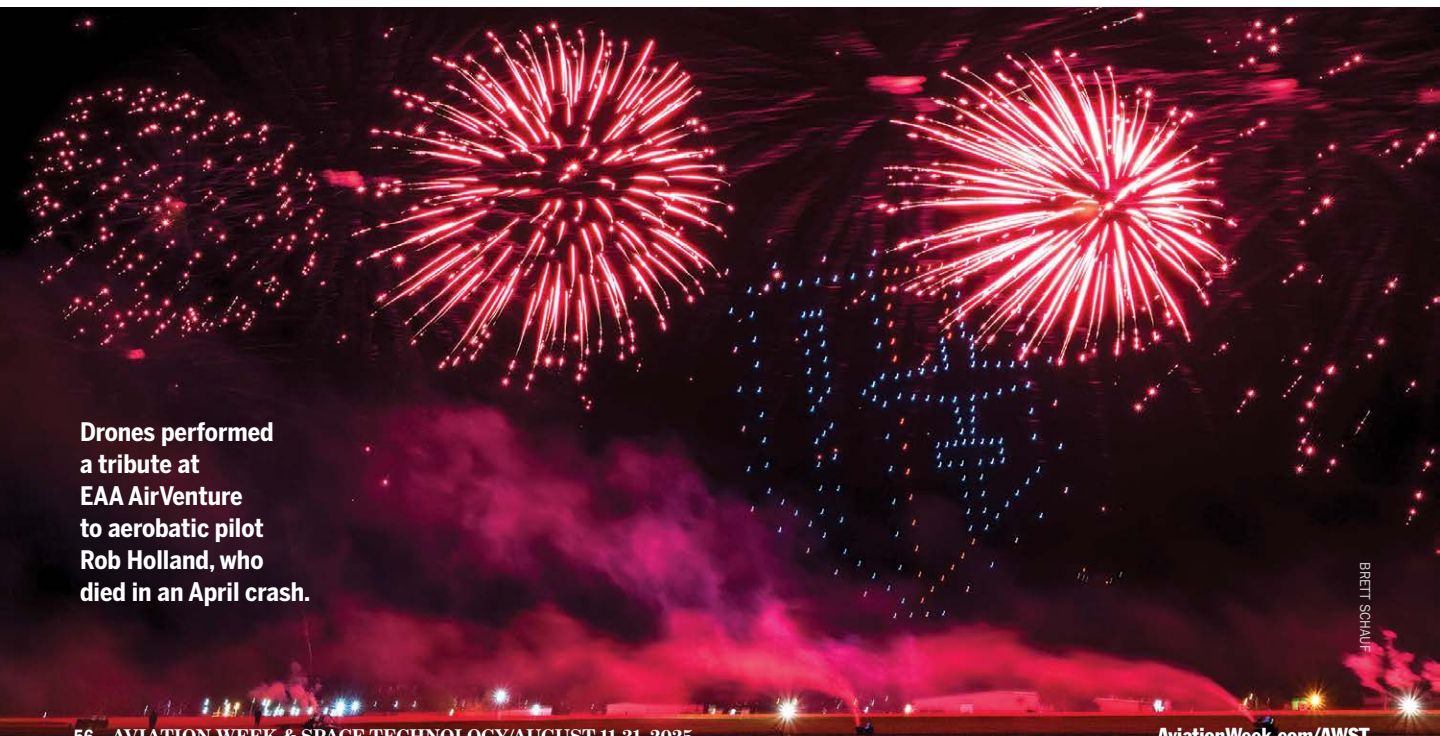
the Modernization of Special Airworthiness Certification (Mosaic) to a big crowd here at the world's largest air show.

"We just finalized a major reform that's going to make recreational flying safer, more accessible and [with] far less red tape to tie us up in," Duffy said. "And as you all know, that is our mission with Mosaic. For too long, our rules have been outdated, holding back our pilots, our builders and our innovators. It's been over 20 years since this rule has been updated, and a lot has changed in the last 20 years, so that's why we're excited to be here today."

The rule removes outdated weight limits on light sport aircraft, increases stall speeds and expands the types of aircraft that qualify as light sport while keeping safety "front and center," Duffy said.

The change will increase access to general aviation by expanding the scope of light sport aircraft and sport pilot privileges while also bringing higher-performance and newly manufactured aircraft into the segment.

"We want to encourage way more interest in aviation,"



Drones performed a tribute at EAA AirVenture to aerobatic pilot Rob Holland, who died in an April crash.

BRETT SCHAU

Duffy said. “It’s also going to allow us more capabilities and benefits to advanced air mobility, the [electric vertical-takeoff-and-landing vehicles] that you’re seeing around the air show. It’s going to enhance safety by ensuring the latest technologies are able to be incorporated into all of the aircraft. So this is an exciting time. I’m thrilled about this rule.”

In creating the final rule, the FAA reviewed more than 1,300 public comments submitted after the proposal was issued.

“It really is a great testament to government and industry coming together to put together rules that make sense, rules that lower bureaucracy and increase safety, because that’s what we’re all about every day,” FAA Deputy Administrator Chris Rocheleau told those gathered for the announcement.

The rule will be phased in over the next year. During that time, the FAA will conduct broad outreach to educate the industry and the public on what is changing and how it will be implemented, Rocheleau said.

The announcement and its publication in the Federal Register allows groups such as the Experimental Aircraft Association (EAA) and others to review the rule and create programming to meet newly available possibilities, the EAA said.

“This is one of most significant rule packages for general aviation in the past 75 years,” said Jack Pelton, EAA CEO and chair. As a result of the rule, the aircraft available to sport pilots could expand to as much as 70% of the current general aviation fleet.

