SPACENEWS
BUSINESS | POLITICS | PERSPECTIVE
AUGUST 2024

Land of the Rising SPACE STARTUPS

Japan's bold leap into the global space race

TOUGH LOVE FROM NASA

Why NASA gives smallsat propulsion such a hard time

INSIDE

ABSL™

PIONEERING SATELLITES NEED PIONEERING POWER

For 20+ years, EnerSys® ABSL™ Lithium-ion (Li-ion) space batteries have been powering the world's most demanding space science and defense missions. From the James Webb Space Telescope to critical Department of Defense (DoD) constellations, EnerSys® ABSL™ power solutions continue to pioneer mission-critical satellite applications.

Visit EnerSys® Booth #253 in the Fieldhouse at Small Satellite 2024.

www.enersys.com

EnerSys®
Power/Full Solutions

DEPARTMENTS

FEATURES

ABOVE: This illustration was created by SpaceNews in the AI art generator Midjourney for this month's deep dive into the smallsat propulsion sector and the growing pains it is experiencing following Astra's brush with bankruptcy. COVER: This month's cover illustration is another AI-enabled SpaceNews creation that started with a prompt inspired by a story in this issue. The red and white illustration features a symbolic rising sun with rays emanating upwards, representing new beginnings and growth in the Japanese space industry.

SPACENEWS

VOLUME 35 | ISSUE 8

SPACENEWS (ISSN 2328-9376) is published monthly by SpaceNews Inc., 6032 Brian CT. Ferndale, WA 98248, USA. SpaceNews is not a publication of NASA. **ANNUAL SUBSCRIPTION RATES:** $219 U.S. Domestic mail; $239 Canada; $289 International mail. Periodicals postage paid at Ferndale, WA and at additional mailing offices. Postmaster: Send all UAA to CFS. (See DMM 207.4.11.5); **NON-POSTAL AND MILITARY FACILITIES:** send address corrections to SpaceNews, PO Box 460654, Escondido, CA 92046. SpaceNews is registered with the British Postal System and Canada Post International Publications Mail (Canada Distribution) Sales Agreement No. 546046. To order SpaceNews, to change an address or for subscription information, call our toll free number (in the U.S.) 866-429-2199, or write to SpaceNews, Customer Service, PO Box 460654, Escondido, CA 92046 or email SpaceNews@pcspublink.com. For changes of address, attach an address label from a recent issue. **TELEPHONE NUMBERS:** Main: 571-421-2300; Circulation: 866-429-2199, fax 845-267-3478; Advertising: 571-278-4090.

SIGNIFICANT DIGITS

$609.6 MILLION

The new projected cost of NASA's Volatiles Investigating Polar Exploration Rover (VIPER) mission, a greater than 30% increase that triggered a termination review and mission cancellation, the agency announced July 17.

The rover was to be sent to the south polar region of the moon on the Griffin commercial lander from Astrobotic Technology, and would have explored terrain to better understand the extent and form of water ice there. NASA projected in 2021 that VIPER would cost $433.5 million.

NASA will keep the CLPS task order for Astrobotic's Griffin lunar lander, flying it instead as a technology demonstration mission. Since announcing the cancellation, NASA has continued to test the spacecraft. It has passed acoustic testing andis scheduled for thermal vacuum testing on Aug. 21.

50 CENTS

The price per share at which Astra's co-founders Chris Kemp and Adam London took the company private July 18, ending the company's three years of public trading. The company's stock had closed at a price of 53.9 cents the day before.

Astra went public through a SPAC merger with Holicity, then over time lost over 99% of its value as the market soured on SPAC deals and as Astra struggled with its small launch vehicle.

$737 MILLION

The amount KBR will pay to acquire defense and space contractor LinQuest. LinQuest, owned since 2018 by a private equity firm, focuses on engineering, data analytics and digital integration for national security space missions. It has secured several major contracts with the U.S. Space Force, including a $500 million, five-year deal in 2021 for analysis support, and a potential nine-year, $200 million contract to advise and assist the Space Force's Space Operations Command.

The deal, expected to close in the fourth quarter, would allow KBR — itself a defense contractor that acquired Centauri in 2020 — to bolster its footprint in the national security space sector.

NASA/ ESA/S. CORVAJA

Europe's Ariane 6 lifts off on its inaugural flight July 9.

CRISIS AVERTED

ESA's leadership believes Europe's "launcher crisis" is behind it after the inaugural Ariane 6 launch July 9. Speaking at the Farnborough International Airshow July 22, Josef Aschbacher called the launch a "100% success" despite an anomaly later in the mission that prevented the upper stage from performing a deorbit burn. "I see so many reports about launchers and the launcher crisis," Aschbacher said at the briefing, declaring the "launcher crisis" over. He also acknowledged that he had emphasized that crisis, which left Europe without independent access to space, many times to "sharpen the focus" for Europeans on ways to resolve it. The first operational Ariane 6 launch is planned for late this year. The smaller Vega C rocket is also on track for a return to flight.

FAULTY FALCON

SpaceX has been cleared by the FAA to resume Falcon 9 launches, with a return to flight mission planned for July 27. This comes after a SpaceX Falcon 9 malfunctioned July 11 two hours afer liftoff, exploding during a second burn, destroying all 20 SpaceX Starlink satellites onboard. It was the Falcon 9's first in-flight failure in over nine years and 300 launches. SpaceX blamed the mishap on excessive cooling of engine components, which prevented the upper stage engine from performing a second burn. The issue was traced to an oxygen leak caused by a crack in a sense line for a pressure sensor. SpaceX asked FAA to conclude its public safety investigation early to allow the company to resume launches while continuing its formal mishap investigation. As the mgazine was going to press July 26, SpaceX was preparing to launch afer midnight July 27 with the short-term fix.

SIGNIFICANT DIGITS

50

The number of countries China wants involved in its International Lunar Research Station (ILRS) effort, according to a July 20 appearance on China Global Television Network by Wu Weiren, chief designer of China's lunar exploration program.

Wu added that "we hope to work with 50 countries by inviting 500 foreign scientific research institutions, and 5,000 foreign scientific research personnel to jointly build our international lunar scientific research station."

Fourteen countries have joined the ILRS project since its 2021 foundation, six of which — Thailand, Ethiopia, Kenya, Turkey, Nicaragua and Serbia — signed on in 2024.

70%

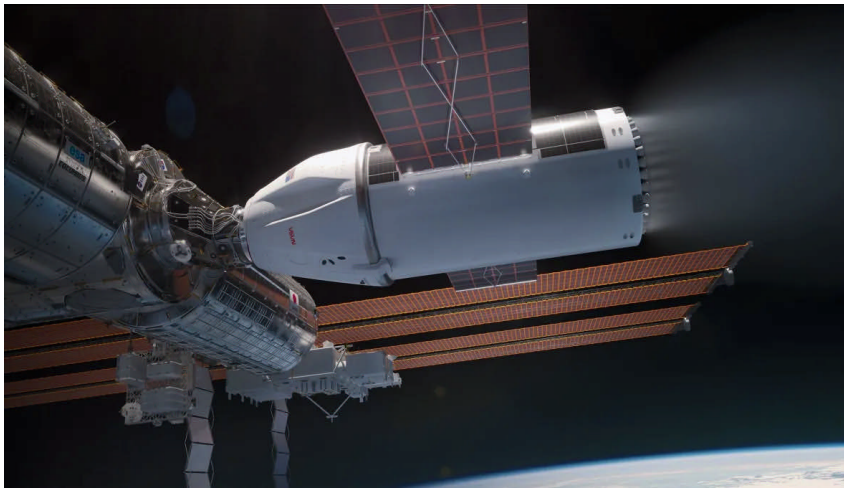
NASA's joint confidence level that the SpaceX Starship lunar lander intended for the Artemis 3 mission will be ready by February 2028. That assessment came from a confirmation review for the Human Landing System (HLS) Initial Capability project, which is supporting the development of the lander. That prediction was set last December but not widely publicized by the agency until it was included in a June 20 GAO report.

However, despite its own projection that the lander has a 30% chance of being at least a year and a half late, the agency is keeping to its scheduled launch date of September 2026. NASA confirmed that date was accurate but stated it was "a conservative approach that assumes broad risk realization."

$40M

The amount Microsoft invested in Armada, a company that emerged from stealth in December 2023 with $100 million in funding.

Armada is focusing on deploying artificial intelligence computing tools designed to empower remotely connected devices. The Microsoft investment will go towards developing mobile data centers tailored for SpaceX's Starlink broadband network. Ultimately, Armada aims to offer ruggedized data centers the size of shipping containers for its cloud computing ecosystem called Galleons, which would enable customers to process data faster and more efficiently on-site.



A SpaceX artist's concept of the U.S. Deorbit Vehicle at the ISS. The Deorbit Vehicle is based on a SpaceX Dragon spacecraft with an enhanced trunk section.

SPACEX

A Deorbiting Dragon

NASA and SpaceX shared new details about the plan to deorbit the International Space Station. They announced on July 17 that the United States Deorbit Vehicle that NASA procured from SpaceX in a June 26 contract worth up to $843 million will be a modified form of the SpaceX Dragon spacecraft with a redesigned, larger trunk section with more Draco thrusters. The spacecraft will have 46 Draco thrusters, 16 for attitude control and 30 to perform the maneuvers needed to lower the station's orbit at the end of its life, said Sarah Walker, director of Dragon mission management at SpaceX.

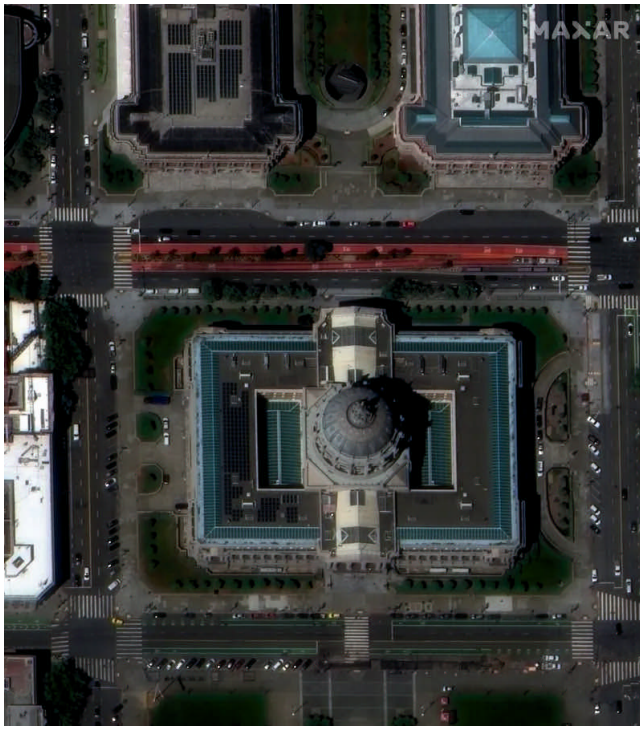
The spacecraft will be used to provide the final push to deorbit the station and ensure it comes down in an open stretch of ocean. NASA will separately procure the launch of the deorbit vehicle, noting that the spacecraft will be too heavy to launch on a Falcon 9.

BURST TEST

Sierra Space announced July 25 that it conducted a second burst test of a full-sized space station module intended for the Orbital Reef commercial space station. The test, held at the Marshall Space Flight Center, the company said, exceeded NASA safety margins by over 20%. This test serves as a milestone in a NASA award to support its development.

GLOBAL GROWTH

The Space Foundation says the global space economy grew by more than 7% last year. The organization estimated the value of space activities worldwide at $570 billion in 2023 according to its annual report released in July. That is a 7.4% increase over the $531 billion for the global space economy in 2022. The increase was driven by an 11% increase in international government spending, with commercial revenues growing 5.4%.



A WorldView Legion image Maxar Intelligence released July 18 of San Francisco City Hall. Solar panels are seen on top of the building and lane markings through intersections and street lamps.

MAXAR TECHNOLOGIES/JEFF FOUST FOR SPACENEWS

New WorldView

Maxar Intelligence released the first high-resolution images from its new WorldView Legion satellites on July 18. The images come from a pair of satellites launched in May on a Falcon 9. The satellites are capable of collecting 30 centimeter-class imagery, providing detailed views of the Earth's surface for a wide range of applications.

Maxar said the commissioning and calibration process for the first two WorldView Legion satellites is still under way, and that it plans to launch the remaining four satellites of the WorldView Legion constellation by the end of the year.

