SPACENEWS
BUSINESS | POLITICS | PERSPECTIVE
NOVEMBER 2024

Expending the Expendables

More launch companies are betting their future on reusability

+

AI TRANSFORMS GOVERNMENT CONTRACTING

Smarter, faster tools for winning bids—without losing the human touch

+

A Cleaner Future for LEO

New initiatives target the rising tide of space debris in Earth's orbit

INSIDE

- Pentagon's Mixed Signals on Innovation
- The Business Case for the Moon?
- Two Takes on the Next Four Years

XIPHOS

Low-SWaP SPACE COMUTING SOLUTIONS

UNMATCHED SIZE, COST & PERFORMANCE

- ✓ 200+ processors operated on orbit with zero board failures
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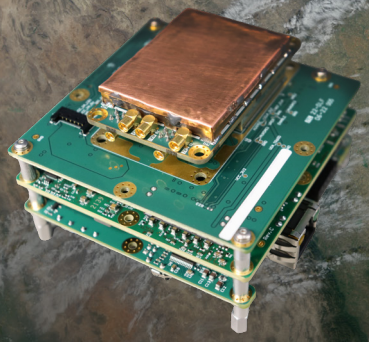
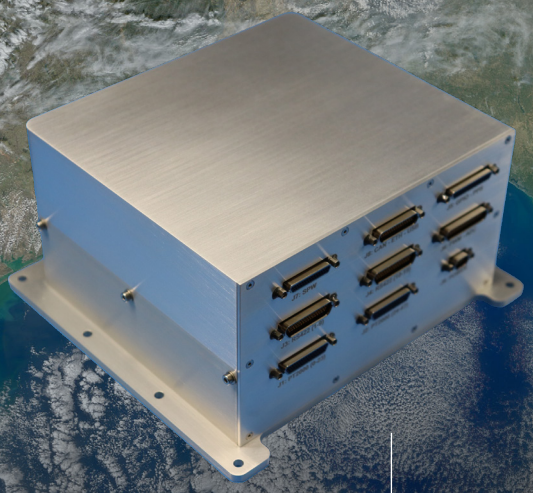




Off-the-shelf processor boards through turnkey solutions

DEPARTMENTS

03 **QUICK TAKES**

23 **COMMENTARY**
Grant Anderson
Space policy for the next president – whoever it might be

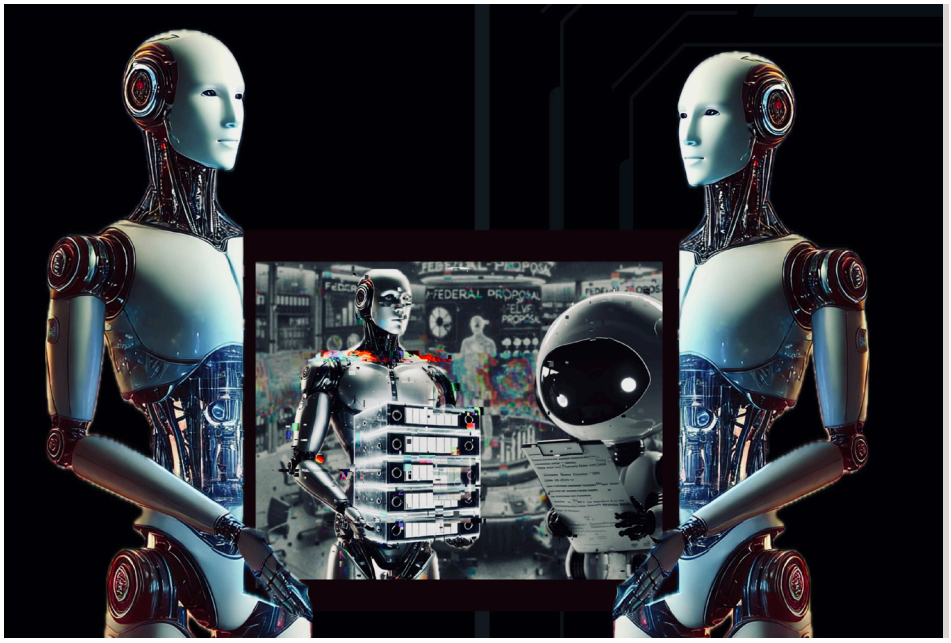
25 **COMMENTARY**
Clayton Swope and Audrey Shaffer
Looking to the next four years: Strengthening America's space leadership

27 **COMMENTARY**
Christopher Cokinos
Planning our lunar return? Get a telescope

29 **CONNECTING THE DOTS**
Jason Rainbow
More data storage, more space AI

30 **ON NATIONAL SECURITY**
Sandra Erwin
Pentagon sends mixed signals on space innovation

32 **FOUST FORWARD**
Jeff Foust
Is there a business case for the moon?