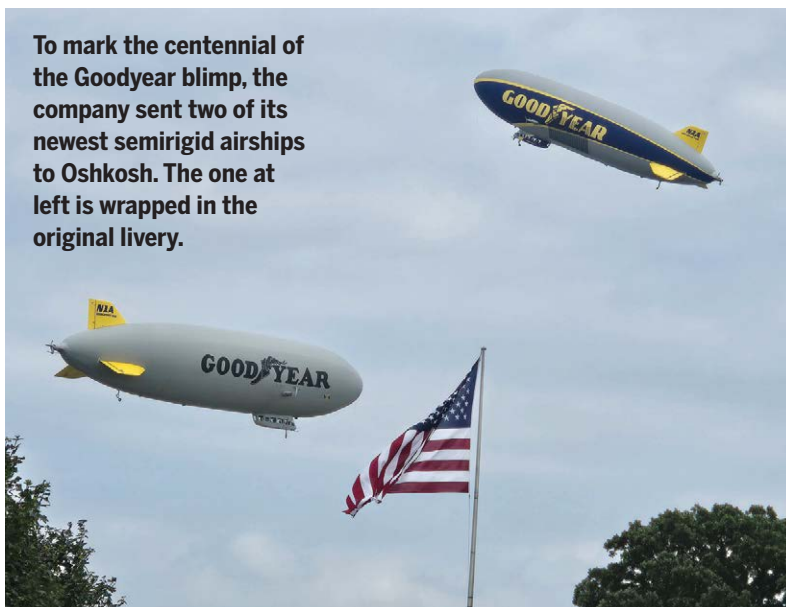
That will reduce the cost of flight training, Pelton said. With the change, most of the current flight training fleet will be available for sport pilot training. It also expands the number of flight instructors available to teach students and the ability for general aviation flight schools to use their fleets for a broader range of students.

“Now you have this giant base of airplanes that people can go and get a sport pilot’s license,” Pelton said. “This way, somebody can go fly a [Cessna] 172 and become a sport pilot. . . . You now have an airplane that’s far more capable as far as useful loads, speeds—it can have retractable gear. It can have a constant speed propeller. There’s no speed restriction, there’s no range restriction, and there’s no weight restriction.”

In addition, aircraft manufacturers have opportunities to introduce new designs without the stricter requirements.

Besides removing aircraft weight limitations, Mosaic increases maximum stall speeds to 59 kt. calibrated air-speed and expands the maximum number of seats to four from two, although a sport pilot can take only one passenger on a flight. It allows pilots to fly, with additional training, aircraft with controllable pitch propellers and those with a retractable gear. After proper training and related endorsements, sport pilots will be allowed to fly at night and operate more complex aircraft.

To mark the centennial of the Goodyear blimp, the company sent two of its newest semirigid airships to Oshkosh. The one at left is wrapped in the original livery.



MICHAEL LAMIT / AWAST



BRETT SCHAUPE

Talos Drones displayed its T60X agricultural drone at Oshkosh. It can carry about 13 gal. and spray as much as 70 acres per hour. Farmers were among the first commercial drone users.

Mosaic also paves the way for electric and hybrid propulsion. Many developers of small personal electric aircraft, including electric vertical-takeoff-and-landing vehicles, plan to go to market through Mosaic.

Todd Simmons, Cirrus Aircraft president of customer experience, says his company supports Mosaic, and he thinks it is “fantastic” that the final rule has been published. “It’s fair to say additional work remains on how to implement Mosaic,” he notes. “I am a big fan of industry-consensus standards, and so I think we at Cirrus see where that can offer a lot of opportunity going forward, but implementation matters.”

Mosaic would apply to the lower end of the Cirrus portfolio, Simmons says. “But, like everybody else, we see opportunity in using a consensus standard, an industry-driven standard,” he adds. The change to stall speed performance and removal of weight limitations should lower the cost of entry.

An American Champion 8KCAB Super Decathlon flew inverted over the center of the show on AirVenture's opening day.



BRETT SCHAUF

STEVE TRIMBLE / AW&ST



"We're going to look at that and see where we can apply that, where Mosaic applies," Simmons says.

Mosaic is good for the industry overall, says Christopher Crow, Textron Aviation vice president of piston sales. It will take time to understand where aircraft fit into the ruling. "It will take a little while to kind of get our bearings around it," he says. ☺

—With Ben Goldstein in Boston

STEVE TRIMBLE / AW&ST



The Titan Aerobatic Team performed just before dark during the AirVenture night flying display on July 23.



BRETT SCHAUF

Racine, Wisconsin-based DeltaHawk's new DHK-4V diesel engine (top left) displayed at Oshkosh burns jet fuel as part of a hybrid-propulsion system. A Chinese drone manufacturer unveiled the Janus-19 (bottom left), which functions like a drone but can be operated by a pilot seated on the underslung gondola using a handheld console.

Electric R66 Demonstrator Could Be a Steppingstone to Serial Production

- ROBINSON HELO TO BE POWERED BY HELISTORM ELECTRIC MOTOR
- THE PROJECT ALSO IS EXPECTED TO INFORM DECISIONS ABOUT PERFORMANCE TRADE-OFFS

Ben Goldstein Boston

The Robinson Helicopter Co. and electric propulsion startup MagniX have partnered to convert a Robinson R66 into an electric-powered flight demonstrator.

Unveiled at the Experimental Aircraft Association's AirVenture fly-in in Oshkosh on July 23, the project comes after MagniX launched the Helistorm family of electric engines this year.

The effort marks the first by MagniX to electrify turbine-powered rotorcraft. The startup has participated in separate projects to fly the piston-powered Robinson R44 on electric propulsion alone and with an electric motor combined with a hydrogen fuel cell.

The electrified R66 is scheduled to start flying in 2026, potentially laying the groundwork to a new product line.

Following the announcement, Robinson CEO David Smith expressed optimism about the possibilities of battery-powered helicopters. But he also acknowledged that battery shortcomings likely will limit them for the foreseeable future to flight training and niche use cases like aerial tourism.

