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OCTOBER–DECEMBER 2026

AEROSPACE

— AMERICA —

CCA comes into focus

Inside the Air Force's
effort to build a fleet
of drone wingmen.

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 AIAA

SMART SCHOLARS 2026

INVESTING IN TOMORROW'S STEM LEADERS

Funded by the Department of War, the Science, Mathematics and Research for Transformation (SMART) Scholarship supports students pursuing degrees in STEM disciplines critical to national security and technological advancement. Scholars receive full tuition, annual stipends, summer internships and civilian employment with the Department of War following graduation.



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The path ahead for CCA

With the first production contracts awarded, the U.S. Air Force's Collaborative Combat Aircraft program is moving forward.

By Jen Kirby

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This U.K. startup's drone service is meant to help reduce railroad delays.

By Paul Marks

30 AI for aircraft design

Commercial aviation companies and regulators are weighing how best to apply these tools.

By Charlotte Ryan

36 NASA is going nuclear

The agency is embracing fission power and propulsion to help achieve some of its top priorities.

By Jon Kelvey

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Meet some of the honorees of AIAA's new recognition program.

By AIAA Communications

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Aerospace America presents readers with independently produced news and feature articles and a rich variety of opinions relevant to the future of aerospace. The views expressed in these pages are not necessarily those of our publisher, AIAA.

EDITOR'S NOTEBOOK

Putting a spotlight on defense

Aerospace America was on site in August at the Space and Missile Defense Symposium in Huntsville, Alabama, for the first time in at least a decade.

It's a sign of our expanded defense coverage, but also heightened interest in Golden Dome, the planned multilayered missile shield that's intended to be operational by early 2029.

Staff reporter Aspen Pflughoeft was on the ground in Huntsville for what organizers described as the conference's largest crowd at 9,785 attendees. She reported a packed venue, with nearby spots running low on food.

One of the event's biggest stories stemmed from remarks by Gen. Michael Guetlein, who oversees Golden Dome. He told attendees the initiative has its "first operational site" at Fort Story, Virginia, and has conducted two tests, including one at White Sands Missile Range, New Mexico. However, Guetlein did not detail the particular equipment assessed.

We will be watching closely — and bringing you more news — as the effort progresses.

Inside the issue

Another sign of our expanded defense coverage? This issue's cover story, which takes a detailed look at the U.S. Air Force's Collaborative Combat Aircraft program (page 24). Author Jen Kirby notes this type of effort to produce so-called loyal wingmen able to perform a variety of tasks is gaining traction not only with other U.S. military services, but also militaries around the world.

She takes a look at the progress thus far and what experts are watching in the coming months as the program moves into production.

Also in this issue: examining whether this might finally be the time for space nuclear (page 36). Jon Kelvey

▲ An artist's concept of Golden Dome.
Lockheed Martin

digs into previous attempts to harness fission power and propulsion to shed new light on the Trump administration's plans for NASA's Space Reactor 1-Freedom and Lunar Reactor-1 programs.

Both are advancing quickly, with what appear to be the key ingredients — beyond the technology itself — to achieve their goals.

For another feature, Charlotte Ryan examines the potential of expanding the role of artificial intelligence in commercial aviation (page 30). Some of the largest companies are looking at how they can best harness AI, and regulators are weighing how it fits into their work. Ryan reports on the existing FAA and European Union Aviation Safety Agency approaches to addressing AI use and what might be coming next.

For our Engineering Notebook department, Keith Button writes about work at the MIT Lincoln Laboratory to develop technology to avoid collisions like the one between a ground truck and an aircraft that occurred earlier this year at LaGuardia Airport (page 20). The lab is developing an in-cab warning device for these vehicles that would make it easier and faster for drivers to be aware of potential collisions.

Finally, don't miss Associate Editor Cat Hofacker's Q&A with Jimmy Kenyon, head of NASA's new Research and Technology Mission Directorate (page 12). This consolidated hub of the agency's work on aeronautics and space R&D oversees many of the technologies NASA envisions as crucial to its Moon Base initiative. ★



Marjorie Censer

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AEROSPACE — AMERICA —



FLIGHT PATH

The Conversations Aerospace Needs Right Now

The Institute's technical leaders gathered at The MITRE Corporation outside Washington, DC, for our third annual CTO Summit on 9-10 September, and the conversation turned quickly to the promise and peril of artificial intelligence (AI) as it hurtles forward in aerospace engineering. The Summit saw a 30% increase in attendance as we heard from Department of War, Congressional staff, and think tank leaders about the need to accelerate the production of aerospace systems to serve growing demand across commercial, civil, and national security verticals.

Whether it's our return to the moon, defending against adversaries, or meeting the growing backlog for aircraft to connect the world, AIAA's engineering workforce is being sought after as never before. AI is seen as a key enabler to aid digital thread engineering as the community looks to scale design, test, and production capabilities.

Speed, AI adoption, and engineering workforce capacity continue to be the key themes driving aerospace forward in 2026.

Speed as a strategic asset. In aerospace, we talk about speed in terms of Mach numbers. But the speed I continue to hear about is the pace of technical progress and how AI-compute power can push development forward. It's how companies can build momentum fast enough to effectively deliver aerospace innovations to the marketplace. It's how quickly investments in technology are multiplying, powered by reformed government acquisition models and private capital investments.

NASA Administrator Jared Isaacman made the case at ASCEND's opening session in May, framing lunar return as a new space race measured in months, not years, and calling on industry to relearn the iterative discipline of the Mercury-Gemini-Apollo era rather than trying to leap straight to a finished product. Don't delay even a day a problem that we can solve, he told the standing-room-only crowd.

At our two classified events this year – AIAA DEFENSE Forum at Johns

Hopkins University Applied Physics Laboratory and ASCEND's inaugural Classified Day at The Aerospace Corporation – we picked up the same thread. Technology leaders discussed the impact of government acquisition reform and updated financing models, as well as whether our manufacturing capabilities can move at the pace the moment demands.

During the CTO Summit, we convened around the theme: Driving Faster Production and Technology Superiority: The Evolving Role of the CTO. We heard a message to American aerospace and defense manufacturers – prime contractors, second tier suppliers, and the extended supply chain – from multiple government speakers: The demand signal is clear. Push production to scale with the confidence that the U.S. government requires reliable technologies today to equip and support our warfighters. This was not a call for exquisite systems, but rather the “good enough” solutions that can be produced quickly at volume.

I also heard this refrain recently from Palmer Luckey, founder of Anduril Industries, a new entrant to the U.S. defense technology industry that designs and manufactures autonomous systems, when we sat down at Anduril headquarters in Costa Mesa, California, for the inaugural recording of my new podcast, Up Next.

Palmer was emphatic about American aerospace and defense manufacturers establishing a production capability second to none. He offered this idea, “We’re living in an age of unprecedented possibility. We need to design missiles that can be made in car factories. We need to design aircraft that can be made in tractor factories. They’re not waiting to be invented. They’re waiting to be implemented.”

I encourage you to listen to our full conversation. It was fascinating how a new, innovative defense company is approaching today's challenges with fresh thinking. Regularly, I have similar conversations with the engineering leaders, CTOs, and CEOs of other AIAA Corporate Member organizations. I'm excited to share more of these insights during the first season of Up Next (read more on next page).



tries, according to the 2025 AIAA/McKinsey annual workforce study. The Bureau of Labor Statistics projects we will need about 3,800 new aerospace engineers every year through 2031 just to keep pace with growth and retirements, not counting the existing gap. Yet our Corporate Mem-

bers tell us that they have a hiring problem. The AIAA/McKinsey study illustrates this: 76% of aerospace and defense companies are struggling to hire engineering talent specifically, with 56% facing shortages in skilled trades.

AIAA pulls two levers to help address this. Our robust continuing education catalog is aimed directly at closing the skills gap. We bring the most current topics to our members, offering more than 40 live instructor-led courses annually, plus a library of over 70 on-demand courses. In the past year, a dozen courses focused on the latest topics in AI, autonomy, and digital engineering. And our dynamic student programming targets the next generation, with engagement from our growing student branch network that surpassed 270 this year, as well as the extensive scholarships and grants available to help offset education expenses.

Where the threads converge. It is clear that speed, AI adoption, and engineering workforce capacity aren't three separate agenda items. They're three faces of the same underlying question: can aerospace move as fast as the moment requires without sacrificing the safety and mission success that have always been non-negotiable in our community?

I do not believe any one company, government agency, or university answers that question alone. I believe we answer it the way AIAA always has – by getting the right people together and pushing the conversations further.

CTO Summit attendees underscored this important role for AIAA in their recommendations. Conversations repeatedly returned to our ability to serve as a neutral convener across companies, government, and academia. Their ideas included developing mission-to-capability roadmaps; advancing shared approaches to AI assurance, provenance, and interoperability; creating practical case studies and implementation playbooks; and establishing grand challenges or testbeds where organizations can learn together around consequential but appropriately noncompetitive problems.

They believe the Institute must continue creating the connective tissue that allows aerospace organizations to learn, trust, and act together. It's an evolving mandate for aerospace technology leadership: Shape. Don't react. ★

AI adaptation is essential. AI cannot be treated as hype, but as a genuine test of what engineering organizations are willing to change. This is what we heard from Lockheed Martin's Renee Pasman during this year's AIAA AVIATION Forum. Renee is vice president, chief information officer, and digital transformation executive at Lockheed Martin Aeronautics. She framed AI as software, with its unique value as a tool that can be used throughout the process of finding a solution. We are all learning how to adapt to working with AI as a tool, even as AI capabilities continue their rapid evolution.

The discussion at the CTO Summit went even further, beyond the thread of defining new AI use cases. ChatGPT debuted four years ago. Newly minted engineering grads have been immersed in AI throughout their college education. And aerospace companies are employing AI in digital thread engineering. Now industry, FFRDCs, and government must work to adapt their organizations and processes to utilize AI tools safely and securely. The key questions raised were:

- How do we build trustworthy AI adoption across aerospace?
- How do we collaborate as a community on setting high standards of AI validation and verification?
- How do we remove friction in integrating AI technologies into manufacturing processes?

We need to grow our workforce to meet demand. There is no dispute the most vital element to addressing the speed and AI themes is ensuring our engineering workforce has the needed skills and tools to accelerate technology at speed.

The discussion among the CTO Summit attendees acknowledged our industry faces a challenge in equipping today's aerospace workforce with new tools and new methodologies, as well as its companion challenge of preparing the next generation of aerospace professionals for new and future realities while they are still in school.

We know the aerospace workforce shortage is being driven by demand outpacing supply, with nearly 29% of the aerospace and defense workforce 55 or older, and industry attrition running close to 15% annually, which is more than double the average across other U.S. indus-

UP NEXT

WITH CLAY MOWRY

Up Next with Clay Mowry is AIAA's interview and storytelling podcast that explores breakthroughs shaping the future of air and space. Launched in September 2026, each episode brings you behind the scenes with aerospace leaders who are building what comes next. AIAA CEO Clay Mowry talks with CEOs, founders, technology leaders, and entrepreneurs redefining what's possible. His conversations range across next-gen aircraft and propulsion systems, commercial spaceflight, lunar exploration, autonomous flight, robotics, and beyond.

Find it on AIAA's YouTube channel, Spotify, Apple Music, or wherever you listen to podcasts.



Clay Mowry
AIAA CEO

BOOK SPOTLIGHT

A SELECTION OF RECENTLY PUBLISHED AND UPCOMING TITLES



Inside Mission Control: My Time During NASA's Shuttle Era

RELEASING NOV. 15, 2026
(Purdue University Press)

Wayne Hale spent more than three decades at NASA, including as flight controller, flight director, and head of the Space Shuttle Program. His book includes “a range of personal stories and reflections experienced during his tenure,” according to the publisher.

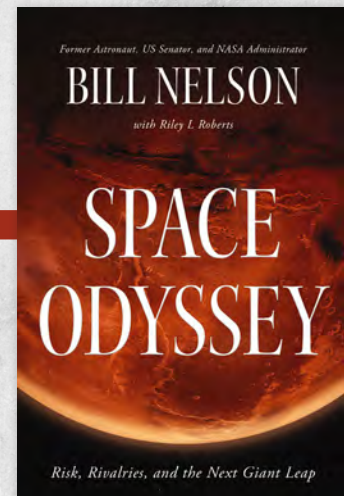
“Also covered are some of the darkest moments in NASA history—the Challenger and Columbia disasters, and the management decisions that serve as a caution to anyone involved in high-risk activities,” the publisher adds. “Hale’s indelible descriptions of the events and the people behind them could only be written by a member of the inner circle.”

Space Odyssey: Risk, Rivalries, and the Next Giant Leap

RELEASING JAN. 26, 2027
(Harper Horizon)

Bill Nelson, a former U.S. senator who was NASA administrator during the Biden administration, “takes readers inside the cockpit, the Situation Room, and the Administrator’s chair as NASA navigates a rapidly changing landscape,” according to the publisher.

He “reveals how seemingly technical decisions—about spacecraft, budgets, and launch timelines—carry enormous consequences for national security, economic strength, and global leadership,” it adds. “Nelson argues that if America cedes its leadership in space, it forfeits far more than prestige. It risks losing the strategic high ground, the scientific infrastructure that monitors climate change, and the innovations that quietly shape everyday life on Earth.”



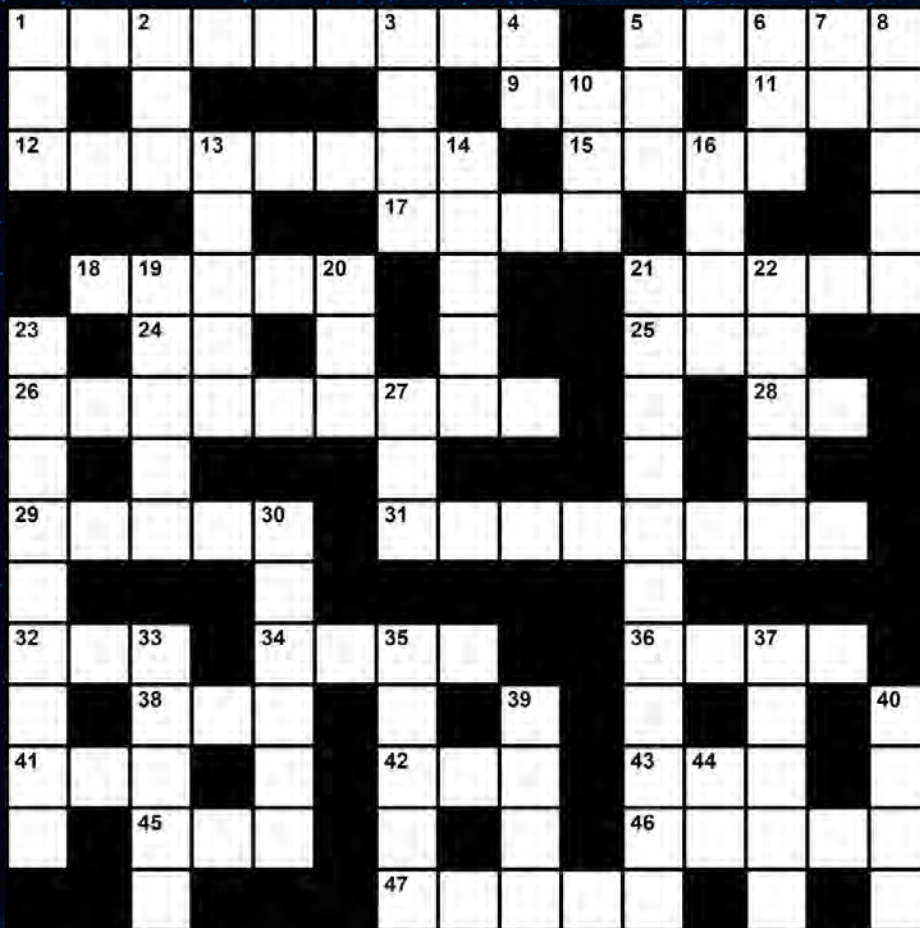
SpaceX's Dragon and Starship: Revolution, Reusability, and the Race to Mars

RELEASING MARCH 1, 2027
(Springer Nature)

Erik Seedhouse, a professor at Embry-Riddle Aeronautical University, takes a look at “how SpaceX took the hard-won experience of building and flying Cargo Dragon and Crew Dragon and used it as the springboard to develop the most ambitious space vehicle ever: Starship,” according to the publisher.

“From delivering supplies to the ISS to launching astronauts safely into orbit, Dragon proved that commercial spaceflight could be fast, reliable, and reusable. But Dragon wasn’t just about missions, it was about learning,” the publisher writes.

Titles are meant to reflect a broad range of topics and are not reviewed or endorsed by Aerospace America or AIAA.



WORD CROSS



Find
the answers
online.

Across

- | | |
|---|---|
| 1 Iridium's new owner (2 words) | 28 Chemical symbol of the most common fuel for ion thrusters |
| 5 Nancy _____ Roman, the mother of Hubble | 29 _____ stellar |
| 9 Mercury-Redstone 2 sent the first of this animal to space | 31 NASA wants to establish this by 2030 (2 words) |
| 11 The most visible component of CFM's next-generation aircraft engine | 32 This company built the primary instrument for NASA's latest flagship telescope |
| 12 SpaceX wants to launch up to a million satellites for this constellation | 34 Ratio of an object's speed to the speed of sound |
| 15 Docking mechanism | 36 A kind of rocket engine that relies on continuous detonations (abbr.) |
| 17 First near-Earth asteroid to be visited by a spacecraft | 38 Where the vast majority of satellites reside |
| 18 One of the most common prefixes in the space industry | 41 This substance reduces friction and dissipates heat in aircraft engines |
| 21 For many, this was the most exciting part of the Artemis II mission | 42 This organization designed the Apollo navigation and guidance system |
| 24 Chemical symbol for tungsten oxide | 43 A more technical name for drone (abbr.) |
| 25 In the manner of (2 words) | 45 The calmest part of a storm |
| 26 First U.S. mission to collect samples from an asteroid | 46 NASA's _____ Observatories |
| | 47 A common welding tool |

Down

- | | |
|---|---|
| 1 Starliner experienced issues with this kind of thruster on its latest flight (abbr.) | 19 This NASA observatory isn't getting a boost after all |
| 2 The U.S. Air Force is testing the first generation of these uncrewed aircraft (abbr.) | 20 Operations (abbr.) |
| 3 The U.S. Space Force refers to each category of the National Security Space Launch program as a _____ | 21 England hosted this biennial air show in July |
| 4 British Airways' IATA abbreviation | 22 Another name for an aircraft's lateral axis |
| 5 This orbit has a smaller population, but the spacecraft usually operate longer | 23 What makes supersonic aircraft so disruptive (2 words) |
| 6 Not forward but _____ | 27 How you measure rotational blade speed |
| 7 FL has the Space Coast, _____ has the Space Beach | 30 Not in-person |
| 8 The E in EDL | 33 First Latina to go to space, _____ Ochoa |
| 10 The more specialized form of GPS (abbr.) | 35 Hale-Bopp, for example |
| 13 Visually, this may be the most exciting part of a helicopter | 37 Metal fastener used extensively in aircraft construction |
| 14 These small craft have played a central role in the Russia-Ukraine war | 39 What base, liner, and ship all have in common |
| 16 "Wow, you're on a _____" | 40 Lead in Ad Astra, Brad _____ |
| | 44 Starlink satellites use this propellant (abbr.) |

R&D

Space Force to demonstrate GEO refueling, orbit transfer in upcoming demos

BY ASPEN PFLUGHOEFT
aspenn@aiaa.org

The U.S. Space Force's program office for servicing, mobility and logistics is looking to two upcoming demonstrations to validate the technology needed for on-orbit satellite refueling and towing. With most of the involved spacecraft slated for launch in early 2027, the missions will test different yet complementary answers to the question: How can the service increase the maneuverability of its satellites?

"A satellite which is locked in a predictable orbit is fighting from a fixed position, and it's a target," Gen. Stephen Whiting, commander of U.S. Space Command, said in April at Space Symposium. "A force that can maneuver, however, and not be limited by the fuel that it was launched with and reposition as operationally needed is the one that holds the initiative."

Overseen by the Space Force's System Delta 80, the two demos could move the service closer to realizing this vision. ★

AT A GLANCE MISSION 1

Refueling

OBJECTIVE: A Provisioner refueler from Astroscale U.S. will get fuel from an Orbit Fab depot and deliver that fuel to two Tetra-5 satellites owned by the Air Force Research Laboratory

CONTRACT VALUES:

\$25.5 million to Astroscale U.S. from Space Systems Command

\$13.3 million to Orbit Fab from the Defense Innovation Unit for the spacecraft

\$12 million to Orbit Fab from the Air Force Research Laboratory for the interfaces

Up to \$44.5 million to Orion Space Solutions from the Air Force Research Laboratory

LAUNCH TARGETS: Early 2027 for Provisioner and the fuel depot. None announced for Tetra-5, which is to launch first



THE SPACE FORCE will test a depot-servicer-client model of operations in geostationary orbit, Col. Scott Carstetter, director of servicing, mobility and logistics for Space Systems Command's System Delta 80, told reporters in May.

"We view that as a potential structure that could scale," he says.

First to be launched are the Tetra-5 client satellites, built by Colorado-based Orion Space Solutions through a combined SSC-Air Force Research Laboratory program. The satellites are to expend fuel during separate anomaly resolution tests before the launch of the other spacecraft: a Provisioner servicer from Denver-based Astroscale U.S. and a fuel depot from Colorado-based Orbit Fab.

This staggered timeline will prove out "the rendezvous from multiple launches," says Adrian Wheelock, AFRL's program manager for Tetra-5, "because you can't guarantee that all of your refuelable systems go up together, and that's also not a desirable logistics end state."

The two identical Tetra-5s will "have the ability to coordinate amongst themselves," says Chad Fish, chief technology officer of Orion Space Solutions. Walkie-talkie-like communications units will allow the satellites to "coordinate and make sure that they're talking and thinking together."

Once all four spacecraft arrive in geosynchronous orbit, "it's basically just orbit phasing to get everyone close," Wheelock says. The refueling operations will initially take place above GEO in a disposal orbit "so that if there is a problem, we're already in a safe space."

From there, Wheelock says plans call for conducting several refuelings in different configurations. In one scenario, says Carstetter, "the servicer is going to first mate with the AFRL client vehicle and refuel it, then go back to the depot, get more fuel itself, and then go back and meet with the [second] Tetra-5 again to refuel that."

"This is really trying to work an ecosystem," Wheelock says.

To facilitate these close-up interactions, the satellites will have fiducials — "basically QR-code-type" labels, Wheelock says — on their sides so any approaching spacecraft can scan and orient to the docking target.



An illustration of a Provisioner refueler.
Astroscale U.S.

“We’re going to be very, very slow [and] very, very gentle. The last few meters might take like 40 minutes.”

Additionally, the spacecraft will be equipped with standardized docking valves from Orbit Fab. The passive side of these Rapidly Attachable Fluid Transfer Interfaces offers a connection point, whereas the active side “has four grapple hooks that kind of reach out,” says Jeff Lints, the company’s chief commercial officer.

Wheelock likened it to “one of the claws that you would see at an arcade to grab your stuffed toy.”

The planned dockings will likely be the most technically challenging part of the mission, says Sarah Law, Astroscale U.S.’s spacecraft design team lead. In any scenario where Provisioner initiates the docking, the servicer will have to complete much of its final approach autonomously because of the communications delay between Earth and GEO.

For that reason, “we’re going to be very, very slow [and] very, very gentle,” Law says. “The last few meters might take like 40 minutes.”

Wheelock says “the whole [refueling] experiment is designed to try to find as many problems with how we currently have things conceived as possible — and find ways to work through them.”



An illustration of an Otter space tug.
Starfish Space

AT A GLANCE MISSION 2

Augmented Maneuver

OBJECTIVE: An Otter space tug from Starfish Space will dock with and move two Space Force satellites, one active and the other nonoperational, to different orbits

CONTRACT VALUE: \$37.5 million to Starfish Space from Space Systems Command

LAUNCH TARGET: Early 2027

THE SECOND DEMO will test another method for increasing satellite mobility: augmented maneuver — “essentially a space tug,” Carstetter says.

For this, Seattle-based Starfish Space is providing one of its Otter spacecraft, which are about the size of a “super big oven,” says Ari Juster, the company’s chief operations officer, like those “in an old French kitchen.”

Unlike the spacecraft involved in the refueling mission, Otter “has the ability to dock with unprepared clients,” Carstetter says, meaning “satellites that were not designed necessarily to have a space tug dock with them and maneuver them.”

“That’s really critical,” says Juster, “because 99% of all the satellites that have been launched to space in history were not prepared for docking.”