IN THIS ISSUE

In ***Improving Space AI*** (p. 7-9), Jason Rainbow highlights how software-defined satellites and AI are enabling smarter, more adaptable operations in orbit. With flexible, reprogrammable systems and new automation capabilities, satellite operators are navigating a rapidly evolving market—and preparing for an autonomous future that's closer than ever.

In ***AI Takes Aim at Tedious Tasks in Government Contracting*** (p. 10-13), Sandra Erwin reveals how artificial intelligence is reshaping the proposal-writing process for government contracts. By automating tasks that once took weeks, AI is helping aerospace and defense contractors cut bid development time by up to 70 percent. From scanning databases to drafting tailored responses, the technology offers a streamlined approach to winning business while meeting stringent security requirements.

In ***Expending the Expendables*** (p. 14-19), Jeff Foust delves into the accelerating shift toward reusability in the global launch industry. From SpaceX's latest success with Starship's booster catch to Blue Origin, Rocket Lab, and European companies racing to adopt similar practices, we examine the forces driving launch providers to rethink expendable rockets.

In ***A Cleaner Future for LEO*** (p. 20-22), Debra Werner delves into the growing efforts by public and private entities to tackle space sustainability challenges. At the recent International Astronautical Congress, leaders discussed initiatives to reduce orbital debris, including JAXA's active debris removal missions and ESA's Zero Debris Charter. Strategies range from incentive-driven measures to "name and shame" policies, shaping how low-Earth orbit is managed amid a rapid increase in satellite populations and rising calls for sustainable space practices.

COVER: A long-exposure shot shows the return of SpaceX's Super Heavy booster to the launch pad, where"chopstick" arms at the tower secure the booster in place. Credit: SpaceX ABOVE: An AI-assisted illustration about AI-assisted proposal writing. Credit: Brian Berger/SpaceNews

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SIGNIFICANT DIGITS

$250M

The losses Boeing took on its Starliner program during Q3, according to financial results released Oct. 23. This brings Boeing's total financial losses on the Starliner program to $1.85 billion. Boeing's new CEO, Kelly Ortberg, said in an earnings call that Boeing did not plan to walk away from troubled fixed-price contracts like Starliner and would instead find ways to improve performance on them.

$13B

The Defense Department's new projected spending on commercial LEO satellite internet services, a more than 14-fold increase from the $900 million ceiling for the military's Proliferated Low Earth Orbit (PLEO) Satellite-Based Services program launched in 2023.

$4.1B

The total value of the U.S. Space Force contracts awarded to Northrop Grumman for two advanced early-warning missile detection satellites, after the company was awarded a $1.8 billion contract extension Oct. 23 to begin production. These satellites are part of the military's Next-Generation Overhead Persistent Infrared (OPIR) program, a defense initiative aimed at enhancing missile threat detection from space. Northrop Grumman was awarded a $2.3 billion contract in 2020 to develop the two satellites.

$733.5M

The amount awarded to SpaceX by the U.S. Space Force's Space Systems Command in a series of contracts for nine launches, expected to occur in 2025 and 2026, under the National Security Space Launch (NSSL) Phase 3 Lane 1 program. The contracts span seven missions for the Space Development Agency and two for the National Reconnaissance Office.