"The battery team at MagniX believes they can hit 1,000 cycles on the chemistries that are 300 [Wh/kg] and above, and if we can demonstrate that, then I think you've got a pretty good training aircraft there," Smith told Aviation Week.

Despite its limitations, Smith said the electric R66 could have a compelling sales pitch, if pursued. In addition to the typical selling points of electric aircraft—low maintenance costs, high reliability and lack of noise and emissions—he noted the high-performance, highly redundant architecture of MagniX's Helistorm as a key feature.

Unveiled in March, the lightweight, high-speed Helistorm family of electric engines will operate in the 6,000-7,000-rpm range. The first engine will provide peak power of 330 kW and leverages lessons learned from flight tests of a reengined R44

with the 280-kW Magni250 electric propulsion unit.

Robinson has sold more than 1,500 models of the R66 powered by the Rolls-Royce RR300 turboshaft engine, the company says.

"I think the real difference maker is the [Helistorm] motor. It's small, very tightly packed and very dense," Smith said. "But the most exciting

back the speed—there's a good chance that's a trade that most customers will make in this weight class," he said. "If it means you go from a 45-min. [endurance] with reserve to an hour with reserve—or a 30% increase—that is likely a trade most people will make."

Meanwhile, Robinson has partnered with United Therapeutics (UT) to develop a hydrogen-fuel-cell-powered R44 proof-of-concept demonstrator, which made its first flight in March, part of a plan to certify a hydrogen-electric version of the R66 eventually.

UT has taken the lead on developing the demonstrator while Robinson will lend its expertise and resources to accelerate certification of the modified R66 for serial production. Smith has said the hydrogen helicopter could be certified by the end of the decade.

The electrified R66 is scheduled to start flying in 2026.



THE ROBINSON HELICOPTER CO.

part is that it's got two stacks inside of it, so it can handle many failures in the same way a twin-engine aircraft can. It's like the best of both worlds—a single powerplant module but with redundancy built inside."

Smith took care to emphasize that the electric R66 demonstrator is not merely a science project but a steppingstone to a potential new product line. The biggest hurdle, in his estimation, is the certification of the Helistorm electric motor—although he thinks the demonstrator will help advance that effort. The project also will provide key feedback to help inform decisions about performance trade-offs.

"One of the trades that I think is fairly straightforward is, 'How fast do you need to go?' And if I trade that against total flexibility of the mission—for example, if I can increase the gross weight of the aircraft because I cut

While he is generally bullish on electric and hydrogen-electric helicopters, Smith is known as a skeptic of electric vertical-takeoff-and-landing (eVTOL) aircraft, citing their high disk loading and inability to hover for long periods of time.

"VTOL is mostly defined by hover," he said. "The reality is, you're going to need an indefinite amount of hover time to be able to accommodate the air traffic that is already in place. . . . You need to be less abusive on batteries and less abusive on motors in a hovering state, and so high disk loading products are a dead idea and really terrible for civil application."

"So to me, it's not even a logical question—big wings are the solution, and in helicopters that's the rotor," he added. "If you want to be as efficient as possible, the best way to do it is a large, lightly loaded disk." 🌀

DUAL-USE SEA SKIMMER



➤ REGENT ANNOUNCES HYBRID, AUTONOMOUS, SUBSCALE VERSIONS OF VICEROY ELECTRIC SEAGLIDER

➤ COMPANY SEES USE FOR ISR, MEDEVAC, TROOP RESUPPLY AND LAUNCHED EFFECTS

REGENT CRAFT IMAGES

Ben Goldstein Boston

U.S. startup Regent Craft has lifted the veil on a new product line aimed at maritime defense missions, including hybrid, autonomous and subscale versions of its 12-passenger electric seaglider.

The Regent Defense business, announced at the Reindustrialize summit in Detroit on July 16, will pivot the Rhode Island-based startup from developing its Viceroy as a purely passenger-focused vessel to serving both commercial and defense customers.

As a hydrofoiling wing-in-ground-effect seaglider, the Viceroy was initially designed to carry two crewmembers and 12 passengers, or a 3,500-lb. payload, over coastal waterways within a wingspan of the water's surface. It has a maximum range of 180 mi. and top speed of 180 mph.

In addition to passenger transport, Regent now sees an opportunity for the Viceroy to augment the U.S. Armed Forces, particularly in the Indo-Pacific theater, with its numerous island chains spread out across vast stretches of ocean. The startup says that as a defense vessel, the Viceroy and its variants can be useful for intelligence, surveillance and reconnaissance (ISR),

medevac and search-and-rescue, troop resupply and logistics, and launched effects, including deployment of uncrewed systems.

Regent also touts the Viceroy family's long-range, high-speed capabilities and low signature. As a vessel that flies about 50 ft. above the ocean surface, the seaglider remains below radar range and above sonar with a low heat and infrared signature, which improves stealth, the company says.

Tom Huntley, Regent's vice president of government relations and new general manager of defense, tells Aviation Week that electric and hybrid seaglidars will offer military customers the ability to conduct stealthy, distributed operations in austere environments "at a cost they can afford and at a scale that we can produce.

"It's not a replacement for any of our legacy vessels or aircraft," Huntley continues. "It really supplements and complements the existing tools in

The Viceroy can travel 180 mi. on batteries and 1,600 mi. with hybrid propulsion.

the tool belt. Fundamentally, it gives our warfighters the ability to surge troops and gear into an austere environment, the ability to land on the water and do medevac, the opportunity to do clandestine.

"And it can be a platform for other products, whether they be sonobuoys or small unmanned drones or surface vehicles," he adds. "So it really is a flexible tool for the warfighter, just like it is a flexible tool on the commercial market."

Regent has unveiled complementary variants of the all-electric Viceroy for defense missions. These include an autonomous version, a hybrid variant with an extended range of 1,600 mi. and a quarter-scale, autonomous hybrid version called the Squire, which has a payload of 50 lb., top speed of 80 mph and range of 115 mi.