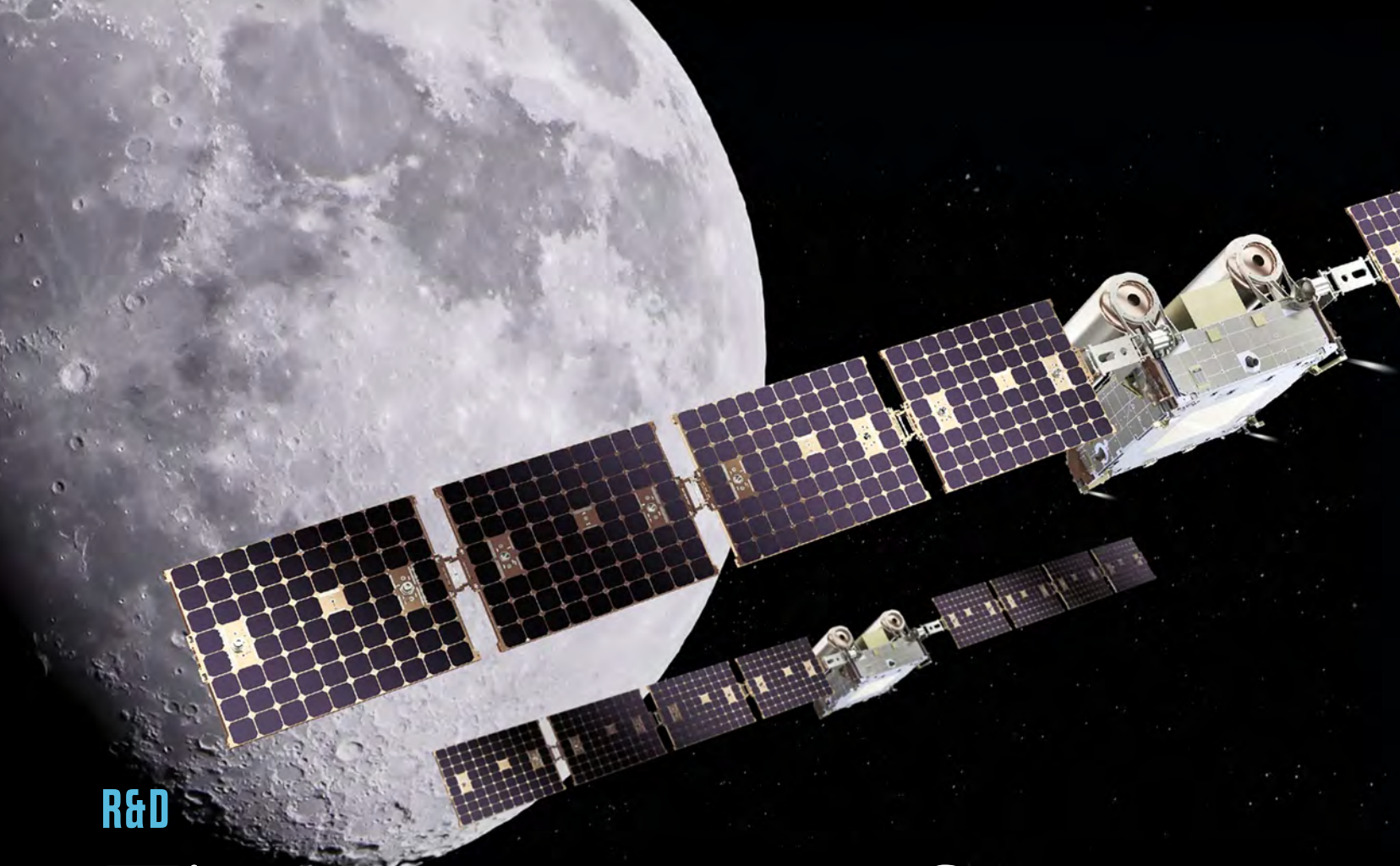
This capability relies on a combination of docking hardware and autonomy software. The hardware is a “robotic claw,” called Nautilus, that was designed to latch onto “all kinds” of common satellite features, Juster says.

Once operators have selected the docking point on the client satellite, Otter is “able to autonomously rendezvous and dock using solely electric propulsion,” Juster says.

For the Space Force mission, Otter will spend two years in GEO demonstrating orbital transfers in different configurations.

“The first vehicle that we’ll mate with is a nonoperational vehicle that we’re going to move to a disposal orbit” using low thrust, Carstetter says. “Once we demonstrate that capability, then we can mate an operational satellite to conduct things like life extension.”

“Ultimately,” Juster adds, this mission will “help bring us closer to the interactive future that we want to build in orbit.”



R&D

The next step for cislunar navigation

BY PAUL BRINKMANN | paulb@aiaa.org

The twin spacecraft slated to be launched next year for NASA's CAPSTONE 02 mission will attempt a few firsts for space navigation, including the first rendezvous in a highly elliptical lunar orbit.

During the Apollo program, NASA became well-versed in joining up two spacecraft in a low lunar orbit. For each of the six crewed landings, the ascent stage of the lander had to blast off the lunar surface to join the Command and Service Module that had remained in orbit. But those maneuvers occurred roughly 100 kilometers above the surface, where the lunar gravity is stronger. The agency expects the upcoming Artemis lunar missions to use different orbits and rendezvous techniques, and views missions like CAPSTONE 02 as a chance to study those operations.

The mission, led by Advanced Space of Colorado, will attempt to rendezvous two spacecraft in a near-rectilinear halo orbit, or NRHO, in cislunar space where lunar and Earth gravity are balanced. Such an orbit encounters what is known in physics as the three-body problem — the bodies in this case being the spacecraft and the gravity of Earth and moon.

"We have not done that; it's never been demonstrated," says Bradley Cheetham, co-founder and CEO of Advanced Space. "The same control laws that you would use in a two-body orbit don't necessarily extend to a three-body orbit. A lot of the analysis we are doing is breaking new ground, to figure out rendezvous and proximity operations safely, so we don't have two spacecraft just crash into each other."

▲ An illustration of the CAPSTONE 02 satellites.

NASA



NASA said in an emailed statement that CAPSTONE 02 will “provide first-hand knowledge on the complexities associated with three-body orbits and will inform future crewed and robotic missions that require rendezvous and proximity operations.”

The agency is targeting 2028 for the first Artemis crewed lunar landings, after which it plans to conduct yearly landings to establish a Moon Base near the south pole. NASA has also contracted a handful of companies to land over a dozen uncrewed landers in the coming years.

Although NASA earlier this year halted development of the lunar Gateway that was to be stationed in NRHO, it still considers the orbit a valuable testbed for future lunar operations. Specifically, the “characteristics that will be tested in NRHO are directly applicable to many other lunar orbits,” NASA said in the statement. “The mission is designed to ensure that lessons learned through a demonstration in NRHO would be transferable to other cislunar orbits.”

Whereas spacecraft in low lunar orbit must expend more fuel to stay on course, the gravitational stability of NRHO requires fewer thruster firings. NRHO also affords views of the lunar poles, as well as relatively easy transitions between high-Earth orbits, low lunar orbits and deep-space trajectories. Additionally, spacecraft in NRHO have a consistent line of sight to Earth, ensuring uninterrupted radio communications.

For the first CAPSTONE (Cislunar Autonomous Positioning System Technology Operations and Navigation Experiment) mission, launched in 2022, Advanced Space

demonstrated a successful spacecraft insertion into a cislunar NRHO and tested navigation and communication software. CAPSTONE 02 is to build on those learnings by having the twin spacecraft demonstrate rendezvous, flying in formation, and communications with each other and Earth — all in the cislunar environment, Cheetham says.

For example, NASA told me, the spacecraft “will evaluate their relative navigation to one another using both visual imaging from cameras and range measurements from radio signals. The spacecraft will use stars, lunar features, and a variety of ground stations on Earth to determine” their positions autonomously.

Advanced Space is to initially control the satellites from its operations center in Colorado, Cheetham says, but plans call for also testing their ability to function autonomously using NASA software. Demonstrating such operations is essential to ensuring safe lunar exploration, he adds, given the high volume of missions planned.

In the future, “we see dozens of satellites operating at the moon, with landers, rovers, orbiters,” he says. “Most of it will likely be uncrewed, and there’s just not enough ground tracking stations on Earth to manage all that.”

NASA said it “has funded Advanced Space’s work on CAPSTONE 02 at a value of \$45 million. We expect that the total value of the Advanced Space contract for the mission with both spacecraft will be approximately \$99 million.”

Under the terms of the contract, Advanced Space will own and operate the spacecraft while delivering data to NASA about the agency’s navigation and communications software, thermal performance and deep space radiation, Cheetham says.

“At first, our ground crew will be very involved, but then we want to move to ground observing and confirming and making sure that the autonomous systems on board are working,” he says. “Eventually, we want robotic missions to happen without the ground issuing every single command.”

The two 400-kilogram satellites are to be built by Lockheed Martin company Terran Orbital, with thrusters provided by California-based Stellar Exploration. Terran is modifying its Ambassador spacecraft bus, the same satellite bus it produces for the U.S. Space Development Agency’s Proliferated Warfighter Space Architecture Transport Layer.

“The Ambassador platform has flight-proven avionics and high-rate production architecture,” says Keith Thompson, Terran’s vice president of business development for civil space.

“But I would not call it a bespoke bus, like a snowflake of a bus that can only be used to support this mission,” he adds. “It’s not your one-off spacecraft design.”

Instead, it “demonstrates that we can take our production architecture and tailor its propulsion and [guidance, navigation and control] system for a demanding cislunar deep-space mission.” ★

JIMMY KENYON, HEAD OF NASA'S RESEARCH AND TECHNOLOGY MISSION DIRECTORATE

KEY POSITIONS:

- Since June, associate administrator of NASA's Research and Technology Mission Directorate that comprises 300 government employees and contractors across four divisions: Aeronautics, Advanced Research and Technology, Space Communications and Navigation, and Space Reactors.
- 2022–May 2026, director of NASA's Glenn Research Center in Ohio.
- 2019–2022, director of the Advanced Air Vehicles Program in NASA's aeronautics directorate.
- 2013–2016, various roles at Pratt & Whitney, including executive director of advanced programs and technologies.
- 2006–2013, associate director of aerospace technology in the Office of the Secretary of Defense.

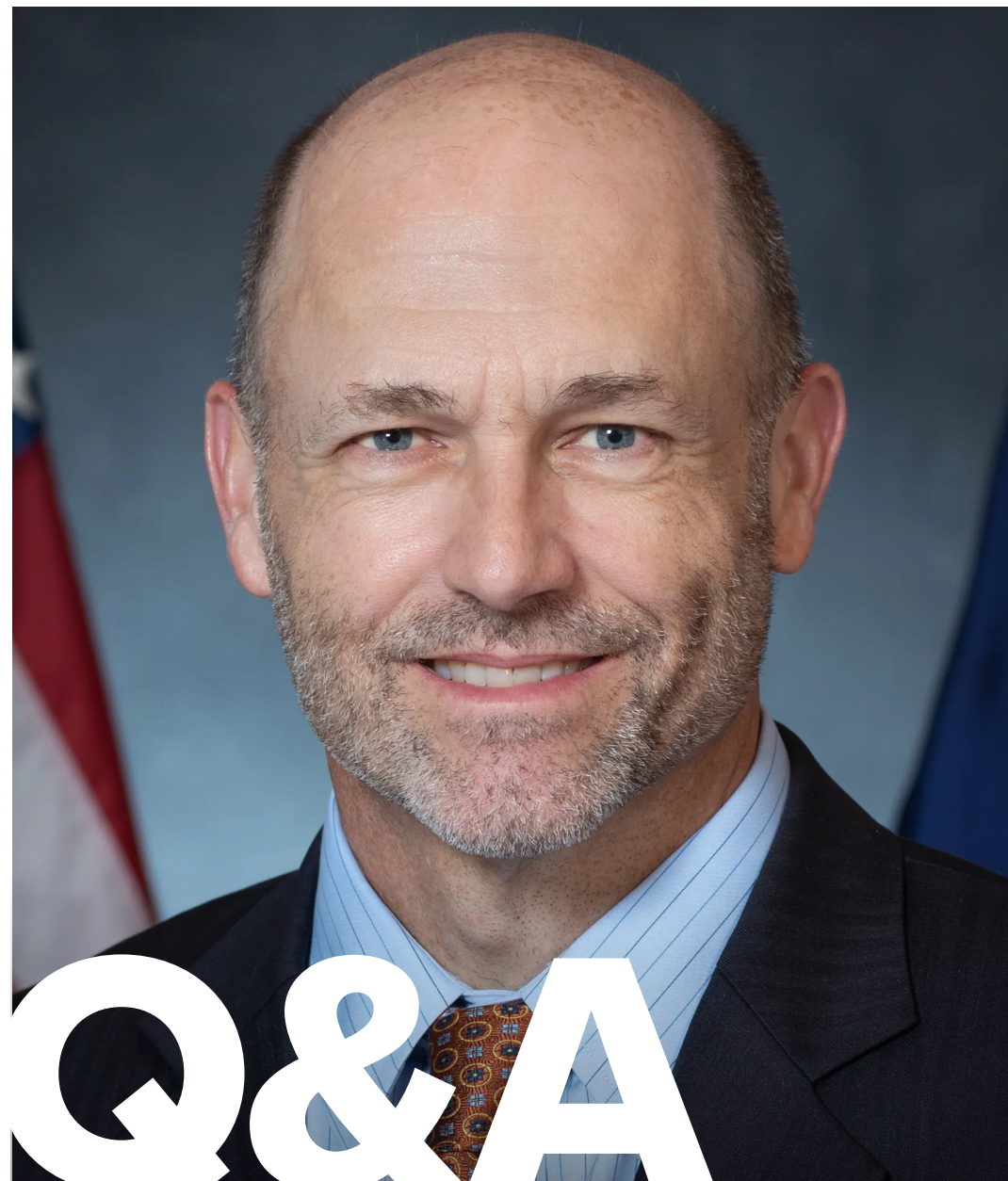
NOTABLE:

- RTMD's proposed fiscal year 2027 budget is \$2.6 billion. That includes the White House's requests for the predecessor directorates, Space Technology and Aeronautics Research, and two programs: SCan (Space Communications and Navigation) and Space Reactor-1 Freedom.
- As NASA Glenn center director, oversaw various initiatives to "modernize the campus" post-COVID, including demolishing outdated facilities, relocating center leadership to a more central location on campus, and establishing a collaboration and business hub "to foster teamwork, innovation, and connection."

AGE: "Old"

RESIDES: Greater Cleveland area

EDUCATION: Bachelor's degree in aerospace engineering from Georgia Tech, 1996; master's degree in mechanical engineering from Purdue University, 1998; Ph.D. in mechanical engineering from Carnegie Mellon University, 2002.



NASA's research and mission technology chief

Pick one of NASA's high-profile research initiatives or missions, and there is a very good chance it falls under Jimmy Kenyon's purview. The consolidation of the agency's aeronautics and space technology directorates into a new Research and Technology Mission Directorate was one of the largest changes under the reorganization Administrator Jared Isaacman announced in May.

RTMD's \$2.6 billion portfolio ranges from X-planes to nuclear power and propulsion, and includes many of the technologies required for the consistent lunar surface operations the agency envisions for its Moon Base. At the same time, Kenyon says he's balancing these and other short-term priorities against the long-term research investments required for innovations decades in the future.

Our wide-ranging conversation has been lightly edited for clarity and length. — *Cat Hofacker*

Q: What are the benefits of bringing everything from aeronautics to space mission technology under the same directorate?

A: The idea overall was to create a single, fast-moving organization that's going to drive and deliver the technologies that our missions need, and that our space and aerospace industry need, including our aviation markets and industry. We find that in many cases, what we're doing in space and what we're doing in aviation and aeronautics are very much synergistic. We've already identified a number of areas where we can bring those investments together in one place, so it's a more holistic investment, a single view of where the technology is going, what the needs and the gaps are.

I can give you a few tangible examples. One is high-temperature materials. When I was the Glenn center director, we were working on a new metal alloy, and we were getting funding from both Space Technology and Aeronautics Research [mission directorates]. It was complementary, but by having it all in one place, now we know what we're investing, and we can make sure that investment stays whole and gets us the outcome and the product that we need.

Another area is communications. When we were working on optical communications, we were doing some testing on a research aircraft and seeing that we could go from a moving aircraft and beaming to the space station. But then we also were working [on that] in Space Operations [Mission Directorate], which eventually transitioned and was demonstrated on Artemis II. Being able to bring that technology across actually allows us to leverage both. Everything we're going to learn on the moon about lunar relay is something that we can use as we expand our airspace.

I'll share just one more example: workforce. It gives us an opportunity to more easily move people between, say, aeronautics and space applications. It gives them a little bit of an advancement and an opportunity to grow their careers in different ways as well.

Q: How do you balance the portfolio to support near-term priorities like Artemis as well as the long-term investments for missions that are decades away?

A: This is a natural tension that always happens in a research and technology organization. You spend some time working on a very fundamental technology, and you'll invest at a certain level. But then you have a breakthrough, and you need to push it to the finish line. Well, pushing it to the finish line can take some [extra] investment. So you have to look at it holistically: What is the mission? What are the priorities? Where do we impact those priorities?

By bringing together the organization the way we have, we actually have an opportunity now to really deliver these technologies to the agency's missions and priorities, be they Artemis, a lot of focus on Moon Base and where that's going to go, the SR-1 Freedom, additional X-planes.

By the same token, we also know that there won't be priorities beyond that if we don't have some investment in what that future is going to look like, which could be different. You always have to think about how you're going to disrupt yourself. There's not an equation or an algorithm that gets you there, but it's a mindfulness of where you are in the mission, where you're driving the mission and where that gives you flexibility to invest in newer things.

Q: The administrator has talked a lot about addressing the "X-plane deficit." What can you share about the plan to do that and when we can expect some announcements?

A: The administrator has clearly expressed to us that we want to fly more. Period. We're looking at our priorities, going through the budget process now, looking at where we want to go with — we loosely call it X-planes, but that actually has a very specific moniker — large-scale flight demonstrators.

We have some things that we want to take to flight, but we're not going to be able to make any real announcements until we go through that budget process. In the meantime, we're also working on a way to accelerate flight at different scales.

One is a project called the Aeronautics Flight Accelerator. We have a number of flight

"By bringing together the organization the way we have, we actually have an opportunity now to really deliver these technologies to the agency's missions and priorities, be they Artemis, a lot of focus on Moon Base and where that's going to go, the SR-1 Freedom, additional X-planes."



▲ The X-59 photographed from a chase plane during a March 2026 subsonic flight.

NASA/Carla Thomas

test assets now that we use as chase airplanes. We can board sensors on them. We can board payloads on them. We completed a couple flights this past year where we did natural laminar flow on a high-speed jet by putting a fin on it that had laminar flow control. We just bolted it on a jet and flew it. So we're doing more of that, and we're working on some internal projects, and hopefully soon we'll be doing something externally where we allow others to come in and flight test with us as well.

If it's something that can be bolted onto another asset, then we'd want to do that, because it's about how do you get to flight and what's the right environment to demonstrate the technology. But there are things that hey, the aircraft configuration is what drives the technology. Take X-59. The outer mold line is designed to mitigate the shock structure. I can't bolt that onto something — I've got to fly that.

Q: When the administrator said “more X-planes,” my mind went to X-66A. Any chance of reviving that flight demonstrator?

A: We have to look at, again, what we're trying to do and the timescale and the complexity and if that makes sense for the technology that we're trying to demonstrate. We're working with Boeing on what that would look like, whether that's the right vehicle — and so we'll have to see how that pans out.

NASA and Boeing originally planned to fly this demonstrator in 2028 to demonstrate the truss-braced wing design, but indefinitely paused aircraft development in 2025. Ground testing of the wing and other components has continued. — CH

I think we're going to get to a good answer on that because there are clearly some really good technologies: the high-aspect ratio, short cord, so-called thin-wing technology has a lot of promise and a lot of benefits. But we need to make sure we're using the right asset to get that to flight.

Q: Shifting gears to Moon Base, paint us a picture of 2030. What does the base look like and what kinds of operations are happening there?

A: The initial Moon Base is largely going to be robotic in nature, and right now we're looking at our Commercial Lunar Payload Services program as a way to take many of those assets up there and put them in place. There's technology demonstration there, but what you're really talking about is placing really mature technology in the operating environment. Figuring out how to operate the robotics in the austere environment that is the moon — the dust, the sand, the illumination, the power constraints, those sorts of things.

A big part of our directorate's focus is Phase Two and Phase Three: a more enduring, more integrated Moon Base. Much of what's going up in Phase One has to take its own power. In Phase Two, I'm going to need a power infrastructure, and so this is where we start getting into radioisotope power systems that we would be sending up. We're going to need to figure out how to do those more rapidly, more efficiently. Eventually, putting a fission power system on the surface of the moon to drive larger-scale power. If we're going to do any sort of industrialization, any sort of regolith mining or regolith processing, we're going to need power to do that. We know from our experience here on our own rock that power is a real constraint to some of the industrial things that we want to do.

We're going to need comms. If I've got robotic systems working together on the surface of the moon, they've got to talk to each other. I need wireless technology, some sort of a technology that's going to allow this system here to talk to that system there and say, "Hey, I've got to meet you here to power up, or I've got to meet you here to get astronauts from here to here." Now I can do scientific experiments, whether it's observations or understanding or excavation and sampling. I can have people interacting with robotic parts of it. This is the exciting part of what we want to get to.

Q: On nuclear power and propulsion, what gives you the confidence that this is the right time for this technology after decades of starts and stops?

A: The difference this time is we're going to stay on the moon, and that means you've got to have power that can survive the lunar night. Solar is great, but when you enter the lunar night or less illuminated parts of the moon — which is where some of the more interesting things are — solar's not going to cut it for you. Nuclear is a great answer to that. So we have a pull for it, we have a purpose for it, and that gives me a lot of confidence that we're going to develop it.

We also see our sights going out beyond Earth, eventually taking people to Mars. Science going interplanetary with larger and larger missions. We need next-generation radioisotope capability, but we also need something larger. Fission power provides some real opportunities there. Clearly, the administrator sees that, the [Trump] administration sees that and so seizing this opportunity with their support where the mission is driving us there, that's what I think is going to get us there ultimately with nuclear power and propulsion in space.

Q: Long term, how widely do you see nuclear propulsion being adopted compared to chemical propulsion?

A: Again, that's going to be driven by the mission. With chemical propulsion, I've got to carry my stuff with me. Getting stuff off of this planet — between the drag going through the atmosphere and the weight getting off with the gravity — it takes a lot to launch a little. With nuclear, the propellant load is not nearly as big. My reactor will operate for years and produce the power I need. The

electric propulsion propellant feed is less mass that I have to carry to be able to operate for a much longer period of time. And so where we see that going is as we expand and we want to stay in space longer, that's the opportunity that going to drive that.

We're going to learn a lot between now and then. We're going to learn that trade space between nuclear-electric and nuclear-thermal. There are going to be hybrid systems between nuclear-electric and chem, between nuclear-thermal and chem. That means I can add a little chem when I need it, but I don't need to carry so much propellant with me. Those are the engineering trades that all of this opens up so that you really can do a robust mission space.

Q: Can you give some tangible examples of how the Moon Base is going to prepare us to send humans to Mars?

A: One of the things for sure is learning how to live and work farther away from our home planet. You don't have all the resources of Earth, and learning how to do that is going to be really instructive. The second thing is how we operate the equipment, whether it's communications, fission power, the robotics, the automation — how we use the resources that are there on the surface.

What we do at the moon isn't necessarily going to tell us what we're going to find at the surface [of Mars], but the techniques that we're going to learn, the tools that we're going to have, we'll be able to work with those and learn how to use those at the surface of the moon. So it provides a great basis for that longer journey.

Q: What's the latest thinking on how soon we can send humans to Mars? Are the 2040s feasible?

A: I hear various people talk about various dates. I think a lot of that's going to be driven ultimately by what we end up finding at the moon, and I think we're going to find a lot on the moon that's going to keep us pretty busy for a little while.

But again, we're going to learn, and that's going to allow us to go on to Mars when it makes sense. We definitely want, as soon as we can, to get people to Mars, but the moon is going to be an important first step. So the focus is on that and getting that done.

Q: A lot of the topics we discussed overlap with NASA Glenn's portfolio. Are there any lessons you're carrying forward from your time as center director?

A: The magic of NASA is our people. Most of our workforce and all of our mission happens at the centers, and so my job as a mission directorate associate administrator is to make sure that the centers and the people there have the resources they need to execute the mission — period and full stop. That means appreciating the challenges of having a center, whether it's an 80-year-old wind tunnel that's a little finicky, power outages, weather. That's what they are dealing with every day, and yet, they come in and they get the mission done. How do I make that job easier? That's where my focus is. ★

ENGINEERING NOTEBOOK

Railroad drone sentries





A responsive drone network is providing U.K. train operators with intelligence on track trespassers and other issues. **Paul Marks** donned a hardhat and went trackside to see how the service works.

BY PAUL MARKS | Paulmarksnews@protonmail.com

At railroad stations in three major British cities — London, Glasgow and Cardiff — a 50-person startup called SkyBound is now fielding a responsive drone service designed to pinpoint trespassers on the tracks, among other issues.

The idea is that by quickly dispatching quadcopters from secure, automated pods placed near regular railroad troublespots, SkyBound's pilots can quickly get a visual of any unauthorized personnel to determine what kind of threat they present. This in turn allows British Transport Police to more rapidly intercept and remove them.

Southampton-based SkyBound is among the handful of companies approved to operate drones at designated stations or sections of line by Network Rail, the government-owned entity that owns and runs the U.K.'s railroad track infrastructure. The goal is to sharply curtail trespassing and the resulting time and money lost. Network Rail last year estimated there are 19,000 track trespassing incidents annually, amounting to 750,000 minutes in service delays and a cost of £75 million (\$101 million) to taxpayers.

"Between April 2025 and June 2026, trespass and fatalities caused almost 14 per cent of cancellations and over 200,000 minutes of delay to SWR and NR Wessex services, making it one of the leading causes of disruption," South Western Railway, one of the train operators using SkyBound's service, said in July.

In the view of SkyBound's CEO and founder, Gemma Alcock, the key to success is more quickly getting information to railroad security teams, who currently "rely on helicopters, which are expensive and scarce, or foot patrol teams who can't cover the ground fast enough," she told me in a July interview.

SkyBound's solution is low-altitude drones that are deployed autonomously from enclosures outside a rail station, on a command from the company's Southampton control center, to the coordinates of the suspected trespass site.