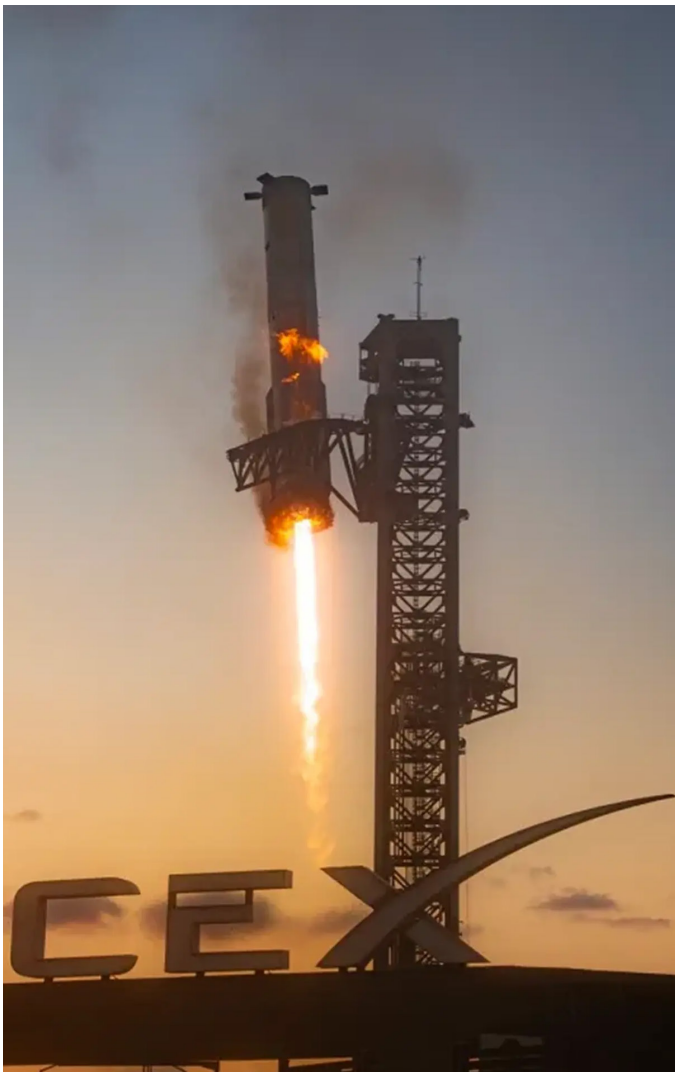
2,500

The number of jobs that Airbus' defense and space division will cut by mid-2026, the company announced Oct. 16, citing a "continued complex business environment." The move follows nearly two years of heavy losses as Airbus' defense and space division has struggled despite holding numerous government satellite contracts.

$386M

The value of a Space Force contract awarded to Millennium Space Systems for six "Epoch 1" missile-warning satellites that will operate in medium Earth orbit, according to an Oct. 23 announcement. The Space Force awarded Millennium a $509 million contract in December for an identical set of six satellites, the full set of which will carry specialized sensors for tracking both traditional ballistic missiles and newer hypersonic weapons.

SPACEX



SpaceX came within one second of aborting its attempt to catch the Super Heavy booster from its Oct. 13 Starship test flight.

CLOSE CALLS

SpaceX narrowly avoided a crash landing of its Super Heavy booster during the Oct. 13 Starship test, with the landing coming within one second of an automatic abort that would have sent the rocket crashing down next to the launch tower. A misconfigured parameter affected the rate at which engines started up for the booster's landing, and critical valves for the landing burn were exposed when a cover came off a structural feature called a chine, according to SpaceX officials. Audio of the briefing, held with Elon Musk, was made public Oct. 25 when Musk posted footage of the video game he was playing at the time to his X account.

QUICK TAKES

A new model of Blue Origin's New Shepard suborbital vehicle lifted off for the first time Oct. 23.

Blue Origin Expands Fleet with New Human-rated New Shepard and Booster

Blue Origin successfully launched and landed a new model of its New Shepard suborbital vehicle Oct. 23, marking the first flight of an upgraded, human-rated capsule — RSS Kármán Line — designed to carry space tourists. The uncrewed flight, originally delayed due to unspecified technical issues, also tested a new booster and reached a peak altitude of 102.4 kilometers. Although this was slightly lower than previous New Shepard flights, Blue Origin said the flight was "nominal and on target," demonstrating the craft's readiness for future crewed missions.

Something Borrowed, Something Blue

On the same day Blue Origin flew its latest New Shepard, Chinese start-up Deep Blue Aerospace announced plans to begin suborbital tourism flights by 2027 with its single-stage reusable Nebula-1 rocket and a capsule that looks like SpaceX's orbital Crew Dragon but is aimed at the same market as New Shepard. Deep Blue plans to complete recovery and reuse tests in 2025 and crewed flights in 2026 to prepare for commercial service. Tickets are expected to cost $210,000 per seat for flights providing six passengers with up to 10 minutes of microgravity — potentially more than double the duration New Shepard delivers, and at a lower price than Blue Origin's estimated $250,000 to $300,000 ticket price.