Huntley says the hybrid variant will maintain the same form factor as the electric version, so there will be no need for extensive modification work. He notes that half the batteries have been removed from the electric Vice-

roy's hull and replaced with a fuel bladder and high-output turbogenerator that powers the propulsion system and charges the batteries in cruise flight.

"The hybrid-electric system uses 1/20th of the fuel of a lift helicopter," he explains. "It really does enable the warfighter to have mission flexibility because they've got range, and in an austere environment, you don't have the charging infrastructure. But at the same time, it maintains the value of the electric-propulsion system: low maintenance, low cost and [high reliability]."

Huntley says the Viceroy's triple-redundant vehicle control system was built "from the ground up" to be autonomous with a human interface, simplifying the amount of work needed for the autonomous variant.

"For the defense market, there is a strong desire for autonomous systems to do logistics missions, to go into conflict areas where having humans onboard may create additional mission risk," he says. "It really is the time right now as we develop the vehicle control system to continue that pathway toward full autonomy."

Lastly, for the Squire, Regent had already built and flight-tested a remotely controlled, quarter-scale demonstrator prior to developing its full-scale prototype, so the design is well understood. As an uncrewed surface vehicle or drone, the miniature vessel can be a critical tool for long-endurance,

stealthy ISR missions, Huntley says.

"It can land on water, and it can have unlimited endurance by just floating on the surface," he says. "Maybe it's collecting intelligence or taking photographs. Really, this provides an unparalleled and unmatched capability in the drone and unmanned surface vehicle market."

tions Command and the Coast Guard Research and Development Center.

Regent's new defense business will be supported by a military advisory panel that was created in 2022, consisting of seven retired officers from the U.S. Navy, Coast Guard, Marine Corps and Special Operations Command.

Regent Defense is launching as the



Regent is testing a full-scale, all-electric prototype in Rhode Island's Narragansett Bay.

The seaglidings will be manufactured at Regent's mass production facility in North Kingstown, Rhode Island, which is expected to come online in 2026.

Regent is already partnering with the U.S. Marine Corps, having been awarded a \$10 million second-phase contract agreement to validate seaglider use cases with the service's Warfighting Laboratory in March.

The company also has ongoing relationships with U.S. Special Opera-

startup tests its first full-scale prototype in Rhode Island's Narragansett Bay, including float and hydrofoil trials, in preparation for first liftoff, which is expected in the coming months.

The startup also is getting going shortly after DARPA ended its Liberty Lifter effort to build a full-scale seaplane demonstrator earlier than originally expected. DARPA decided it was not cost-effective or feasible to build the aircraft. ☒

AdvancedAirMobility
REPORT

INTELLIGENCE AND ANALYSIS OF KEY DEVELOPMENTS HAPPENING IN ADVANCED AIR MOBILITY

Learn more at
aviationweek.com/AAMinfo

Contact Melissa Crum at +1 913 284 2951 | melissa.crum@aviationweek.com

**AVIATION
WEEK**
NETWORK

TECH TAKE

By **Graham Warwick**

For the latest, go to [AVIATIONWEEK.COM](https://www.aviationweek.com)

Michigan Plans Air Mobility Testbed

The state of Michigan plans to create an advanced air mobility testbed that consists of a 40-mi. airspace corridor for drones and air taxis to connect the University of Michigan in Ann Arbor with the Michigan Central technology hub in downtown Detroit.

UNIVERSITY OF MICHIGAN



The M-Air test site is an extension of the autonomous transport research center.

The Michigan Economic Development Corp. is providing \$1 million in funding support for the M-Air project. The advanced air mobility (AAM) testbed is an expansion of the existing Mcity public-private partnership, which provides a connected and automated vehicle test facility under the University of Michigan (U-M) Transportation Research Institute.

In addition to the state funding, U-M is providing another \$1 million and Michigan's Transportation Department will provide a similar amount to build out and operate the infrastructure, Venkat Viswanathan, director of M-Air and an associate professor at U-M, tells Aviation Week.

M-Air has signed letters of intent with five potential industry members of the public-private partnership, each of which will pay \$300,000-500,000 to participate. "We will have \$5-8 million to start with in the next two months," Viswanathan says.

The five potential founding members include a communications services provider for beyond-visual-line-of-sight drone operations, an electric vertical-takeoff-and-landing (eVTOL) platform developer, an aircraft OEM, a drone-maker and an automotive manufacturer, Viswanathan says. He notes that Joby investor Toyota is a founding partner of Mcity and that Archer backer Stellantis

has a major presence in Michigan.

U-M plans to make the M-Air facilities compatible with electric short-takeoff-and-landing aircraft as well as eVTOL vehicles by connecting the Mcity vertiport to an adjacent test road. "They will not be able to land only vertically," Viswanathan says. "We will have enough runway space."

Planning for M-Air has been underway for a year, but the pace of development has accelerated after Gov. Gretchen Whitmer signed an executive order on July to establish the Michigan Advanced Air Mobility Initiative. The goal of the initiative is to scale the state's AAM capabilities, ensure safe and efficient integration across public and private sectors, and position Michigan's industry to lead the deployment of AAM technologies.

The two major elements of M-Air will be iron bird testbed facilities at U-M Ann Arbor and the flight corridor, which will be anchored by vertiports already in place at the Mcity test facility at one end and Michigan Central at the other. Beta Technologies is installing charging stations for electric aircraft.

The iron bird test facilities include a propeller stand that enables users to demonstrate the performance of batteries and motors on the ground before flight testing. The testbed will be supported by the U-M Battery Lab, a facility for battery cell fabrication and testing that is open to academic and industry users.

The flight corridor will follow a disused Amtrak railway line from Ann Arbor to Michigan Central Station in Detroit, which closed in 1988 but was purchased and renovated by Ford and is now home to the Michigan Central advanced mobility incubator. The corridor will be equipped with an uncrewed traffic management system, enabling drones to share low-altitude airspace beyond the operator's line of sight. The system will support testing of swarm operations with multiple cooperating drones.