Earlier, on July 9, Maxar unveiled the Vivid Advanced 15-centimeter HD Basemap and announced that it offers 15-centimeter resolution imagery of major metropolitan areas to customers that include national map makers as well as companies focused on visualization and simulation. The increased resolution and Maxar's planned annual refresh rate for areas that undergo frequent change will prove particularly important for mapping and navigation applications, the company said.

PUSHING THE ARCTIC FRONT

The Department of Defense released its 2024 Arctic Strategy on June 21, laying out the military's stance and priorities regarding the increasing geopolitical and environmental challenges in the Arctic region.

In the report, the DoD directs the U.S. military to "build readiness for operations at high latitudes," and emphasizes the increasing reliance on satellites for critical activities in the Arctic. As climate change reshapes the region's landscape and geopolitical dynamics, the Pentagon is calling for investments in space-based capabilities to enhance communications, intelligence gathering and monitoring activities.

The strategy document highlights China's ambition to expand its reach into the Arctic through infrastructure investments and military presence, noting that China's collaboration with Russia in the region complicates the security landscape. The DoD calls for modernization of U.S. and Canada-operated missile warning and defense systems in the Arctic, which the document says should include space-based missile-warning and observational systems with greater polar coverage.

Korea's New Control Tower

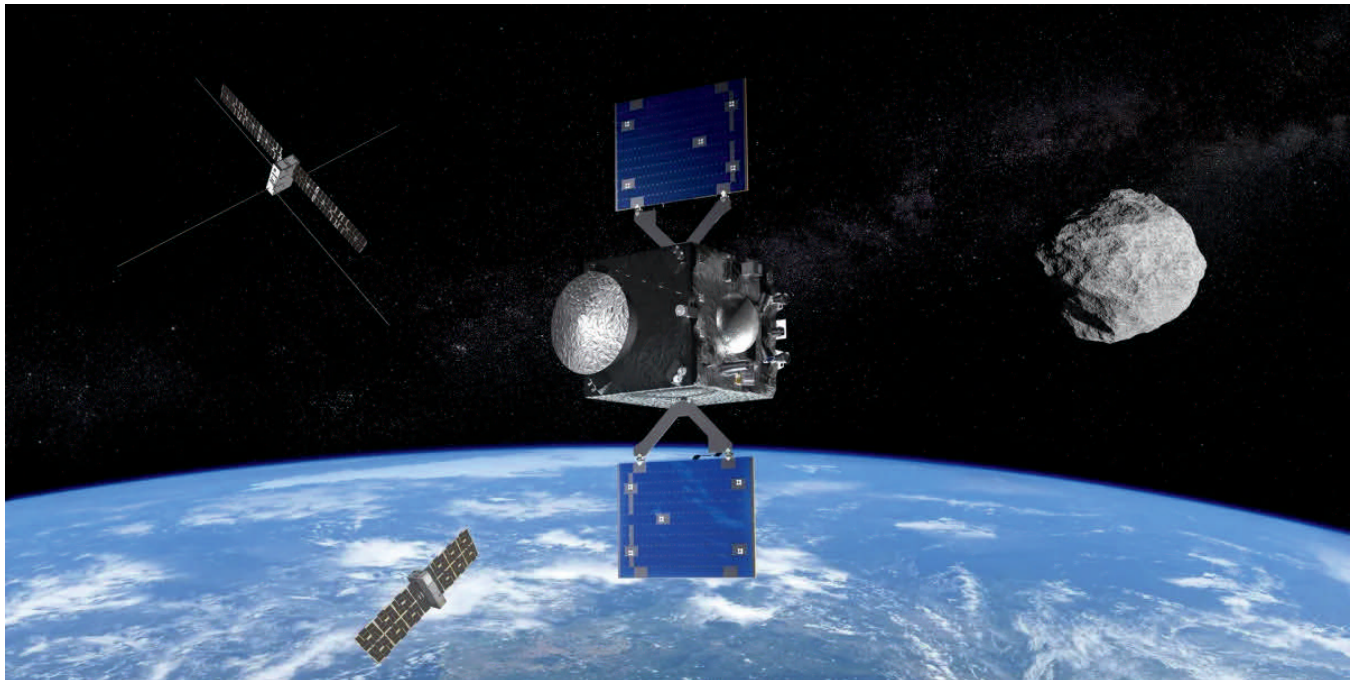
Officials from South Korea's space agency, dubbed the Korea Aerospace Administration, or KASA, shared new details on the role and responsibilities of the brand-new agency.

The KASA, which started operations May 27, will "serve as the control tower for national space affairs and international cooperation," KASA administrator Youngbin Yoon said July 15.

South Korea has never had a single dedicated government agency to oversee commercial and civil space operations in the country, and KASA will manage international cooperation as it assumes the task of creating an aerospace economy there, focused on space transportation, satellite, space exploration and aviation. KASA has long-term goals, Yoon added, of sending a robotic lander to the moon in 2032 and another to Mars in 2045.

John Lee, deputy administrator of South Korea's new space agency KASA, discussed the agency's plans during a July 17 talk at the COSPAR Scientific Assembly.

QUICK TAKES



ESA's Ramses mission would arrive two months before Apophis's close flyby of Earth

ESA

Crossing The Pond

A Royal Air Force officer joined the leadership of the U.S. Space Force. As of July 17, Air Marshal Paul Godfrey serves as assistant chief of space operations for future concepts and partnerships. Godfrey spent the past three years as the inaugural leader of the U.K. Space Command, which was established April 1, 2021.

Chief of Space Operations Gen. Chance Saltzman said he brought Godfrey into his headquarters staff to promote cooperation with a key ally. In the job, Godfrey will advise Saltzman in matters involving space superiority and resilience through international partnerships.

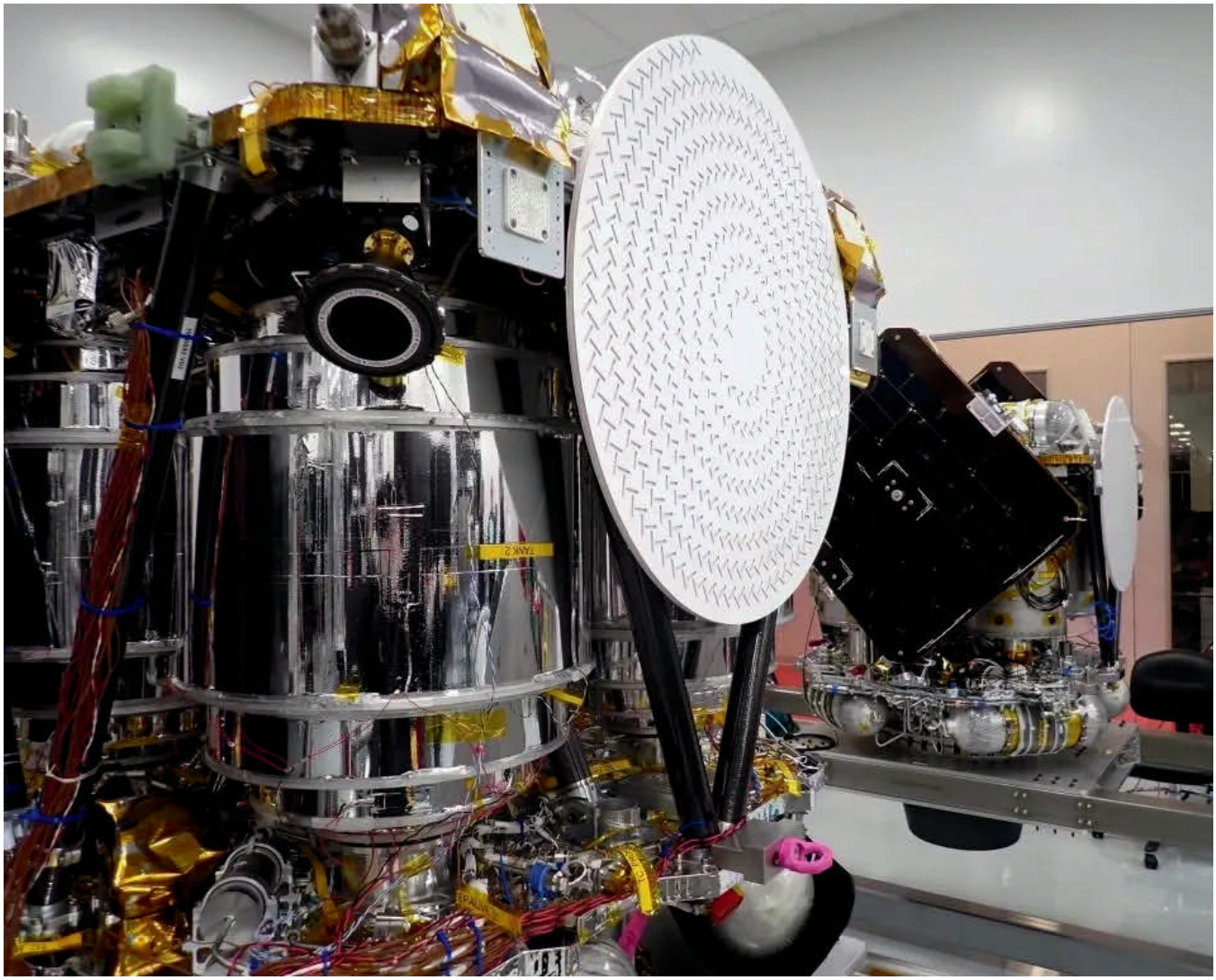
"AM Godfrey's integration into a senior service staff is unprecedented," Saltzman wrote in an internal Space Force announcement, "and it pushes the boundaries of what it means to be integrated by design."

Asteroid Mission Planning

Two asteroid missions, one by Europe and the other by China, are moving ahead for a 2028 and 2027 launch, respectively. ESA is allowing a proposed mission to the asteroid Apophis to move ahead before a funding decision next year. ESA announced July 16 that it gave the Rapid Apophis Mission for Space Safety (Ramses) mission permission to begin preparatory work before a funding decision at the 2025 ministerial meeting. It would launch in 2028 and arrive at Apophis about two months before the asteroid makes a very close flyby of Earth, offering earlier data than NASA's OSIRIS-APEX mission.

Meanwhile, China revised the schedule of its planetary defense demonstration mission that involves sending one spacecraft on a collision course with a small asteroid and sending a second spacecraft to observe. Though Chinese officials announced a 2025 launch date back in April 2023, Li Mingtao of the National Space Science Center of the Chinese Academy of Sciences announced July 15 at the Committee on Space Research (COSPAR) 45th Scientific Assembly that the mission would now be scheduled for 2027.

He said the two spacecraft will launch together on a Long March 3B. The observer spacecraft will make a flyby of Venus before arriving at the vicinity of the asteroid in early 2029. About three months later, in April 2029, the impactor will collide with the asteroid at a speed of 10 kilometers per second. That will take place when the asteroid is within seven million kilometers of Earth.



The two Rocket Lab-built ESCAPADE spacecraft, called Blue and Gold, are finishing up testing ahead of a launch ona Blue Origin New Glenn rocket this fall.

ROCKET LAB

Vaguely on Schedule

NASA's ESCAPADE Mars smallsat mission is on track to launch this fall but doesn't yet have a specific launch date, according to a July 15 presentation at the Committee on Space Research (COSPAR) 45th Scientific Assembly by Rob Lillis of the University of California Berkeley Space Sciences Laboratory.

Lillis added that the Sept. 29 launch date shown on the mission's website is an out-of-date placeholder. The launch window for Mars missions of any kind this year extends roughly through mid-October.

ESCAPADE features two identical smallsats, called Blue and Gold, that will go into orbit around Mars. The spacecraft carry instruments to study the planet's magnetosphere and its interaction with the solar wind.

If ESCAPADE launches this fall, the spacecraft will arrive at Mars 48 hours apart in September 2025 and begin their one-year prime science mission in April 2026. Lillis said he hoped that the spacecraft could work in conjunction with several other Mars orbiters from NASA and other agencies to open a "golden era" of studies of the Martian magnetosphere.

QUICK TAKES

Sustainable Progress

Speaking at the Secure World Foundation's Summit for Space Sustainability in Tokyo July 12, NASA Deputy Administrator Pam Melroy outlined the progress the agency is making on the Space Sustainability Strategy it announced in April.