BLUE ORIGIN/ DEEP BLUE AEROSPACE

China's Satellite Surge Tests US Space Force in Indo-Pacific

As China continues to ramp up its satellite deployments, the U.S. Space Force faces growing pressure to expand its presence in the Indo-Pacific — a region spanning from Africa's East coast to Asia's southern and Australia's northern coasts. Brig. Gen. Anthony Mastalir, commander of U.S. Space Forces Indo-Pacific, noted a rising "demand signal" for space defense tactics, satellite services and specialized training in orbital warfare to counter China's rapid advancements. Speaking Oct. 22 at the Mitchell Institute for Aerospace Studies, Mastalir said that while the Indo-Pacific Space Force component is working to integrate space operations in the region, it lacks sufficient resources to fully meet emerging threats. China conducted 67 orbital launches in 2023, setting a national record, and is aiming for 100 launches in 2024.

EASING EXPORT CONTROLS

The U.S. Department of Commerce announced Oct. 17 that it will ease export controls for space technologies, aiming to boost the global competitiveness of American companies and facilitate sales of satellites, launch vehicles and related technologies to allied nations. One change removes licensing requirements for technologies related to remote sensing, space-based logistics and servicing spacecraft bound for the U.K., Canada and Australia. Another change allows certain "least sensitive" spacecraft components to be exported more easily to more than 40 trusted allies and partners.

In addition, the Commerce Department proposed shifting some space-related defense articles from the State Department's restrictive U.S. Munitions List to the more flexible Commerce Control List. This transfer would apply to items like spacecraft capable of autonomous collision avoidance and spacecraft capable of refueling others, with the goal of streamlining commercial exports while maintaining safeguards to prevent China, Russia and other U.S. adversaries from accessing sensitive technologies.

A Falcon Heavy lifted off Oct. 14 from the Kennedy Space Center carrying NASA's Europa Clipper spacecraft.

Europa Clipper Begins Six-Year Journey to Jupiter's Most Potentially Habitable Moon

NASA's long-awaited Europa Clipper mission, in development since 2013, began a nearly six-year journey to Jupiter's most potentially habitable moon Oct. 14, launching aboard a SpaceX Falcon Heavy rocket. Developed by NASA's Jet Propulsion Laboratory with key components from the Johns Hopkins University Applied Physics Laboratory, the $5 billion spacecraft is expected to reach Jupiter in 2030 and will conduct 49 flybys of Europa over at least four years to study the moon's icy surface and subsurface ocean. The mission's objective: determining if Europa has the right conditions to support life.

Spaceport Alliance Aims To Share Standards

Eight spaceports in six countries, ranging from established sites to early-stage projects, signed a memorandum of understanding Oct. 13 during the International Astronautical Congress in Milan. The alliance aims to share lessons learned and potentially establish international standards for launch facilities worldwide. Participating spaceports include the Mid-Atlantic Regional Spaceport (MARS) in Virginia, Pacific Spaceport Complex-Alaska, Sweden's Esrange Space Center, and others under development in the United Kingdom, Japan, Australia, and Peru. Representatives said their initial meeting will focus on key topics for collaboration to improve resilience and streamline operations across different regulatory environments. "This partnership demonstrates our collective commitment to supporting the future of spaceports and enabling a new era of growth in the space industry," said Roosevelt "Ted" Mercer, head of the Virginia Spaceport Authority.

Mid-Atlantic Regional Spaceport (MARS) on Wallops Island, Virginia, hosts launches by Northrop Grumman and Rocket Lab.

BRANDON LINDNER/ VIRGINIA SPACEPORT AUTHORITY

QUICK TAKES

Axiom Space worked with Prada on the design of a spacesuit for use on Artemis lunar missions.

Axiom x Prada

Axiom Space shared new details of its Artemis spacesuit, developed with Prada, during the International Astronautical Congress in Milan on Oct. 16. The Axiom Extravehicular Mobility Unit (AxEMU) suit, intended for NASA's Artemis 3 lunar landing in 2026, features enhanced mobility as well as greater system redundancies and health-monitoring systems than the suits worn by Apollo-era astronauts. Beyond aesthetics, Prada contributed its expertise in fabrics and garment design to the suit's outer layer, which reflects sunlight and resists lunar dust. Axiom described the design as near-final but undergoing rigorous testing to ensure readiness for both lunar and low Earth orbit missions.

SPACENEWS/J. FOUST/ VAST

Haven-2

Vast Space unveiled on Oct. 14 the designs for Haven-2, a multiple-module space station it intends to pitch to NASA as a commercially-operated successor for the International Space Station as part of NASA's Commercial LEO Destinations program.