SkyBound began rolling out this Automated Drone Station (ADS) in late 2025 in the Welsh capital, Cardiff. That was followed by an ADS installation at the English capital's largest station, London Waterloo, in January, and Scotland's largest city, Glasgow, in May. Additional stations are slated to be installed later this year at Clapham Junction, Europe's busiest station; and eventually at the South West Main Line, an express route out of London; and at Walton-On-Thames, Surrey.

"At Waterloo, our Automated Drone Station is situated just where it's needed for rapid response to trespassers — at the far end of a platform," Alcock says. "It's also used for continuous site awareness and infrastructure monitoring, for which we're flying patrols every day, spotting faults on the tracks before they have an impact."

Earlier this year, a drone detected smoke under the tracks, she says. "Waterloo has raised track and a yard underneath it was on fire — and our early detection of that meant firefighters responded and no trains were delayed."



Paul Marks

is a London journalist focused on technology, cybersecurity, aviation and spaceflight. A regular contributor to the BBC, New Scientist and The Economist, his current interests include innovation in electric aviation and commercial spaceflight.

◀ A SkyBound drone deploys from its container near the London Waterloo Train Station.

SkyBound



▲ For its Automated Drone Station, SkyBound added a proprietary unit for power, processing, storage and communications to a commercially available drone and dock.

SkyBound

Inside the tech

To see the ADS and SkyBound's other drone technology firsthand, I took a train to Waterloo on a sunny afternoon in August. On a skinny stretch of platform with clanking trains passing either side, Alcock and James Watt, a SkyBound drone pilot, talked me through their technology.

The ADS has two parts: First is a commercially available dock from Chinese drone manufacturer DJI. This cubic box, about 80 centimeters per side, contains the drone — a DJI Matrice 4-series quadcopter — and its charger. That dock, in turn, is bolted to a large plinth that's about 1.2 meters long and 80 cm high.

SkyBound's addition to the setup is what it calls the SkyBound Core, a proprietary power, processing, storage and communications unit.

"The ADS automates the takeoff, landing, and recharging of the drone," Alcock says. The Skybound Core "makes the docking station more resilient and self-sufficient in the field, and it provides, for instance, backup communications, backup power, edge computing and encrypted data storage."

Depending on local connectivity, the core's backup communications can include the Starlink satellite service, additional cellular channels or — if the local railroad infrastructure allows — fast Ethernet cabling.

The company needs the core's deep pool of data storage, Chief Technology Officer Piotr Pladzyk told me in an earlier video call, because the drone's video cameras, infrared thermal and lidar sensors generate 10 gigabytes of data in every 30-minute flight.

"The video is crazy high resolution, at 4K HD, and at a very high frame rate too, at 60 frames per second," he says.

SkyBound collects such a high volume, says Pladzyk, so its engineers can generate synthetic data to build ever-more-accurate simulations of the flight environments they operate in. This in turn allows them to research, in simulation, a variety of AI techniques — large and video language models (LLMs and VLMs, respectively) and advanced computer vision algorithms — to iterate and improve how their drones lock onto trespassers and track them automatically.

Tracking uncooperative people is a tough ask, notes Alcock, who earlier in her career participated in drone-based search-and-rescue operations. "A missing person wants to be found," she says. "A trespasser does not."

Navigating air traffic

There's something else SkyBound's drones must locate: conflicting air traffic.

My visit to Waterloo included a demonstration of how this is done. When it came time to launch the drone, SkyBound coordinators at the Southampton control center checked ADS-B traffic on FlightRadar24 and contacted other nearby airborne services to check for any conflicting flight plans.

London Waterloo is near two medical centers, St. Thomas' Hospital and Guy's Hospital, that fly pathology samples between their labs on Matternet M2 drones operated by Apian Health — a 35-minute road trip reduced to a 3-minute flight.

Strict altitude separation is enforced: Apian drones fly at an altitude of around 300 feet, while SkyBound's fly at 150 ft. London's helicopter air ambulance services often fly low and fast over central London too. And Waterloo is near the River Thames, which is heavily overflowed by helicopters heading for the London Heliport, near Battersea Power Station, and airliners headed east over the river to London City Airport and west to London Heathrow.

Apian has been running its medical drone service since late 2024, and it has achieved full beyond visual line of sight (BVLOS) flight certification from the U.K. Civil Aviation Authority. SkyBound, however, is still flying on



visual line of sight (VLOS) rules.

“For BVLOS drone operations such as the Guy’s and St. Thomas’s and police operations in London, we typically use a Temporary Reserved Area or Temporary Danger Area, which only the drone should operate in without prior notification,” says Sophie O’Sullivan, the CAA’s director of Future Safety & Innovation.

She continues: “VLOS, such as the SkyBound operation at Waterloo, requires a remote pilot or visual observer to identify any conflicting traffic and ensure that the drone remains well clear of it. This is much in the same way that crewed aviation avoids other air traffic over shorter distances.”

Separate from the controllers at Southampton, SkyBound has a visual observer at Waterloo with a drone controller handset, who can override Southampton’s point-and-click automation — but they have never needed to use it, says Alcock, so she hopes that role will lapse late this year, when she expects the company to receive BVLOS approval.

“Apian and Matternet work collaboratively with those drone operators who need to fly in close proximity to our operations,” says Louisa Smith, chief aviation officer at Apian. “Much like traditional aviation, we agree how to deconflict in advance, wherever possible.”

This agreement-based uncrewed traffic management (UTM) is likely more loosely coupled than the systems being crafted by the U.K.’s National Air Traffic Services, Alcock notes, “but we can’t wait for those solutions to be rolled out. So we’re kind of having to do UTM ourselves until there’s a supplier that does it.”

All goes as planned for my demo: The SkyBound drone reaches 150 ft, loiters, and captures ultra-sharp footage of the Big Ben clock half a mile away, before switching to thermal imaging mode, which reveals the clock face to be at 16 degrees Celsius. The drone then drops to hover a few feet above the DJI dock, and the clamshell opens to receive it, closing once the drone sits on its charger.

SkyBound is also pursuing additional use cases. Its Southampton control center is colocated with that of the global control room of marine exploration company Ocean Infinity, SkyBound’s major investor. Until January, it was Ocean Infinity whose deep ocean ships hosted multiple underwater drone searches in the Indian Ocean for the wreckage of MH370, the Malaysia Airlines Boeing 777 that went missing in 2014.

SkyBound is fielding its technology on Ocean Infinity’s ships in a number of roles, Alcock says. “In ISR [intelligence, surveillance and reconnaissance] missions in and around ports and maritime environments, in places like Kuwait, we can pair a drone with one of their vessels. It can then fly ahead and find a potentially uncooperative vessel, rather than using the ship to do the search.”

Another potential use case is scanning the water around Ocean Infinity’s vessels that deploy autonomous underwater vehicles, to ensure the area is free of sea creatures when a vehicle is launched or recovered.

“At the moment, they’re using people and cameras” for that task, Alcock says. “A drone can see much further, making sure there are no marine mammals in the area, and that they’re not disrupting their habitat.” ★

▲ SkyBound’s drone flights are coordinated from its control center in Southampton, pictured here.

SkyBound

Collision avoidance for airport ground vehicles



Spurred by the fatal collision of a fire truck and passenger plane at LaGuardia Airport in March, engineers at the MIT Lincoln Laboratory are developing a way to warn airport ground vehicle drivers when a collision is imminent. **Keith Button** spoke to the project leader about the work ahead.

BY KEITH BUTTON | buttonkeith@gmail.com

On March 22, a CRJ-900 passenger jet landing at LaGuardia Airport in New York collided with a fire truck crossing in front of it on the runway, killing the plane's pilot and first officer and seriously injuring six other people.

The airport has radars, sensors and transponders designed to detect nearby aircraft and vehicles and display them on screens in the air traffic control tower, but this ground surveillance system "did not issue an aural or visual alert" of the truck on the controllers' displays, according to the preliminary report issued by the National Transportation Safety Board.

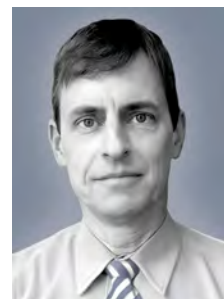
The event was a stark reminder of gaps in existing runway safety systems, says Wes Olson, leader of the MIT Lincoln Laboratory's transportation safety and resilience group. Specifically, many ground vehicles do not carry transponders that would broadcast their positions to air traffic controllers, a more precise method than relying on surface radar.

"We identified, even before this accident, [ground] vehicles as one of the issues with protection," says Olson, whose group has designed various runway stoplight systems for large airports and plane-tracking technology for small airports. "The LaGuardia accident crystallized that and highlighted to us the need to do something for vehicles."

Airport safety experts told me such collisions are relatively rare, but not unheard of. Last year, a Boeing 737 MAX 8 starting its takeoff from the Rio de Janeiro airport sheared off the top of a pickup truck parked on the runway; no one was injured. In 2022, a 737 had to abort its landing at Toronto Pearson International Airport to avoid a maintenance truck that an air traffic controller spotted crossing in front of it.

The LaGuardia accident was notable because of the fatalities.

"It was a terrible tragedy, and it should not have happened," says Hassan Shahidi, chief executive officer of



Keith Button

has written for C4ISR Journal and Hedge Fund Alert, where he broke news of the 2007 Bear Stearns hedge fund blowup that kicked off the global credit crisis. He is based in New York.



the Flight Safety Foundation, a Virginia nonprofit that tracks aviation incidents and advocates for new safety standards. “Many lessons learned are coming from that, certainly.”

According to the NTSB report, the LaGuardia truck wasn’t equipped with a Vehicle Movement Area Transponder, or VMAT, a device developed in 2012 to broadcast a ground vehicle’s location, velocity and call sign — just as an ADS-B Out transponder does for an aircraft.

The devices are not required, but partly because of the accident, orders for VMATs by airports have surged, according to executives at PASSUR Aerospace and uAvionix, the two largest sellers. The event also prompted FAA in May to accelerate plans to spend \$16.5 million equipping 1,900 vehicles across 44 airports. Currently, an estimated 50 to 60 airports have at least some VMAT-equipped vehicles, says Chris Zanardi, PASSUR vice president of commercial operations.

A new warning device

Although installing more vehicles with VMATs could improve situational awareness for air traffic controllers, that information wouldn’t be available to ground vehicle drivers.

That’s what Lincoln Lab is seeking to rectify, Olson says, by developing an in-cab warning device for fire trucks, snow plows and other airport vehicles that traverse runways and taxiways.

The plan is to have a prototype within 12 months for demonstration at a major airport, he says. In parallel, engineers will conduct trials at the Hanscom Field airport in Bedford, Massachusetts, to collect more data and validate the prototype design.

uAvionix plans to release its own in-cab alert system for ground vehicles in October, says Cyriel Kronenburg, the company’s vice president of airports and air traffic management. This Surface Ops app, designed for tablets or smartphones, displays a digital map of an airport’s runways and taxiways marked with the locations of ground vehicles and aircraft that are taxiing, taking off or landing.

Runways on the digital display will turn red when an aircraft is rolling for takeoff or inbound on final approach, he says, and loud, increasingly urgent beeps will sound with “Traffic final” or “Traffic runway” messages flashing on the screen if the ground vehicle is on that runway.

ADS-B Out and VMAT transponders will provide location information for the aircraft and ground vehicles, respectively.

▲ For its ground vehicle collision-warning device, Lincoln Lab plans to adapt the algorithms it previously created for the Runway Status Lights (pictured here) installed at 20 of the busiest U.S. airports. Embedded in the pavement at runway crossings and other intersections, the lights turn red to alert pilots and drivers that a particular runway is not safe to cross.

FAA

The human factors element

Technology alone might not have been enough to prevent the LaGuardia Airport collision between a passenger jet and fire truck earlier this year.

Although the truck wasn't equipped with a Vehicle Movement Area Transponder, or VMAT, the National Transportation Safety Board's preliminary report noted human decision-making played a significant role, notes Christopher Oswald, senior vice president of safety and regulatory affairs for Airports Council International – North America, which represents airport owners and operators in the United States and Canada.

In the final seconds before the collision, an air traffic controller instructed the truck driver to cross the runway as the jet was approaching for landing, then ordered the truck to stop, then to stop again as the truck kept driving onto the runway, according to the report.

In this sense, increased adoption of VMATs alone “may not be a panacea,” Oswald says.

He points to the oft-cited Swiss cheese model of accident prevention: Each individual technology provides a layer of security but also its own gaps. It's only by stacking multiple techniques along with awareness procedures for drivers, pilots and air traffic controllers that the industry ensures a combination of safeguards to hopefully prevent accidents.

“There will always be places, unfortunately, where some of those holes in the Swiss cheese line up,” Oswald says. “And looking to what issues can we address, technology may be part of that solution.” — *Keith Button*

Kronenburg says uAvionix spent three months beta testing the app at seven U.S. airports. Five airports are scheduled to deploy the app starting in October, including Savannah/Hilton Head International Airport in Georgia and Tampa International Airport in Florida, he adds.

For the Lincoln Lab device, Olson says the idea is to piggyback on the warning logic its engineers previously developed for different collision-avoidance technologies. These include algorithms that turn on and off stoplights located at runway crossings at the largest U.S. airports. The engineers will modify those algorithms to run on an airport computer server, so they can be fed transponder tracking information for ground vehicles and any aircraft landing, taking off or taxiing.

The new ground vehicle warning system could use tracking information supplied by FAA-operated systems. Alternatively, an airport could build its own tracking system, Olson says, because the airport antennas and networking hardware needed to pick up ADS-B and VMAT signals are inexpensive. Each VMAT costs about \$4,000, according to PASSUR and uAvionix executives.

If the collision avoidance algorithms determine a runway is not safe for a ground vehicle to cross, a warning would pop up on the in-cab device, Olson says.

Lincoln Lab is still refining the device's design, but among the possibilities is having the unsafe runway lit up in red on a dashboard-mounted digital map, paired with an audible alert tone or a spoken “Unsafe, stop” warning to the driver.

“You could feed a display right in the vehicle itself,” he says. That would shorten the current alert sequence, in which air traffic controllers must first see a potential collision on their own displays or be alerted to it by the runway safety system, then convey the warning to the driver.

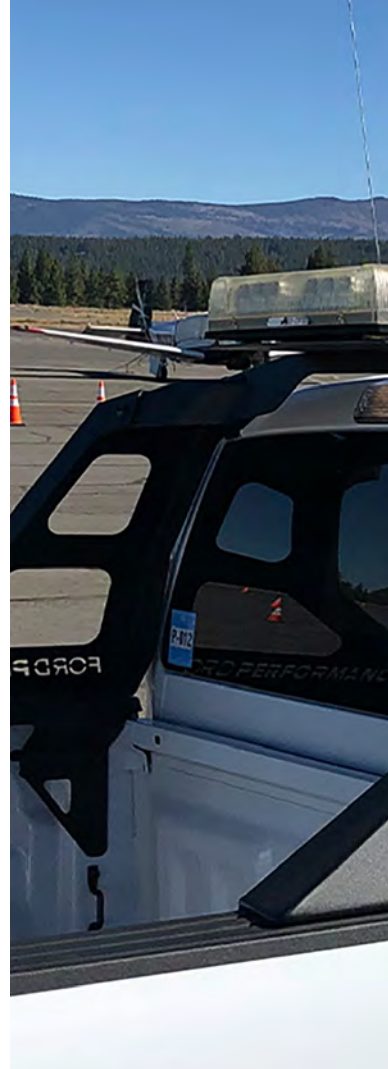
“Simply adding an aural alert, a tone, would make it much more obvious to the operators, having something right in front of them instead of looking out at runways and taxiways, at lights,” Olson notes.

To adapt the algorithms to alert ground vehicles, the engineers must modify the logic that determines whether the stoplights at the runway and taxiway crossings should be activated. The stoplights' logic calculates when an aircraft will be traversing specific intersections on a runway, but the in-cab warning logic will potentially need to calculate when that plane would travel past any point where a ground vehicle could drive on the runway from the grass, he says.

The goal is to develop software that is device-agnostic and capable of being loaded onto a tablet, phone or other device of whichever operator Lincoln Lab transfers the technology to. The lab plans to develop and demonstrate the software on a device, and perhaps build a prototype, but not build or operate devices for customers.

The testing ahead

The engineers began building the software prototype in July. Initial tests will be conducted with a digital tool





▲ Lincoln Lab's in-cab warning device is designed to complement the VMATs, or Vehicle Movement Area Transponders, that some airport ground vehicles carry to alert air traffic controllers of their position. A VMAT transmission is illustrated here.

PASSUR

that simulates runway scenarios based on recorded operations from actual airports, Olson says. The tool allows them to see how the software would generate alerts with the recorded air traffic or with simulated traffic to create unusual situations, such as aborted takeoffs or landings that suddenly switch to a parallel runway.

Engineers can employ the tool to watch individual scenarios unfold on a digital map, or to conduct randomized Monte Carlo simulations for thousands or millions of runway encounters. These simulations can incorporate varying vehicle speed and location, for example, or vary how vehicle operators might respond.

"We'll use the data to do a lot of modeling and simulation, pre-evaluations of performance, before we put anything in a vehicle," he says.

Once the software has proven itself in simulations, the engineers plan to test it in a ground vehicle, driving and parking on taxiways as planes land and depart at Hanscom Field, where Lincoln Lab has a hangar.

Initially, the vehicle will be operated in "shadow mode," Olson says, with a certified airport driver in the driver's seat and an observer in the backseat, who will watch to make sure the alerting is operating accurately and not making too many false alarms.

Depending on which operator Lincoln Lab partners with, engineers may conduct another airport demo at

the same time as the Hanscom testing.

The initial customers for the devices are major U.S. airports, Olson says, but the tech could be adapted for any airport runway configuration.

Based on future discussions with FAA and airports, Lincoln Lab could also add more features. For instance, snowplow operators may appreciate a countdown alert to give them time to move off a runway, Olson says, or there might be ways to warn drivers of a wider range of situations.

"For surface vehicles, there are other alerts, because you have more flexibility to turn a truck to jump off the runway," he notes.

For airports that handle small aircraft that don't carry ADS-B Out transponders, the alerting system might also incorporate cameras to track runway traffic, he adds.

Additionally, the alerting logic could be extended to the runway collision warnings that sound off inside cockpits, which would require a much higher standard for certification and safety, he says.

"The hope would be that whatever we develop for surface vehicles could perhaps transition to maybe aircraft at some point," Olson says. "We felt strongly that if we could demonstrate and close gaps with surface vehicles, that would be important and a stepping stone to something broader." ★



Taking **CCA** from vision to reality



The U.S. Air Force is moving forward with its Collaborative Combat Aircraft program, meant to provide a fleet of drone wingmen to team with conventionally piloted fighter jets. As the CCA concept gains interest around the world, **Jen Kirby** spoke to service officials and industry executives about the ongoing testing and potential challenges ahead.

BY JEN KIRBY | jenkirby@proton.me

When it comes to its Collaborative Combat Aircraft program, the U.S. Air Force wants options.

The first group of these drone wingmen is tailored for air-to-air missions, but future CCAs might be used for surveillance or electronic jamming, or they might just serve as decoys. The service also wants the aircraft to be able to carry different payloads. Future designs might take off from a short runway — or no runway at all.

The Air Force is also keeping its options open when it comes to vendors. In June, it selected Anduril Industries and General Atomics Aeronautical Systems to move their aircraft — now known as the FQ-44 Fury and the FQ-42 Vengeance, respectively — into production for Increment 1 of the program.

The service that month also announced it had selected six vendors to provide mission autonomy software and awarded three — Anduril, RTX's Collins Aerospace and Shield AI — production options to accelerate delivery of that technology.

These announcements mark significant steps forward for the CCA program, an effort to build AI-enabled, semi-autonomous aircraft affordable enough to be produced at scale. Plans call for CCAs to work alongside conventionally piloted fighter jets, like the F-22 or the future F-47, creating a new kind of human-machine team.

“Most of us, based on what we’ve seen from artificial intelligence, would assess that there will come a point where a robot fighter is better than a manned fighter,” Lt. Gen. Christopher Niemi, who heads Air Force modernization, told the Senate Armed Services Committee in May. “The question is when will that happen, and I think it would be a tragic shame if the United States didn’t have a better answer if we were facing robot fighters that were better than our manned fighters.”

“So, for all these reasons,” he added, “I’m very bullish on CCAs.”



Jen Kirby is a freelance journalist covering foreign policy, national security, politics, human rights and democracy. Based in Rome, she was previously a senior reporter at Vox.



The CCA concept is gaining traction elsewhere. The U.S. Navy and Marine Corps are pursuing their own versions of collaborative combat aircraft, as are other countries, from Germany to China to the United Kingdom. For instance, Boeing Australia since 2017 has been developing its MQ-28 Ghost Bat for the Royal Australian Air Force. In June, an MQ-28 operated alongside fighter jets in Exercise Valiant Shield, a joint U.S. and allied forces training event in the Indo-Pacific.

“It’s becoming apparent that these capabilities are just the price of admission to being a capable air force in the near future,” says Andrew Hunter, a former U.S. Air Force acquisition chief who helped develop the service’s CCA program.

Air Force and industry officials are now focused on achieving that core capability: seamless teaming between a CCA and a human pilot. Determining how they will work together will make clear how CCAs can be used — and how transformative they might be.

“We need to imagine a world in which fighter planes aren’t the dominant platform, and that the CCAs are not just there to help the fighter planes; they’re actually there to win the war,” says former Air Force Secretary Frank Kendall, who introduced the CCA program. “You’ve got to free your mind of the idea that there will always be a fighter pilot.”

The initial pitch

During his tenure as Air Force secretary, Kendall pitched CCAs as a way to add mass to the U.S. combat fleet at a cheaper price point than crewed jets.

CCAs were intended as an asymmetric capability the service could specialize and tweak by adding sensors or swapping in different weapons systems. The service would develop these aircraft in increments, promoting competition among industry and the ability to adjust capabilities over time.

In early 2024, the Air Force tapped a group of five companies to design and develop prototypes; several months later, it selected Anduril and General Atomics for

additional funding to continue refining their aircraft and begin flight testing.

Since their inaugural flights last year, Fury and Vengeance (previously known as Dark Merlin) prototypes have participated in multiple flight tests and exercises, experimenting with techniques and procedures meant to help the Air Force understand how to best deploy and integrate these aircraft.

In July, a Fury struck a simulated target with an AIM-120, a medium-range air-to-air-missile. General Atomics is slated to conduct a live-fire test with a Vengeance before the end of the year, according to company spokesman C. Mark Brinkley.

The Air Force aims to field 500 CCAs by 2032, and for fiscal year 2027, has requested about \$1 billion for procurement and \$1.4 billion for research and development.

The service is also already preparing for future increments, working with nine contractors to refine the attributes, capabilities and new technologies for Increment 2. Brig. Gen. Timothy Helfrich, the Air Force’s portfolio acquisition executive for fighters and advanced aircraft, said earlier this year the service would likely open that competition up to even more vendors.

Software competition

Key to the CCA program is the AI-enabled mission autonomy software, considered the brains of the aircraft. While CCAs will be equipped with platform or flight autonomy software that oversees the safety-critical functions any aircraft needs, like being able to take off and maneuver, the mission autonomy software is layered on top of that. It gives CCAs the capacity to collaborate and receive and execute commands from a human operator.

The Air Force in June selected six contractors — Anduril, General Atomics, Lockheed Martin, Northrop Grumman, RTX’s Collins Aerospace and Shield AI — to establish what it described as a “competitive marketplace” for the effort. The service also awarded Anduril, Collins and Shield AI production options.

After six months, the service said, it plans to evaluate

▲ One of General Atomics’ CCA prototypes during a descent toward Creech Air Force Base in Nevada. The July flight was conducted by the Air Force’s Experimental Operations Unit.

U.S. Air Force/Staff Sgt. Jake Jacobsen

A closer look at the designs

Anduril Industries and General Atomics Aeronautical Systems, both awarded production contracts for the U.S. Air Force's Collaborative Combat Aircraft program, have embraced distinct designs for their aircraft, the FQ-44 Fury and FQ-42 Vengeance, respectively. These differences could shape how each CCA performs and what missions they are tasked with, analysts told me.

Anduril's Fury emerged from a prototype first built in 2019 by Blue Force Technologies, which Anduril acquired in 2023. Anduril had an expertise in software and autonomy and initially needed a partner to build an aircraft of this class, says Jason Levin, an Anduril executive. The company sought to design a CCA that would be modular and easily adaptable.

Before CCA, General Atomics was known for its decades of experience building uncrewed aircraft, ranging from the MQ-20 Avenger to the Predator drones.

"It wasn't a question of could we build an uncrewed jet," says company spokesman C. Mark Brinkley. "For us, it was about 'What is the future?' If you're really going to move to a future where we're taking more and more humans out of the aircraft, you still need an aircraft that's capable like those advanced fighters."

One visible difference in the designs is Vengeance has an internal weapons bay, whereas Fury carries its weapons externally.

"That can affect their supply ability and stealth signatures," says Mark Gunzinger, director of future concepts and capabilities assessment at the Mitchell Institute for Aerospace Studies.

Air Force and industry officials say the CCA acquisition process encouraged different designs by focusing on the missions the CCAs would need to accomplish and the designs that could facilitate them.

"We had a use case with high-level attributes that we worked with our requirements, operator teammates, and then we brought in an industry pool and worked with them to see what were the actual possible designs that we could come up with based on technology," Brig. Gen. Timothy Helfrich, the Air Force's portfolio acquisition executive for fighters and advanced aircraft, said in an April interview, before the production awards were announced. "That process eventually led us into where we are right now, with Increment 1, with our final requirements set and multiple designs."