Melroy said that NASA has been making progress toward developing a "widely accepted framework" for assessing space sustainability, which it identified as the first goal of the new strategy. NASA is also working on an analysis of uncertainties in collision risk assessments, and has polled its workforce on how to make missions more sustainable. Also since April, NASA published a report on an economic analysis of debris tracking remediation.

The agency has selected an official in its space technology directorate as an interim director of space sustainability, leading that work, as it continued the process to hire a person to take the job on a permanent basis.

Melroy emphasized when NASA rolled out its strategy in April that it wanted to complete both the framework and analysis of uncertainties before investing in any debris removal technologies, what she called an "investment portfolio" in her speech.

NASA Deputy Administrator Pam Melroy provided an update on the agency's space sustainability strategy at the Summit for Space Sustainability July 12 in Tokyo.

Kurt "Spuds" Vogel, NASA associate administrator for space technology, said in April the community input on space technology shortfalls will help the agency prioritize investments in them.

Significant Departures

NASA announced July 16 that Kurt "Spuds" Vogel, head of the agency's space technology mission directorate, retired from the agency after six months on the job. Vogel took the job in January after serving as director of space architectures at NASA, spearheading work on the Moon to Mars Architecture. Vogel replaced Jim Reuter, who retired the previous June. Vogel joined NASA in July 2021 as director of space architectures, helping lead the development of the agency's Moon to Mars architecture. He will be replaced on an interim basis by Clayton Turner, director of the Langley Research Center.

Meanwhile, Firefly Aerospace announced July 17 that CEO Bill Weber had left the company. In a brief statement late July 17, Firefly announced that Bill Weber was no longer the chief executive of the launch vehicle and lunar lander company. The statement did not disclose the reason for his departure and whether Weber resigned or was fired.

Firefly said at the time it was looking into allegations that Weber had an inappropriate relationship with an employee, but did not comment further. Peter Schumacher, a member of Firefly's board, will serve as interim chief executive while the company conducts a search for a permanent replacement.

NASA/BILL INGALLS/ SPACENEWS/JEFF FOUST

Land of the Rising Space Startups

From debris removal to lunar exploration, Astroscale and ispace are leading the charge with innovative technology and government-backed initiatives, marking a new era for the Japanese space industry.

SPACENEWS ILLUSTRATION

Since April, a small Japanese spacecraft has been loitering in the vicinity of an abandoned upper stage from an H-2A rocket in low Earth orbit. The Active Debris Removal by Astroscale-Japan (ADRAS-J) spacecraft has, at times, approached within 50 meters of the stage, inspecting it as a precursor for a future mission that would grab the stage and remove it from orbit.

ADRAS-J comes after years of effort by Astroscale to tackle the orbital debris problem. "In 2013, I realized that we had already made the space environment unsustainable and no one had the solution for the problem," recalled Nobu Okada, chief executive of Astroscale, about his decision to found the company.

It is also a symbol of the advances that Japan's commercial space ventures have made after many years of effort. Companies like Astroscale and lunar lander developer ispace, whose roots also date back more than a decade, are achieving key technical and financial milestones that include launching spacecraft and going public.

More companies are following in areas ranging from small launch vehicles to synthetic aperture radar (SAR) imaging satellites. That interest attracted a record crowd to Spacetide, an annual commercial space conference in Tokyo in July where Okada and others spoke.

The Japanese government is taking notice. It is preparing to put billions of dollars into the Japanese space industry to support work on key technologies. That is intended to foster the development of emerging space companies in the country, helping them advance and to be more competitive with those in the United States, Europe and elsewhere, even as those companies try to determine how much they should emphasize the Japanese market versus other parts of the world.

JEFF FOUST

SPACE STRATEGIC FUND

In March, Japan's cabinet approved a new Space Strategic Fund that will spend one trillion yen ($6.5 billion) over 10 years on Japan's space industry through targeted investments in more than 20 areas. The Japanese space agency JAXA is administering the fund and started issuing requests for proposals for those technology topics in July.

"In order to ensure Japan's independence in space activities, we will promote technological development that continues to strengthen Japan's technological superiority, ensuring supply chain autonomy," said Jun Kazeki, director-general of the National Space Policy Secretariat within the Japanese government's Cabinet Office, during a panel at Spacetide.

Startups are among those eligible to compete for funding, he said, along with universities. The goal of the fund, he said, is to create "a virtuous cycle of business expansion for private >

Right: Resilience, the second ispace lunar lander, recently completed environmental testing ahead of a launch scheduled for late this year.

< > companies" analogous to the support that American companies get from NASA and Defense Department contracts and grants.

"In the U.S., there are NASA and DARPA with space-specific funds," said Shinichi Nakasuka, a professor of aeronautics and astronautics at the University of Tokyo, during another conference panel. "For the first time, we have a specific fund available for space R&D."

Since the effort is just starting, both companies and JAXA are uncertain how well the fund will work. Yasuo Ishii, senior vice president of JAXA, said the agency has assigned 450 people to administer the fund, including researchers and other experts. "We used to be an R&D institution and now we're a funder," he said.

He said JAXA will closely monitor progress on the initial awards made through the fund. "If some don't go well, we may terminate them."

COMMERCIAL SPACE STATIONS

One focus area for the Space Strategic Fund involves commercial space stations. Among the topics that JAXA will solicit proposals on include cargo transportation systems, life science experiment systems and space station modules.

Ishii said that emphasis is driven by a desire to play a role in commercial space stations that will replace the International Space Station. That work is being led by American companies, leading other Western ISS partners — Canada, Europe and Japan — to decide how to participate in ways that don't involve simply handing over money to those American operators.

"We are discussing how we will join NASA's Commercial LEO Destination program," he said. "Our responsibility is not clear yet, but, of course, commitment at the government level is essential to commercial operations."

Even before JAXA said the fund would support commercial space station technologies, some larger Japanese companies were thinking about roles they would play in those stations. In April, Mitsubishi joined the Starlab Space joint venture led by Voyager Space along with Airbus Defence and Space and, more recently, MDA Space.

"For JAXA, having to deal with a

"In order to ensure Japan's independence in space activities, we will promote technological development that continues to strengthen Japan's technological superiority, ensuring supply chain autonomy."

– Jun Kazeki, director-general of Japan's National Space Policy Secretariat

ISPACE

Left: Jun Kazeki, director-general of Japan's National Space Policy Secretariat, discusses the new Space Strategic Fund at the Summit for Space Sustainability. The fund aims to invest one trillion yen over 10 years to bolster Japan's space industry.

SPACENEWS/JEFF FOUST

non-Japanese company is uncomfortable," said Jeffrey Manber, president of international and space stations at Voyager Space, at Spacetide. "JAXA will work with Mitsubishi, not with us."

The key role for Mitsubishi in Starlab is "commercial capture," said Kohei Okamura, director of business development for Starlab Space who came to the joint venture from Mitsubishi. That means lining up commercial customers for the station. "The government is not enough."

He agreed with others, though, about the potential of the new Space Strategic Fund. "I strongly believe this opportunity is really beneficial for Japan," he said. Starlab's interest, he said, is to develop technologies based on the demand it sees from potential station customers. "Without thinking about the demand, it's difficult to think about viable, sustainable technology development."

Another Japanese venture tied to a larger company is also proposing a role for the country in commercial space stations. Japan LEO Shachu, Inc., is a wholly owned subsidiary of the conglomerate Mitsui & Co. that started operation at the beginning of July. It is proposing a "Japan Module" that could be installed on commercial stations.

That module would leverage technologies developed for the HTV and new HTV-X cargo vehicles, said Yudai Yamamoto, chief executive of the new company, at Spacetide. The module would include a pressurized area for research, manufacturing and other applications, as well as an external platform for additional payloads and its own high-bandwidth communications.

He said his company, like Starlab, is focusing less on the technology than the demand. "Launch of the new vehicle is not our only goal," he said. "It needs to be used, so most of our strategy today is to create a new market."

The company is only starting conversations with commercial space station developers about ways to add the module to the stations. "Having a module that is complementary to them, and how we can contribute to global commercial LEO systems, is also important," he said.

FUNDING AND MARKETS

Japanese companies, like those in other countries, also face challenges raising money. There have been some notable recent successes, though, like SAR company Synspective, which raised seven billion yen in a Series C round in June, not long after it signed a contract with Rocket Lab for 10 Electron launches of its satellites.

"The private investment market in Japan has been growing, but it is relatively smaller than the U.S.," said Jumpei Nozaki, chief financial officer of ispace, in an interview at the company's Tokyo headquarters.

However, he said Japanese banks are increasingly interested in supporting space companies through loans. "The last several years have totally changed," he said. "Now they see the necessity and importance to support deep tech companies in Japan, so there are good signs of banks willing to support."

That is true of ispace itself: the company announced July 12 it raised $62 million as part of a loan agreement with Sumitomo Mitsui Banking Corporation and Mizuho Bank, Ltd. The company said it would use the money to support its work on lunar landers and rovers for future missions.

That deal came more than a year after ispace went public on the Tokyo Stock Exchange, the first Japanese space startup to do so. As of late July, shares were trading at 590 yen, a new low and less than a third of the peak shortly after going public.

Nozaki acknowledged that going public was "challenging" for the company, including the regular public disclosures of its finances required. "But we are taking this in a very positive way because we do need many people to be involved. We need many supporters, including government people, investors and banks," he said. "This lets them know about the company."

He believed investors were willing >

"This shows the global investor community sees the significance of space sustainability but also the market opportunity for on-orbit servicing." – Nobu Okada, CEO of Astroscale

Right: Nobu Okada, CEO and founder of Astroscale, speaking at the Spacetide conference.

< > to take the long view on the company and not demand near-term profits. However, he said we wanted to ensure that they understood that ispace was not doing missions solely as an "adventure" and will, eventually, make money. "We do have a huge, ambitious mission that we are going to make as our business and monetize."

Since ispace has gone public, two other Japanese space companies have followed: iQPS, a SAR satellite company, and Astroscale. In the case of Astroscale, its shares soared 60% in its first day of trading June 5. Since then, though, it has given up those gains and more, falling below its initial public offering price of 850 yen to less than 670 yen by late July.

Okada, speaking at Spacetide, was not publicly deterred by that rise and fall. "This shows the global investor community sees the significance of space sustainability but also the market opportunity for on-orbit servicing," he said.

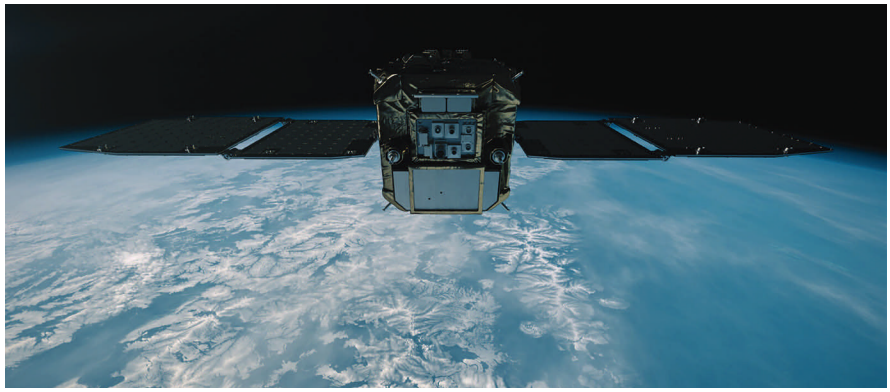
Another question for Japanese space startups is the size of that market opportunity. Focusing on Japan alone may not be sufficient for many space companies, who need to look beyond to the broader Asia-Pacific region or even globally. That is what both Astroscale and ispace have done, establishing subsidiaries in the U.S. and Europe.

Masayasu Ishida, head of the Spacetide Foundation that runs the conference, is optimistic there is plenty of room for growth for Japanese and other Asia-Pacific space companies, citing high growth rates and a population of three billion in the Asia-Pacific region. "It's the next driver of the global space economy," he said in remarks opening the conference.

But ispace's Nozaki believes startups need to look beyond Japan. "I think we tend to start by thinking about the Japanese market, but the global market is very important," he said. "It's really important to have a business plan and a mindset to make this into a global business."

He was optimistic about the overall prospects of the emerging commercial space industry in Japan. "Finally, the boom is coming," he said, citing strong interest from young professionals. "There are so many young people looking to join this industry."

Okada noted in his address that ADRAS-J is just the latest step for his company. JAXA has selected Astroscale for a second mission to deorbit the rocket stage that the satellite is currently inspecting, and the company is working on other satellite servicing and life extension programs in Japan, the U.K. and the U.S. "Our journey," he said, "is still at the beginning." **SN**



Above: The Active Debris Removal by Astroscale-Japan (ADRAS-J) spacecraft in orbit.