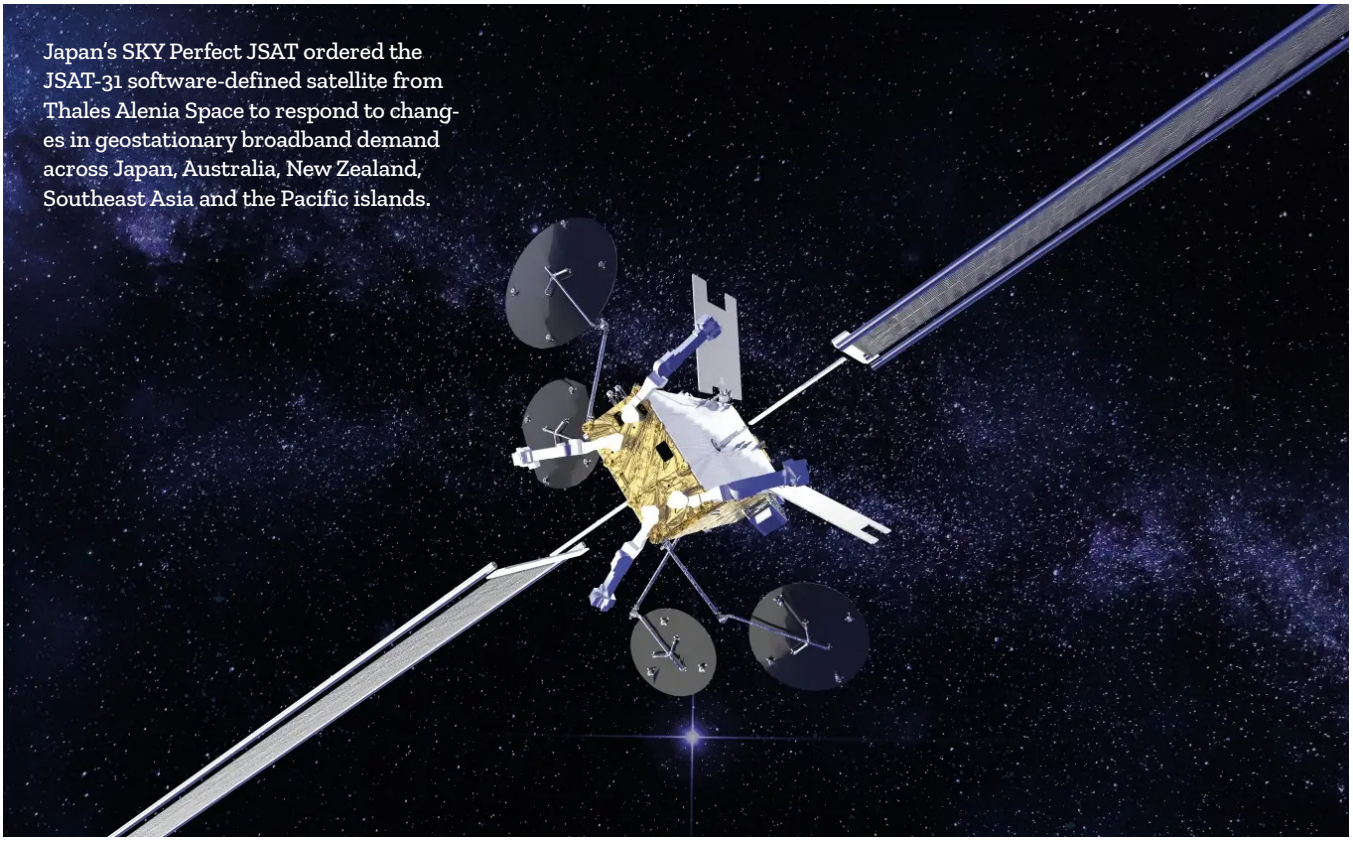
Unlike the single-module design of Haven-1, which Vast hopes to launch in 2025, Haven-2 will involve four identical modules resembling stretched-out versions of Haven-1 that would be launched into orbit beginning in 2028 so that operations can overlap with those on the ISS. In the following years, Vast would launch and link additional modules that are outfitted with scientific facilities.

Hurricanes Renew Call for Space National Guard

As October's back-to-back hurricanes in Florida and North Carolina highlighted Starlink's critical role in disaster response, advocates renewed calls for the Pentagon to establish a Space National Guard. During discussions Oct. 9 at George Washington University's Space Policy Institute, Scott Pace, the institute's director, cited Starlink's deployment during the storms as evidence of the need for a specialized space force for rapid domestic disaster response. Critics, including Pentagon and White House officials, however, argue that forming a new division would add unnecessary costs and bureaucracy, suggesting instead that Air National Guard units supporting space operations be integrated into the Space Force.