To enable real-world testing of eVTOL air taxis, the flight corridor will include two diversion landing sites at Willow Run Airport and Detroit Metro Airport, Viswanathan says. The corridor will also run through U-M Dearborn, providing access to a second campus.

U-M plans to use M-Air to help advance Michigan Medicine's Survival Flight emergency medical service, which currently uses helicopters to transport patients and organs for transplant. Goals include enabling drones to share airspace with helicopters and using drones and eVTOLs to transport organs.

Joby and L3Harris Hybrid eVTOL

Joby Aviation has partnered with L3Harris Technologies to explore development of a hybrid-electric vertical-takeoff-and-landing aircraft for defense applications. The aircraft is an optionally piloted, turbine hybrid version of Joby's S4 tiltprop electric air taxi.

Joby joins Archer Aviation, Beta Technologies and UK startup Vertical Aerospace in developing longer-range hybrid-electric versions of their commercial eVTOL aircraft for defense use.

The partnership combines Joby's aircraft development and manufacturing capabilities with L3Harris' platform missionization expertise in sensors, effectors, communications and collaborative autonomy. Flight testing is expected to start this fall, followed by operational demonstrations and exercises in 2026.

"The next generation of vertical lift technology enables long-range, crewed-uncrewed teaming for a range of missions," L3Harris Integrated Mission Systems President Jon Rambeau said in a statement.



JOBY AVIATION

Joby and L3Harris are developing an optionally piloted S4 for defense.

Joby demonstrated its ability to hybridize the S4 eVTOL aircraft by flying a version modified with hydrogen-electric propulsion. Fitted with a fuel cell power generation system developed with Joby subsidiary H2Fly and a smaller number of batteries in the wing—but the same tilting nacelles, motors and propellers—the uncrewed demonstrator flew 561 mi. in June 2024.

Joby also has been observed flying the uncrewed hydrogen-electric conventional-takeoff-off-and-landing (CTOL) JAI30 over a test range in Oregon but has declined to comment. The aircraft completed a 24-hr. flight on July 24, investigative news outlet Hunterbrook Media reported.

Joby says it is developing a gas-turbine hybrid powertrain for the S4 and has demonstrated aircraft-level autonomy

following its acquisition of the autonomy division of Xwing in June 2024.

“We have worked closely with the Department of Defense over the past decade to give them a front-row seat to the development of our dual-purpose technologies, and we’re now ready to demonstrate and deploy it,” Joby founder and CEO Joe Ben Bevirt said in a statement.

After supporting development of the U.S. eVTOL industry through U.S. Air Force innovation unit AFWerx’s Agility Prime program, the Defense Department has pivoted toward hybrid-electric platforms and away from battery-powered aircraft because of their lack of range and payload capacity.

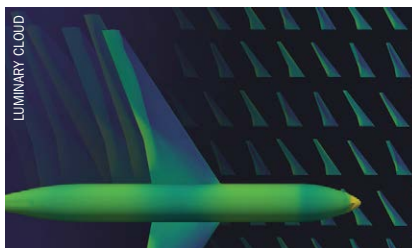
Archer Aviation partnered with defense company Anduril in December to develop an autonomous and attributable hybrid-electric aircraft based on Archer’s Midnight eVTOL air taxi. The company also raised additional funding to back Archer Defense, its venture into the military market, and believes defense demand could outstrip that of the civil market for the first 10 years.

Beta is promoting the optionally piloted MV250 derivative of its Alia A250 eVTOL for the defense market, offering a range exceeding 1,000 nm with hybrid power. The startup has flown the Alia VTOL with a range-extender kit based on an internal combustion engine and is developing a turbogenerator-based hybrid-electric propulsion system that would power the Alia through all modes of flight, including VTOL.

Vertical Aerospace announced in May that it is developing a turbine-based hybrid-electric version of its VX4 eVTOL air taxi for longer-range applications in defense, logistics and commercial missions such as air ambulance services. The hybrid version will have a range of up to 1,000 mi., 10 times that of the battery-electric VX4, and be able to carry up to 1,100 kg (2,425 lb.).

Simulation Tackles Transonic Wings

A U.S. startup that promises to accelerate engineering simulation using physics-based artificial intelligence and cloud access to massive computing power has released its first model for transonic wing design. Luminary Cloud has developed the Shift-Wing model in collaboration with business jet developer Otto Aviation, which is using the simula-



Shift-Wing is a machine-learning model trained on simulations of NASA’s CRM.

tion platform to design low-drag, natural laminar flow wings.

Luminary’s founding principle was to enable rapid design exploration, iteration and optimization using a massively scalable simulation platform. That platform leverages secure cloud access to high-performance computing based on the raw power of graphics processing units (GPU) used for machine learning and artificial intelligence (AI).

Whereas conventional computational fluid dynamics (CFD) simulations require significant manual preparation, substantial computing power and time to calculate flows, Luminary says its software rapidly and accurately produces results by inference using physics-based machine-learning models.

Luminary developed the Shift-Wing model and its initial dataset using GPU manufacturer Nvidia’s PhysicsNeMo framework for building, training and fine-tuning physics-based AI models. The model is being pretrained using a large-scale, high-fidelity dataset generated by parametrically modifying and simulating several thousand variants of the NASA Common Research Model (CRM) wing-body geometry.

The CRM is a publicly accessible configuration similar to the Boeing 777 that allows researchers worldwide to conduct analyses and experiments on a common geometry. “We start with the CRM and vary 30 parameters, including geometry, lift coefficient and Mach number; to give us quite a large distribution of force and moment coefficients,” Luminary co-founder and Chief Technology Officer Juan Alonso tells Aviation Week.

Luminary is releasing Shift-Wing, backed by about 3,000 simulations. Alonso says the startup is “marching toward” meeting its inference accuracy target of 1% for lift, drag and moment coefficients once it has completed pretraining of the Shift-Wing model with 10,000-20,000 simulations. The model takes 2.5 sec. to execute a simulation, compared with hours or days for conventional CFD, he says.