SPACENEWS/JEFF FOUST/ASTROSCALE

NASA

Defying the Heat

Inflatable shields bringing spacecraft protection to the next frontier

Above: The first (and smallest) torus for the 10-meter aeroshell NASA is developing with ULA, sitting on top of the six-meter LOFTID aeroshell that completed its mission in November 2022.

Space agencies are advancing inflatable heat shields they see as not only key for future missions to Mars, but also for unlocking fully reusable rockets and larger cargo deliveries back to Earth.

Since the dawn of the space era, rigid aeroshells have been the mainstay for safely returning people and cargo through the atmosphere with the aid of parachutes and retro propulsion.

However, they are limited by the shape of launch vehicle fairings and can be no more than four to five meters based on what is currently available.

"That four to five meters limits the amount of down mass you can bring back from orbit," Joe Del Corso, project manager for the Low-Earth Orbit Flight Test of an Inflatable Decelerator (LOFTID) at NASA's at Langley Research Center, said in an interview.

"The bigger you can make the aeroshell during the re-entry phase, the more mass you can bring back from orbit."

A four-to-five-meter rigid aeroshell using classic heat-resistant materials is suitable for returning up to one and a half metric tons from space.

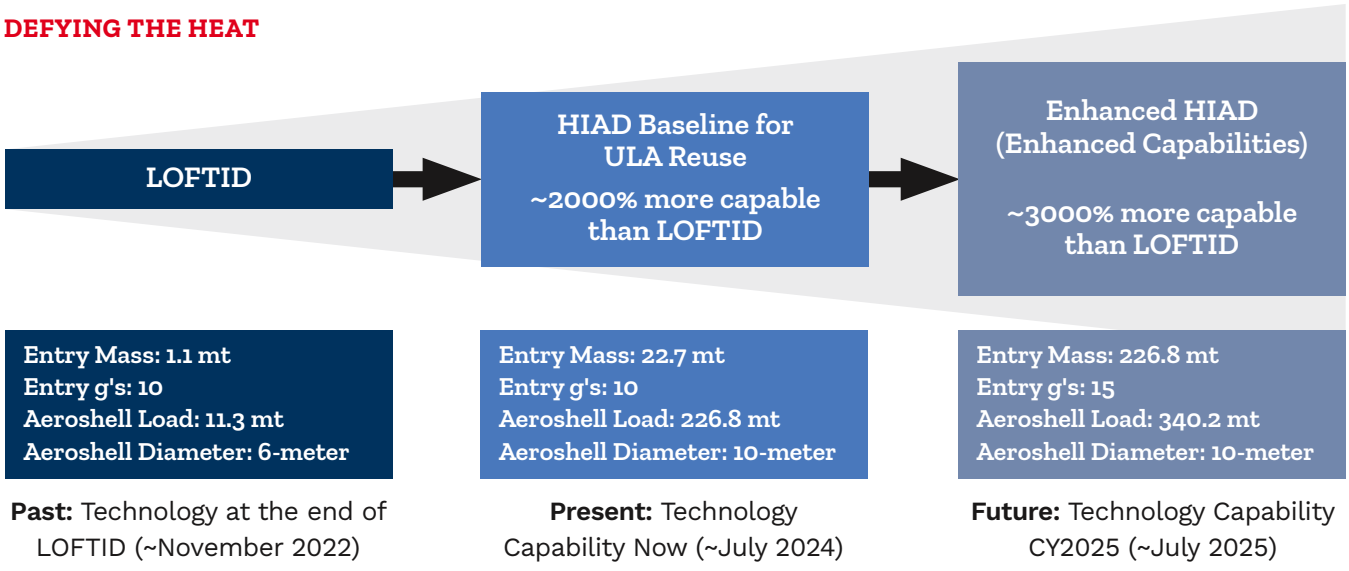
Hypersonic Inflatable Aerodynamic Decelerator (HIAD) technology, on the other hand, can be compacted for launch, and then inflated to far larger sizes to protect spacecraft from burning up in the atmosphere.

A larger surface area increases drag, slowing down the spacecraft more effectively during re-entry, and this is particularly useful for a planet with a thin atmosphere such as Mars to ensure safe deceleration and landing.

"For us, we're looking at going >

JASON RAINBOW

DEFYING THE HEAT



CREDIT: NASA

GRAPHIC BY SPACENEWS

Above: LOFTID's success paved the way for NASA to work with United Launch Alliance and other industry partners to develop larger, more capable inflatable heat shields.

< > from one and a half metric tons to 20-40 metric tons," Del Corso said.

"One and a half metric tons is a well-instrumented golf cart. 20-40 metric tons is more like a small ranch house, fully furnished with a car in the carport."

Inflatables are also generally lighter than rigids, leveraging flexible materials that enable them to conform to various shapes and sizes for a greater variety of payloads and missions.

But while traditional rigid heat shields like those used on SpaceX's Dragon cargo transportation spacecraft are well-proven, it's still early days for HIADs.

After launching on China's Long March 5B rocket in 2020, an experimental Chinese cargo spacecraft with an inflatable, umbrella-shaped heat shield about three meters in diameter failed on its return to Earth.

Two years later, NASA's LOFTID took off as a secondary payload on a United Launch Alliance Atlas 5 rocket, and successfully splashed down a six-meter HIAD — the largest blunt body aeroshell to ever go through atmospheric entry.

EUROPE ENTERS THE RACE

In June, Europe kicked off ICARUS, or Inflatable Concept Aeroshell for the Recovery of a re-Usable launcher Stage, which would culminate in 2028 with the return of a three-meter demonstrator after launching on a sounding rocket.

The European Commission recently awarded a consortium led by Deimos, the technology branch of Spanish contractor Elecnor, 10 million euros ($11 million) of funding for ICARUS.

Ali Gülhan, head of the department for supersonic and hypersonic technology at DLR, and principal investigator for ICARUS at the German space agency, said one of the main advantages of a foldable inflatable system is its compatibility with rockets and spacecraft already in use.

"Such inflatable aeroshells can be more easily integrated into existing launcher systems and used for heavy re-entry configurations," Gülhan said.

DLR is responsible for the ICARUS launch campaign, flight test and the re-entry vehicle's health monitoring system.

"In addition to several ground experiments to demonstrate or to verify the functionality of selected subsystems, a complete inflatable aeroshell payload will be tested in a ballistic flight with a two-stage sounding rocket configuration," he said.

"The separation of the payload from the launcher and the deployment of the folded inflatable structure are critical events of the flight experiment."

According to Deimos CEO Simone Centouri, the mission would set Europe up for testing a 10-meter shield that could help launchers bring back rockets for reuse, particularly for stages housing costly avionics and propulsion systems.

"If we have the possibility to reuse something [then] this is good because the impact of resources on Earth is lower," Centouri continued, "and you can reduce your ecological footprint."

NASA GOES LARGE

With a 1.1 metric ton re-entry mass, LOFTID withstood about 11.3 metric tons of drag load on the aeroshell during the November 2022 demo.

Since then, NASA has been "approached by a number of different companies and agencies looking to utilize the HIAD technology," according to Del Corso.

United Launch Alliance has a Space Act Agreement with NASA to develop a larger inflatable heat shield for recovering BE-4 booster engines, which account for 65-70% of the cost of ULA's next-generation Vulcan rocket.

NASA

Right: The LOFTID inflatable heat shield recovered from the Pacific after successfully re-entering the atmosphere.

NASA/GREG SWANSON

SpaceX, which pioneered rocket reusability and has been regularly reusing first stages since 2017, has so far landed more than 300 orbital-class rockets after lift-off.

However, SpaceX can get away without HIADs for Falcon 9 and Falcon Heavy (which use the same boosters) because their first stage burns much shorter than conventional rockets, leaving the second stage to do most of the legwork to orbit.

ULA and other launch providers have beefier first stages and wimpier second stages.

"The bigger you make that first stage, the more propellant you have to have for that return trip," Del Corso said, requiring a more sizable heat shield.

He said Vulcan's engines would have around 23 metric tons of entry mass, putting 10 times that in aerodynamic loading on an aeroshell that would need a diameter of 10 meters.

"It's a huge advancement in the HIAD technology," Del Corso continued, "and it starts making it viable for things like bringing down pieces of the International Space Station or even sending humans to Mars."

ULA's first mission with the upgraded HIAD is slated for around 2026-2027.

It is "entirely possible" for heat shields to enable full rocket reusability, Del Corso added, but NASA has not received any approaches for that just yet

"The challenge you've got with full first stage or even larger rockets is you get your center of gravity moving further and further backwards," he said, making re-entry more unstable and challenging.

Next year, NASA plans to start working on leveling up the HIAD technology to accommodate more than 3.4 metric tons of drag load, involving a heat shield between 16 and 20 meters in size.

"That's really the entry point for enabling human access to Mars," Del Corso said.

Other organizations that have expressed interest in HIAD include the U.S. Department of Defense, although it is unclear whether the military would be a good fit.

"We decelerate really high in the atmosphere and we're a giant, slow-moving target," he added, "so that's not really the best application for what they want to use. It's better for folks who want to just bring down really large payloads."

ALTERNATIVE SHIELDS

Californian space technology startup Outpost, one of LOFTID's partners, is looking to mechanically deployable heat shields for a business focused on returning small satellites and payloads from orbit.

HIADs are not for everyone, Outpost co-founder and CEO Jason Dunn said.

"They use materials that are expensive," Dunn continued, and "there's a variety of vendors and subcontractors that get involved when NASA builds one, so that adds in the cost."

While HIADs work well for giant payloads, he said the technology gets bulkier when scaled down to around three meters in size.

"And the inflation system can be rather large," he added, "so it's harder to close the design case on a small scale."

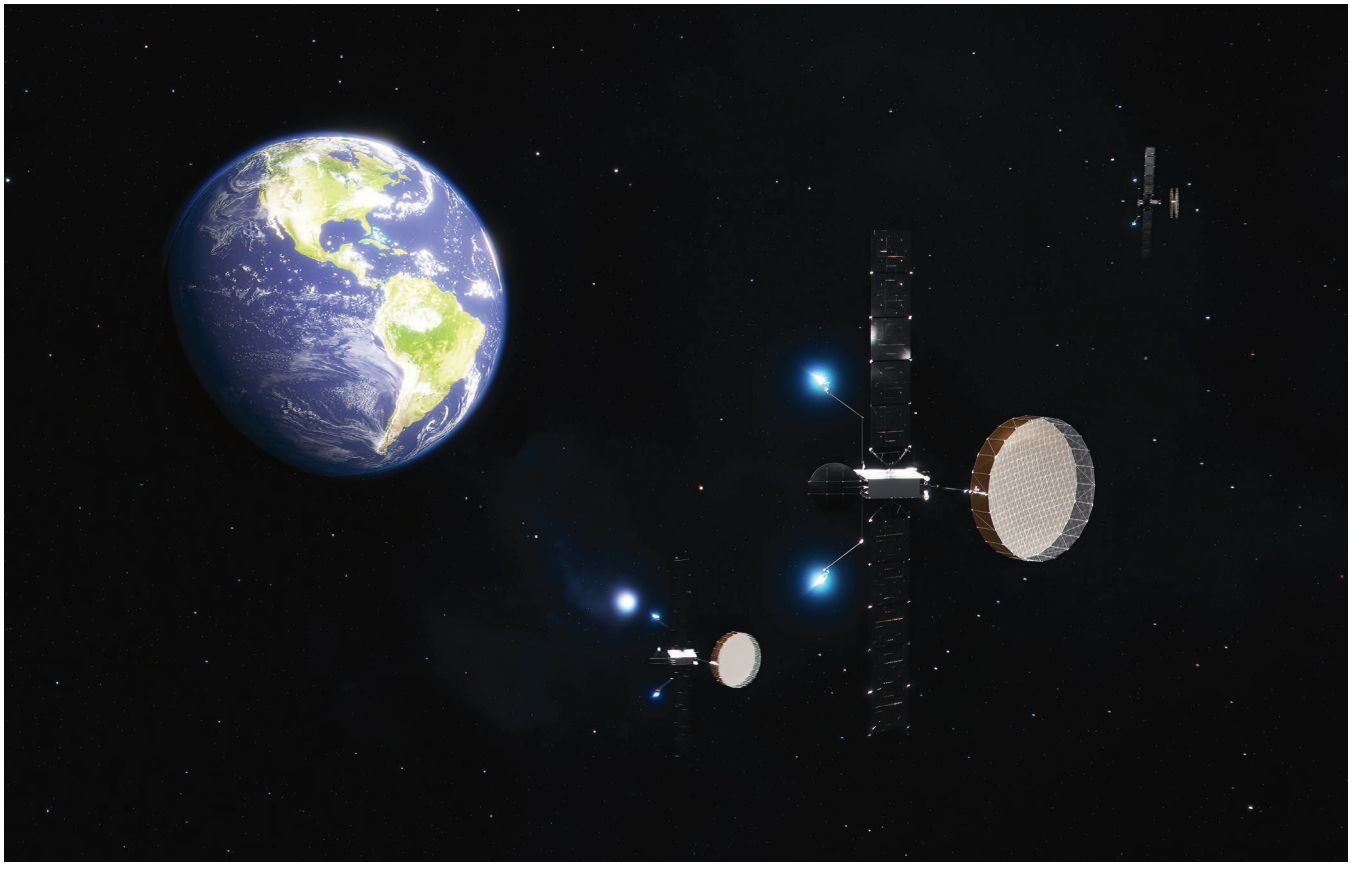
Outpost's first mission is slated for 2026 when it aims to return a small, 200-kilogram satellite with a mechanically deployable heat shield the venture plans to mass-produce in-house.