Expanding Olympic Defender

France and Germany officially joined Operation Olympic Defender, a U.S.-led initiative coalition to counter space threats such as cyberattacks, satellite jamming and anti-satellite weapons, U.S. Space Command announced Oct. 14. Formed in 2013, the coalition — which also includes Canada, the United Kingdom, Australia, and, as of September, New Zealand — coordinates space defense efforts among allies. Ceremonies in Berlin and Paris marked the entry of France and Germany, signaling deepened military space ties between the U.S. and Europe amid concerns over China and Russia's satellite-disruptive capabilities.



Japan's SKY Perfect JSAT ordered the JSAT-31 software-defined satellite from Thales Alenia Space to respond to changes in geostationary broadband demand across Japan, Australia, New Zealand, Southeast Asia and the Pacific islands.

THALES ALENIA SPACE

Improving Space AI

Ground-to-orbit efforts aim to advance satellite intelligence

AI-driven technologies are on the cusp of unlocking true autonomy in orbit, with the potential to enable spacecraft to operate independently and deliver more customized, intelligently managed data to Earth.

Terrestrial networks will also need to become more intelligent to handle the satellite communications market's unprecedented expansion, driven by cheaper satellite bandwidth and smaller, more user-friendly terminals.

JASON RAINBOW

SOFTWARE-DEFINED REVOLUTION

The advent of flexible satellites with software-defined payloads over the last decade laid the foundations for bringing intelligence to orbit. A satellite's capabilities no longer have to be locked in at launch, with fixed beam patterns and power levels targeting specific regions.

"The beam pattern was designed before launch, usually in the shape of one or more continents, with set power levels per beam," said Quilty Analytics analyst Caleb Henry.

"If a new customer emerged outside of that footprint, that's too bad. Or if a new customer emerged inside that footprint, but the beam was already saturated, that's also too bad."

Software-defined satellites, which can be reprogrammed on the fly, now make up a growing share of spacecraft orders, primarily from geostationary operators looking for flexibility to adapt as low Earth orbit (LEO) constellations, such as OneWeb and Starlink, reshape the market.

However, software-defined satellites vary widely in their flexibility.

At the basic level, there's simple coverage redefinition, such as steering beams without altering their shape or capacity, said Nathan de Ruiter, managing director of Novaspace (formerly Euroconsult).

On the other end of the scale, full in-orbit reconfigurability includes the ability to adjust beam power and modify the radio waves used for

Technical Glossary

Artificial Intelligence (AI): The simulation of human intelligence by machines, enabling them to make decisions, solve problems, and perform tasks autonomously. In the satellite industry, AI can help streamline operations, manage complex network systems, and improve data processing.

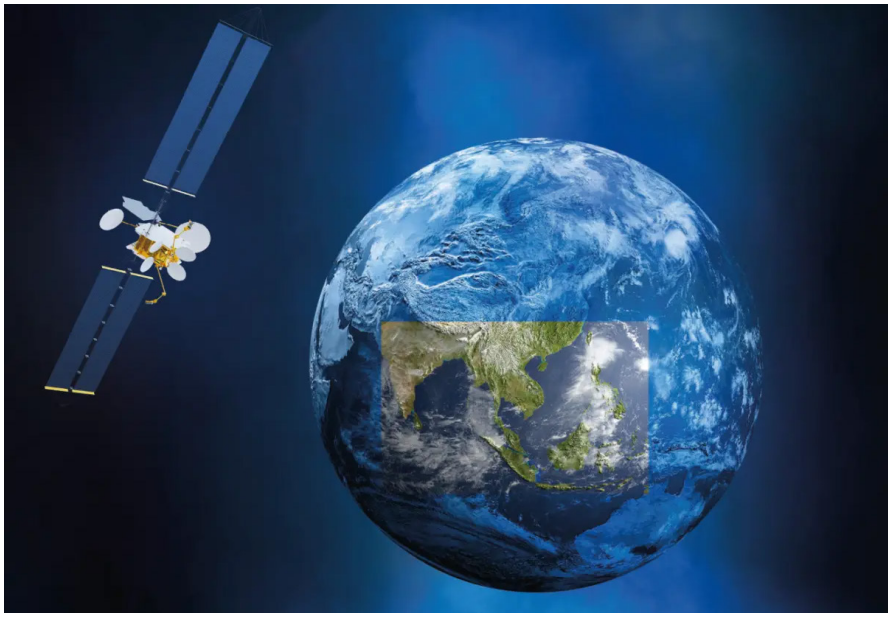
Machine Learning (ML): A type of artificial intelligence that enables computers to learn and improve from experience without explicit programming. In space applications, ML can analyze data patterns to make predictions or optimize satellite performance based on real-time conditions.