Once it has been pretrained on a large dataset, Shift-Wing can be tailored to a specific customer’s needs by pretraining the model with a smaller set of bespoke data. This is how startup Otto is using Luminary’s software to refine the slotted laminar flow wing design for its Phantom 3500 business jet.

EU Funds Slovakian Hydrogen VTOL

A Slovakian-led research project to develop a hydrogen-powered eVTOL aircraft has been approved to receive almost €60 million (\$70 million) in European Union funding.

The six-year H2 VTOL project is led by Tomark Proton, a spinoff of Slovakian light sport aircraft manufacturer Tomark Aero. The project involves Airbus in Germany and Spain, BMW, Spanish electric mobility specialist Evolution Synergetique Automotive, hydrogen technology companies HDF Energy in France and Neuman & Esser in Germany, and Estonian supercapacitor producer Skeleton Technologies.



The H2 VTOL project plans to develop a hydrogen-powered eVTOL aircraft.

Nine universities in the Czech Republic, Estonia, Finland, Germany and Slovakia are involved. VSB-Technical University of Ostrava, in the Czech Republic, will test and analyze composite hydrogen tanks developed in cooperation with BMW. The Technical University of Kosice, in Slovakia, will develop a training system for hydrogen aviation based on virtual reality and developed with Airbus Spain.

In addition to developing a hydrogen-electric VTOL aircraft for medical rescue and urban mobility by 2030, the project aims to develop and certify recyclable composite high-pressure hydrogen tanks and valves for aviation, which could also find application in other forms of transport and industry.

The H2 VTOL project is funded under the European Commission’s Hy2Move program. ☼

Aviation Week Marketplace is a digital directory connecting **buyers with sellers** in the aerospace, air transport, business aviation, MRO and defense industries. *Become a power user by registering at marketplace.aviationweek.com/register. Registration is FREE, enabling you to find thousands of products like the ones featured below and to connect with more than 12,000 global suppliers. Create a personalized save list, learn about companies' specialties, get contact details and request information. Connect today at marketplace.aviationweek.com. Aviation Week Marketplace is the one source to find everything needed in aviation.*

Advertise on the Marketplace: contact **Elizabeth Zlitni** at **212-600-3713** or elizabeth.zlitni@aviationweek.com.

Place a classified ad: contact **Beth Eddy** at **561-279-4646** or beth@aviationexhibits.com.

FUEL/LUBRICANTS

Tiodize

T8E 1400°F LUBRICATIVE ANTI-SEIZE GREASE

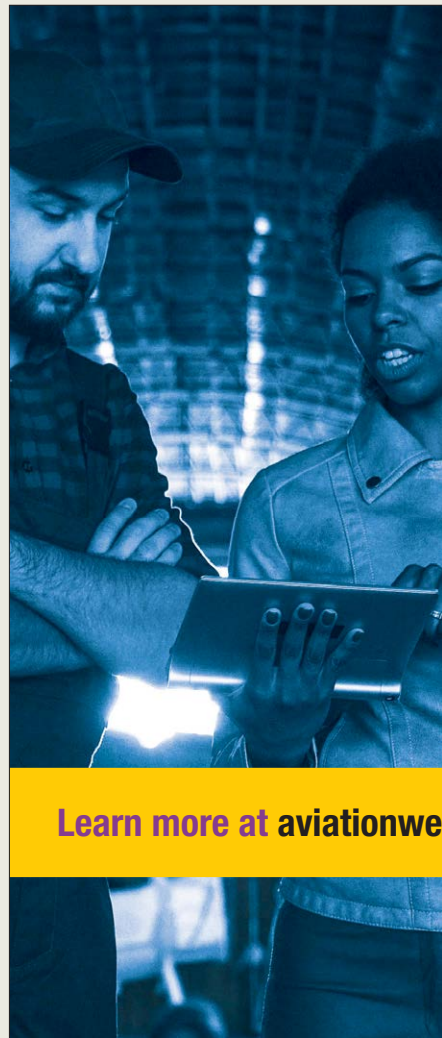
Tiodize T8E-H 1400° F Anti-Seize Grease replaces graphite petroleum grease on the new Gen-X and 9X Jet Engines. T8E-H is designed to be used as an aid for the installation and removal of threaded fasteners which are exposed to temperatures to 1400° F for long periods of time. Galled nuts and bolts are a big deal! Use T8E-H to eliminate the galling. You will be sold on it the first time you encounter stuck bolts during maintenance. To prevent these occurrences, use T8E-H on all fasteners. T8E-H is approved to SAFRAN DMR 75-905 and GE Aviation D6Y31 C2 and **does not contain calcium**.



www.tiodize.com

<https://marketplace.aviationweek.com/product/tiodize-t8e-1400-f-lubricative-anti-seize-grease>

TECHNOLOGY



Marketplace

Where **Buyers** Meet **Suppliers**.

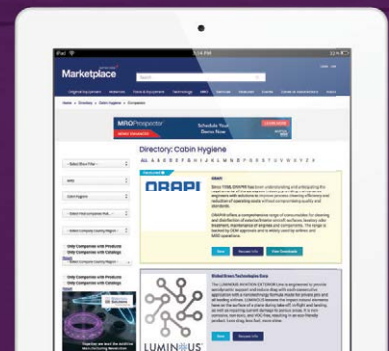
Join **12,000+** Global Suppliers and Growing

Aviation Week Marketplace is the next generation interactive supplier directory. Buyers turn to Aviation Week Marketplace to find, research, and connect to products and services around the world.

Join the Marketplace today and easily reach aerospace professionals looking for **YOUR** products and services.

Learn more at aviationweek.com/marketplace

AVIATION
WEEK
NETWORK



Go to marketplace.aviationweek.com for more information.