The startup hopes to pioneer a new market for operators interested in reusing satellites that have completed their missions in low Earth orbit, rather than allowing them to vaporize as they fall back to Earth after running out of fuel.

Dunn said Outpost had also worked with NASA's Ames Research Center on mechanically deployable heat shields, under the Adaptable Deployable Entry Placement Technology (ADEPT) program, before the space agency concentrated resources on HIADs.

"NASA has put a lot of funding into HIADs and I think that's why we saw LOFTID be so successful," he said, "and a lot of times the best technology is just the one that gets the most funding and gets developed out."

As for LOFTID, Del Corso said NASA is working with the Smithsonian Institution to find its final home alongside other space industry firsts. **SN**



ASTRANIS

Above: Illustration of Astranis' next-gen Omega small GEO satellites for geostationary telecom services.

Space Force seeks agile solutions with 'small GEO' services

Interest in nimbler geostationary satellites creating openings for new class of builder-operators reaching space

In its never-ending search for agile, cost-effective ways to enhanced military communications, the U.S. Space Force is zooming in on a new class of 'small GEO' satellites that have entered the market.

SANDRA ERWIN

Generally weighing between 300 and 500 kilograms, these satellites promise geostationary capabilities at reduced costs and faster development cycles than traditional multi-ton geostationary Earth orbit (GEO) satellites.

The Space Force is preparing to unveil details of a satellite services procurement aimed at the low but growing number of companies building and operating small satellites for geostationary orbit.

SPACE FORCE'S SMALL GEO STRATEGY

Cordell DeLaPena, program executive officer for military communications at the Space Force's Space Systems Command, said the U.S. military's interest in these more compact GEO satellites stems from the need for more agile and resilient communication systems.

He said at the recent Milsatcom USA conference that "There's going to be a business case" for small GEO

"We're looking to take advantage of smaller satellites designed for geostationary orbit."
– Clare Hopper, head of the U.S. Space Force's Commercial Satellite Communications Office

satellites in military space architecture. While low Earth orbit (LEO) systems dominate the small satellite market, GEO variants are carving out their own niche, offering potential advantages that appeal to military customers, such as maneuverability.

Small GEO platforms are an example of solutions the commercial satellite industry is pioneering to make satellite communication systems more resilient and less costly, DeLaPena added. "Not every environment needs exquisite capability."

'MANEUVERABLE GEO' PROGRAM

Clare Hopper, head of the U.S. Space Force's Commercial Satellite Communications Office, recently announced plans to start a new program this year called "maneuverable GEO."

She said this initiative aims to capture innovations in the small GEO sector and is expected to encompass a range of services, including satellite communications and the leasing of satellites for military operations. Hopper said a draft request for industry proposals should be released in the coming weeks.

"We're looking to take advantage of smaller satellites designed for geostationary orbit," Hopper said. "These capabilities, I think, are promising for the DoD."

Hopper said small GEO satellites that weigh a few hundred kilograms, compared to several tons for conventional GEO satellites, would give the Space Force options to buy or lease a constellation at relatively low cost.

A geostationary orbit, located approximately 36,000 kilometers above the equator, has traditionally been the preferred location for communications satellites. Satellites in this orbit appear to remain in a fixed position relative to the Earth's surface, allowing ground-based antennas to point at them continuously without the need for rotation to track their movement.

Hopper said the idea of maneuverable GEO communications is about bringing agility to traditionally static GEO operations.

The Space Force issued a request for information in October to assess the capabilities of the small GEO satellite sector and is incorporating the industry's feedback in a draft solicitation for bids.

The maneuverable GEO program is expected to utilize Indefinite Delivery/ Indefinite Quantity (IDIQ) contracts, which will provide a framework for the Space Force to place task orders for satellite communications services and hardware as needed.

The procurement strategy for small GEO services draws from previous models used for proliferated LEO satellite communications. "We envision this contract having some of the same kind of key tenets as the PLEO procurement, enabling industry to offer any available capability, service plan packages, custom offerings or custom blends," she explained.

COMMERCIAL OPPORTUNITIES AND PLAYERS

Small satellites reduce the risk of creating "big juicy targets" in the GEO belt, noted Col. Eric Felt, director of architecture and integration at the Office of the Assistant Secretary of the Air Force for Space Acquisition and Integration.

Above: Clare Hopper, chief of the Space Systems Command's Commercial Satellite Communications Office.

The Space Force expects to leverage commercial small GEO satellites for its Protected Tactical Satcom Global (PTS-G) program, intended to provide worldwide assured-access communications for tactical warfighters across military Ka-band and X-band frequencies. Felt said this approach would reduce the vulnerabilities of larger, more traditional satellites.

The Space Force's 2025 budget proposes $248 million in funding for the PTS-G constellation. Initially, PTS-G would provide services in select regions, with the goal of eventually offering worldwide coverage. The first deployment will be four small GEO satellites — two for the X band and two for the Ka-band.

The military is eyeing small GEO satellites as commercial activity in the sector is picking up. The startup Astranis, which manufactures small >

Above: Astranis co-founders John Gedmark (left) and Ryan McLinko.

"At the end of the day, you need to have 'proliferated everything.'"
– John Gedmark, CEO of Astranis

< > telecommunications GEO satellites, has adopted the term "proliferated GEO" in its marketing campaign. This branding is a nod to the "proliferated LEO" concept that has been gaining traction in the national security satellite market.

Rather than viewing GEO as the domain of large, solitary satellites, Astranis is promoting a vision of a more dynamic, populous geostationary environment. "We're big fans of proliferated LEO," said John Gedmark, CEO of Astranis. "But at the end of the day, you need to have 'proliferated everything.'"

The San Francisco company launched its first satellite in 2023 for Alaskan telecom operator Pacific Dataport and plans to put more satellites in orbit in the coming years, with the goal of providing dedicated broadband capacity to underserved markets and regions.

Gedmark told *SpaceNews* that Astranis has sold satellites to various commercial and government customers worldwide, including in the United States, Mexico, Argentina, the Philippines and Thailand.

He said the company is also actively pursuing military contracts. "We've demonstrated our satellites can support the Protected Tactical Waveform," he said. PTW is a government-developed waveform used in military satellites to safeguard communications from jamming, cyber-attacks or other disruptions.

Gedmark said Astranis is developing a new dual-use satellite with all-electric propulsion that will operate on commercial and military Ka-band frequencies as well as military-only X-band.

This positions Astranis to compete in the Space Force's maneuverable GEO program and the Protected Tactical Satcom Global (PTS-G) procurement, said Gedmark. "They would get the resilience of having smaller satellites that can also operate the protected tactical waveforms."

Gedmark explained that satellites with all-electric propulsion align with the DoD's interest in maneuverability because they use less fuel than chemically propelled satellites, allowing for more frequent adjustments without worrying about running out of fuel. "We have demonstrated you can put up a small GEO satellite that provides concentrated bandwidth over a targeted area and do that on short notice," Gedmark said. "And if that capacity is needed somewhere else, then you can move it from one part of the GEO belt to another."

The company's new satellite platform, called Omega, is being designed for constellations of small GEOs flying in formation. "We found that you could operate four to 12 of these satellites in a single orbital slot," said Gedmark. "That's just a resilience that you would not get if all that capability was in the form of a single large satellite."

Terran Orbital, a LEO satellite specialist based in Boca Raton, Florida, recently announced a new line of small satellite buses designed for geostationary orbit. This new product line, named SmallSat GEO, is intended to compete in the emerging small GEO satellite market.

"The geosynchronous market is moving more towards small satellites with more and more GEO spacecraft ordered in the 'small' size class," said Terran Orbital CEO Marc Bell.

Bell said Terran Orbital is seeing growing international interest in their technology, noting that the company is in early discussions with an unnamed country to supply geostationary satellites equipped with Ku- and Ka-band communications links.

Matthew Gann, Terran Orbital's

ASTRANIS

"The geosynchronous market is moving more towards small satellites with more and more GEO spacecraft ordered in the small size class."
– Marc Bell, CEO of Terran Orbital

Left: Marc Bell, CEO of Terran Orbital **Above:** Terran Orbital in March unveiled a new line of small satellite buses aimed at geostationary operations.

senior vice president of strategy and business growth, said the goal is to bring a small GEO satellite to market in 18 to 24 months. "The price points are one-tenth of the price of what you pay for the big GEO comms," he told *SpaceNews*.

Terran Orbital is monitoring the Space Force's maneuverable GEO program as a potential opportunity. "We're trying to put our footprint down" in this sector, Gann said.

Despite specializing in LEO satellites, Terran Orbital has gained GEO experience through its role in NASA's CAPSTONE mission. The company designed and integrated a cubesat for the Cislunar Autonomous Positioning System Technology Operations and Navigation Experiment, which was launched in 2022 for partner Advanced Space. Initially designed for an 18-month mission, CAPSTONE is currently operating in its extended mission phase, testing near-lunar communication and navigation technologies as well as new software tools for autonomous spacecraft operations.

Another emerging player in the small GEO sector is SWISSto12, a Swiss manufacturer that developed a line of smallsats for telecommunications services in partnership with the European Space Agency. The Renens, Switzerland-based company has secured contracts with satellite operators Intelsat and Viasat. The first "HummingSats" are slated for launch in 2026.

Meanwhile, York Space Systems, an established smallsat builder based in Denver, is also eyeing opportunities in the geostationary realm. Dirk Wallinger, CEO of York Space Systems, told an investors conference in June that the company "sees the small GEO market as a natural extension of our capabilities." However, York has not yet announced specific small GEO products.

DRIVING INNOVATION THROUGH DEMAND

Hopper, the head of the Space Force's commercial satcom office, said the military's interest in small GEO satellites exemplifies the U.S. government's strategy of leveraging commercial innovations to enhance defense capabilities.

By driving demand for these smaller, more versatile satellites, she noted, the military can stimulate further innovation and investment in the sector. This, in turn, could lead to the development of new technologies and capabilities that benefit both military and commercial applications.

DeLaPena, Hopper's superior at Space Systems Command, emphasized this strategy: "I think the future of DoD space is that we're going to leverage every commercial investment out there." **SN**

TERRAN ORBITAL

Growing Pains for Smallsat Propulsion

How financial turbulence and rapid innovation are shaping the sector

Astra Space seemed poised to dominate the smallsat propulsion landscape. Its 2021 acquisition of Apollo Fusion positioned the Northern California company as a favored partner among prime contractors building satellites for the U.S. Space Force Space Development Agency.

Astra's subsequent financial troubles have prompted a significant realignment within the smallsat propulsion industry. Severe cash flow issues nearly drove the SPAC-funded rocket startup to file for Chapter 7 bankruptcy this year, shaking investor confidence in the sector and prompting customers to scramble for new suppliers. The uncertainty has led to reduced investment for some companies, and forced competitors to adapt quickly. Many companies have restructured operations, expanded facilities or formed new partnerships in an effort to attract large constellation orders. The disruption in the sector, caused in part by Astra's struggles, highlights the interconnected nature of financial health and market stability.