Predictive analytics: The use of data, statistical algorithms, and machine learning to identify the likelihood of future outcomes. In satellite networks, predictive analytics can help forecast potential issues, enabling proactive maintenance and improved reliability.

Software-defined Satellite: A satellite with a flexible payload that can be reprogrammed after launch. Unlike traditional satellites with fixed configurations, software-defined satellites can adjust parameters such as beam shape, power levels, and frequencies in response to changing

Beam pattern: The specific direction and area covered by a satellite's signal. Traditional satellites have fixed beam patterns, while software-defined spacecraft can adjust these patterns to match evolving demand.

Telemetry data: Data that is collected and transmitted by a satellite to monitor its health, performance, and operational status. This information is critical for maintaining optimal function throughout a satellite's lifecycle.



AIRBUS

Above: Thai operator Thaicom agreed a deal to lease half Thaicom-10's Ku-band broadband capacity to Eutelsat of France ahead of deploying the Airbus-built software-defined geostationary satellite in 2027.

communications.

Airbus Onesat, Thales Inspire, and MDA's Aurora platforms meet the strictest definition of fully software-defined satellites, he added, though none ordered to date are expected to launch before 2026.

This timeline poses an obstacle for fully integrating advanced AI, noted Stuart Daughtridge, vice president of advanced technology at Kratos, which is providing the ground system for Thaicom's first software-defined satellite, based on the Onesat platform and due to launch in 2027.

"To implement AI, you must already have a system and training data to be able to implement it," Daughtridge said. "So since these [fully software-defined satellites really aren't deployed yet, you can look at how you would implement the AI … you could do it with some simulated data, but you really can't deploy it at any scale until you have systems up and running, and can get real data to ensure training."

However, Daughtridge anticipates rapid AI development in orbit once more flexible software-defined satellites are launched, particularly to help manage the influx of available capacity.

"[I]f I've got to manage massive amounts more capacity, I need more automation," he said, "and as soon as you start talking automation, you start talking AI."

Software-defined satellites >

"Software-defined satellites ultimately help operators reduce total service delivery costs by increasing efficiency." – Cynthia Harty, senior vice president of corporate development at ST Engineering iDirect.

Above: Satellites launching in mid-2026 for Telesat's Lightspeed constellation in low Earth orbit are set to be the first to use MDA Space's software-defined Aurora platform in orbit.

"If I've got to manage massive amounts more capacity, I need more automation."
– Stuart Daughtridge, vice president of advanced technology at Kratos.

< > also require a more coordinated ground system to match their flexibility, Daughtridge added, with AI aiding in the management of satellite and terrestrial communications as a unified network.

HANDS OFF THE STEERING WHEEL

Today's data and technology make it possible to leverage AI to control satellites in orbit, streamlining operations and reducing complexity for ground crews.

Canadian software startup Mission Control recently announced plans to test long-term spacecraft autonomy in partnership with Spire, which is providing a small satellite for a mission of at least a year to evaluate machine learning (ML) capabilities.

The payload, scheduled to launch no earlier than 2025, will include AI-powered software primarily to analyze imagery data from the satellite's onboard cameras.

Notably, Mission Control's software will also analyze the spacecraft's telemetry data, using AI to monitor the satellite's health and ensure consistent performance throughout its operational lifetime.

"For a space exploration mission, there is limited data to train ML models before flight," said Michele Faragalli, Mission Control's chief technology officer.

"This means that the flight conditions might be completely different than the training conditions for such missions [so] re-training the model and updating it in flight, using data collected in-situ is an important step to ensure the ML model is performing as intended."

The issue isn't limited to space exploration. Spacecraft performance can degrade over time, and anomalies or unforeseen circumstances may arise due to changes in onboard performance or the environment.

GETTING MORE OUT OF GEO

Static beams from a non-software-defined geostationary satellite may illuminate an area at peak performance for 16 hours a day but leave capacity underutilized at night, affecting the operator's cost per megabit.

Software-defined satellites ultimately help operators reduce total service delivery costs by increasing efficiency, said Cynthia Harty, senior vice president of corporate development at ground network specialist ST Engineering iDirect.

"And the ability to do that is all based upon this flexibility and utilizing those software-defined satellites as optimally as possible," Harty said.

ST Engineering iDirect plans to release a software-defined ground system in September 2025 that would be capable of leveraging AI to assist network management tasks.