Contact Us

President/Publisher: Gregory D. Hamilton
hamilton@aviationweek.com

Vice President, Sales of Data, Intelligence & Media:
Thom Clayton
thom.clayton@aviationweek.com

U.S. Sales Offices

Senior Director, North American Media: Rob Howlett
rob.howlett@aviationweek.com

International Regional Sales Offices

Managing Director, Defense & Space:
Andrea Rossi Prudente
andrea.rossiprudente@aviationweek.co.uk

Marketing Services

Director, Digital Customer Solutions: Jason Washburn
jason.washburn@informa.com

Sales Team Listings: @AviationWeek.com/sales-contacts

Business/Production

Ad Operations Manager: Bonnie Streit
yvonne.streit@informa.com

Advertising/Marketing Services

Media Kits, Promotions or Custom Media:
www.aviationweek.com/mediakits or Elizabeth Sisk
elizabeth.sisk@aviationweek.com

Business and Finance Manager: Gabriel Balmes
gabriel.balmes@informa.com

Subscriber Service

U.S.: (877) 369-3767

Outside the U.S.: +1 (913) 850-6931

Manage Your Subscription (and Claim Digital Edition) at:
aviationweek.com/awstcustomers

Conferences/Exhibitions

www.aviationweek.com/events:

To Sponsor/Exhibit: Beth Eddy;
(561) 279-4646; betheddy@aviationexhibits.com

To Register: Virginia Gongora
virginia.gongora@aviationweek.com

AW&ST Mailing List Rental and Sales

Anthony Treglia anthony.treglia@informa.com

Reprints, Photocopies and Permissions

Custom Reprints: informa@wrightsmedia.com

Social Media

Join the conversation. Follow us at:

linkedin.com/company/aviation-week
Twitter.com/AviationWeek
Facebook.com/AvWeek
YouTube.com/AviationWeek

Aviation Week & Space Technology is published biweekly, with one issue in August by Informa Markets, a trading division of Informa Media, LLC, 22701 W. 68th Terrace, Ste. 100, Shawnee, KS 66226-3583. Member of Audit Bureau of Circulations and Magazine Publishers of America. Periodicals postage paid at Kansas City, MO and additional mailing offices. Canadian GST #R126431964. Title reg.® in U.S. Patent Office. Copyright © 2025 by Informa Markets, a trading division of Informa Media, LLC. All rights reserved. All rights to these names are reserved by Informa Markets. **Postmaster:** Send address changes to *Aviation Week & Space Technology*, Attention: Subscription Services, 22701 W. 68th Terrace, Ste. 100, Shawnee, KS 66226-3583.

Aviation Week & Space Technology
August 11-31, 2025
Vol. 187, No. 16 (ISSN 0005-2175)

AviationWeek.com/AWST

AeroEngines

AVIATION WEEK
EUROPE

September 9-10, 2025
CCH Congress Center, Hamburg, Germany

The leading event
dedicated to the
region's aero engine
community

3 days of exclusive networking,
2 days of content, 1 unforgettable event!

aeroengineconference.com

AVIATION WEEK
NETWORK

Aviation Week Network Events

+1 (800) 722-6344 or Events.AviationWeek.com

Sept. 9-10—AeroEngines Europe. Hamburg, Germany.

Sept. 9-10—CAPA Airline Leader Summit – Latin America & Caribbean. Lima, Peru.

Sept. 16-18—MRO Asia-Pacific. Singapore.

Sept. 24-26—Routes World. Hong Kong.

Oct. 14-16—MRO Europe. London.

Oct. 30-31—CAPA Airline Leader Summit – Asia. Singapore.

Nov. 4—GAD Asia. Hong Kong.

Nov. 4-6—TakeOff North America. Tallahassee, Florida.

Dec. 10-11—GAD World. Lisbon, Portugal.

Dec. 11-12—CAPA Airline Leader Summit – World. Lisbon, Portugal.

Jan. 14-15, 2026—MRO Latin America. Santiago, Chile.

Feb. 4-5—MRO Middle East. Dubai, United Arab Emirates.

ADVERTISERS IN THIS ISSUE

Aviation Week Events

AeroEngines Europe	33
MRO Asia-Pacific	50
MRO Europe	37

Aviation Week Network

Advanced Air Mobility Report.....	61
Defense Market Analyzer	29
Fleet & MRO Forecasts.....	51

Market Briefings	4
Space Community of Brands	3rd Cover
Dubai Airshow	7
Lockheed Martin.....	4th Cover
Rockwell Automation.....	20-21
RTX	2nd Cover
Seoul ADEX 2025	19
AVIATION WEEK MARKETPLACE	64
Tiodize.....	64

A Bridge to the Future

By **Anthony L. Velocci, Jr.**

In wildfire zones, at trauma scenes and on offshore oil rigs and law enforcement missions, rotor blades are falling silent—not because of a drop in demand, but rather because there is a shortage of pilots and technicians.

The helicopter industry—a critical pillar of public safety, infrastructure support and emergency response—is facing a talent crisis so severe that it threatens lives, delays vital services and weakens national readiness. Yet this worsening situation is unfolding with barely a whisper on the national stage.

Pilots and mechanics are aging out, training pipelines are underfunded, and younger generations are turning away from rotorcraft careers. This is not just a workforce issue; it is a threat to national resilience—one that demands immediate, coordinated action before the consequences become dire.

The helicopter field is uniquely challenging compared with other sectors of the aviation and aerospace industry, especially commercial airlines and space technology. There are distinct factors at play:

Helicopter operations require technical skills not typically transferable from fixed-wing aviation, and maintenance personnel need specific certifications and experience with rotary-wing aircraft, which limits the talent pool.

Fewer training institutions focus on helicopter pilot and technician education compared with fixed-wing programs. Moreover, helicopter training tends to be more expensive per hour, which can discourage new entrants. Compared with commercial airline pilots or aerospace engineers, helicopter professionals also often face lower pay and fewer long-term advancement opportunities, making recruitment and retention difficult.