FQ-42 VENGEANCE



FQ-44 FURY

Helfrich added that the Air Force is taking a similar approach for Increment 2.

Andrew "Scar" Van Timmeren, a former Air Force pilot who worked on the Fury at both Blue Force and Anduril, praised the service's approach.

"They are completely different airplanes, but they both accomplished the mission that Increment 1 was designed for," he says. "The only reason why you get two completely different airplanes that actually both do the job is by allowing that space to be open for industry to get after it."



the progress and initiate a second competitive award, with the plan of selecting a primary mission autonomy provider for Increment 1 by summer 2027.

However, the service hopes to keep multiple vendors working to potentially compete in the future. According to an Air Force spokesperson, the service is planning a “fly-off” approximately three years after the initial contract award, where each mission autonomy maker will get a CCA to prove its software.

“CCA was an attempt to really change the dynamic and say, ‘Listen, we’re not going to buy from just one; we’re going to buy from multiple sources,’” says Jerry McGinn, director of the Center for the Industrial Base at the Center for Strategic and International Studies.

The foundation of this effort is the Autonomy Government Reference Architecture, or A-GRA. Using a modular open systems approach, the government sets and owns the baseline standards and interfaces, allowing vendors to bring in software that matches. It’s a bit like Apple or Android owning the operating system that app developers can then use to build their particular app.

Helfrich calls the approach “software sold separately,” allowing the Air Force to “plug and play” the software that best suits the CCA mission.

“The software can update quite quickly,” Helfrich says. “It will allow our airmen to have something that they can quickly innovate with and find the best way to use it for whatever situation they happen to be in.”

In late February, the Air Force tested the concept, flying a Fury on two mission autonomy platforms. The prototype switched mid-flight between Anduril’s Lattice and Shield AI’s Hivemind. Previously, a Vengeance flew on the Sidekick platform developed by Collins.

Jason Levin, senior vice president of engineering for Anduril’s Air Dominance & Strike business, says the way the Air Force has decoupled the software from the CCA airframe is a net positive, as it enhances competition and allows the best mission autonomy software to win out.

“It will make us a more capable system,” he says. “It’ll make the Air Force as a whole much better.”

Brinkley says “part of the long-term vision for us from the very beginning was to not get locked into anything.”

What’s ahead

The Increment 1 vendors are now manufacturing their first aircraft. Anduril rolled the first Fury off the production line in July. Levin says the company’s Arsenal-1 facility in Ohio is sized to produce up to 150 aircraft per year.

“It’s a modular production line to build at rate and at cost, and so again, very easily [you] see that we could adapt that production line and that scalable manufacturing technique for another CCA,” Levin says.

General Atomics’ facilities are tooled to build about six CCAs a month, according to Brinkley.

The Air Force has not released the value of the contracts or how many CCAs it is ordering in this initial tranche. The service initially estimated the Increment 1 aircraft would cost \$30 million each. Officials have not provided an updated figure for either CCA design, but Air Force Secretary Troy Meink testified to the Senate in June that “the platforms are on schedule” and “sticking to their budget targets.”

“With respect to keeping that cost down going forward, we have competition, we have open standards, that allows [us] to bring in several contracts for different pieces of the hardware and bring on additional contractors everywhere from the avionics to the aircraft bodies themselves and engines,” Meink told lawmakers. “We’re really trying to make sure we have a very modular open structure, which would drive those costs down going forward.”

The Air Force said it plans to test a piloted F-22 quarterbacking a CCA later this year, and the aircraft is slated to participate in its first large force exercise in December, according to a service official.

These tests — coupled with the broader experimentation led by the service’s Experimental Operations Unit, which is developing the CCA operational concepts — are meant to ensure service members can shape the CCAs.

“It’s our job to wring them out and make sure that, beyond the technical specifications of it, that we’re

▲ In July, a Fury prototype fired an AIM-120 missile at a “digital target.” This ground-controlled test over the Mojave Desert marked the first live munitions test with a CCA prototype.

U.S. Air Force/Jennifer Healy



“We need to imagine a world in which fighter planes aren’t the dominant platform, and that the CCAs are not just there to help the fighter planes; they’re actually there to win the war.”

— Frank Kendall, former U.S. Air Force secretary

experimenting with the more complex things like logistics and C2 [command and control],” said Lt. Col. Lyndon Bartlett, commander of the Experimental Operations Unit, at the Air, Space & Cyber conference in September.

Hunter, the former Air Force acquisition chief, says “there were specific things that had been modeled to say we think [a CCA] system like this could be extremely useful in very clear mission applications, but there will be many things that we didn’t originally anticipate that it will also be good at.”

“And also, the way in which you accomplish even the applications that we initially anticipated still has to be figured out,” he adds.

The CCA program is also demonstrating how the Pentagon can integrate AI-enabled systems.

“We’re at the front end of really understanding the kinds of functions and missions that AI will be able to perform in the future — not in the middle, not in the back end, we really are in the front end,” says Mark Gunzinger, director of future concepts and capabilities assessment at the Mitchell Institute for Aerospace Studies.

Air Force and industry officials say the program’s most significant hurdle is building pilot confidence the CCAs

will work as promised.

“The biggest challenge going forward — but it seems to be going well — will be getting the warfighter to trust the system and use it,” says Anduril’s Levin.

Ryan Bunge, president of missions systems at Collins Aerospace, told reporters in September that pilots’ understanding of the technology will evolve as they train more.

Once “you get an opportunity to get these out in some operational testing and refine the tactics together ... you’ll start to see the autonomy actually be able to — using AI — drive rapid recommendations of what to do,” he said.

Several analysts and executives told me there remain plenty of decisions ahead about how best to use CCAs, from understanding the technology to planning the training around them.

“They fly pretty far relative to manned aircraft. They bring sensors to the fight. They do bring kinetic and non-kinetic effects,” says Richard Brisbin, chief strategy officer at Poseidon Aerospace and a former Anduril executive who worked on maritime autonomous air power and collaborative combat aircraft at the company. “But the best and most tactically beneficial way to employ that is still, I would say, still in its infancy.” ★

▲ A Boeing MQ-28 Ghost Bat (bottom) flew alongside a piloted F-15EX in late June during the Valiant Shield exercise in the Pacific.

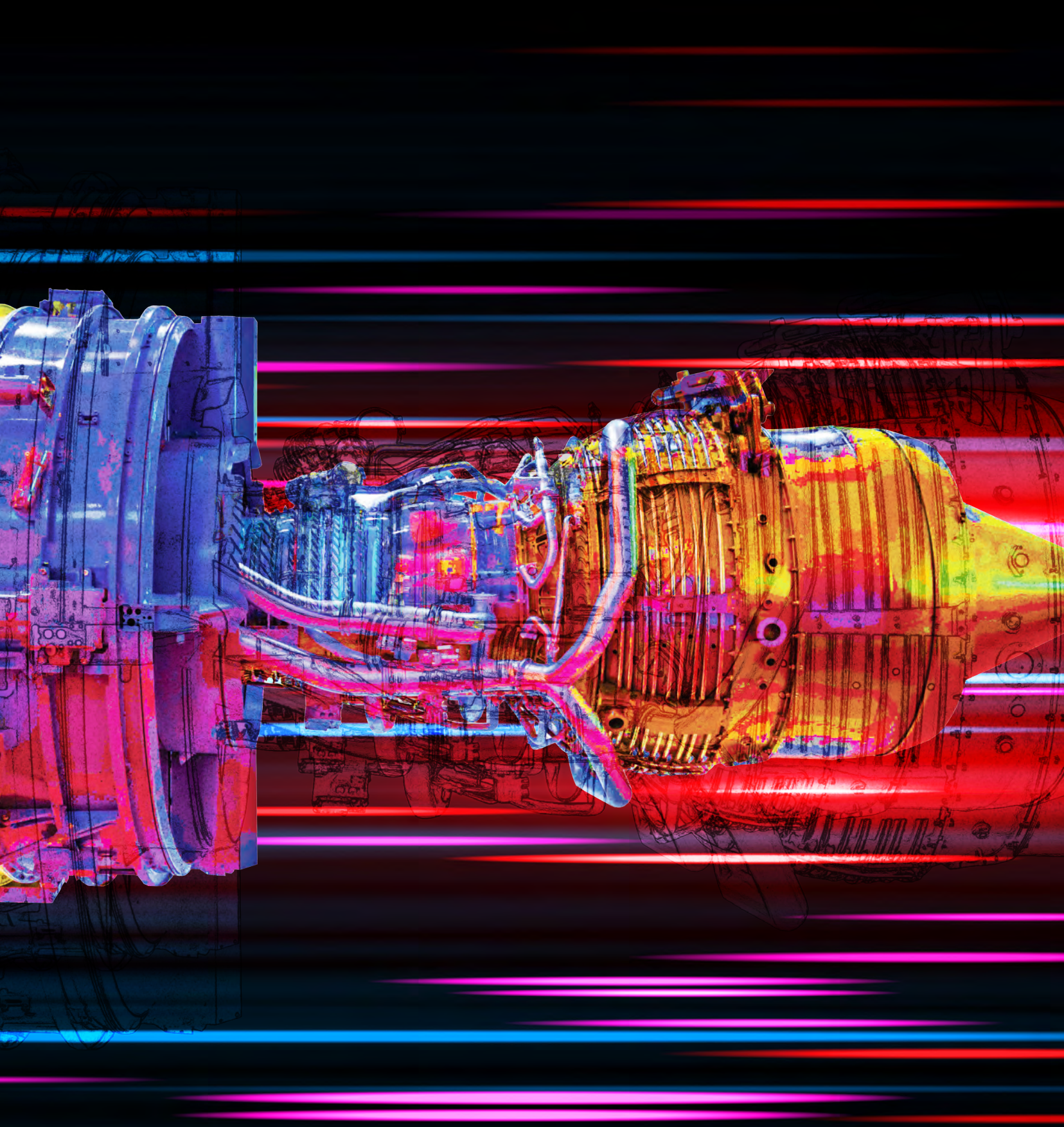
U.S. Air Force/Tech Sgt. Thomas Barley

Adding AI to aircraft design



Commercial aviation executives say artificial intelligence shows promise for optimizing the industry's design and test process — but there are plenty of regulatory hurdles. **Charlotte Ryan** takes a look.

BY CHARLOTTE RYAN | charlotte-ryan1@hotmail.co.uk



Source: photo composite of Adobe Stock images



Inside GE Aerospace's research center in Niskayuna, New York, a computer terminal started a simulation. The result, produced within seconds, was a preliminary design for a hypersonic ramjet engine.

Such concepts have traditionally been the result of months of design work by a team of engineers. This time, however, the lead developer fed the desired flight conditions and criteria, including thermal performance and the engine's structure, into a generative AI dashboard, which returned a design almost immediately.

The demonstration, announced by GE in May and recounted to me by Joe Vinciguerra, general manager and senior executive director of GE Aerospace Research, illustrates the kind of computational speeds the company says could significantly accelerate the development of next-generation commercial aircraft engines, including RISE. The company is developing this open-fan concept with French partner Safran Aircraft Engines through their joint venture, CFM International.

"When we think about the practical use of that tool, it is poised to just dramatically shorten the design cycles of our products," Vinciguerra told me in an interview. "We can shrink the amount of digital iterations that we do and get to those physical tests faster, to have even more robust, durable and safe products on the other end."

The commercial aviation industry has historically operated on lengthy and expensive development cycles, with brand new engines and clean-sheet airframes each taking several years to develop. The cost is typically \$5 billion to \$7 billion for an engine and \$10 billion to \$20 billion for an aircraft, according to the consultancy Leeham.

The process is extensive, even as the industry has begun to rely more heavily on computer modeling, digital twins and other tools. First, engineers create 3D models based on the requirements received from the customer. Next, the most promising designs are fleshed out in a preliminary design phase, where engineers conduct simulations with techniques like computational fluid dynamics to predict gas and liquid flows, and optimize the structure.

This is followed by materials selection and extensive physical testing — including pushing and pulling on components to simulate the stress they will undergo in flight, and wind tunnel testing for parts like engines, flaps and rudders.

Almost every stage of the process could be improved by increased adoption of AI, according to Jonas Zinn, an analyst and AI expert at consultancy Roland Berger. For instance, large language models could narrow down the part specifications provided by manufacturers. Then, instead of constructing 3D models, designers could prompt an AI algorithm to generate "100, 200 designs" that match the requirements, he says. Finally, AI could be used during the simulation stage to speed up testing.

Rather than having to wait up to three days between physical test cycles, engineers could use AI models to instantly evaluate design tweaks, reserving costly full-scale simulations for when they are confident the new part will work. This would help to reduce costs overall, Zinn says.

Airbus' Fast Track Lead for Artificial Intelligence Pooja Narayan, who is responsible for leading AI strategy and integration across the company, sees the technology as a game changer.



Charlotte Ryan is a London-based freelance journalist who previously covered the aerospace industry for Bloomberg News.

“Can we use that agentic AI to do more of the hard work — not just a pure optimization, but to explore the design space better? It’s not just helping you sift through routine data, it’s helping you explore the design space, the areas that we just simply wouldn’t have the time to do.”

— Alan Newby, Rolls-Royce

◀ GE Aerospace announced in May that a team of its researchers used generative AI to create the preliminary design for a ramjet engine.

GE Aerospace

“If I go into design today, the most promising application is saving the time on cost,” she says. “We run these kinds of simulations, and they are quite time expensive, meaning if it is for the whole engine or for the whole aircraft, they take a long time to run. It could be days to weeks sometimes.”

Multiple companies — from Rolls-Royce to Airbus to RTX’s Collins Aerospace — told me they are incorporating AI into their work. However, some executives say there remains a gap between future applications they are considering for AI and what the existing regulations permit.

FAA and other regulators typically require engineers to “show their working,” as a Rolls-Royce executive describes it, and explain exactly how every part is designed — a level of transparency today’s AI tools cannot provide.

The aerospace standards that exist today don’t account for the use of artificial intelligence, according to Narayan. “Industry and regulators acknowledge that gap today, and the industry is working together to close that gap,” she says.

Although GE’s AI-generated ramjet design demonstrated the potential of AI, Vinciguerra notes the company is only using the technology in early-stage design.

“It’s really more like a quicker pace to the starting line,” he says. “By shrinking that early development time, it allows us to do things like detailed design, engine test and whatnot, where you really begin to build the regulatory record in earnest.”

Regulatory approaches

FAA and the European Union Aviation Safety Agency (EASA) have so far embraced different approaches to AI.

EASA has taken what industry executives describe as a more prescriptive, structured approach, grounded in its AI Roadmap that is in the process of being updated and the overarching framework of the EU AI Act enacted in 2024. The agency’s core principle is human oversight of AI systems, according to Guillaume Soudain, EASA’s AI project manager.

In other words, it can’t be two machines talking to each other. “We are saying if a tool is preparing, for instance, a preliminary design, we want a human or an independent process that is not AI-based to verify this output,” he told me. “If it’s a double verification, like a development plus verification, AI-driven, for now we say no.”

EASA has published specific technical standards companies must meet and categorizes AI applications into three different levels of human-machine collaboration: assistance, teaming where the machine is more like a coworker, and AI working autonomously and potentially without human ability to override it.

In contrast, FAA has crafted a more flexible framework. As outlined in its Roadmap for Artificial Intelligence Safety Assurance, the agency provides principles and allows companies to propose their own means of compliance, provided they can prove safety equivalence.

FAA declined to make an official available for an interview, but outlined this strategy in emailed comments, noting the agency’s approach is to implement AI incrementally while learning from real-world applications.

“Applicants in this innovative area can propose a compliance method that is most appropriate for their product,” spokeswoman Crystal Essiaw said.

This could be an existing standard from the standards organization SAE International, “or another method that the company proposes or adapts from other industries. The FAA must accept the proposed means of compliance.”

Essiaw added that FAA also aims to adopt consensus standards with other regulators to promote global harmonization — an approach supported by the International Civil Aviation Organization, which has been working since 2023 on a framework to guide national authorities in shaping compliance.

FAA’s core principles, as laid out in its roadmap, include to “avoid personification,” meaning users should “treat AI as a tool, not a human.”

In other words, the ultimate responsibility lies with the human who designs or maintains the AI, not the software itself. The document also states AI should be integrated within the existing aviation safety framework, rather than overhauling the framework.

Both regulators have acknowledged the challenges of implementing AI in aircraft design, testing and manufacturing. As FAA’s roadmap puts it: “The application of AI faces the challenge of determining how to assure the safe operation of an AI system which was not traditionally designed, but instead learned how to perform its task. Conventional aviation safety assurance techniques assume that a designer can explain every aspect of the system design, but such explanations are not readily extendable to AI.”

To navigate the transition, both regulators envision a phased, step-by-step timeline. They advocate starting with non-safety-critical ground applications — predictive maintenance analytics in maintenance, repair and overhaul facilities, for instance — before moving into safety-critical flight systems as confidence in the technology matures.

EASA’s Soudain says the agency has been in an exploratory phase and is now in a “consolidation phase,” where it transitions from exploring the use cases for AI to making rules and regulations. That means solidifying its requirements for human-AI assistance and human-AI teaming use cases, while thinking more about the next level: advanced automation.

“The next phase after that in 2028-plus will be a ‘pushing barriers’ phase, because we know we have set barriers in different ways,” Soudain says.

Even so, he notes the pace of AI adoption is likely to be slower than in other industries.

“Aviation is a very regulated and safety-relevant domain, so we will not make a change like in other domains,” he says. “We have decades before we even think about concretely replacing people. But the overall effort is not to replace; in fact, it’s more to be more efficient, be safer.”

Industry applications

When it comes to adopting AI, executives said their companies are starting with provable and easily replicable use cases, such as digital threads or connecting data across different stages of the product lifecycle.

Collins Aerospace, for instance, is using AI tools for



predictive maintenance, says Nicole White, vice president of the company’s Connected Aviation business. Here, AI combs through mountains of data and flags to airline customers when parts might need maintenance.

“It’s continuously analyzing operational and component health data to look for early signs of system degradation before the failure occurs,” White says. “Instead of just waiting on failures or relying solely on scheduled maintenance intervals, we’re trying to give our airline teams the ability to have insight into that, so they can prepare and then overall improve their dispatch reliability.”

Rolls-Royce is using AI to answer customer queries on engines, according to Alan Newby, the company’s head of research and technology. An AI-enabled system sorts through data to see if other customers are having similar issues, then offers potential solutions. Rolls also uses it to write and structure analytical reports, he says.

Airbus has adopted the technology for aircraft inspections, according to Narayan. Drones or human engineers take photographs of the aircraft’s exterior, which are then fed to AI software that compares these images against a database to identify potential faults.

At this year’s Farnborough Airshow, Boeing’s chief technology officer said he sees potential in using AI to speed early design work and to analyze large amounts of data to uncover trends or issues with parts.

“The solutions we’re going to put forward always are going to maintain the highest levels of quality and safety, so engineer in the lead,” Lane Ballard told reporters during a July 21 roundtable. “But here’s the beauty of AI: It is able to consume large amounts of data and help you ensure you can pull from gleaned information the powerful stuff that that engineer can use.”

▲ Airbus’ current AI applications include aircraft inspections. AI software compares a database of images against photos of the plane’s exterior (taken by an engineer or by a drone, like in this picture), to identify parts that might require maintenance or repair.

Airbus

At the same time, companies are readying for more expansive applications. In Newby's view, AI could revolutionize the design process, specifically by helping engineers explore new technologies — "next-generation systems, fan systems, aerodynamics," he says — in a way that's not possible with traditional methods.

"We're in the foothills to some extent of what we can do on this," he says. "Can we use that agentic AI to do more of the hard work — not just a pure optimization, but to explore the design space better? It's not just helping you sift through routine data, it's helping you explore the design space, the areas that we just simply wouldn't have the time to do."

According to a late 2025 report from Kearney, a Chicago-based management consultancy, AI is prompting aerospace companies to rethink how they "discover, test, validate, and optimize materials."

"Instead of relying solely on laboratory experimentation, AI models analyze patterns across thousands of combinations, identifying which elements and structures could deliver specific required performance outcomes," the report reads.

White, the Collins executive, also sees AI assisting with the industry's long-standing workforce shortage by improving productivity.

"You hear about [a] lack of pilots, lack of technicians, lack of all these different skillsets," she says. "It isn't that these tools are going to replace technicians, but what it is doing is enabling these technicians to be much more productive with the tools that they have."

In the long term, industry leaders anticipate a gradual shift toward true human-AI collaboration. Narayan of Airbus says she expects generative AI assistants to one day evolve into "agents" that work alongside engineers like human colleagues. She also foresees AI-driven robotics transforming manufacturing floors.

"We will start to see multitask robots that configure on the fly rather than performing single, hard-coded actions," Narayan says. "Whether screwing a fitting or sorting precision components, an AI brain allows them to pivot between complex tasks without requiring manual reprogramming."

For GE, which says it has utilized machine learning in design workflows for 20 years, there are clear benefits to making such a future reality.

"We're in a long-cycle business," says GE's Vinciguerra. "Jet engines are extremely complicated, highly engineered systems. The quicker we can generate designs and physically test them for durability and system-level performance, the better the end result is for the customer." ★



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SPOTLIGHT ON

SPACE NUCLEAR



Over the past seven decades, a variety of U.S. space nuclear power and propulsion initiatives have failed to reach orbit. NASA is betting the combination of matured technology and regulatory changes will enable success this time around. **Jon Kelvey tells the story.**

BY JON KELVEY | jonkelvey@gmail.com

Accomplishing some of NASA's top priorities would be difficult, if not impossible, with the traditional tools at its disposal.

Take the Trump administration's directive for the agency to establish the "initial elements of a permanent" lunar surface base by 2030. The solar power and batteries that have been staples of past moon missions would be of limited utility in ensuring consistent operations through the 14-day lunar night. Or consider NASA's long-term goal of sending humans to Mars. Relying on chemical rockets for such transits would require huge amounts of cryogenic propellant and complicated, costly refueling maneuvers.

So the agency plans to leverage nuclear power and propulsion to advance both these objectives, unveiling two pathfinder programs in March: Space Reactor-1 Freedom and Lunar Reactor-1.

SR-1 is to be a first-of-its-kind nuclear electric propulsion spacecraft, in which a fission reactor powers ion thrusters to propel the craft using a fraction of the propellant a chemical rocket would require. Plans call for it to be launched in late 2028 and deliver three science helicopters to Mars, a mission NASA is calling Skyfall. The agency intends to incorporate lessons from SR-1 into LR-1, a fission surface power system slated to be delivered to the moon in 2030.

Largely driving both timelines is the 2030 deadline for the Moon Base, which the White House laid out in a December 2025 executive order.

While the SR-1 and LR-1 programs are new, the underlying ambition is not. The U.S. has spent more than 70 years and about \$20 billion on space nuclear power or propulsion initiatives, according to Steve Sinacore, NASA's SR-1 program director.

Only one fission reactor was ever flown: the one that powered NASA's SNAP-10A satellite, launched in 1965. Later programs fell short of demonstrating fission propulsion in space; most recently, DARPA and NASA last year canceled a joint effort to develop a nuclear thermal rocket, dubbed DRACO, due to rising cost estimates.

There are good reasons to think this time may be different, according to the experts I spoke with, who included NASA and U.S. Department of Energy leadership, and space nuclear technology and policy experts from academia, industry and think



Jon Kelvey

previously covered space for The Independent in the U.K. His work has appeared in Air and Space Smithsonian, Slate and the Washington Post. He is based in Maryland.

Photo illustration by Evgen via Adobe Stock



tanks. In Sinacore's view, SR-1 and LR-1 are riding the crest of a decade-long wave of nuclear regulatory reform, technical innovation and industry capacity build-out, all of which will help ensure the success of those missions.

Moreover, the U.S. nuclear community has learned from the past. In his March presentation for SR-1's announcement, Sinacore heavily referenced a 2025 report on the history and future of space nuclear prepared for the Idaho National Laboratory to argue that SR-1 and LR-1 have the right missions, technological readiness, timelines and agency leadership to succeed.

"The lack of an operational space nuclear reactor is not a technology problem," Sinacore told the audience at NASA headquarters. "It's an execution problem."

Examining past hurdles

Space nuclear power and propulsion are technically challenging, but historically, technology alone has rarely been the limiting factor, according to Bhavya Lal, a professor of policy analysis at the RAND School of Public Policy and one of the authors of the 2025 report. The Soviet Union, after all, from 1970 to 1988 flew more than 30 satellites powered by fission reactors.

Instead, she has said in papers and public remarks, the hurdles facing past U.S. initiatives have been in the execution, beginning with the lack of a clear rationale for why specific missions required nuclear fission.

The SNAP-10A satellite in 1965, part of the Atomic Energy Commission's Systems for Nuclear Auxiliary Power program, carried a 500-watt reactor that operated for 43 days before an unrelated electrical fault killed the craft. But with the growing availability of solar power for

satellites, there was no clear need for fission power, and the fission portion of SNAP fizzled.

"Nuclear power in space is just like any other application in space, where if it meets the mission better than any other technology, then that's why you use it," says Sebastian Corbisiero, national technical director for the Department of Energy's Space Reactor Program. His team is developing the reactor for SR-1.

Past program timelines were also mismatched with political cycles, inviting cancellations. Consider Project Rover/NERVA, a joint effort of NASA and the Atomic Energy Commission that tested multiple nuclear thermal reactors and rocket engines between 1959 and 1973. Nuclear-thermal propulsion uses a fission reactor to heat liquid hydrogen propellant and expel it from a nozzle, producing high thrust more efficiently than a chemical rocket.