In addition, after years of development, new thrusters are being flight tested. And satellite manufacturers are demanding speedy delivery, prompting propulsion suppliers to scale up capacity.

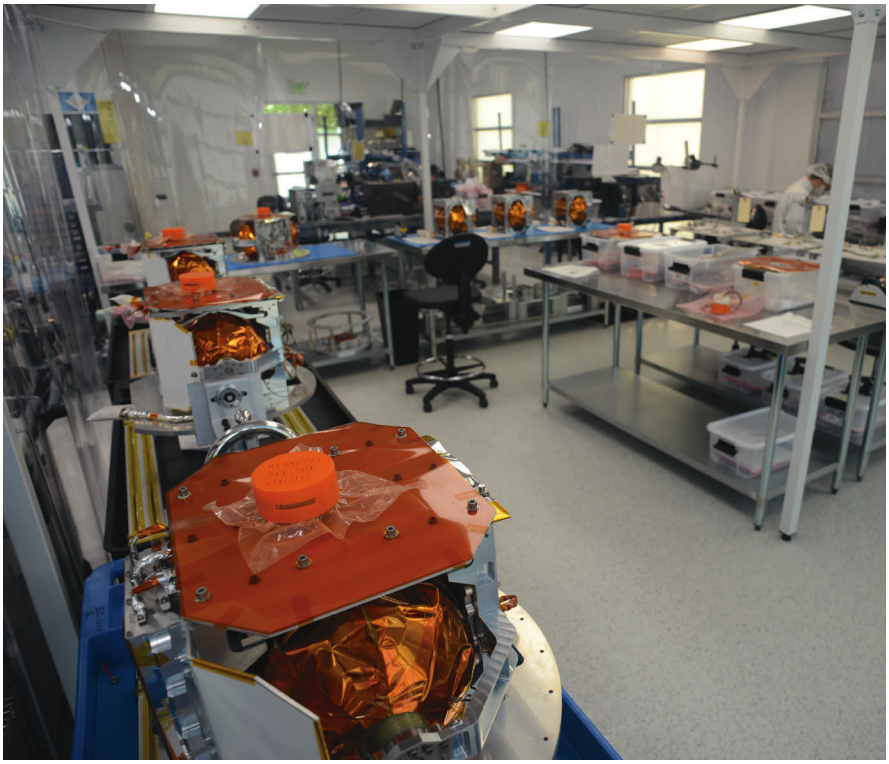
The smallsat propulsion market is "in the middle of the churn right now," said Gabriel Benavides, senior researcher and engineer in the NASA Glenn Research Center's Electric Propulsion Systems branch. "There will be those that come out on top and those that don't."

DEBRA WERNER

HYPE CYCLE

A few years ago, analysts tracking emerging satellite constellations predicted sky-high demand for smallsat propulsion. Massive commercial and military constellations were being proposed, investment capital was >

DALL-E ILLUSTRATION GENERATED BY SPACENEWS FOR THIS ARTICLE



Above: Technicians assemble and test components in ExoTerra Resource's smallsat propulsion manufacturing facility.

Smallsat propulsion is "in the middle of the churn right now...There will be those that come out on top and those that don't."

– Gabriel Benavides, senior researcher and engineer at NASA Glenn Research Center

flowing into space-related startups and companies were positioning themselves for massive orders. While demand for propulsion has grown, it has not lived up to the hype. SpaceX, the largest constellation operator, produces its own Hall-effect thrusters.

"The total addressable market for propulsion is smaller than we thought it would be, smaller than people said in their 2021 pitch decks," said a propulsion industry executive.

The hype coupled with the dip in Astra shares from $12.35 in 2021, when the company went public through a merger with a special purpose acquisition company, to 53.9 cents in mid-July, when Astra co-founders Chris Kemp and Adam London took the company private, has "scared away a lot of investment in Astra competitors," said a space industry executive and investor.

RAMPING UP

Despite the chilling effect Astra has had on the investment climate, some startups are still proving they can raise money, expand manufacturing and speed up deliveries. These companies are successfully navigating the challenging environment and attracting funding for new factories to increase production capacity.

"We are living in a fast-paced world. Nobody has the time to wait a year for any subsystem," said Morpheus Space CEO Daniel Bock.

"There are missions that they want to occur tomorrow," Benavides said. "If you can't deliver, they're going to find somebody that can."

A propulsion executive added, "People are asking for hardware in five or six months. We work miracles pretty regularly, but we cannot make material appear out of thin air. When we exhaust our inventories, we need to go back to supply chain."

Natick, Massachusetts-based Busek stepped up production of Hall-effect thrusters when the war in Ukraine prevented Airbus OneWeb Satellites from purchasing thrusters from another supplier, Russia-based EDB Fakel. Busek is continuing to speed up manufacturing due to an influx of constellation orders.

"What the market is asking for is a dependable supplier who has the scale to meet the market demand," said Busek Vice President Peter Hruby. "That's the space we want to occupy."

Benchmark Space Systems, a firm known primarily for nontoxic chemical propulsion, began large-scale production of its first electric thruster, Xantus, after the metal-plasma thruster reached orbit for the first time earlier this year.

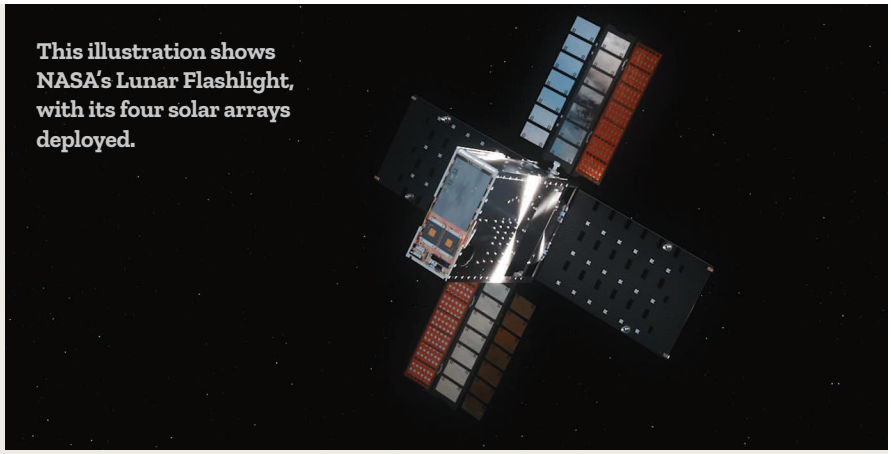
Near its Burlington, Vermont, headquarters, Benchmark has established a 3,700-square-meter facility to design, test, build and integrate chemical, electric and hybrid propulsion systems.

"We have immediate capacity for about 100 systems a year and the building can be configured for 200 systems a year," said Chris Carella, Benchmark chief commercial officer. >

EXOTERRA RESOURCE

TOUGH LOVE

Why NASA gives smallsat propulsion such a hard time



This illustration shows NASA's Lunar Flashlight, with its four solar arrays deployed.

NASA/JPL-CALTECH

Propulsion problems began soon after NASA launched Lunar Flashlight in 2022. In early commissioning, two of the four thrusters on the cubesat built to look for water ice on the moon produced little to no thrust, preventing the spacecraft from reaching lunar orbit.

NASA officials emphasize the experimental nature of Lunar Flashlight, which demonstrated many novel technologies. Still, the mission underscored a lesson hitting home with many spacecraft operators: Smallsat propulsion is hard.

"Miniaturizing chemical and electric propulsion systems for small satellites is complicated," said Bruce Yost, director of NASA's Small Spacecraft Systems Virtual Institute.

Some smallsat propulsion systems have narrow channels for delivering propellant to the thrust chamber. A NASA investigation determined that small particles blocked propellant lines in Lunar Flashlight's additively manufactured propulsion system.

"You have to be very careful with those systems as they're being manufactured and prepared for flight, because a little bit of contamination will mess up the whole thing," Yost said. "Whereas the bigger systems may not have that problem at that scale. They have other problems, obviously."

EXTENSIVE ABUSE

NASA's plans to send cubesats to the moon and Mars can stress the most carefully designed propulsion systems.

One of the twin Mars Cube One satellites overcame a fuel leak on its journey to the Red Planet. And CAPSTONE, the Cislunar Autonomous Positioning System Technology Operations and Navigation Experiment, reached lunar orbit in spite of problems with a malfunctioning thruster valve.

Most cubesats and small satellites operate in low-Earth orbit. Whereas NASA seeks smallsats that can "go farther, last longer and operate in some pretty nasty space environments," Yost said. "The other thing we want to do is start and stop over and over again. Some propulsion systems haven't been designed for such a long life of abuse."

In spite of those hurdles, NASA officials see promise in the burgeoning smallsat propulsion market.

"A whole boatload of companies" are focusing on propulsion, from small startups to large aerospace technology suppliers, Yost said. Plus, many different chemical and electric propulsion technologies are being flight tested.

"We're not stuck up the creek without a paddle. We just need a better paddle," Yost added.

Five years ago, discussions at propulsion conferences often revolved around new technologies and laboratory testing.

"Now a lot of the conversation has shifted to units that have flown," said Gabriel Benavides, senior researcher and engineer in the NASA Glenn Research Center's Electric Propulsion Systems branch.

ENABLING TECHNOLOGY

Some of the technologies haven't been demonstrated extensively, but "they are flying and they have some real data," Benavides said. "The fact that they even got into space with a mission to begin with is a huge step."

Demand for smallsat propulsion is coming primarily from commercial communications constellations and military organizations. The U.S. Space Force Space Development Agency, which plans to deploy hundreds of satellites for missile warning and missile tracking, is having a particularly important influence on the marketplace.

In contrast, NASA is "not yet buying or fielding the high numbers of smallsats yet," Yost said. "We hope to, someday."

There's no question that NASA's future smallsat swarms or constellations will need propulsion to desaturate attitude control wheels and move around in orbit.

"Propulsion has been holding back our ability to get these missions going and to field them," Yost said.

If NASA had access to some "fairly reliable propulsion systems, you would see a whole other layer of science applications within NASA open up," Yost said. "People would start to be comfortable funding those missions. Propulsion is an enabling technology for us." **SN**

"We are living in a fast-paced world. Nobody has the time to wait a year for any subsystem." – Daniel Bock, CEO of Morpheus

Right: Attending the July 23 opening of the Morpheus factory in Dresden, Germany, were (left to right) Michael Kretschmer, minister president of Saxony, Morpheus President Kevin Lausten, Morpheus CEO Daniel Bock, and Martin Kelterer, Morpheus chief operations officer.

< > Similarly, ExoTerra Resource opened a 3,500-square-meter production facility in Littleton, Colorado, to address a backlog of more than 200 propulsion modules.

In late July, Morpheus opened a 1,260-square-meter factory in Dresden, Germany. Initially, the factory will produce 100 Field Emission Electric Propulsion-based GO-2 electric propulsion systems per year. With additional staff and equipment, the factory can be scaled to manufacture 500 units annually.

Even Hawthorne, California-based Phase Four, a company known for radio-frequency thrusters, is entering the Hall-effect thruster market through a partnership with Redwire Corp. Redwire and Phase Four announced plans in July to jointly develop Valkyrie, a thruster based on a NASA-licensed design.

"Anticipated supply in the market isn't coming online as fast as people hoped, while demand grows unabated," said Phase Four CEO Steve Kiser. "So, of course, we're going to make the strategic decision to jump into an under-supplied market."

ATTENTION TO DETAIL

Experts are not surprised by growing pains in the smallsat propulsion sector.

Some propulsion companies "are chasing the wrong things," said Tomas Svitek, president of Stellar Exploration of San Luis Obispo, California. "They worry about fancy manufacturing techniques, fashionable propellant, new business models, maybe an extra digit in the performance specs. But in the end, it is all about the basics — make sure the tank does not leak and the system works as promised."

What's more, companies that successfully flight test a single propulsion system often struggle to produce dozens or hundreds. Add onto that the difficulty of keeping a business afloat like raising money and hiring people.

"It's a lot to ask of any young, innovative company," said Al Tadros, Redwire chief commercial officer.

Startups often excel at innovating "technologies, designs and development, but getting to quality and then scaling that quality to full-rate production is an issue," Tadros said. "Part of that is because you can get an A team to build the first item, but you need to document processes, develop supply chains and develop manufacturing facilities in order to get to the full-scale production required for proliferated low-Earth orbit constellations."