Exacerbating the problem is that the broader aviation and aerospace sectors attract more attention, funding and workforce interest than the rotorcraft field, which in turn makes their talent-pool pipelines stronger and more sustainable.

Traditional job fairs and other one-dimensional recruiting initiatives will not be enough to break this paradigm. The pool of qualified candidates is just too shallow.

For innovative, underexploited alternatives, look no further than Oklahoma. In 2022, its legislators were persuaded to provide curriculum incentives to high schools willing to offer aviation courses for which students were awarded core-curriculum credits. The result was a significant spike in enrollment.

With the support of the Oklahoma Department of Aerospace and Aeronautics, the state has since become a national leader in high school aviation education—and a

model that other states could follow. Imagine the possibilities if all states saw the value of such a program.

Taking this enterprising approach one step further, a group of concerned stakeholders recently rolled out a recruiting tool unlike anything the industry had ever seen. HeliStorm, as it is called, is an interactive event showcasing scale radio-control (RC) model helicopters to attract students, educators and early-career influencers, and it

involves some of the biggest players in the business.

As a recruiting tool, the event was designed to guide interested individuals toward careers in the helicopter industry. Planning is underway for next year's HeliStorm, based on strong enthusiasm among the 1,500 or so people who attended this year's event.

By making tangible, hands-on engagement the centerpiece, RC models provide visual and physical interactivity, which is far more compelling than static displays or slick promotional material. Students can see the mechanics of flight up close and even pilot simplified versions, giving them a taste of control and precision.

Scale models and RC helicopter demonstrations are an accessible entry point into a complicated field. They can demystify the complexity of helicopters by breaking down flight principles, rotor dynamics and maneuver-

ability in an understandable way.

In addition, RC models and demonstrations also offer an emotional and inspirational hook. Watching or controlling an RC helicopter in action often triggers awe and curiosity, which are powerful motivators for career interest.

It does not require a leap of faith to imagine educators who are exposed to such interactive recruiting events being inspired to integrate aerospace concepts into their science, technology, engineering and math curricula or invite industry speakers, creating a multiplier effect.

There is nothing new about leveraging model aviation to inspire interest in full-scale aviation. What is new is combining the most complex form of model aviation with an event that offers young people a powerful, engaging entry point into the industry.

It is the kind of inspired recruiting the industry needs to support—not simply as a recurring annual event, but as part of a broader, sustained outreach strategy. Here's why: It is probably as close to a bridge to the helicopter industry's future as anyone has formulated. 🌉

Anthony L. Velocci, Jr., was editor-in-chief of Aviation Week & Space Technology from 2003 to 2012.



CHERYL PRICHARD/NATIONAL MUSEUM OF THE U.S. AIR FORCE

**“SCALE MODELS AND RC
HELICOPTERS ARE AN
ACCESSIBLE ENTRY
POINT INTO A
COMPLICATED FIELD.”**

**AVIATION
WEEK**
NETWORK

**YOUR
GLOBAL SPACE
COMMUNITY**
OF BRANDS

AVIATIONWEEK
& SPACE TECHNOLOGY

AerospaceDaily
& DEFENSE REPORT

AVIATION WEEK
Intelligence
NETWORK



When you engage with our brands you'll tap into powerful resources to support critical decision-making and connect with people and opportunities. Each is a trusted source for market insights and opportunities within the space market — together they provide a powerful, integrated solution to support your growth and success.

Contact us to find the right solution for your organization.

Know. Predict. Connect.

aviationweek.com/knowpredictconnect

BATTLE-TESTED. NOT JUST BETA-TESTED.

Air dominance in action. The F-35 is more than a fighter jet, it's the ultimate force multiplier. Pressure-tested, combat-proven and mission-ready, it remains the quarterback of 21st century global security. And ensures those we serve always stay

AHEAD OF READY



Digital Edition Copyright Notice

The content contained in this digital edition ("Digital Material"), as well as its selection and arrangement, is owned by Informa and its affiliated companies, licensors, and suppliers, and is protected by their respective copyright, trademark and other proprietary rights.

Upon payment of the subscription price, if applicable, you are hereby authorized to view, download, copy, and print Digital Material solely for your own personal, non-commercial use, provided that by doing any of the foregoing, you acknowledge that (i) you do not and will not acquire any ownership rights of any kind in the Digital Material or any portion thereof, (ii) you must preserve all copyright and other proprietary notices included in any downloaded Digital Material, and (iii) you must comply in all respects with the use restrictions set forth below and in the Informa Privacy Policy and the Informa Terms of Use (the "Use Restrictions"), each of which is hereby incorporated by reference. Any use not in accordance with, and any failure to comply fully with, the Use Restrictions is expressly prohibited by law, and may result in severe civil and criminal penalties. Violators will be prosecuted to the maximum possible extent.

You may not modify, publish, license, transmit (including by way of email, facsimile or other electronic means), transfer, sell, reproduce (including by copying or posting on any network computer), create derivative works from, display, store, or in any way exploit, broadcast, disseminate or distribute, in any format or media of any kind, any of the Digital Material, in whole or in part, without the express prior written consent of Informa. To request content for commercial use or Informa's approval of any other restricted activity described above, please contact the Reprints Department at (877) 652-5295. Without in any way limiting the foregoing, you may not use spiders, robots, data mining techniques or other automated techniques to catalog, download or otherwise reproduce, store or distribute any Digital Material.

NEITHER Informa NOR ANY THIRD PARTY CONTENT PROVIDER OR THEIR AGENTS SHALL BE LIABLE FOR ANY ACT, DIRECT OR INDIRECT, INCIDENTAL, SPECIAL OR CONSEQUENTIAL DAMAGES ARISING OUT OF THE USE OF OR ACCESS TO ANY DIGITAL MATERIAL, AND/OR ANY INFORMATION CONTAINED THEREIN.