The idea for Rover/NERVA was to develop a nuclear-powered upper stage for chemical rockets launching to the moon and more distant destinations. By swapping out the Saturn V's third stage for nuclear propulsion, NASA estimated it could land up to 75% more payload on the moon than was possible with chemical rockets alone, according to a 1965 report.

But then-President Richard Nixon, who was already winding down the Apollo program and looking to cut spending, canceled Rover/NERVA in 1973.

Other programs depended on technological leaps that were too large, and often grew too costly, according to Sinacore — in part because of the lack of a coordinating authority to keep the budget under control.

For example, NASA's Jupiter Icy Moons Orbiter (JIMO)

▲ NASA's Marshall Space Flight Center last year conducted dozens of tests on this reactor engineering development unit built by BWX Technologies. The campaign culminated in a series of cold-flow tests meant to capture the reactor's response to vibrations and other effects of propellant flowing through it.

NASA/Adam Butt

Past and future plans

The U.S. has been studying space nuclear power and propulsion since the 1950s.



NASA's Glenn Research Center

ROVER/NERVA

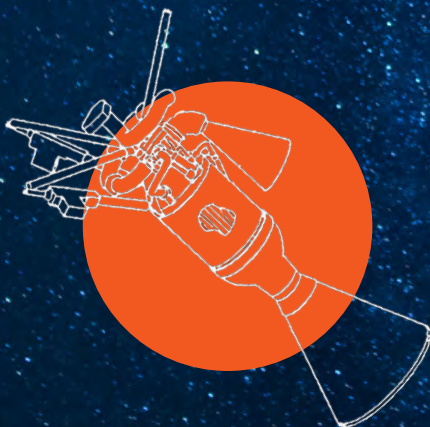
Starting in 1959, NASA and the Atomic Energy Commission ground-tested multiple variants of nuclear-thermal reactors under Project Rover. Plans called for building a flight version for a related program called NERVA, or Nuclear Engine for Rocket Vehicle Application. The effort was canceled in 1973, and an engine was never flown.



U.S. Department of Energy

SNAP-10A

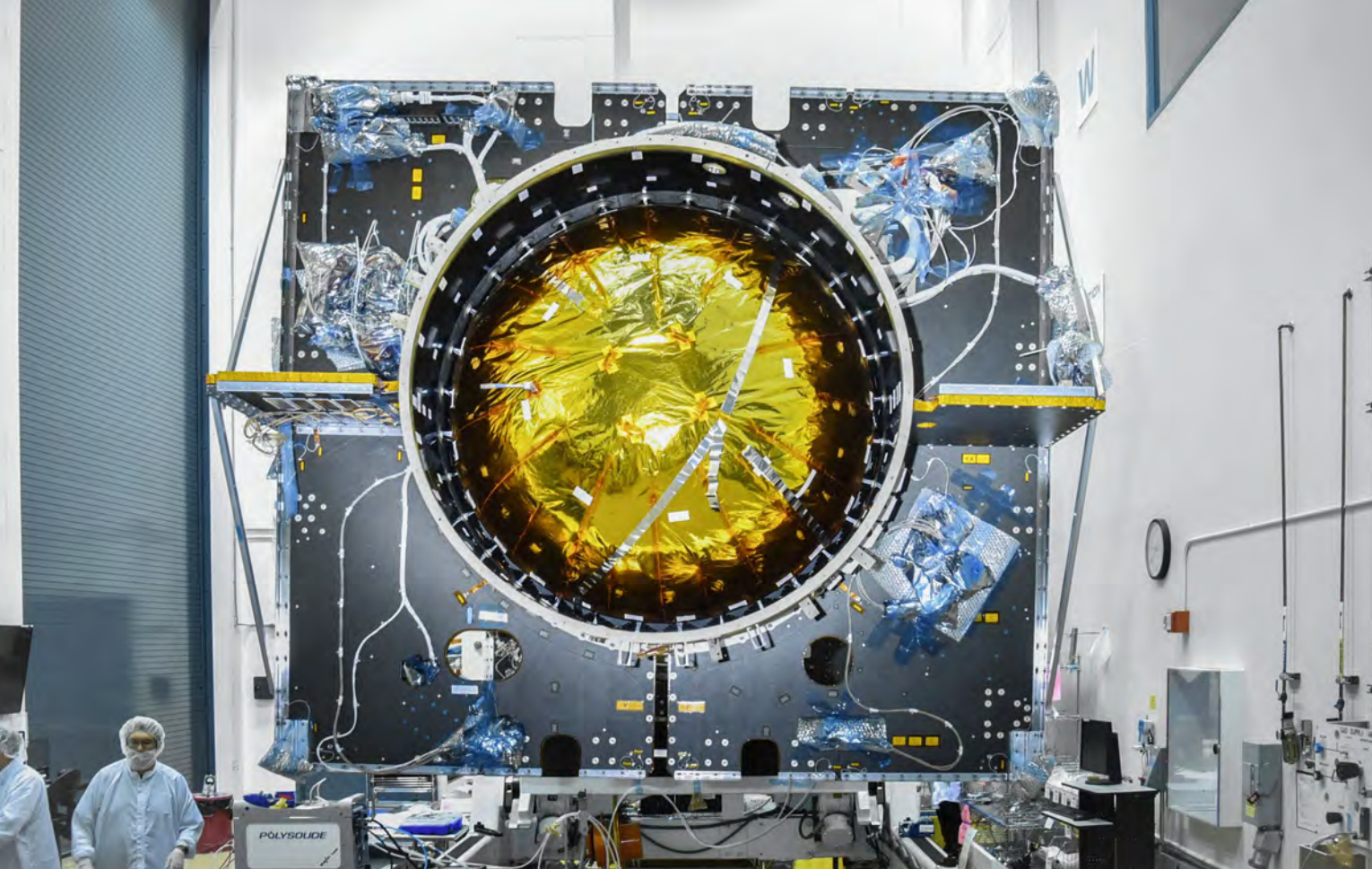
The 1965 launch of this NASA satellite marked the only time the U.S. has sent a nuclear reactor to space. Instead of propelling the satellite, the reactor generated 500 watts of electricity by converting heat from a compact nuclear reactor.



NUCLEAR ROCKET RESEARCH

Then-President Ronald Reagan announced the Strategic Defense Initiative during a televised speech in March 1983. Research was conducted on a variety of weapons concepts, including a nuclear-thermal rocket under Project Timberwind. This classified project was terminated in 1992, but research continued until 1994 under the Air Force's Space Nuclear Thermal Propulsion Program.

CONTINUED ON PAGE 41 ►



program, proposed in the early 2000s, would have used a 200-kilowatt reactor — 400 times the power of SNAP-10A — in a nuclear-electric craft destined to explore the moons of Jupiter. At a talk at MIT in July, Lal argued that the lack of a clear lead among the three teams working on JIMO — NASA, DOE and the commercial team designing the spacecraft — contributed to the rapid increase of the mission's projected cost. Indeed, when the program was canceled in 2005, NASA estimated a price tag of more than \$20 billion.

Inside NASA's strategy

NASA officials believe their plans for SR-1 and LR-1 have accounted for these previous failure modes, according to Sinacore.

Let's start with the mission cases. Sinacore likens spacecraft with nuclear-electric propulsion, or NEP, to astronomical railroads, moving large cargo across deep space far more efficiently than chemical rockets. For a Mars mission like SR-1, this means less of the spacecraft's mass is reserved for carrying propellant, opening up the potential for larger and more complex science payloads. On the lunar surface, he says, fission power is the only viable solution to keeping the Moon Base operating during the 354 hours of lunar night that occur every two weeks, when the moon's surface gets no sun exposure. In NASA's view, developing a handful of fission reactors is more practical than erecting fields of solar panels to shore up sunlight.

As for the political component, both SR-1 and LR-1 have clear deadlines and support from the Trump administration, stemming from the December executive order that also outlined a space nuclear strategy.

The White House followed up in April with another policy directive, National Space Technology Memorandum-3 (NSTM-3), that gave more detailed guidelines for federal agency coordination in reaching space nuclear power and propulsion goals.

These directives were the latest in a line of regulatory changes and executive orders directing federal agencies to pursue space nuclear applications, going back to the first Trump administration and continuing under former President Joe Biden, whose administration significantly revised the rulemaking pathways for new reactors.

Altogether, these changes "have helped streamline a lot of the regulatory paths that programs like DRACO have taken advantage of," says Joel Sema, space market segment director for BWXT Advanced Technologies, which was contracted to develop the reactor for DRACO, the joint DARPA-NASA program.

These regulatory and policy changes have coincided with geopolitical competition, according to Jake Hecla, assistant professor in MIT's departments of Aeronautics and Astronautics and Nuclear Science and Engineering. He points to China's plan to place a nuclear reactor at the lunar south pole by the mid-2030s, and its cooperation with Russia to develop a 500-kW NEP space tug that could be used for space-based electronic warfare.

▲ To expedite development of Space Reactor-1, NASA plans to repurpose the Power and Propulsion Element initially constructed for the lunar Gateway space station. The PPE's main bus is pictured here in early 2025 during assembly at Lanteris Space Systems, previously Maxar.

Lanteris Space Systems

"We see a class of capabilities that are being developed, which cannot be met with solar power, and they're being developed by our geopolitical adversaries," Hecla says. "That provides significant mission pull."

NSTM-3 also addressed the agency leadership issue, assigning the White House Office of Science Technology Policy as the overall coordinating agency. NASA followed suit in May, consolidating its space nuclear efforts under a newly created Division of Space Reactors led by Cynthia Simmons, formerly the deputy director of Goddard Space Flight Center. OSTP did not respond to multiple requests to comment for this story.

"I have a very clean line of accountability on Space Reactor-1 Freedom," Sinacore says, "through Cynthia, to the new mission directorate, through to [NASA Administrator Jared Isaacman] himself." That structure "puts a laser focus on accountability."

Designing SR-1

Technologically, NASA believes SR-1 is in a sweet spot: ambitious enough to fulfill a unique mission, but consisting of existing technologies that can be built quickly. The DOE, for instance, has developed expertise in rapidly developing small reactors on the ground over just the past few years, according to Michael Goff, principal deputy assistant secretary for the department's Office of Nuclear Energy.

"Some of these goals that we thought might have been obtainable a few years ago, now I think are very obtainable," he says. "This is not just some technology that's for next decade. It's ready now, and it's ready now for space applications."

Fission reactors that will operate in space pose unique design challenges. Unlike their terrestrial counterparts, they must be optimized for low mass, different fuel types and higher temperatures, Hecla notes. They must also withstand the vibrations of a rocket launch and use specialized means of cooling and converting heat into electric power.

"It's the difference between trying to make an F-150 and trying to build a Ferrari," Hecla says.

One such challenge is dealing with excess heat. Terrestrial reactors can use evaporation with large cooling towers to clear excess heat leftover after generating electricity. In space, reactors have to rely on thermal radiation, shedding waste heat primarily as infrared light through large radiators.

"The nuclear core is frankly probably about a quarter or less of your total mass," says Randy Bell, a senior project leader and space nuclear power and propulsion analyst with the Aerospace Corp., which operates a federally funded research and development center in Virginia. "Your radiator dominates the volume and mass," especially as a reactor gets larger and produces more power.

But because of SR-1's modest 20-kW reactor, "the heat rejection system actually is not one of the things that keeps me up at night," Sinacore says, noting that NASA expects to be able to stick to well-understood and mature

PAST AND FUTURE PLANS CONTINUED FROM PAGE 39

JIMO

NASA in 2002 proposed a nuclear-electric spacecraft that would orbit three of Jupiter's moons thought to contain subsurface oceans, as indicated by images taken by the Galileo spacecraft. This Jupiter Icy Moons Orbiter, or JIMO, was to be powered by a fission reactor, depicted in this illustration as a thin rod (at right). The mission was canceled in 2005.



DRACO

This DARPA program, started in 2020, was to culminate in 2025 with the first in-space demonstration of nuclear thermal propulsion. Three years in, NASA joined the effort, short for Demonstration Rocket for Agile Cislunar Operations, and the flight target shifted to 2027. DARPA canceled DRACO in 2025, citing increased costs and lingering questions about the benefits of nuclear thermal propulsion.

NEW REACTOR DEVELOPMENT

NASA in 2021 awarded three companies \$5 million contracts to develop concepts for nuclear-thermal reactors. The concept by BWX Technologies was later selected for DRACO.



CONTINUED ON PAGE 43 ►

technologies for this particular mission.

What that system will look like for SR-1 is a reactor core that heats a gas — possibly helium or xenon — that will be compressed and used to turn a turbine. A heat exchanger will transfer heat from the gas to water within a heat pipe, a sealed tube that allows heated water vapor to travel its length to radiator panels at the far end, for thermal radiation into space. The cooled vapor then condenses and returns down the length of the pipe through a wicking material, possibly metal mesh, using only capillary action — no moving parts.

At a high level, the largest challenge isn't a particular set of components, but in integrating the reactor with a spacecraft — and doing so on a short timetable. Here, Sinacore says NASA hopes to save time by repurposing the Power and Propulsion Element (PPE) from the now-canceled lunar Gateway space station.

"What makes the aggressive 2028 launch date achievable is the fact that PPE was nearly complete from a spacecraft bus perspective," he says. "What that spacecraft bus gives me is the electric thrusters integrated with all the fuel systems and control systems."

NASA Administrator Jared Isaacman told members of the House Science Committee in April the first two Gateway habitation modules had corrosion, but an agency spokesperson confirmed the PPE module does not have that issue.

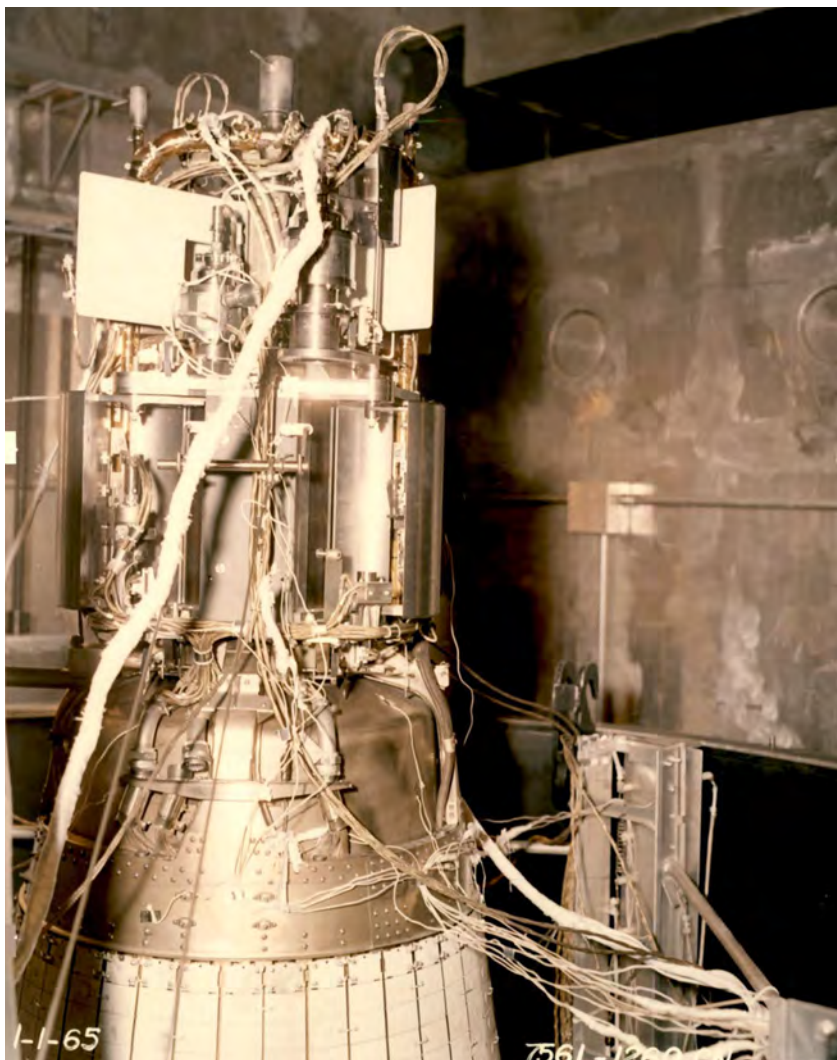
NASA is working with contractor Intuitive Machines to identify the necessary PPE modifications for its new mission, Sinacore says. The spacecraft will need a more powerful X-band radio than the Ka-band planned for the Gateway, for instance. It also needs only three 12-kW Hall effect thrusters, so the agency can drop the additional four 6-kW thrusters required for lunar orbit.

"While this mission has an aggressive timeline, we're confident in our ability to meet the launch date since we've been building and flying high-power systems for commercial customers for decades," Chris Coker, vice president of civil space programs at Intuitive Machines, said in an emailed statement. "Our PPE hardware has undergone rigorous review and testing to meet NASA's standards."

Hall effect thrusters ionize atoms of a gas such as neon or xenon, then use an electric field to accelerate them out of the rear of the thruster to generate thrust. Although this thrust is low compared to that of chemical rockets, thrusters are so propellant efficient they can operate continuously for long periods, allowing deep space missions to pick up large changes in velocity over time with less propellant than chemical rockets.

The conceptual rendering of SR-1 released in March shows what the spacecraft could look like: A long, tapering bus with a rectangular cross section and the 20-kW reactor behind a boron carbide radiation shield at its head, the thinnest end of the spacecraft.

The heat pipe would run from the reactor to an array of titanium and composite radiator panels two-thirds of the length toward the aft of the craft. The rear is taken up



by the repurposed PPE, which houses the electronics for controlling the reactor as well as the thrusters and propellant.

"You should start seeing hardware sub-scale tests, and then more assembly-level tests starting in early '27," Sinacore says.

The basic reactor and radiator design for LR-1 likely won't differ too much from that of SR-1, he says, barring any major lessons learned in the deployment of the latter. But he expects there may be some different design tradeoffs when it comes to balancing the mass of "a significantly larger and heavier shield" to protect astronauts on the lunar surface from the reactor's radiation, and keeping LR-1's overall mass low enough that it can fit on a lander.

One of the things NASA hopes to learn from SR-1 is to "truly understand what the shielding needs to look like to ensure we are able to have those human-rated missions in the future," Sinacore adds.

And while NASA is doing much of SR-1's development internally, LR-1 is to be an industry-led effort, according to Sinacore. The agency in early August posted a notice seeking industry interest in providing space power and reactor capabilities.

▲ A close up of a SNAP-10 reactor at a U.S. Department of Energy testing facility. A similar reactor was aboard NASA's SNAP-10A satellite, launched in 1965, the only U.S. spacecraft to be powered by nuclear fission.

U.S. Department of Energy

The path forward

SR-1 is intended to usher in a series of nuclear-powered missions, Isaacman said in September remarks at the Air, Space & Cyber Conference.

“Now, SR-1 is just the beginning of what will become the nuclear NASA,” he said. “There will be an SR-2, an SR-3, and four as we progressively build the capability to reach deeper into the solar system and commission a new fission-powered American star fleet.”

MIT’s Hecla says success for SR-1 and LR-1 won’t be enough to guarantee a sustainable future for follow-on missions. Rather, long-term success requires further technological innovations. SR-1’s 20-kW reactor is sufficient for a pathfinder mission leveraging existing technologies, he says, but larger deep space missions — something like the canceled JIMO craft, for instance — will require reactors capable of generating at least 100 kW. Those, in turn, would require developing some truly novel technologies, particularly when it comes to the radiators.

“My belief is that things will move toward a droplet radiator concept,” Hecla says. In this design, instead of a sealed heat pipe, an emitter would eject tiny droplets of heated metal to be exposed to the vacuum of space, radiate heat and be reabsorbed by a receiver and cycled back through the radiator. “Millimeter-scale droplets have an enormous surface-area-to-volume ratio, and so they form a very effective radiating surface.”

And there are potential applications beyond deep space missions. Last year’s executive order also tasked the U.S. government with developing nuclear power for spacecraft orbiting Earth, Hecla notes, possibly for use in the Trump administration’s planned Golden Dome missile defense shield. But current reactor and radiator technology wouldn’t be practical, in his view, because they’d take up more size and mass and cost more than traditional solar arrays.

“Unless we build lighter radiators, we cannot compete with the amount of solar power available in low-Earth orbit,” Hecla says.

Another limiting factor is the availability of sufficiently large launch vehicles and — for LR-1 and other large surface systems — landers.

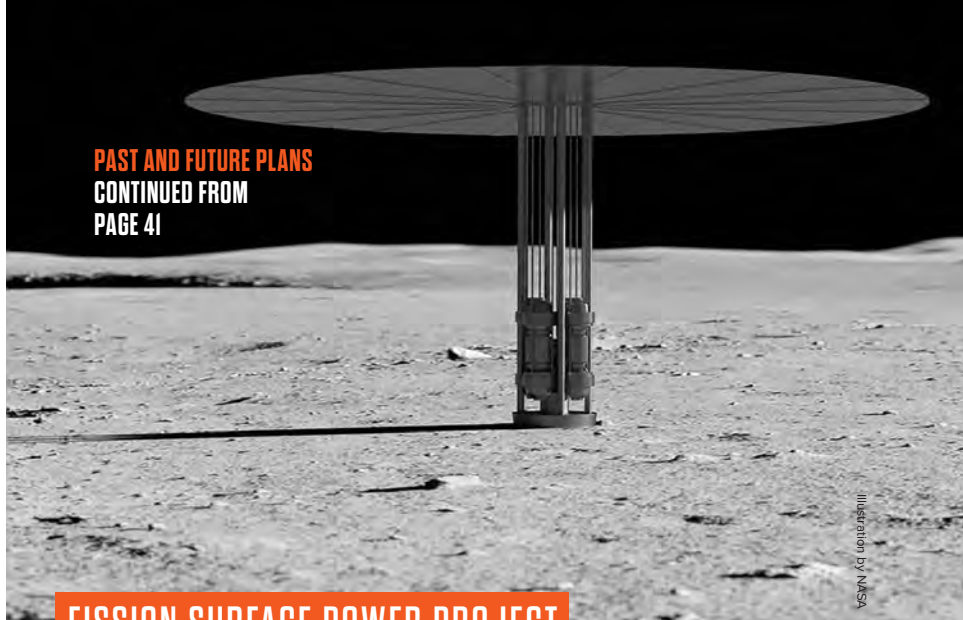
“It’s not that we don’t have the technology to do any of this. It’s that we’re not sure we have the ability to put it all together in a package that is small enough,” says Bell of the Aerospace Corp. “We could build a 100-kW system today. It would just be very large and difficult to land” on the moon.

The future might be more modular, he says, where the task is to get five 20-kW reactors working together rather than building one 100-kW system.

But for now, all eyes are on SR-1 and its 2028 launch target.

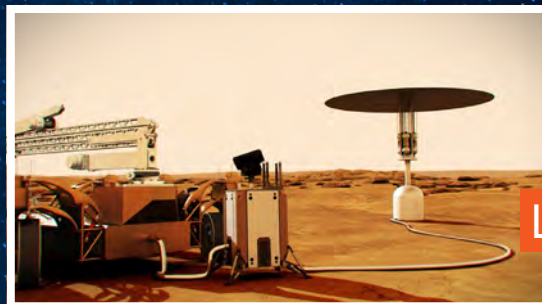
For the “first time in 60 years, the country has a space nuclear program with a real mission, a real deadline,” Lal said during her July presentation at MIT. “This is a moment.” ★

PAST AND FUTURE PLANS CONTINUED FROM PAGE 41



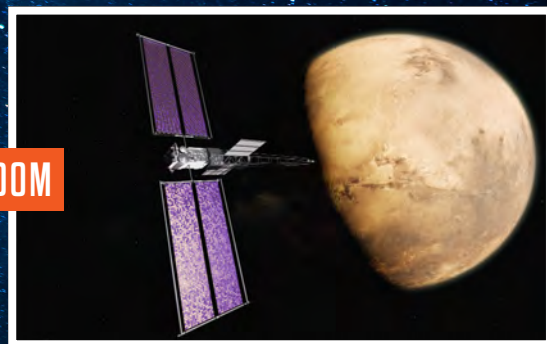
FISSION SURFACE POWER PROJECT

NASA in 2022 awarded three companies \$5 million contracts to develop concepts for fission reactors that could generate power for future moon missions.



LUNAR REACTOR-1

A December 2025 executive order directed NASA to establish the initial elements of a lunar surface base by 2030. As part of this effort, NASA and the Department of Energy renewed their longstanding partnership to develop fission surface power systems, the first of which is dubbed Lunar Reactor-1.



SR-I FREEDOM

NASA in March 2026 announced this nuclear-electric spacecraft that is to be launched toward Mars in 2028. Plans call for repurposing hardware originally built for the lunar Gateway space station and collaborating with the Department of Energy on the required fission reactor. Once in Mars’ orbit, the spacecraft would deploy three Skyfall helicopters to survey the planet’s terrain, among other tasks.

ABOVE + BEYOND

AIAA'S PHOTO SECTION HIGHLIGHTING THE BEST IMAGES OF THE QUARTER

A full-page photograph showing a SpaceX Falcon Heavy rocket ascending vertically. The rocket is silhouetted against a bright, circular sun that is partially obscured by the launch plume. The plume is a dense, textured column of white and yellow smoke and fire trailing behind the rocket. The background is a clear, pale blue sky.

A SpaceX Falcon Heavy rocket with NASA's Nancy Grace Roman Space Telescope on board is seen transiting the sun during launch from Launch Complex 39A at NASA Kennedy Space Center on 30 August.

NASA/John Kraus

Teams inside the Payload Hazardous Servicing Facility at Kennedy Space Center encapsulate the telescope within the payload fairing on 21 August.