To ramp up production, Morpheus brought in a new chief operations officer, Martin Kelterer, whose previous roles at Mercedes-Benz included head of production engines. Under Kelterer's guidance, Morpheus has worked to reduce the amount of manual labor involved in manufacturing and to establish clear quality-control processes.

Ensuring that every propulsion system from a manufacturing line works like every other one can be difficult and expensive. Each step in the manufacturing process requires painstaking attention to detail.

"It's more complicated than cutting a piece of metal," Benavides said. "It's how you cut it, the acceptance testing, the heat treatments, the coatings, the way in which you handle it, the cleanliness. All these things add up in terms of costs." **SN**

MORPHEUS SPACE

COMMENTARY Daniel Duchaine

An AI-generated scene of orbital destruction raining down. Image generated by the author using DALL-E.

U.S. faces a 'Cuban Missile Crisis' in space amid Russia's growing desperation

House Intelligence Committee Chairman Mike Turner (R-Ohio) warned this summer that the United States is on the brink of a "Cuban Missile Crisis in space" if Russia operationalizes a nuclear-armed satellite weapon. In reality, it could be even more dangerous. Today's Russia is more paranoid and desperate than the Soviet Union was in 1962. In 2024, the U.S. has more to lose and fewer options to counter Russia's move. In this so-called Cuban Missile Crisis in space, the U.S. must carefully balance deterring a reckless Russia while avoiding actions that could provoke catastrophic consequences.

By considering the differences between these scenarios, we can see how the U.S. has fewer good options and Russia is more dangerous.

DIFFERENCE #1: RUSSIAN DESPERATION

May 1960: The Soviet Union, fearing the U.S. would try to invade Cuba and overthrow Fidel Castro, placed medium and intermediate-range nuclear missiles to defend the country.

The Soviet Union in the 1960s was a global superpower, and saw the U.S. as a rising power and a threat to Soviet hegemony. Placing missiles in Cuba was a defensive move. 2024 Russia is a declining power seeking to change the status-quo. If Russia were to place a nuclear weapon in space, it

With Russia's decline fueling its aggression in space, the stakes are higher and the risks greater than in October 1962.

would be an offensive move to target U.S. satellite systems and threaten the U.S.-led order. Russia in 1962 was a bear guarding its territory with incentive to protect the forest. The Russian bear in 2024 is wounded and starving. It has little to lose and is willing to do anything to survive.

DIFFERENCE #2: U.S. CREDIBILITY

October 22, 1962: In a dramatic 18-minute television speech, President John F. Kennedy shocked Americans by revealing "unmistakable evidence" of the missile threat in Cuba. He announced that the U.S. would prevent ships carrying weapons from reaching Cuba, while demanding that the Soviets withdraw their missiles.

In the 1960s, the U.S. held a strategic missile advantage that allowed Kennedy to threaten the Soviet Union with a game of chicken. Today, the U.S. has a strategic advantage on Earth, but not in space. Financial constraints crippled Russia's space endeavors, leading to fewer payload launches, and the U.S. now has a major lead in space. With more to defend and less to attack, the U.S. must carefully moderate its actions to avoid a catastrophic Russian response.

DIFFERENCE #3: U.S. OPTIONS

October 23, 1962: U.S. Ambassador Adlai Stevenson explained the matter to the U.N. Security Council as U.S. ships moved into position around Cuba.

President John F. Kennedy established a blockade of Cuba and engaged diplomatically with the Soviet Premier. Eventually, the two reached a compromise: the U.S. withdrew missiles from Turkey and promised not to invade Cuba, and the Soviet Union dismantled the missiles on Cuba. Unlike the Port of Havana, however, you cannot blockade a spaceport.

Barring a risky interception or a strike on the launch facility, a nuclear co-orbital satellite will reach its designated orbit. Kennedy considered a range of options, from doing nothing (ineffective at best, dangerous at worst), to a full scale invasion of Cuba (most risky), to a naval blockade (the least bad option). If Russia launches its nuclear armed satellites, 2024 U.S. will have fewer options at its disposal than 1962 U.S. had.

The ineffective options (ignore the Soviet missiles in Cuba)

- Do nothing: Russia is a declining power desperate to regain its lost status. But Russia's decline cannot be solved by threatening U.S. space assets. If the U.S. appeases Russia, it would enter a never-ending cycle of bad behavior and appeasement.
- President-to-President diplomacy: Given the war in Ukraine and presidential elections in November, direct diplomacy at this level is likely off the table.
- Economic sanctions: Russia probably views sanctions as a nuisance, while it sees its geopolitical position as an existential crisis. At best, sanctions will have little to no effect. At worst, they will exacerbate Russia's decline, potentially leading to even more reckless behavior.

The riskiest option (a full invasion of Cuba)

- Destroy the satellite in orbit: The U.S. likely lacks the offensive cyber capabilities to neutralize the satellite in orbit. A direct ascent anti-satellite attack is possible but incredibly risky. Like the Soviets would retaliate facing a U.S. invasion, facing a "use it or lose it" scenario, Russia might decide to set off the weapon rather than watch it be destroyed.

The least bad options (impose a naval blockade around Cuba)

- Low level diplomacy: The administration is currently reaching out to Moscow to negotiate an off-ramp prior to launching the satellite. Russia is a declining power, so time is on the U.S.'s side.
- International diplomacy: China, India, and the United Kingdom all have significant satellites in the same orbit as Russia's test satellite. Presenting a united front may deter Russia where a single actor cannot.

This is not your father's Cuban Missile Crisis. Today's Russia, a declining power with existential anxieties, is more unpredictable and willing to take risks that could destabilize global space assets. The U.S. faces a more constrained set of responses compared to the bold moves available during the Cold War. Ultimately, the U.S. must prevent a catastrophic escalation while preserving the stability and security of space, an increasingly vital domain for all of humanity. **SN**

DANIEL DUCHAINE IS A FELLOW AT THE CENTER FOR SPACE GOVERNANCE AND THE SPACE GOVERNANCE AND POWER FELLOW AT AL FUSAIC. HE IS CURRENTLY A GOVERNMENT RELATIONS ASSOCIATE AT APPLIED RESEARCH ASSOCIATES (ARA). THE VIEWS EXPRESSED HERE ARE HIS ALONE AND DO NOT REFLECT THOSE OF APPLIED RESEARCH ASSOCIATES.

COMMENTARY James E. Dunstan

Regulating outer space after Loper Bright

Above: A view of the U.S. Supreme Court Building reimagined as if situated in space, illustrating the far-reaching implications of the court's recent ruling on space industry regulations.

SPACENEWS PHOTO ILLUSTRATION USING WIKIMEDIA COMMONS / JOE RAVI, CC BY-SA 3.0.

It's been a busy summer for the U.S Supreme Court. Among the decisions that are being hailed as the most significant in decades, the court issued *Loper Bright v. Raimondo,* overturning the 40 year old Chevron doctrine, which directed courts to defer to an agency's interpretation of their authorizing statutes.

What does fishing for herring (the fact pattern of *Loper Bright*) have to do with developing outer space? A lot, actually. While space exploration began 67 years ago with the launch of Sputnik, the rules regulating commercial activities in outer space in many ways are just now being written. Agencies from the Federal Communications Commission (FCC) to the Federal Aviation Administration (FAA) to the National Institute of Standards and

Technology (NIST) all have open proceedings affecting outer space. And without Chevron deference, all of these agency actions may be subject to challenge.

Loper Bright says that courts must determine what powers agencies hold when an authorizing statute is unclear. The decision does not say that non-expert judges will now have to make critical technical decisions, contrary to what some are saying. Agencies will retain the ability to make factual findings in implementing statutes, especially on highly technical issues, and courts will give them great weight. Administrative law nerds will note that agencies still retain Skidmore deference, the older cousin of Chevron, which still directs courts to provide substantial weight to an agency's interpretation of statutes, based on the agency's expertise, procedural due process and consistency in the way it has implemented its authority in the past. Then there's the Administrative Procedure Act, passed in 1946, after Skidmore but almost 40 years before Chevron, which directs courts to review rules under a relatively low bar requiring appellants to demonstrate that the agency has been arbitrary and capricious. So agency deference is not dead, it's just no longer a slam dunk.

"Agency deference is not dead, it's just no longer a slam dunk."

This is important to the future of commercial space precisely because we've never had a National Space Act. Congress has never passed a comprehensive statute clearly assigning authority to specific agencies to regulate commercial outer space development. Agencies have been left to cobble together their authority from enabling statutes that, in many instances, were crafted prior to the space age. And without clear congressional direction, agencies — some with sharp elbows — have crafted a regulatory regime for outer space that, as I wrote for Utah State University's Center for Growth and Prosperity, is full of "gaps, overlaps, and stovepipes."

Yes, the FCC has statutory authority over allocating and licensing spectrum for space communications. But the FCC wants to regulate major aspects of in-space servicing, assembly and manufacturing (ISAM) that go well beyond simply spectrum use. And the FAA has statutory authority over licensing launch and reentry of rockets. But the FAA wants to impose rules on rocket upper stages that will affect them after they obtain orbit, a domain over which Congress has explicitly denied the FAA authority. Finally, NIST has been tasked by the White House to develop a framework around government march-in rights on patents developed using government grants. Each agency was doubtless counting on courts to immunize these decisions from legal challenge under Chevron deference.

In April, TechFreedom filed comments at the FCC questioning their authority over ISAM operations. We also filed comments at the end of June questioning whether the FCC even has statutory authority to issue orbital debris rules. Last December, we warned the FAA that its authority over launch and reentry might not apply to what happens to upper stages left in orbit. All of these comments contemplated what might happen after *Loper Bright*.

Chief Justice Roberts's opinion also implicates Congress in this inter-branch scrum. It is up to Congress to make clear what powers it is delegating to agencies. If it wants the agency to promulgate rules of a certain type, it needs to tell the agency to do so. And that's exactly what Congress needs to >

"It is up to Congress to make clear what powers it is delegating to agencies."

< > do with regard to commercial outer space development. We need a National Space Act that clearly assigns regulatory authority to the relevant agencies, but also provides the necessary guardrails against agencies making overlapping, or worse, conflicting rules. Bills like H.R. 6131 are a good start but must be retooled after *Loper Bright* to better define agency rulemaking authority, when deference is appropriate, and how it should work. As I testified before a House space subcommittee last year:

Congress's task is to find a balance on the continuum between "permissionless innovation" (where nearly anything goes), and the "precautionary principle" (where the government must micromanage and approve every activity by U.S. citizens in space). This is a hard, but necessary, task if we wish to continue to be leaders in the cislunar economy going forward.

Here's hoping that *Loper Bright* prods Congress into action to provide a clear framework for commercial development and American leadership on the high frontier. **SN**

JAMES E. DUNSTAN IS SENIOR COUNSEL AT TECHFREEDOM AND THE FOUNDER OF MOBIUS LEGAL GROUP, PLLC. HE HAS MORE THAN 40 YEARS OF EXPERIENCE IN ADMINISTRATIVE AND OUTER SPACE LAW.

Chevron Deference and *Loper Bright*

Additional analysis by Scout Space CEO Philip Hoover-Smoot

UNDERSTANDING CHEVRON DEFERENCE

Origins: The Chevron doctrine, established by the 1984 Supreme Court case Chevron U.S.A., Inc. v. Natural Resources Defense Council, Inc., provided a framework for judicial review of agency interpretations of ambiguous statutes. As a result, the past 40 years saw the legislative, executive and judicial branches yield to federal agencies a wide ambit of responsibility.

Framework: Chevron deference, as it came to be known, introduced two scenarios for courts to overrule these federal agencies. First, if an agency introduced regulations that clearly contradicted Congress's legislative intent. And second, in the case of ambiguous legislative intent, the court would defer to the federal agency's interpretation as long as it was reasonable.

Impact: For 40 years, Chevron deference facilitated regulatory stability but also allowed for significant policy shifts with changing administrations.

IMPLICATIONS OF LOPER BRIGHT

Judicial shift: The *Loper Bright* decision doesn't entirely invaliate agency expertise, but it does reduce the government's reliance on it. The decision largely eliminates Chevron deference, mandating courts to independently interpret regulatory matters. "All relevant questions of law" will now be resolved by the judiciary, Chief Justice Roberts wrote for the majority, leaving the judiciary to determine the single "best reading" of any law.

Potential outcomes: This shift may lead to increased legal challenges, less regulatory consistency and a greater need for detailed legislative directives. With Chevron overruled, it is anticipated that federal agencies may adopt a more circumspect posture, moving more slowly and taking more narrowly tailored steps with new regulations.