NASA/Sydney Rohde (Rocz)



An hour and 23 minutes after launch, Roman began to emerge from the tight configuration that allowed it to fit in the rocket fairing. The solar panels and sunshade deployed, shading the rest of the observatory and providing power to the systems. The antenna will swing out and the visor-like deployable aperture cover will move into place to permanently reveal and shade the primary mirror.



The AIAA X-Plane is a Thorp S-18 – a two-seat, high-performance experimental aircraft originally designed in the 1960s by aeronautical engineer John Willard Thorp, beloved by the homebuilt community for its fighter-inspired handling and clean aerodynamics. Wearing fresh AIAA livery, it is a flying brand platform, a mobile classroom, and a declaration that AIAA's commitment to flight is alive and airborne.

Learn more about the AIAA X-Plane on page 57.



After making an appearance at EAA AirVenture Oshkosh 2026 where attendees including NASA Administrator Jared Isaacman had a chance to view it, the AIAA X-Plane will continue its yearlong campaign.



From the Institute

OCTOBER-DECEMBER | AIAA NEWS AND EVENTS

DATE	MEETING	LOCATION	ABSTRACT DEADLINE
2026			
5 Oct	2026 AIAA-NAE Yvonne C. Brill Lecture in Aerospace Engineering	Washington, D.C.	
5–9 Oct*	76th International Astronautical Congress	Antalya, Turkey (iac2026.org)	
6 Oct–5 Nov	Diagnostic Methods for Electric Propulsion Research and Development Course	ONLINE (learning.aiaa.org)	
6–15 Oct	Business Development for Aerospace Professionals Course	ONLINE (learning.aiaa.org)	
13 Oct–19 Nov	Airplane Performance and Flight Test Practices Course	ONLINE (learning.aiaa.org)	
19 Oct–4 Nov	Vertical Flight Infrastructure: What You Don't Know You Don't Know	ONLINE (learning.aiaa.org)	
20 Oct–12 Nov	Hypersonic Propulsion Concepts Course	ONLINE (learning.aiaa.org)	
26 Oct–4 Nov	Technical Writing Essentials for Engineers Course	ONLINE (learning.aiaa.org)	
26–29 Oct	Mission Design Workshop	ONLINE (learning.aiaa.org)	
27 Oct–3 Dec	Fundamentals of Python for Engineering Programming and Machine Learning Course	ONLINE (learning.aiaa.org)	
3–5 Nov	Launch Vehicle Coupled Loads Analysis: Theory and Approaches	ONLINE (learning.aiaa.org)	
3–12 Nov	Project Execution for Aerospace Professionals Course	ONLINE (learning.aiaa.org)	
3–12 Nov	Aircraft Reliability & Reliability Centered Maintenance Course	ONLINE (learning.aiaa.org)	
7–8 Nov	SmallSat Education Conference	Kennedy Space Center, FL	
9–18 Nov	Generative AI for Code Generation and Evaluation Course	ONLINE (learning.aiaa.org)	
16–19 Nov	Practical Design Methods for Aircraft and Rotorcraft Flight Control Course	ONLINE (learning.aiaa.org)	
16–19 Nov	Applied Model-Based Systems Engineering Course	ONLINE (learning.aiaa.org)	
20 November	AIAA Young Professionals, Students, and Educators (YPSE) Conference	Laurel, MD (https://www.aiaaypse.com)	
30 Nov–1 Dec	AIAA Region VII Student Conference	Adelaide, Australia & Online	

DATE	MEETING	LOCATION	ABSTRACT DEADLINE
2027			
11–15 Jan	AIAA SciTech Forum	Orlando, FL	21 May 26
13 Jan	2027 AIAA Associate Fellows Induction Ceremony and Dinner	Orlando, FL	
6–13 Mar*	2027 IEEE Aerospace Conference	Big Sky, MT (www.aeroconf.org)	
16–18 Mar	AIAA DEFENSE Forum	Laurel, MD	13 Aug 26
20–21 Mar	AIAA Region I Student Conference	Worcester, MA.	15 Jan 2027
1–2 Apr	AIAA Region V Student Conference	Wichita, KS	22 Jan 2027
2–4 Apr	AIAA Region VI Student Conference	Moscow, ID	19 Jan 2027
2–4 Apr	AIAA Region IV Student Conference	Socorro, NM	19 Jan 2027
2–3 Apr	AIAA Region III Student Conference	Kent, OH	1 Feb 2027
5–6 Apr	AIAA Region II Student Conference	Starkville, MS	5 Feb 2027
15–18 Apr	AIAA Design/Build/Fly Competition	Tucson, AZ (aiaa.org/dbf)	
17 May	2027 AIAA Fellows and Honorary Fellows Induction Ceremony and Dinner	Washington, DC	
18–20 May	ASCEND 2027	Washington, DC	8 Oct 26
27–30 May*	ICNPAA 2027: Mathematical Problems in Engineering, Aerospace and Sciences	Sanlirufa, Turkey	
7–11 Jun	AIAA AVIATION Forum	San Diego, CA	12 Nov 26

*Meetings cosponsored by AIAA. Cosponsorship forms can be found at aiaa.org/events-learning/exhibit-sponsorship/co-sponsorship-opportunities.

 AIAA Continuing Education offerings



FOR MORE INFORMATION on meetings listed below, visit our website at aiaa.org/events or call 800.639.AIAA or 703.264.7500 (outside U.S.).



2026 Recipients Announced

AIAA has identified 30 exceptional young professionals who are already advancing aerospace through technical achievement, innovation, and leadership. The 30/30 Program highlights individuals in their 30s who are driving breakthrough research, advancing next-generation technologies, leading impactful programs and teams, and accelerating innovation across aerospace.

Aerospace Design and Structures

Taylor Fazzini

Modeling & Simulation Engineer
Northrop Grumman Corporation



Taylor Fazzini has a combination of technical vision, professional leadership, and commitment to strengthening the aerospace community that is exceptionally rare for an early career engineer. At Northrop Grumman, she is a strong advocate for integrating mission

engineering and operations analysis into the traditional aerospace disciplines to help push the industry toward design approaches that connect aircraft capability, operational effectiveness, and real-world mission outcomes. Her doctoral work reflects this same forward-looking mindset as it couples aircraft design and operations analysis through emerging and state-of-the-art digital tools.



In addition to her technical depth, Fazzini has demonstrated significant volunteer leadership across AIAA. She is a member of the Design/Build/Fly organizing committee, Director Emeritus of the Young Professional Group, member of the AIAA SciTech Forum Advisory Committee, provides national-level mentorship, and participates in her local community through both AIAA and SWE. Through these roles, she consistently advocates and shapes opportunities for students and young professionals while contributing to the broader technical direction of the aerospace community.

Fazzini is pushing the industry toward revolutionary new ways to design while also making the industry more welcoming and a better place to work. As a vocal champion for the young engineer's voice, she is ensuring emerging leaders are heard, supported, and empowered.

Explore profiles of our other **Aerospace Design and Structures 30/30 recipients** on the [Aerospace America](https://aerospaceamerica.aiaa.org) website.



Angela Buccio

Engineering Specialist, Rotor Dynamics and Aeromechanics
Bell Textron Inc.



Alex Carrere

Associate Technical Fellow
The Boeing Company



Jason Ginn

Mechanical Systems Engineer
NASA Jet Propulsion Laboratory



John Warren

Systems Engineer Staff
Lockheed Martin Corporation.

Aerospace Sciences

Daniel Donahue

Aerodynamic Stability and Control Engineer
The Boeing Company



As Associate Technical Fellow at The Boeing Company, Dan Donahue repeatedly advances the identification, testing techniques, and modeling methodologies of dynamic derivatives and unsteady aerodynamic effects while guiding the next generation of engineers. As lead aerodynamic stability and control engineer for a proprietary program, he shapes technical direction across multiple platforms – including F-15, F/A-18, T-7A, and MQ-25 – and leads a cross-divisional research group spanning several Boeing divisions. Throughout these efforts, Donahue directed over 40 experimental test campaigns of static and dynamic wind tunnel, water tunnel, and flight testing to validate and refine his theories. His most consequential advancements include methods for isolating quasi-static and unsteady aerodynamic derivatives during dynamic testing, applying reduced-order modeling as simulation alternatives to traditional Taylor Series expansion methods, and developing methods to identify regions of unsteady aerodynamics from static wind tunnel and CFD data. These contributions directly shape how the aerospace industry will model unsteady aerodynamics in future simulations – moving the field from approximation toward precision.



Donahue's impact extends beyond research. He holds a patent in flight controls, authors Boeing Design Practices, mentors over a dozen early-career engineers, instructs a Fluid Dynamics Laboratory at Washington University in St. Louis, and previously served as Young Professional chair for the AIAA St. Louis Section. Through sustained knowledge advancement, leading cross-disciplinary teams, publishing best practices, and sustained mentorship, Donahue's blend of technical rigor, program impact, and commitment to future workforce development leaves measurable and lasting marks on the field that merits recognition as a rising technical leader.

Explore profiles of our other **Aerospace Sciences 30/30** recipients on the **Aerospace America** website.



Anthony Ashley

Advanced Technology Leadership Program /
Aeronautical Engineer Staff
Lockheed Martin Corporation



Jeremy Boling

Mechanical Engineer
U.S. Army DEVCOM Armaments Center



Roshan T. Eapen

Assistant Professor, Aerospace Engineering
Pennsylvania State University



Richard Hann

Director, UAV Icing Lab
Norwegian University of Science and Technology
& Head of Aerodynamics
Ubiq Aerospace



Ryan J. Meritt

Director, Ahmic Operations
CUBRC



Harry Smith

Director of Flight Sciences
Flexcompute

Aircraft Technology, Integration, and Operations

James "JP" Stewart

Senior Vice President of Product Development
Electra



James "JP" Stewart is a 31-year-old aerospace engineer and leader of note. As senior vice president of Product Development at Electra, he is responsible for all aspects of the company's operations.

Stewart is transforming the future of flight through a new Direct Aviation paradigm for regional air mobility that gives people the freedom to travel from where they are to where they want to go, avoiding long drives and overburdened airports. Ultra-short takeoff and landing aircraft are the key enablers. Electra has successfully designed and flight demonstrated the world's first two-seat EL-2 Goldfinch aircraft, which requires only a 150-foot runway for takeoff and landing. EL-2 proved the feasibility of an



A man with short brown hair and a friendly smile is wearing a grey polo shirt with the Electra logo on the left chest. He is standing in front of a yellow aircraft, which is slightly out of focus in the background.

When you're engineering a new
era in aviation, you start with
a new way of thinking.

Congratulations to AIAA 30/30 honoree JP Stewart.

AIAA's 30/30 Recognition Program honors 30 exceptional young professionals who are advancing aerospace through technical achievement and leadership early in their careers. JP Stewart, our SVP of product development and an AIAA Associate Fellow, exemplifies the mindset for innovation and the passion for aviation that powers Electra and the industry. Congratulations to JP and all the honorees.



integrated system with blown-lift technology and hybrid-electric propulsion. As the EL-2 Program Manager, Stewart brought his exceptional technical expertise, practical insights, and impressive business acumen to bear on this successful endeavor. Stewart is now focused on developing the game-changing nine-passenger ultra-STOL EL-9 aircraft with entry into service in 2029.

Stewart is a 2026 AIAA Associate Fellow; a National Business Aviation Association 2024 Business Aviation Top 40 Under 40 award recipient; a 2021 Virginia Tech Alumni Emerging Leaders award honoree; and a 2016 Aviation Week 20 Twenties laureate. He is an active pilot and instructor, flying both sailplanes and powered aircraft. He has represented the U.S. Soaring Team four times in World Championships. Stewart earned a University Honors Bachelor of Science in Aerospace Engineering from Virginia Tech in 2018.

Explore profiles of our other **Aircraft Technology, Integration, and Operations 30/30 recipients** on the [Aerospace America website](#).



Evan Harrison

Senior Research Engineer and Division Chief
Georgia Institute of Technology



Sang-A Lee

Graduate Research Assistant
Embry-Riddle Aeronautical University



Max Z. Li

Assistant Professor, Aerospace Engineering
University of Michigan



Aman Deep Tripathi

Product and Commercialization Lead
Wisk Aero

Business and Communications

Camille Bergin

Chief Marketing Officer
Star Catcher Industries



A 2018 AIAA Wernher von Braun Scholarship recipient, Camille Bergin trained as an aerospace engineer before working on NASA's Artemis program and classified national security missions. But her real distinction is what she did next: she paired her technical fluency with communications command to build category-defining companies, and a new category of technical marketing itself.

As Chief Marketing Officer of Star Catcher, the company building the first power grid in space, Bergin has, in less than two years, transformed an unknown seed-stage startup into a market leader. In October 2025, she led communications for Star Catcher's world-record optical power-beaming demonstration at NASA Kennedy Space Center. She landed an exclusive in Bloomberg and framed a deeply technical milestone for the investors, customers, and policymakers who decide a company's future. The positioning



and thought leadership Bergin leads have directly enabled a \$65 million oversubscribed Series A, ten signed commercial Power Purchase Agreements, and multiple government contracts.

Her influence extends across the industry: she pioneered orbital infrastructure narratives at Orbit Fab, built Vast's first marketing team, and co-founded Modulate Media. She built The Galactic Gal, a platform of more than 800,000 followers, earning the first creator partnership in U.S. Space Force history.

For the next generation in STEM, Bergin is proof that an engineer can also be a builder, a communicator, and a public voice, all at once. She isn't just opening doors; she's showing others where to find them.

Explore profiles of our other **Business and Communications 30/30 recipients** on the [Aerospace America website](#).



Olga Isabel Pérez Encarnación

Air Traffic Controller and Aerospace Media Producer
Dominican Institute of Civil Aviation (IDAC), El Nuevo Diario, & Nolim Studios



Chad Stearns

Program Management Manager - Chief of Staff
The Boeing Company

Information Systems

Kerianne Hobbs

Senior Engineering Specialist
The Aerospace Corporation



Kerianne Hobbs is a rare force in aerospace, uniquely spanning the air and space domains with an impactful career of leadership and achievement that bridges fundamental theory and real-world flight testing. In her prior role at Air Force Research Laboratory she led the Safe Trusted Autonomy for Responsible Spacecraft (STARS) program from 2023 to 2025, directing 50+ researchers in trailblazing work on neural network control systems, runtime assurance, and human-autonomy team-

CELEBRATING AEROSPACE PIONEERS



Anthony Ashley
Advanced Technology
Leadership Program /
Aeronautical Engineer Staff



Daniel Castro Ortega
Senior Propulsion Engineer



John Warren
Systems Engineer Staff

Congratulations to Daniel Castro Ortega, Anthony Ashley and John Warren for being named to the American Institute of Aeronautics and Astronautics 30/30 Recognition Program. Your insightful and compelling contributions are propelling the aerospace industry to new heights and inspiring the next generation of changemakers.



LEARN MORE

LOCKHEED MARTIN 



ing. She contributed to the Automatic Ground Collision Avoidance System (Auto-GCAS), which won the 2018 Collier Trophy as a technology that has prevented 13 pilot fatalities. Hobbs pioneered the Space Trusted Autonomy Readiness (STAR) Levels, now integral to government roadmaps.

Currently at The Aerospace Corporation, she is increasing the technology readiness level of safe machine learning-based autonomous control. As lead author of the 2025 AIAA white paper on “Autonomous Aerospace Systems R&D Priorities,” she literally wrote the roadmap for the future of safe autonomy. With 70+ technical publications, a decade of service on the AIAA Intelligent Systems Technical Committee, and recognition as a 2024 AIAA Associate Fellow, Hobbs is a thought leader in high-assurance autonomous flight control. Mentoring 40+ students, serving on 11 graduate committees at seven universities, and inspiring multiple students to pursue Ph.D.s in aerospace engineering, Hobbs exemplifies the future leader who is defining the safety-critical standards that will govern autonomous flight for decades to come.

Explore profiles of our other **Information Systems 30/30** recipients on the Aerospace America website.



Carolyn Eady

Senior Professional Staff II and Assistant Project Manager
Johns Hopkins University Applied Physics Laboratory (JHUAPL)

Propulsion and Energy

Daniel Castro Ortega

Senior Propulsion Engineer
Lockheed Martin Corporation



Daniel Castro is known to his colleagues for his balance of propulsion defense innovation and proactive aerospace community leadership. Castro joined Lockheed Martin Aeronautics in 2018, and is currently excelling as the engine mechanical and systems engineering

integrator for a major SkunkWorks® program. In this role, he manages the vital bridge between complex hardware and vehicle architecture. Castro has steered his team to deliver critical milestones under compressed timelines, securing a 15% program cost reduction and positioning the platform for further funding.

Castro's technical contributions significantly advance propulsion systems and engine integration. Born in Colombia and with Bachelor and Master of Science

degrees in Aerospace Engineering from UCF and UCLA, he leads ADP Skunk-Works® Projects focused on engine development and model-based systems engineering (MBSE). Castro recently led and moderated the LM Inlet Systems Symposium, an internal event that gathered inlet practitioners across the corporation for a one-day exchange of technical projects. He is the AIAA INPSI



(Inlet Nozzle Propulsion Systems Integration) Deputy TDC (Technical Discipline Chair) for AIAA SciTech Forum 2027, overseeing the selection of INPSI papers to be presented during the forum and coordinating the logistics.

Castro is leaving a permanent mark by rewriting the blueprint for early-career engagement. As project manager for the AIAA AVIATION Forum 2024 RECAP initiative, he restored the strategic framework to revitalize early-career conference participation by securing company budget, orchestrating logistics, and providing direct mentorship. Within Lockheed Martin, he actively fosters a collaborative culture that empowers junior engineers. Castro is already establishing the professional infrastructure and human talent necessary to sustain the future of aviation.

Explore profiles of our other **Propulsion and Energy 30/30** recipients on the Aerospace America website.



Oliver Jia-Richards

Assistant Professor, Aerospace Engineering
University of Michigan



Suo Yang

Associate Professor, Mechanical Engineering
University of Minnesota

Space and Missiles

Paula do Vale Pereira

Assistant Professor of Aerospace Engineering
University of Central Florida



Paula do Vale Pereira is advancing aerospace engineering by expanding the design space for complex space missions through innovative solutions to thermal challenges that affect spacecraft performance, efficiency, and reliability.

As a graduate student, she contributed to three CubeSat missions, leading thermal control efforts for technically demanding applications,



including a deformable mirror requiring exceptional thermal stability and a laser system with significant cooling requirements. As a faculty member, she continues to push the boundaries of small satellite capabilities. Through the University Nanosatellite Program Mission Concept, sponsored by AFRL and NASA, her team is developing methods to minimize thermal cycling in high-performance onboard computers. This work aims to enable nanosatellites to function as nodes within long-duration, distributed “supercomputers” in space, potentially revolutionizing low-cost, scalable orbital computing for missions extending beyond Earth orbit.

Do Vale Pereira also has a history of leadership within AIAA. Since 2023, she has served as Deputy Technical Program Chair for ASCEND, chaired the Small Satellite Technical Committee’s Technical Affairs Subcommittee, and has been a member of the Space Exploration Integration Committee

since 2024. She has reviewed abstracts and chaired technical sessions for ASCEND and AIAA SciTech since 2022. As faculty advisor to the AIAA Florida Tech Student Branch in 2023 and 2024, she mentored students who were hosting the record-breaking 2024 AIAA Region II Student Conference

Explore profiles of our other **Space and Missiles 30/30** recipients on the **Aerospace America** website.



Chip Andrews

Senior Principal Systems Engineer
Raytheon, an RTX Business



Eleonora Botta

Associate Professor, Mechanical and Aerospace Engineering
University at Buffalo – State University of New York



Mahhad Nayyer

Ph.D. Candidate and Mirzayan Fellow at
National Academy of Sciences
Purdue University



Ashwin Rao

Branch Chief, Analysis
Space Systems Command

Congratulations to
Dr. Kerianne Hobbs
Vehicle Autonomy and System Trust at The Aerospace Corporation

**Selected to the inaugural
AIAA 30/30 Recognition Program**

*Solving the hardest problems to meet
the mission. We make space work.
Learn more at aerospace.org.*

AEROSPACE

AIAA Joins in “The World’s Greatest Aviation Celebration” at Oshkosh

The AIAA X-Plane debuted at EAA AirVenture Oshkosh 2026 – the 73rd annual edition of what is simply known as “the world’s greatest aviation celebration.” The event draws aviation enthusiasts, pilots, builders, engineers, and families from around the globe to Wittman Regional Airport each July. It is the natural home for everything the AIAA X-Plane represents.

BY REBECCA GRAY

Origins of the AIAA X-Plane

The project came to life with the remarkable contributions of two AIAA members – Mujahid “TULSI” Abdulrahim, Ph.D., and Jessica “STING” Peterson, Ph.D. Mujahid even contributed his experimental plane to the project – a Thorp S-18 – a two-seat, high-performance experimental aircraft originally designed in the 1960s by aeronautical engineer John Willard Thorp, beloved by the homebuilt community for its fighter-inspired handling and clean aerodynamics.

Throughout the week at Oshkosh, Mujahid showed off the AIAA X-Plane in its fresh livery on the flight line. We welcomed special guests for an up-close experience, including NASA Administrator Jared Isaac-

man and AIAA Associate Fellow and former Assistant Secretary of the Air Force Ravi Chaudhary. Jessica welcomed guests at the AIAA booth for a unique virtual reality (VR) immersive flight experience filmed inside the X-Plane.

The Story Continues All Year

What began in July becomes a yearlong campaign – flights, presentations, digital content, and community appearances that carry AIAA’s message to reach new audiences around the world. In the coming weeks, you will hear more about Mujahid’s and Jessica’s journeys. We’ll put you in the cockpit for everything they do next.



CUBRC
Ahmic — Newly Acquired



Capturing Critical Hypersonic
Ground and Flight Test Data



CUBRC is proud to recognize Dr. Ryan Meritt for being selected as one of AIAA's 30 exceptional young professionals shaping the future of aerospace. This prestigious recognition highlights early-career leaders who advance technical achievement, innovation, and leadership. Dr. Meritt provides critical technological development and advancements in wall shear sensors, temperature gauges, and aerodynamic balances. Congratulations Ryan!

CUBRC, Inc is an independent, not for profit company executing research, development, testing and systems integration focused on solving our country's most high-stakes challenges. Our Aerosciences team conducts hypersonic ground and flight testing, advanced computational modeling, analysis and unique test capability development.

MAKING AN IMPACT

Building Connections Before College: How Two High School Students Found Their Dream Internship

In January 2026, two high school students attended AIAA SciTech Forum for the first time.

Stephen Griggs was an 18-year-old senior from Georgia and Dev Goda a 17-year-old junior from Northern Virginia. The two young men had first met and bonded over their shared interest in flying model airplanes and discovered a mutual connection through AIAA.

BY JAKE WILLIAMS



"I've been an AIAA member since my sophomore year in high school," Stephen said. "I've been following AIAA news and conference proceedings for a while and I had a paper that I figured *maybe* AIAA SciTech worthy, so I sent in an abstract and was delighted when it was accepted." He remembers the shock and excitement he felt while sitting in a café with his mother and receiving the email saying his paper had been accepted. "Presenting it here has been amazing because so many people had great questions for me. I appreciated the audience engagement and their experience." Stephen's accepted paper focused on the design, analysis, and testing of a long-endurance solar UAV intended to support emergency communications in disaster environments, with an emphasis on power-constrained flight, endurance trade studies, and real-world deployment considerations.

Dev became an AIAA member a year earlier when he heard about the organization after winning a regional science fair. Stephen encouraged Dev to join him on his first trip to the forum and the two students traveled to Orlando, Florida.

"My whole experience with AIAA has been incredible," Stephen said. "One of the things I appreciate about being a member is the *Aerospace America* subscription, and My Daily Launch. I generally like to read those each morning. I appreciate the technical documentation through ARC. I've referenced that many times. And I enjoy the networking opportunities that AIAA offers... I appreciate the people here taking the time to talk to us and guide us through our future as AIAA members and future professionals."

Dev agreed. "Before coming to AIAA SciTech I didn't have many connections in the industry. I didn't know many people who do this work. ... I was surprised at all the things to see and do, and the variety of people to meet. I've made so many connections. I've already met multiple mentors who are willing to help me through the processes as I work on hopefully having a research paper to present next year."

One of the networking opportunities Stephen and Dev took advantage of was Meet the Employers: an event for students and young professionals to engage with AIAA corporate members and learn about internships, corporate culture, future employment opportunities, and various company projects. At the event, they met John Langford, the aerospace entrepreneur who founded Aurora Flight Sciences, Athena Technologies,

and Electra.aero, and is a past President of AIAA. Langford was impressed with the two students and interested in the overlap between Stephen's paper and a new initiative Langford was working on.

The three had a follow-up lunch to discuss their respective interests in greater depth. Stephen noted, "[Langford's] an amazing man with an amazing history. It would be an honor to have anything to do with one of his projects."

That dream came true this past summer, as both students interned at a new Langford company; Iris Aero was founded in 2025 by Langford and atmospheric scientist James Anderson. Their focus is on opportunities that leverage recent breakthroughs in solar power, lightweight structures, batteries, and sensing technologies to create and develop the Stratospheric Airborne Comprehensive Observation System (SACOS), an ultralight, autonomous, all-electric aircraft designed for persistent stratospheric operations.

Stephen and Dev joined a select group of other students working with experts at Iris Aero to make the *Dawn One* solar aircraft flightworthy. In addition to the expertise, guidance, and support they received from company employees, they also built indelible friendships with the other interns who worked together shoulder-to-shoulder throughout the summer.

In comparing their past experiences experimenting with RC aircraft and how that's different from the advanced, real-world work they're did over the summer, Stephen and Dev laughed: "In the past we did a whole lot of educated guessing, and now we're doing a whole lot of education."