CONNECTING THE DOTS Jason Rainbow

Avoiding space explosions

New FCC rules aim to manage debris-generating explosions, but the debate continues over whether they adequately address the growing risks in orbit

The Federal Communications Commission has proposed new rules to manage the risk of debris-generating explosions in space, but whether they go far enough for the new reality in orbit is a source of debate.

In May, FCC chair Jessica Rosenworcel put forward rules that would force applicants to assess and limit the probability of accidental explosions to less than one in a thousand for each satellite up for approval.

ASSESSING THE EXPLOSION RISK

Although the U.S. regulator already requires satellite licensees to affirm they have effectively mitigated this risk, it would be the first time this requirement is tied to a probability metric.

The metric is derived from NASA's standard and would apply during and after the completion of mission operations — if a majority of the FCC's five commissioners approve the rule-making.

Accidental satellite explosions are exceedingly rare. One contender in recent years is the Boeing-built Intelsat 29e satellite, which spewed out fuel in geostationary orbit after a sudden failure in 2019.

An investigation pinned that failure on either a meteoroid impact or a wiring flaw that led to an electrostatic discharge following heightened solar weather activity.

However, as SpaceX's Starlink broadband constellation passes over 6,000 satellites in low Earth orbit (LEO), and tens of thousands of other spacecraft are in the works, there are warnings that a one-in-a-thousand risk threshold misses the mark.

"From a probabilistic perspective, small risks add up when dealing with large numbers of potential collisions," a satellite executive said.

The total number of LEO satellites in a constellation, their aggregate mass and cross-sectional area all factor into the level of risk posed by a single network.

"The alternative is to come up with an appropriate aggregate risk metric for the entirety of a large constellation," the person added, rather than one tied to a satellite-by-satellite basis.

The call joins a wider debate at the FCC over whether a satellite-by-satellite approach still makes sense for regulating the risk of collisions in orbit.

According to filings lodged with the regulator, proponents of some kind of aggregate risk metric include Eutelsat, SES and Viasat.

Opponents include SpaceX and large LEO constellation hopefuls Amazon and Telesat.

Moving away from a satellite-by-satellite basis would fail to adequately address the risk individual spacecraft pose, opponents have argued, and involve novel, untested methodologies.

Amazon told the FCC in July that "an aggregate risk framework is deeply flawed because it is premised on the assumption that a single authorized constellation creates more safety concerns than the same number of satellites spread across multiple constellations, when the opposite is more likely true."

In allowing SpaceX to launch up to a quarter of its proposed 30,000 second-generation Starlink satellites in 2022, the FCC sought to manage aggregate collision risk with a "100 object years" rule.

This rule requires SpaceX to pause constellation deployment if the total number of years that each failed Gen2 Starlink remains in orbit passes 100 years.

However, even operators pushing for aggregate constellation risk measures have cautioned the FCC to move away from an object years approach.

"[S]uch metrics do not account for potential risks that may be realized in the future," Viasat told the FCC in June, "and therefore may give a false sense that total risk had been limited effectively.

"For example, if subject only to a realized risk limit, an operator could launch an unlimited number of satellites with high collision probabilities in the event that they become non-maneuverable, but would be stopped from further launches only after some defined level of risk has actually been realized."

By that point, Viasat said many more risky satellites with potentially fundamentally flawed designs could have already been deployed.

"There would be no way to put the genie back in the bottle," Viasat wrote.

LEARNING FROM EUROPE

Meanwhile, across the Atlantic, an aggregate risk metric is currently being considered as part of the European Space Agency's Zero Debris Charter.

Among targets to improve space sustainability, the charter calls for identifying a suitable aggregate risk threshold for LEO constellations to address the probability of debris-causing collisions and break-ups. SN

ON NATIONAL SECURITY Sandra Erwin

Space Force reshapes for a new era of competition

The U.S. Space Force is making organizational moves that the industry should closely monitor. These changes, spearheaded by Chief of Space Operations Gen. Chance Saltzman, aim to amplify the voices of satellite operators and personnel on the front lines of space operations and create new mechanisms to stay abreast of cutting-edge developments.

Key initiatives include establishing Integrated Mission Deltas (IMDs) and creating a Space Futures Command.

While these may sound like typical military jargon, they signal important shifts in the Space Force's operations and innovation plans.

The Space Force IMDs combine units that handle specific mission areas — such as space electromagnetic warfare and positioning, navigation and timing — with program offices responsible for testing, maintenance and acquisition activities. Officials said this integration breaks down traditional silos and allows for a more streamlined command structure where one leader oversees all aspects of mission readiness.

ACCELERATING MODERNIZATION

Saltzman has advocated for this approach in order to accelerate modernization and posture the Space Force to compete more effectively with rival powers that are challenging the U.S. in the space domain.

Beijing's accelerating pursuit of space capabilities, from anti-satellite weapons to advanced surveillance systems, has necessitated these changes, Saltzman has said.

While it's still early days, positive feedback from the electromagnetic warfare and PNT integrated units suggests that the Space Force's organizational gambit will pay off in the long run, according to Col. Joseph Roth, director of innovation and prototyping at the Space Force's Space Systems Command.

A key goal, he said, is to facilitate faster technology integration and more rapid fielding of new capabilities.

"You'll see new integrated mission deltas pop up, and I think it's a great way to work," said Roth. "It gets the operations and acquisition community closer together" and ensures that investments are more closely aligned with actual operational demands, he said.

This bottom-up approach contrasts the top-down decision-making that has typically characterized military acquisitions.

NEW COMMAND COMING

The forthcoming establishment of a Space Futures Command is also significant for long-term industry planning. This new entity will identify emerging technologies and capabilities that the Space Force will need to maintain its edge.

Saltzman, in February, announced plans to create a Space Futures Command to help identify emerging threats, validate new concepts and provide insights into the types of capabilities that could be needed in the years ahead.

The new command is not expected to create bureaucratic bloat but to consolidate existing functions spread across the Space Force. It will consist of three primary centers: the Space Warfighting Analysis Center, the Concepts and Technology Center, and a Wargaming Center.

Roth said the provisional standup of Futures Command is expected in August. "By the end of the year, we'll have a general officer running the organization, and we'll be moving units and capabilities," he said.

FRONT-LINE FOCUS

These organizational moves recognize a simple truth: those directly managing space assets often have the clearest understanding of operational needs and technological gaps, said Lt. Gen. David Miller, commander of Space Operations Command.

He emphasized that the Space Force's primary focus is meeting the needs of the military's combatant commands worldwide, which rely on space services like satellite communications, GPS navigation and early warning of missile launches.

The reorganization into IMDs and the establishment of Space Futures Command are strategic moves designed to streamline the delivery of space capabilities, Miller said.

These reorganizations reflect a Space Force that is striving to become more operationally responsive and technologically adaptive. What this signals to the space industry is that while innovation is crucial, it should mostly be grounded in practical military utility.. **SN**

ON THE HORIZON

DATE	EVENT	PLACE
AUGUST		
3-8	**Small Satellite Conference** smallsat.org	Logan, UT
SEPTEMBER		
11-12	**Space-Comm Expo Scotland** space-comm-scotland.co.uk	Scotland
16-20	**World Satellite Business Week** wsbw.com	France
OCTOBER		
14-18	**IAC 2024** iac2024.org	Italy
21-22	**Satellite Innovation** satelliteinnovation.com	Silicon Valley, CA
23-24	**MilSat Symposium** milsatshow.com	Silicon Valley, CA
NOVEMBER		
4-7	**Global MilSatCom** www.smgconferences.com/defence/uk/conference/global-milsatcom	United Kingdom
19-21	**Space Tech Expo Europe** www.spacetechexpo.eu	Germany
MARCH		
10-13	**Satellite 2025** www.satshow.com	Washington, DC
11-12	**Space-Comm Expo** www.space-comm.co.uk	United Kingdom
APRIL		
7-10	**Space Symposium** spacesymposium.org	Colorado Springs, CO

FOUST FORWARD Jeff Foust

Mind the launch gap

UK's launch ambitions face setbacks, but hope and resilience remain

At the Farnborough International Airshow six years ago, the United Kingdom made a major push to become a launch country. The U.K. Space Agency endorsed the development of Sutherland Spaceport, a vertical launch site in northern Scotland, and awarded contracts to Lockheed Martin and the launch startup Orbex to conduct launches there. Separately, Cornwall Airport Newquay, also known as Spaceport Cornwall, announced an agreement with Virgin Orbit to host LauncherOne missions there. Within a few years, it appeared, rockets would be launching regularly from British soil.

FARNBOROUGH FRUSTRATIONS

This year at Farnborough demonstrated that, like so many other things in space, things don't go according to plan. To date, the U.K. has hosted one orbital launch attempt, a LauncherOne mission from Cornwall. However, the upper stage malfunctioned a few minutes into the flight, causing the rocket to plummet back to the Atlantic Ocean. Virgin Orbit itself plummeted, filing for bankruptcy less than three months later.

Sutherland Spaceport is finally under construction after years of delays, now as a site to be used solely by Orbex. Lockheed Martin has instead elected to perform its "U.K. Pathfinder" launch from another site, SaxaVord Spaceport in the Shetland Islands, using an RS1 rocket from ABL Space Systems. A scale model of ABL's RS1, with the U.K. Space Agency logo on it, was on display at Lockheed's booth in the small "Space Zone" corner of the show's sprawling exhibit hall — just as ABL revealed a real RS1 suffered irreparable damage during tests ahead of a launch from Alaska.

OPTIMISM AMIDST TURBULENCE

Despite the delays and failures, U.K. officials and executives remain cautiously optimistic that the launch industry will find its footing in the country. The failed LauncherOne was a setback, acknowledged Matthew Archer, director of launch at the U.K. Space Agency, in an interview at the show. But he said that, in retrospect, Virgin Orbit had an "investment risk" that put the company's future in question even if the launch had been a technical success.

"The key thing for that first mission was always going to be exercising, stress testing, our ability to license, and Virgin Orbit definitely did a lot of stress-testing of that process," Archer said. That provided lessons for future launches, such as negotiating with neighboring countries for access to airspace in crowded North Atlantic aviation corridors.

The U.K. Civil Aviation Authority (CAA), which regulates launches, agreed. "Virgin Orbit's mission didn't do what it hoped it would do, but for us it assured that entire system does work from end to end," said Colin Macleod, head of U.K. space regulation at the CAA, in another interview.

That has helped refine the process for future applicants, of which he expects several. "We've got four potential orbital launch companies that have got plausible ambitions to launch in the next 18 months," he said.

He didn't name the companies, but at the top of the list is Germany's Rocket Factory Augsburg, which plans to carry out its first orbital launch from SaxaVord in the fall. The company is busy testing the first stage there, said Scott Hammond, SaxaVord's deputy CEO, as other components of the rocket and its payloads arrive there.

Orbex hopes to follow with the first launch of its Prime small rocket from Sutherland next year. Both the launch site and the rocket are taking shape, CEO Phillip Chambers said at Farnborough, but he was hesitant to be more specific about a launch date than some time in 2025. "But I do want it to be 2025."

Archer said that while several other sites beyond Sutherland and SaxaVord had previously expressed interest in hosting spaceports, they are unlikely to be developed. Those two spaceports are approved to host a combined 42 launches annually, "enough to see them through the next couple of decades."

"It definitely is a struggle for Spaceport Cornwall," he added, citing the lack of horizontal launch providers. But spaceport officials seem undaunted: their booth at Farnborough emphasized their desire to become a test site for hypersonic vehicles, the Virgin Orbit experience all but forgotten. **SN**

ZERO-TRUST SECURITY FOR ZERO-GRAVITY ENVIRONMENTS

Radical increases in the number and uses of satellites are ushering in an era where operators are now using third-party ground stations, splitting the roles of spacecraft, and even sharing payload operators with other entities. In this hybrid, multi-party environment, security can no longer be based on trust.

SpiderOak is proud to introduce **OrbitSecure**, an agile, secure, lightweight communications and extreme key management solution designed to bring new levels of cyber-resiliency to spacecraft and payloads operating in proliferated low-Earth orbit.

Leveraging a combination of blockchain/distributed ledger and public-private key cryptology, **OrbitSecure** is designed to bring **Zero-Trust security and resilience to Zero-Gravity environments.**

To learn more about SpiderOak and Space Cybersecurity visit us at www.spideroak.com.

SPIDEROAK | ORBITSECURE