"We learned so much doing this project; doing the structural tests, doing

the documentation, because this is our first internship and work environment we learned so much about how to properly document," said Dev.

"I could not have had a better preparation for working in aerospace," emphasized Stephen, "This opportunity was the best thing to happen to me, truly."

Standing in the Iris Aero headquarters, Langford reflected on the moment he first met the students at the beginning of the 2026, back in Orlando: "It's unusual to have a high school student presenting a paper, and Stephen was giving a paper in exactly what we were interested in. So that was a no brainer... AIAA SciTech did exactly what it was supposed to do in terms of being the networking center."

Dev is now in his final year of high school and working on college applications. However, he plans to come back to Iris Aero regularly to continue working on the project throughout the year.

Stephen has started his first year at Purdue University where he is studying aerospace engineering. He also plans to continue working on his own side solar projects.

As he left his first summer internship, Dev remarked, "I plan to be an AIAA member for life."

Learn more about AIAA membership and the opportunities for students to get involved at aiaa.org/membership and aiaa.org/foundation.

CONGRATULATIONS Class of 2027 AIAA Associate Fellows

AIAA Associate Fellows Induction Ceremony and Dinner

Wednesday, 13 January 2027

Hyatt Regency Orlando
Orlando, Florida

The Class of 2027 AIAA Associate Fellows will be officially recognized for their accomplishments in engineering or scientific work, outstanding merit, and contributions to the art, science, or technology of aeronautics or astronautics.

Purchase Tickets at
scitech.aiaa.org/registration

You do not have to register for AIAA SciTech Forum to register for this event.



The AIAA Foundation has announced the winners of its 2026 undergraduate scholarships and graduate awards. Through its Foundation and supported by nearly 33,000 members, AIAA awards over \$160,000 in academic scholarships and STEM educational grants to support the next generation of aerospace professionals.

2026 Graduate Award Winners

NEIL ARMSTRONG GRADUATE AWARD (\$10,000)

Shanmurugan (Shan) Selvamurugan
Ph.D. student in Aerospace Engineering
Georgia Institute of Technology



To receive an award bearing Neil Armstrong's name is immensely humbling. His legacy is a timeless reminder that extraordinary leaps stem from rigorous technical discipline and the courage to pursue the impossible. This generous support directly fuels my research in next-generation space systems, inspiring me to help drive the future of space flight.

ORVILLE AND WILBUR WRIGHT GRADUATE AWARD (\$10,000)

Bikash Kunwar
Ph.D. student in Aerospace Engineering
Auburn University



Receiving this award is an honor. It gives me confidence in the research direction and long-term career goals I have set for myself and motivates me to continue my work on advanced air mobility aircraft. The recognition also strengthens my commitment to building a career in research, teaching, and mentorship dedicated to advancing aerospace technologies.

DR. HASSAN A. HASSAN GRADUATE AWARD IN AEROSPACE ENGINEERING (\$9,000)

Aiden MacQueen
M.S. student in Aerospace Engineering
North Carolina State University



This award is a huge blessing for me. It allows me the freedom to throw myself into research activities and project work during my graduate years rather than having to dedicate that time to a second job to cover my tuition payments. Because of this fellowship, I can focus my remaining time at NC State on hands-on design work, and I can engage in far more depth with the incredible faculty at NC State.

DR. HASSAN A. HASSAN GRADUATE AWARD IN AEROSPACE ENGINEERING (\$9,000)

Kierra Shook
M.S. student in Aerospace Engineering
North Carolina State University



While I never had the opportunity to meet Dr. Hassan during my time at NC State, his reputation preceded him, serving as a reminder of what it means to be truly dedicated to one's field. His passion for aerospace engineering inspired me to approach every day with curiosity, seeking new challenges and excitement within the field. My undergraduate journey was far from easy, particularly coming from a small North Carolina town where the STEM curriculum was less robust than the humanities. However, I am deeply grateful for those difficulties. I learned to embrace every aspect of aerospace engineering with a dream filled mindset, finding value even in the most demanding subjects.

GUIDANCE, NAVIGATION AND CONTROL GRADUATE AWARD (\$3,500)

Jasmine Jerry Aloor
Ph.D. candidate in Aeronautics and Astronautics
Massachusetts Institute of Technology



Receiving this award is a meaningful milestone in my doctoral journey. It encourages me to continue pursuing challenging problems at the intersection of learning, control, and autonomous flight, to make future air transportation safer and more scalable. I am especially grateful for the recognition from the GNC community, whose work and mentorship have helped shape my own path in aerospace.

LIQUID PROPULSION TC GRADUATE AWARD (\$2,500)

Schuyler McNaughton
Ph.D. student
Purdue University



This award will help me achieve my goal of becoming a professor, so I can pay forward the guidance I've received and mentor the next generation of scientific innovators.

WILLIAM T. PIPER, SR. GENERAL AVIATION SYSTEMS GRADUATE AWARD (\$1,500)

Luis Jose Alarcon-Aneiva
Ph.D. student in Aerospace Engineering
Auburn University



Life never stops surprising me. I'm grateful for this award and for what it stands for: making general aviation safer for everyone. I wouldn't be here without my parents, who believed in my goals when they seemed impossible, and who taught me that where you start does not decide where you can go.

MARTIN SUMMERFIELD PROPELLANTS AND COMBUSTION GRADUATE AWARD (\$1,500)

Andrea Ruan
Ph.D. candidate in Aeronautics and Astronautics
Purdue University



Receiving the award is a meaningful recognition of my work to move rotating detonation combustion closer to practical propulsion systems. It motivates me to continue addressing the performance, thermal-management, and integration challenges that separate promising combustion concepts from deployable technologies. I am grateful to AIAA and the Propellants and Combustion Technical Committee for supporting my development and my long-term goal of advancing next-generation propulsion systems.

JOHN LELAND ATWOOD GRADUATE AWARD (\$1,250)

Kristoffer Saeves
M.S. student in Aerospace Engineering
Texas A&M University



Receiving the award is a great honor and reflects AIAA's deep commitment to catalyze the future of aerospace science. This generous award provides support that directly advances my work on subsonic wind tunnel research and academic pursuits.

**GORDON C. OATES AIR BREATHING PROPULSION
GRADUATE AWARD (\$1,000)**

Adhiraj Bhagat

Ph.D. student

Georgia Institute of Technology



Receiving the award is a tremendous honor. Recognition from the Air Breathing Propulsion community at this stage of my career is both humbling and motivating, reinforcing my commitment to advancing our understanding of supersonic combustion. As our field continues to drive innovations in high-speed air-breathing propulsion, this award inspires me to continue pushing the boundaries of supersonic combustion research while contributing to the technologies that will shape the future of supersonic and hypersonic flight.

**2026 Undergraduate
Scholarship Winners**

DAEDALUS 88 SCHOLARSHIP (\$10,000)

Tomas Salvo

Senior in Aerospace Engineering

Georgia Institute of Technology



This scholarship lets me finish my degree at Georgia Tech while continuing to work on my projects. I'm incredibly grateful to Dr. Langford and the AIAA Foundation for backing student builders.

MARY W. JACKSON SCHOLARSHIP (\$10,000)

Rodrigo Martinez Chavez

Undergraduate Aerospace Engineering student

University of California, Berkeley



Receiving the scholarship is an incredible honor and a meaningful reminder of how far a dream can travel. Growing up in Peru, pursuing a career in aerospace once felt like a distant goal, and this recognition from AIAA encourages me to keep pushing that dream forward. This scholarship will help me continue developing as an engineer through research, hands-on projects, and opportunities to engage with the broader aerospace community. I hope to use those experiences not only to contribute to future space exploration, but also to help strengthen Peru's growing aerospace ecosystem and expand opportunities for the next generation of engineers across Latin America. I am deeply grateful to the AIAA Foundation for believing in and supporting that journey.

**INAUGURAL STEVE L. KARMAN JR. AEROSPACE
ENGINEERING SCHOLARSHIP (\$10,000)**

Vivian Zhang

Fourth-year student

Georgia Institute of Technology



I am honored to receive this scholarship. This award will allow me to continue my research in the intersection of aerospace, computational engineering, and mathematics. Thank you to AIAA, John, Kristen, and the Karman family for supporting my academic journey!

DAVID AND CATHERINE THOMPSON SPACE TECHNOLOGY SCHOLARSHIP (\$10,000)

Giol Vinyals-i-Roca

Aerospace Engineering student

Embry-Riddle Aeronautical University



Receiving the scholarship is both a great honor and a responsibility — to keep working hard to achieve my goals, and to have a positive impact on our incredible world.

**VICKI AND GEORGE MUELLNER SCHOLARSHIP FOR
AEROSPACE ENGINEERING (\$5,000)**

Anthony Vo

Senior, Aerospace Engineering

University of Oklahoma



Receiving this scholarship validates my dedication to leadership and service. This support enables me to stay focused on my academics, empowering me to transition into high impact fields where I can contribute to our nation's aerospace excellence.

ELLIS F. HITT DIGITAL AVIONICS SCHOLARSHIP (\$3,000)

Rayni Rister

Fourth-year Honors student pursuing dual majors in Aviation Flight and Aviation Management

Ohio University



This scholarship is an invaluable investment in me as I develop into a well-rounded pilot who embodies excellence, lifelong learning and passionate service.

DENISE PONCHAK DIGITAL AVIONICS SCHOLARSHIP (\$3,000)

Shree Shenpagam

Undergraduate student pursuing Electrical and Electronics Engineering

Nitte Meenakshi Institute of Technology (NMIT), Bangalore



This scholarship provides the launching pad for my goal of advancing space exploration while developing technologies that improve life on Earth.

DR. AMY R. PRITCHETT DIGITAL AVIONICS SCHOLARSHIP (\$3,000)

Michael-Anthony Kline

Sophomore studying Aerospace Engineering

University of Hartford



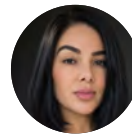
Lead by example and follow your dreams.

CARY SPITZER DIGITAL AVIONICS SCHOLARSHIP (\$3,000)

Tabitha Nabulsi

Aviation student

Liberty University



Aerospace is changing at a pace we've never seen before and advanced avionics are at the heart of that transformation. Receiving this scholarship strengthens my ability to grow with this industry and pursue my goals as both a law enforcement pilot and a future corporate pilot.

SPACE TRANSPORTATION SCHOLARSHIP (\$1,500)

Priyanka Supraja Balaji

Sophomore studying Mechanical Engineering

California Institute of Technology



I am deeply thankful to AIAA for this support, which allows me to focus on my research goals to contribute to the next generation of innovative, safe space exploration.

ROCKY MOUNTAIN SECTION SCHOLARSHIP (\$500)

Carolyn James

Studying Computer Science with a Space specialty
Colorado School of Mines



Winning an AIAA Foundation scholarship will be a big help to me. It will help me attend college while reducing the amount of student debt I must take on, allowing me to focus on school rather than finances.

2027 scholarships and graduate awards

Applications for the 2027 scholarships and graduate awards are being accepted from 15 October to 31 January. Please visit the AIAA Foundation's Scholarship and Graduate Awards website (aiaa.org/get-involved/university-students/undergraduate-scholarships-graduate-awards/) for more information.

Obituaries

[View more obituaries](#)


AIAA Honorary Fellow Jameson Died in June 2026

Known as the Father of Computational Modeling for Airplane Design



Antony Jameson, a Texas A&M University professor in both aerospace engineering and ocean engineering, died 11 June, at the age of 91.

Jameson received his bachelor's degree from Cambridge University in 1958, then received a Ph.D. from Cambridge in 1963. He spent time in the United States as an Alfred P. Sloan Foreign Post-Doctoral

Fellow at MIT before returning to England to serve as an economist for the British Trades Union Congress. From 1965 to 1966, he served as the chief mathematician for the Hawker Siddeley Dynamics Missile Division.

Returning to the United States in 1966, Jameson joined Grumman Aerospace to focus on the application of optimal control theory to the design of stability augmentation systems. After he began to focus on predicting transonic flow, he became a research scientist at New York University's Courant Institute of Mathematical Sciences in 1972. He was first an associate professor of mathematics and later became a professor of computer science.

In 1980, he joined the faculty at Princeton University as a professor of mechanical and aerospace engineering. He was named James S. McDonnell Distinguished University Professor in 1982. Moving to Stanford University in 1997, Jameson became Thomas V. Jones Professor of Engineering, and was later research professor from 2015 to 2017. moved to Stanford University. He came to Texas A&M University in 2018 and was named the Jack E. and Frances Brown Chair in Engineering in 2020.

Jameson was recognized with many awards that highlighted his work, including the 1988 Gold Medal from the Royal Aeronautical Society, 1993 AIAA Fluid Dynamics Award, the 1995 ASME Spirit of St. Louis Medal, the 2006 Elmer A. Sperry Award, the 2015 Daniel Guggenheim Medal, the 2015 John von Neumann Medal from the U.S. Association for Computational Mechanics, and the 2015 Pendray Aerospace Literature Award.

He was an Honorary Fellow of AIAA (Class of 2018), a Fellow of the Royal Society of London, a Fellow of the Royal Academy of Engineering, and a foreign member of the U.S. National Academy of Engineering.

Jameson published a book that demonstrated his expertise in the field of computational aerodynamics in 2022. His innovations in computational fluid dynamics form the basis for aircraft that are used from commercial airlines to the military.



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Aerospace & Defense

Unlocking the Next Golden Age of Aviation

March 23, 2027

WACO Education Center & Air Museum
 Troy, Ohio



AIAA Announces Winner of Prestigious Zarem Graduate Student Award for Distinguished Achievement in Astronautics

AIAA is pleased to announce that **Hossam Adel** is the recipient of the 2026 Zarem Graduate Student Award for Distinguished Achievement in Astronautics.

Adel will receive his award at AIAA SciTech Forum 2027, Orlando, Florida, 11–15 January 2027. This award was established by AIAA Honorary Fellow Abe Zarem, founder and managing director of Frontier Associates, to annually recognize graduate students in aeronautics and astronautics who have demonstrated outstanding scholarship in their field.



Hossam Adel is a graduate student and research assistant in the Department of Aerospace Engineering at Auburn University. He is a member of the Advanced Propulsion Research Laboratory, directed by Professor Joseph Majdalani. His research interests include numerical modeling, optimization, and the application of level-set methods to complex systems and flow geometries.

“I am deeply honored by this recognition and grateful to everyone who has supported me throughout this journey, especially Dr. Majdalani, my wonderful advisor.”



Hossam's faculty advisor, **Joseph Majdalani**, is the Francis Chair of Excellence in Aerospace Engineering at Auburn University. An AIAA Fellow, he is recognized for pioneering work in acoustic instability and cyclonic-engine technology. With over 350 publications and 23,000 citations, he ranks in the top 0.8% of aerospace researchers globally. His breakthroughs include new cyclonic, vorticoacoustic, asymptotic, computational, similarity, stability, boundary-layer, and high-speed flow formulations. He is known for coauthoring *Viscous Fluid Flow* with Professor Frank M. White. Besides 18 regional and 11 national best papers, his main

accomplishments include the William Walker Teaching, Mark Spencer Mentorship, James Wyld Propulsion, Von Kármán Lectureship, Abe Zarem Educator (5 times recipient), Auburn Senior Research Excellence, Auburn Book Author, Auburn Outstanding Graduate Mentor, ASEE Leland Atwood Educator, AIAA Sustained Service, Foundation Faculty Advisor, Konrad Dannenberg Educator, Hap Arnold, SAE Ralph Teetor Educator, Marquette Outstanding Teacher (twice), and NSF CAREER Awards.

“I would like to thank God Almighty for blessing us with such exceptional students as Hossam, who passionately pursue perfection, and a little bit of ‘magis,’ in everything they touch. Thanks to Hossam's outstanding performance, an obviously fair and thoughtful selection committee, and a bit of magic from above, history is made in two consecutive years: back-to-back Mike Freeman Awards in the Southeast Region, and back-to-back Abe Zarem Awards on the national stage! To be named the nation's Abe Zarem Educator for a fifth time is both profoundly humbling and tremendously appreciated! We are immensely grateful to everyone at AIAA, our beloved society of premier professionals, for this deeply meaningful recognition and quite extraordinary honor.”

For more information on the Abe M. Zarem Graduate Awards for Distinguished Achievement, please contact Merridith Kauten, at meridithk@aiaa.org or 703.264.7503.



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Join us for the AIAA Foundation's 2026 Day of Giving on 1 December. Your contribution will help launch the next generation of aerospace leaders.

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Recognizing Top Achievements an AIAA Tradition

AIAA is committed to ensuring that aerospace professionals are recognized and celebrated for their achievements, innovations, and discoveries that make the world safer, more connected, more accessible, and more prosperous. From the major missions that reimagine how our nation utilizes air and space to the inventive new applications that enhance everyday living, aerospace professionals leverage their knowledge for the benefit of society. AIAA continues to celebrate that pioneering spirit showcasing the very best in the aerospace industry.

AIAA acknowledges the following individuals and organizations who were recognized between July 2026 and October 2026.

2026 International Conference on Environmental Systems

12–16 July 2026
Rio Grande, Puerto Rico

Technical Excellence Award

2026 AIAA Jeffries Aerospace Medicine and Life Sciences Research Award

The award is presented for outstanding research accomplishments in aerospace medicine and space life sciences.

Robert Morrow
Sierra Space



"For excellence in scientific and technical leadership toward

development of state-of-the-art plant growth facilities for spacecraft, enabling high quality space life science research."

32nd AIAA/CEAS Aeroacoustics Conference

26–29 May 2026
Brussels, Belgium

Technical Excellence Award

2026 AIAA Aeroacoustics Award

This award is presented for an outstanding technical or scientific achievement resulting from an individual's contribution to the field of aircraft community noise reduction.

Stephen A. Rizzi
NASA Langley Research Center



"For substantial contributions to understanding and reducing noise impact on communities and air vehicles in areas of perception-influenced design, advanced air mobility, and acoustic fatigue."

AIAA Aerodynamic Decelerator Systems Technology Conference held in collaboration with the Royal Aeronautical Society

1–5 June 2026
London, United Kingdom

Technical Excellence Award

2026 AIAA Theodor W. Knacke Aerodynamic Decelerator Systems Award

This award recognizes significant contributions to the advancement of aeronautical or aerospace systems through research, development and application of the art and science of aerodynamic decelerator technology.

Jean Potvin
Saint Louis University



"For significant contributions to aerodynamic deceleration system science, data interpretation and integration, and education."

SAE's AeroTech® Conference

2–4 June 2026
West Palm Beach, Florida

Technical Excellence Award

2026 AIAA F.E. Newbold V/STOL Award

This award recognizes outstanding creative contributions to the advancement and realization of powered lift flight in one or more of the following areas: initiation, definition and/or management of key V/STOL programs; development of enabling technologies including critical methodology; program engineering and design; and/or other relevant related activities or combinations thereof which have advanced the science of powered lift flight.

Mark Douglass Moore
Whisper Aero



"For 40 years of technical leadership in breakthrough VTOL and

STOL technologies: a pioneer of distributed electric propulsion, eVTOL, and the advanced air mobility ecosystem."

27th AIAA International Space Planes and Hypersonic Systems and Technologies Conference

7–9 July 2026
Naples, Italy

Technical Excellence Award

2026 AIAA Hypersonic Systems and Technologies Award

This award recognizes outstanding sustained contributions and achievements in enabling technologies and/or the integration of technologies for system applications in the advancement of hypersonic flight.

Peter J. Erbland
Department of Defense, Amentum



"For an unparalleled career dedicated to the advancement of

hypersonic technologies and flight systems, exemplifying the greatest integrity, personality, passion, and technical excellence while elevating our professional community."

ASCEND

19–21 May 2026
Washington, D.C.

Premier Awards

2026 AIAA Distinguished Service Award

This award gives unique recognition to an individual member of AIAA who has provided distinguished service to the Institute for a period of at least 15 years.

Mark J. Lewis
President & CEO, Purdue Applied Research Institute



"For outstanding and notable contributions to AIAA at the sectional, regional, and national level over the past four decades."

2026 AIAA Goddard Astronautics Award

This award is the highest honor AIAA bestows for notable achievements in the field of astronautics.

Indian Space Research Organisation



"For the groundbreaking landing of the ISRO's Chandrayaan-3 near the lunar south pole region, to deepen our understanding of the moon and beyond."

Premier Lectures

2026 AIAA David W. Thompson Lecture in Space Commerce

This premier lecture recognizes a prominent industry leader or senior management team who have created or grown a space-related business and generated substantial economic benefits and market value.

Tory Bruno
President, Blue National Security
Blue Origin, LLC



Lecture: "Transforming ULA: Shaping the Future of Space Launch"

2026 AIAA von Kármán Lecture in Astronautics

This lectureship recognizes an individual who has performed notably and distinguished themselves technically in the field of astronautics.

Maruthi Akella

Professor and Cockrell Family Chair in Engineering
University of Texas at Austin



Lecture: "Opinion Dynamics, Learning, Trust, and Control of Autonomous Space Systems"

AIAA AVIATION Forum

8–12 June 2026
San Diego, California

Premier Awards

2026 AIAA Reed Aeronautics Award

This award is the highest honor AIAA bestows for notable achievement in aeronautics that represents a significant engineering advancement milestone.

Boom Supersonic XB-1 Team



"In recognition of the historic design and development of Boom Supersonic's demonstrator, XB-1, the first independently developed supersonic jet, which demonstrated Boomless Cruise on two supersonic flights in 2025."

2026 Daniel Guggenheim Medal

The Daniel Guggenheim Medal was established as an international award for the purpose of honoring an individual who makes notable achievements in advancing the safety and practicality of aviation. The Medal recognizes contributions to aeronautical research & development and educational outreach, the development of civil aircraft and equipment, and the application of aircraft to the economic and social activities of the nation.

Charbel Farhat

Vivian Church Hoff Professor of Aircraft Structures, School of Engineering, Stanford University



"For pioneering advances in the computational mechanics of

fluid–structure interaction, transforming simulation methodologies and enabling major breakthroughs in aircraft design and optimization."

Management Award

2026 AIAA Hap Arnold Award for Excellence in Aeronautical Program Management

This award is presented to an individual for outstanding contributions in the management of a significant aeronautical or aeronautical related program or project.

Leonard Zentz

Navy Strategic Systems Program (retired), System Planning & Analysis



"For programmatic and technical leadership of the U.S. Navy's Con-

ventional Prompt Strike effort leading to successful transition to Navy and Army prototype weapon systems."

Technical Excellence Awards

2026 AIAA Aerodynamics Award

This award is presented for meritorious achievement in the field of applied aerodynamics, recognizing notable contributions in the development, application, and evaluation of aerodynamic concepts and method.

Walter Silva

NASA Langley Research Center



"For seminal contributions to CFD-based unsteady aerodynamics,

reduced-order models, visionary leadership in aeroelasticity, and internationally recognized excellence in teaching and research."

2026 AIAA Fluid Dynamics Award

This award is presented for outstanding contributions to the understanding of the behavior of liquids and gases in motion as related to need in aeronautics and astronautics.

Brian J. Cantwell

Stanford University



"For lifelong seminal advancements of fluid dynamics principles and

turbulence modeling including the development of a highly accurate Universal Velocity Profile for wall-bounded flows."

2026 AIAA Ground Testing Award

This award is presented for outstanding achievement in the development or effective utilization of technology, procedures, facilities, or modeling techniques for flight simulation, space simulation, propulsion testing, aerodynamic testing, or other ground testing associated with aeronautics and astronautics.

Carson D. Slabaugh

Purdue University



"For pioneering experimental research and dedi-

cated mentorship that advanced aerospace propulsion through groundbreaking ground testing, benchmark datasets, community leadership, and translation of discoveries into national capabilities for flight."

2026 AIAA Multidisciplinary Design Optimization Award

This award is presented to an individual for outstanding contributions to the development and/or application of techniques of multidisciplinary design optimization in the context of aerospace engineering.

Anne Gazaix

Airbus Operations SAS



"For pioneering contributions to simulation software, col-

laborative innovation, and the industrial adoption of MDO methodologies."

2026 AIAA Plasmadynamics and Lasers Award

This award is presented to an individual who has made outstanding contributions to the understanding of the physical properties and dynamical behavior of matter in the plasma state and lasers as related to aeronautics and astronautics.

Campbell D. Carter

Air Force Research Laboratory



"In recognition of outstanding achievements in high-speed

advanced laser diagnostics and development of laser-based measuring systems for combustion and fluid dynamics research."

2026 AIAA Thermophysics Award

This award is presented for an outstanding singular or sustained technical or scientific contribution by an individual in thermophysics, specifically as related to the study and application of the properties and mechanisms involved in thermal energy transfer and the study of environmental effects on such properties and mechanisms.

Christopher O. Johnston

NASA Langley Research Center



"For groundbreaking advancements in the field of shock-layer

radiative heating with significant impacts to entry vehicle designs, crew safety, and planetary protection threat assessments."

Premier Lecture

5 October 2026
Washington, D.C.

AIAA-NAE Yvonne C. Brill Lecture in Aerospace Engineering

This lectureship was established in memory of Yvonne Brill, pioneering rocket scientist, AIAA Honorary Fellow and NAE member. The lecture emphasizes research or engineering issues for space travel and exploration, aerospace education of students and the public, and other aerospace issues such as ensuring a diverse and robust engineering community.

Marilyn J. Smith

David S. Lewis Professor of Aerospace Engineering in the School of Aerospace Engineering at Georgia Institute of Technology, and Director of the Georgia Tech Army/Navy/NASA Vertical Lift Research Center of Excellence



Lecture: "Rotorcraft – The New Frontier in Extraterrestrial Exploration"

Call for Nominations Open!

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Presented for an outstanding contribution in the field of aerospace communications. Candidates are individuals or small teams (up to 4 members) whose achievements have had a positive impact on technology and society.

AIAA Dr. John C. Ruth Digital Avionics Award

Recognizes outstanding achievement in technical management and/or implementation of digital avionics in space or aeronautical systems, including system analysis, design, and development or application.

Deadlines:

Nominations Open: 10 November

Nominations Deadline: 15 January

Endorsement Letters Deadline: 1 February

Learn more: aiaa.org/get-involved/honors-awards/awards

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THE UNIVERSITY OF
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Styslinger
College of Engineering
Department of Aerospace Engineering
and Mechanics

The Department of Aerospace Engineering and Mechanics (AEM)
within the Lee J. Styslinger Jr. College of

Engineering at The University of Alabama (UA), a Carnegie R1 research institution, invites applications for the position of Department Head. This is a full-time, tenured appointment at the rank of Professor. We seek a distinguished scholar, accomplished researcher, and visionary leader to guide the department's continued growth in research, education, and service while fostering a collaborative, innovative, and inclusive academic environment. Candidates from all areas of aerospace engineering, engineering mechanics, and related disciplines are encouraged to apply.

Applicants must hold a Ph.D. in aerospace engineering, engineering mechanics, or a closely related field and demonstrate a record of excellence in research, graduate education, and academic leadership consistent with appointment as a tenured Professor. Candidates with nationally and internationally recognized accomplishments may also be considered for appointment as an Endowed Shelby Distinguished Professor, which provides significant endowment support for exceptional faculty achievements (<https://provost.ua.edu/the-shelby-endowment-for-distinguished-faculty>).

This is an exciting opportunity to lead a rapidly growing department within one of the nation's largest and most dynamic engineering colleges. The Styslinger College of Engineering has experienced substantial expansion in faculty, facilities, research activity, and student enrollment over the past decade and currently serves more than 4,800 undergraduate and nearly 800 graduate students. The AEM Department has similarly grown, now enrolling more than 550 undergraduate and nearly 200 graduate students. Located in Tuscaloosa, Alabama, which combines an outstanding quality of life with a dynamic university environment, UA is strategically positioned near major aerospace and technology centers across the Southeast, including Huntsville and Mobile.

Review of applications will begin immediately. To receive full consideration, applications should be submitted by **September 30, 2026**; however, the search will remain open until the position is filled. The anticipated start date is August 16, 2027, although flexibility is available. For additional information and application instructions, please visit The University of Alabama employment website at <https://careers.ua.edu/jobs/aerospace-engineering-and-mechanics-department-head-530189-tuscaloosa-alabama-united-states>. The University of Alabama is an Equal Employment/Equal Educational Opportunity Institution.

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ALABAMA

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Department of Aerospace Engineering
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The Department of Aerospace Engineering and Mechanics within The University of Alabama's Styslinger College of Engineering invites applications for faculty positions at the Assistant, Associate, and Full Professor levels. Candidates with research and teaching interests across all areas of aerospace engineering and mechanics are encouraged to apply.

Particular emphasis is placed on Assistant and Associate Professor candidates specializing in guidance, navigation, dynamics, and control, and on Full Professor candidates with expertise in fatigue, fracture mechanics, and experimental solid mechanics.

The department seeks individuals who will contribute to excellence in research, teaching, and service while fostering a collaborative academic environment. Outstanding Associate and Full Professor candidates with exceptional scholarly accomplishments and strong national and international reputations may be considered for endowed appointments as a Shelby Distinguished Associate Professor or Professor (<https://provost.ua.edu/the-shelby-endowment-for-distinguished-faculty>).

For additional information and application instructions, visit <https://careers.ua.edu/jobs/search/college-of-engineering> and search "aerospace." Review of applications will begin immediately. The University of Alabama is an Equal Employment/Equal Educational Opportunity Institution.

Aerospace Engineering, The University of Kansas

KU SCHOOL OF
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The Department of Aerospace Engineering at the University of Kansas is seeking outstanding individuals for two full-time tenure-track faculty positions at the rank of Assistant Professor. Applications are welcome in any area of collaboration with existing faculty, including but not limited to **AI/ML in aerospace applications, unmanned aircraft, advanced air mobility systems, aerospace autonomy, flight testing, remote sensing, emerging aerospace propulsion, VLEO/reentry applications, and space systems engineering.** Current faculty are integrally engaged in a broad array of transportation-related research, as well as research supporting earth, energy, and the environment through environmental remote sensing in the Center for Remote Sensing and Integrated Systems (CRISIS). The department encourages interdisciplinary research, and the new hires are encouraged to collaborate with faculty in Aerospace, Mechanical, Electrical, Chemical, and Petroleum Engineering, as well as other disciplines to advance research and education, and create an impactful and sustained externally funded research program.

Applications are sought from candidates with earned doctorates in Aerospace Engineering or a closely related field in Engineering by the time of appointment. Candidates should demonstrate a sustained commitment to excellence in undergraduate and graduate teaching, scholarly research, local and international service, and departmental and student mentoring. The successful candidate will be results-oriented and have a record of or high potential for superior scholarship demonstrated by: 1) a promising vision for and experience in developing and maintaining externally funded research, and 2) ability or high potential to teach high-quality courses at both the undergraduate and graduate levels and mentor and graduate M.S. and Ph.D. students. The department values impact and engagement in pedagogy, in the curriculum, in outreach to students, and in research.

Review of complete applications will begin on November 20, 2026 and continue until the positions are filled. The successful candidate must be eligible to work in the U.S. by the effective date of appointment. Salary is commensurate with experience.

KU is an EO/AAE. All qualified applicants will receive consideration for employment without regard to race, color, religion, sex, age, national origin, gender identity, disability, genetic information or protected Veteran status. <http://policy.ku.edu/IOA/nondiscrimination>

For additional information or to apply, go to <https://employment.ku.edu/academic/33654BR>. Applications should include a cover letter, complete curriculum vitae, a vision statement for research interests and plans, a statement of teaching philosophy and approach to engaging teaching/advising practices, and contact information for three professional references.



SIMPSON'S VIEW

As new autonomous systems emerge, age-old questions about the role of the human persist

BY AMANDA SIMPSON | simpson.amanda.r@gmail.com

Headlines about autonomous weapons often evoke visions of The Terminator or The Matrix: machines independently deciding whom to kill. The reality is far less dramatic and far more consequential.

Take the collaborative combat aircraft, or CCA, that militaries around the world are developing to assist existing and future crewed fighter jets. They could be equipped for missions ranging from air engagements to intelligence, surveillance and reconnaissance. These aircraft would be tasked and controlled by a human operator, but navigate and operate semi-autonomously using AI-enabled software.

CCA and other emerging semi-autonomous and autonomous systems are not a sudden leap into science fiction. They are the latest step in a technological evolution that has been underway for more than half a century, steadily shifting more battlefield tasks from human operators to increasingly capable machines.

Having spent part of my career designing and testing missiles, drones and unmanned aircraft, I've watched that evolution firsthand. Today's systems are the product of decades of incremental advances in guidance systems, automation, machine learning and artificial intelligence. However, while the technologies have advanced, the question of human control has remained unresolved.

A look back

From my experience, there is an important distinction between automation and autonomy. Automation executes preplanned commands when predefined conditions are met. Autonomy goes further, allowing a system to evaluate its environment, adapt to changing conditions and carry out assigned missions with limited human direction.

Initial projectiles were unguided and simply ballistic, with neither automation nor autonomy. Throw a rock, shoot an arrow, fire a bullet, drop a bomb. Aim them and boost their velocity and they are on the way to the target. Early rockets like the Hydra and Zuni extended range, but remained unguided.

The late 1950s introduced Lock-on-Before-Launch (LOBL) guidance for air-to-air heat seeking missiles, like the Sidewinder, where very basic automation guided the weapon toward a designated target. In the late 1960s, air-to-ground weapons like the Maverick incorporated LOBL guidance requiring the weapon to lock on to a target leveraging visual, infrared, electro-optical, or radar seekers. The information enabled



Amanda Simpson

is a consultant, a former U.S. deputy assistant secretary of defense for operational energy, and a former head of research and technology at Airbus Americas, where she led sustainability efforts. An AIAA fellow, she's a licensed pilot and certified flight instructor.

by inexpensive signal processors would ensure accurate guidance.

Later, using GPS with digital signal processing along with flight path guidance would allow “smart bombs” like the dual-mode Enhanced Paveway to augment precision targeting, even when line of sight wasn’t available.

Next came missiles like the Phoenix in the 1970s and AMRAAM in the 1990s that could engage targets beyond visual range. Rather than simply flying toward a designated target, they could update their course during flight and complete the engagement using onboard sensors and software.

This was a notable leap forward. The weapon was no longer just following instructions — it was making limited tactical decisions within carefully defined parameters. That meant the next generation of Lock-on-After-Launch weapons could be carried internally and launched more quickly with minimal data from the launch platform due to their advanced software. Consider the Tomahawk missiles, which used digital scene-matching algorithms to refine their navigation during cruise to greatly improve target location accuracy. Once the operator launches the weapon, they no longer have control to change targets or abort the mission if conditions change.

By the 1980s, that evolution had reached programs I would eventually help develop. I was the test director on the millimeter-wave Maverick program, a follow-on to the Wasp mini-missile demonstration. These were attempts at early autonomy that relied on high-resolution radars and pattern matching to search for and engage massed armor or air defense units.

In the early 2000s, I was chief engineer of one contender for the joint DARPA-U.S. Army Unmanned Combat Armed Rotorcraft program, an effort to field a “robotic rotary wingman” to augment manned platforms. Our proposal included complete autonomous operation of a patrolling triad of UCAR that would use advanced signal processing and data analytics, along with electro-optical sensors, to triangulate and engage threats to clear an area prior to deploying troops.

DARPA embraced the technical feasibility, but the Army was reluctant to delegate so much battlefield decision-making to software that lacked the maturity, transparency and reliability commanders required. The obstacle was less whether the aircraft could fly autonomously than whether military leaders were prepared to trust autonomous systems with greater operational and lethal authority.

Advancements in autonomy provided an opportunity for a captive-carry demonstration project I managed in the 2000s. By then, autonomy was considered mature enough to search, classify and prioritize targets over a large area in real-world conditions. Based upon the airframe of a small loitering munition, the mission concept was to find Soviet-era Scud launchers, tanks and military vehicles in an area and attack the highest-value target.

The test aircraft, using a large parallel processor with

advanced pattern correlation, machine learning and automated decision logic, successfully discriminated between military and civilian vehicles in real time over a 50-square-kilometer search area. Once the aircraft reached the initial point, human involvement was limited to navigation cues provided to the captive flight test pilot. In an operational scenario, there would be no time for a human to intervene in the lethality process as target selection to target prosecution would only be seconds.

What’s ahead

While many of these programs never entered production, the technologies they proved were matured, migrated into other programs and steadily became part of today’s operational systems.

For autonomous technologies, the real question is no longer whether machines can perform increasingly complex combat tasks — they can. It’s where we choose to draw the line between machine autonomy and human judgment, especially when lethal force is involved.

The Pentagon already has a directive focused on autonomy that requires autonomous and semi-autonomous weapon systems to “be designed to allow commanders and operators to exercise appropriate levels of human judgment over the use of force.” International Humanitarian Law, which instructs combatants to operate within defined rules of engagement, requires judgment about the particular circumstances at the time of attack. Can a weapon operate autonomously while still allowing the people responsible for the attack to make the context-dependent judgments that IHL requires? Who is responsible if an autonomous weapon can’t distinguish that battlefield conditions have changed after the weapon is launched? Will the speed of the engagement preclude human intervention?

In July, a bipartisan group of U.S. lawmakers introduced legislation that would require human control over autonomous weapons. “The bill would establish a clear legal requirement that commanders and operators retain appropriate levels of human judgment in decisions involving the use of lethal force,” according to a press release from Rep. Don Beyer (D-Va.), one of the co-sponsors.

The United States may insist that humans remain responsible for decisions involving lethal force; whether our adversaries adopt the same restraint is less certain. In the compressed decision cycle of future combat, commanders may face pressure to delegate more authority to autonomous systems to gain or maintain a battlefield advantage.

Technology will continue advancing. Whether policy, law and ethics keep pace is the decision that still belongs to us. ★

Aerospace America publishes a rich variety of opinions relevant to the future of aerospace. The views expressed are those of the author(s) and do not necessarily reflect those of our publisher, AIAA.

LOOKING BACK

100, 75, 50, 25 YEARS AGO IN OCTOBER–DECEMBER

COMPILED BY FRANK H. WINTER AND ROBERT VAN DER LINDEN



1926

1 Oct. 14 The U.S. Coast Guard Air Service receives its first purpose-built aircraft, a modified Loening OL-5. Congress appropriated \$162,000 for the service to acquire five of these aircraft, which feature strengthened fuselage hulls, special skids on the wing tip floats and two Lewis machine guns. Three are delivered as of early November. **Aviation**, Dec. 20, 1926, p. 1,033.

2 Oct. 21 The British airship R.33 releases two Gloster Grebe single-seater fighters 2,000 feet above the Royal Naval Air Service's Pulham Airship Station, demonstrating the possibility of using airships as multiplane carriers. The fighters are suspended from the airship's keel, one ahead of the two front engine nacelles, the other closer to the rear. Previous flights were conducted with a single D.H.53 light monoplane. **Flight**, Oct. 28, 1926, pp. 703-706.

Dec. 7 The U.S. Commerce Department's Aeronautics Branch, the precursor to the Federal Aviation Administration, conducts its first official inspection of a U.S. aircraft. Inspector Ralph Lockwood tests a Stinson Detroit that is to be delivered to Canadian Air Express. Arnold E. Briddon, et al., **FAA Historical Fact Book**, p. 10.

Dec. 31 The first Air Commerce Regulations from the U.S. Commerce Department's Aeronautics Branch go into effect. These regulations require all aircraft to be registered and marked with an appropriate identification number. Commercial mechanics are required to secure licenses, and the regulations also prescribe air traffic safety rules. Arnold E. Briddon, et al., **FAA Historical Fact Book**, pp. 10-11.

1951

Oct. 10 The Corporal E-11 ballistic missile developed by the Jet Propulsion Laboratory is launched from White Sands Proving Ground, New Mexico. The test demonstrates the basic configuration for the U.S. Army's first operational guided ballistic missile and America's first guided missile approved to carry a nuclear warhead. Eugene M. Emme, **Aeronautics and Astronautics, 1915-1960**, p. 68; James W. Bragg, **Development of the Corporal: The Embryo of the Army Missile Program: Volume 1, Narrative**, 1961, pp. 126, 175, 179.

Nov. 13 NASA's predecessor, the National Advisory Committee for Aeronautics, conducts the first experimental investigation into a transonic turbojet compressor. This component becomes a key enabler in the development of advanced turbojet engines. Eugene M. Emme, **Aeronautics and Astronautics, 1915-1960**, p. 68.

Dec. 9 The Fiat G.80 two-seat jet trainer flies for the first time. Designed by Giuseppe Gabrielli, this aircraft has tandem seating for a student pilot and instructor, with provisions for a single seat close-support version. William Green and Roy Cross, **The Jet Aircraft of the World**, p. 135.

3 Dec. 11 Kaman chief test pilot W. R. Murray completes the first test flight of the K-225 helicopter, the first to be powered by a gas-turbine-driven transmission. Adrian Van Wyen and Lee Pearson, **U.S. Naval Aviation 1910-1970**, p. 187.

1976

Oct. 26 Cape Canaveral, Florida, marks its 2,000th "major missile launch," when a U.S. Army Pershing missile is fired. The area's first launch occurred 26 years prior with a captured German V-2 rocket. **KSC Spaceport News**, Nov. 12, 1976, p. 1.

Nov. 5 The Soviet Union activates its Ekran communications satellite after a series of technical checks, the Tass news agency reports. The spacecraft, which was launched in late October, is to transmit TV programs to Siberia using more powerful transmitters than those carried by the Molniya satellites. This negates the need for 12-meter ground antennas as in the previous communications system. NASA, **Astronautics and Aeronautics, 1976**, p. 272.

4 Dec. 1 A U.S. Army team demolishes the service tower at Launch Complex 14 at NASA's Kennedy Space Center, the launchpad for various historic crewed U.S. launches until 1966. The Air Force deemed the rusty and obsolete tower a hazardous area. The scrap metal is to be sold to the highest bidder, and a stainless-steel memorial will be built to mark the site where the seven original U.S. astronauts were sent into orbit. **Washington Star**, Dec. 2, 1976, p. A-3.

Dec. 7 The People's Republic of China launches its seventh satellite, designated the FSW-0-2. This surveillance satellite spends about two days in orbit then releases a film capsule, which reenters Earth's atmosphere and is later recovered. **Aviation Week**, Dec. 13, 1976, p. 29; Wang Xiji, **Development of China's Recoverable Satellites**, pp. 3-4.

2001

5 Oct. 26 Lockheed Martin receives an \$18.9 billion System Development and Demonstration contract for the F-35 Joint Strike Fighter. Plans call for at least 3,000 units to be produced over the life of the program. **Flight International**, Oct. 30-Nov. 5, 2001, pp. 4-5.

Nov. 22 Starchaser Industries launches a prototype of its Nova rocket from Morecambe Bay, U.K. The 11-meter-tall vehicle attains an altitude of 1,520 meters (5,000 feet). The launch is a key step toward the full-scale design, Thunderbird, the company intends to put forward for the Ansari X Prize: \$10 million to the first team to conduct two crewed flights up to 100 kilometers within two weeks. **Flight International**, Dec. 4-10, 2001, p. 26 and Dec. 11-17, 2001, p. 24.

6 Nov. 30 The European Space Agency demonstrates the first use of a laser to transmit imagery between two satellites. The French imaging satellite SPOT 4 orbiting at 832 kilometers transmits to ESA's Artemis 4 satellite at 31,000 km. **European Space Agency, PR 75-2001**, Dec. 6, 2001; **Flight International**, Dec. 4-10, 2001, p. 27.



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Kaman

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U.S. Defense Department

6



European Space Agency

TRAJECTORIES

Young professionals shaping the future of aerospace

Abigail Mizzi, 23

Purdue University

Growing up in the shadow of a bustling airport, Abigail felt drawn toward aviation at a young age. Continued exposure to aerospace fueled her growing passion for suborbital flight and early conceptual design work. Now, Abigail is preparing for her own flight opportunity in 2027: conducting microgravity experiments on computational fluid dynamics aboard a Virgin Galactic spaceplane. — *Aspen Pflughoeft*

What's your aerospace origin story? ▶ I grew up near O'Hare Airport in the Chicago suburbs, and there were just so many airplanes flying overhead. So when I was asked as a little kid what superpower I'd want to have, I would always say, 'I want to be able to fly.' That led to me wanting to build airplanes. Then, early in high school, I attended an aerospace summer camp and talked to real engineers. That really began my fascination with aerospace.

Once I got more immersed and started at Purdue University, I learned about what aerospace can really encompass and how spaceflight has changed so much from being not just NASA astronauts but now also having the private spaceflight world. It's a whole new platform we can do research on, and that's really exciting.

Favorite thing about your job? ▶ We're pretty much at the halfway mark for Purdue 1, our Virgin Galactic suborbital flight. What's exciting is the buildup. I have a team of 10 undergraduate students every semester and summer, and we work together on this experiment. I get to lead them — helping them go through the engineering design cycle, working with hardware and software for the experiment and building out how the experiment will interact with myself, the human controller. It's been a very fun process of learning how to lead a team and help teach young engineers.

What motivates you? ▶ I like doing something with a purpose. I've done some aviation defense work, which was really important to me to support our national security. With this more space-related work, I find a lot of passion in knowing that the data we collect will help improve future missions. That's what drives me: knowing my work is going to help continue making spaceflight possible and also protecting the lives and people that will be going up into orbit.

Program/tech area outside your field that fascinates you? ▶ Robotics. I went to an artificial intelligence conference recently, and the humanoid robotics there were very interesting. I found it really cool to see how the technology is decreasing the risk for humans in some dangerous scenarios.

What will the world look like in 2050? ▶ My hope is that there's been more Artemis-level missions, and we've continued expanding in that way. I'd also imagine that suborbital flight would be more prevalent, maybe becoming more like aircraft today — happening more often to where we can continue doing even more research. Today, fewer than 1,000 people have gone to space, so by 2050 we should be way over that number. ★



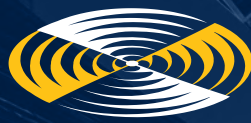
MORE ABOUT ABIGAIL

AIAA CONNECTION AIAA's 2024 co-located ASCEND and AVIATION Forum "was my first technical conference," she said, "which was perfect, because at that point I was interested in going into graduate school ... and I found a lot of great mentors at AIAA." Looking back, "that conference was a great push for me to go to graduate school."

EDUCATION Bachelor's in aeronautical and astronautical engineering from Purdue University, 2025. Master's in aeronautical and astronautical engineering from Purdue University, expected 2027.

GOING SUBORBITAL As a graduate research assistant for Purdue 1, she will gather data on how fluids move and settle in microgravity, a "very nonlinear" process that is "hard for us to predict," she said. The experiment consists of a carry-on-suitcase-sized unit with faux propellant tanks filled to four different levels, to simulate the performance of traditional and green propellants. Cameras will record how the liquids move.

CREATIVE ENGINEERING "I also really love art, and I feel like engineering is so creative and has so many artistic parts to it. You have to be creative to make a new technology. Maybe people don't talk about that as much, but that side of aerospace engineering really blends well with my mind and is very, very fun to me."

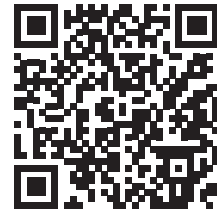


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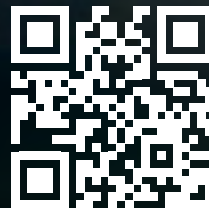
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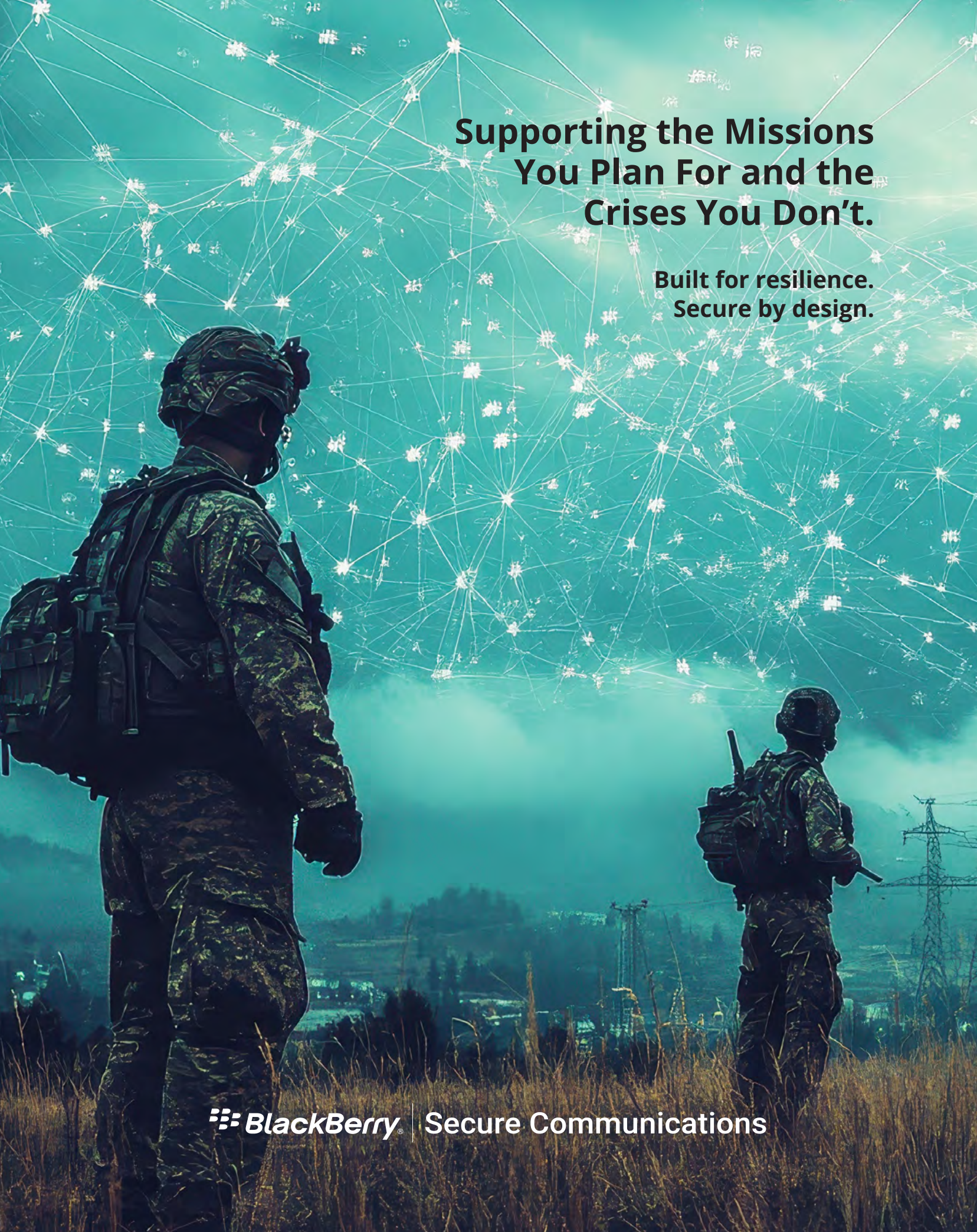
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