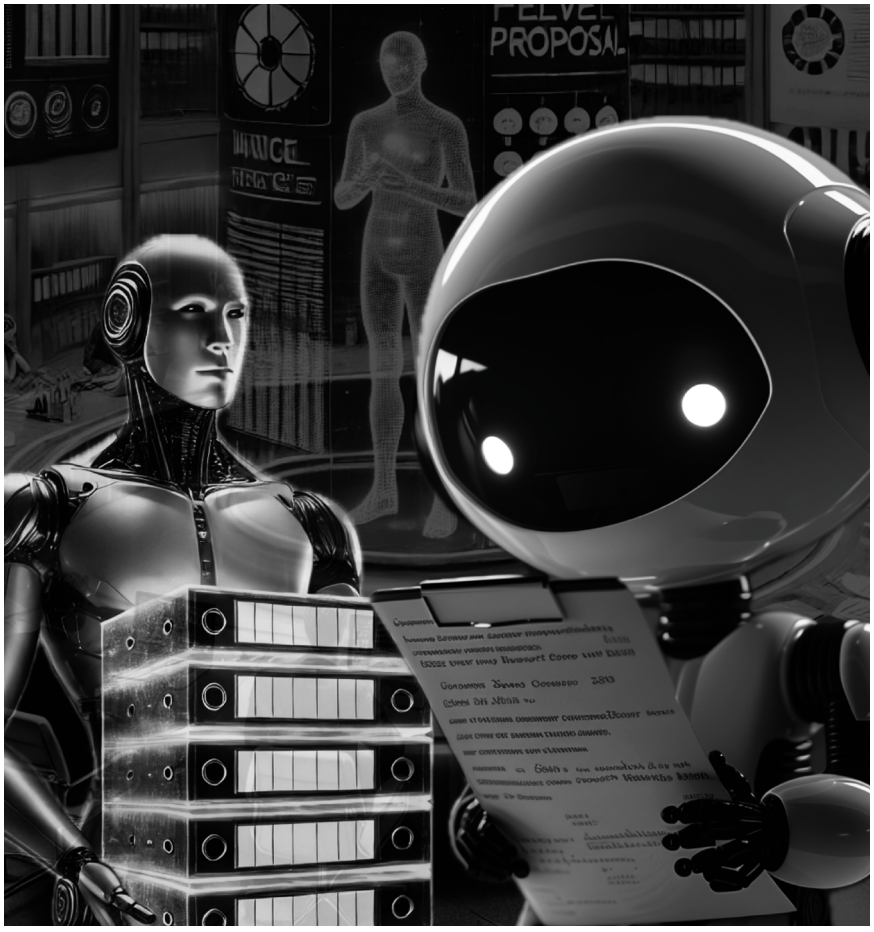
However, while outsourcing network management to AI could significantly boost efficiency, operators are generally hesitant to fully embrace these tools due to concerns over reliability and trust.

"Day one, we are not advocating automagically letting these two [ground and space network] systems just run unabated," Harty said.

She envisions a "natural evolution where there are several use cases that are tested, tested again, and tested again before an operator is willing to flip that switch and have it be truly automatic and let the two systems talk together."

In the meantime, she said ST Engineering iDirect is researching several anomaly detection algorithms for monitoring its ground networks, which could inform predictive analytics to protect against potent issues. SN

TELESAT



AI-ASSISTED DIGITAL ILLUSTRATION BY BRIAN BERGER FOR SPACENEWS

AI takes aim at tedious tasks in government contracting

Proposal writing AI isn't your average chatbot assistant

Pursuing government contracts demands procurement specialists spend weeks methodically combing through databases and documents, all while racing against unforgiving deadlines.

SANDRA ERWIN

Today, that scene is rapidly changing as artificial intelligence transforms this traditionally manual process, offering new tools that can slash proposal writing time by up to 70%.

The adoption of AI is reshaping how companies develop their government bids, said Joe Schurman, a partner and principal at PricewaterhouseCoopers (PwC) who leads AI services for the company's aerospace and defense sector and co-leads the firm's U.S. space program

From identifying opportunities to drafting complex technical responses, he says, AI is streamlining nearly every aspect of the government contracting process.

PwC, in April 2023, announced a $1 billion investment to expand and scale its global AI offerings. It has created specific AI solutions for aerospace and defense, including flight sciences and engineering design AI and PartsGPTs. "But AI for proposal writing is the most often requested application in our practice," Schurman told SpaceNews.

These aren't your typical chatbots. The newer generation of AI tools is specifically designed to navigate the complex world of government contracting, where security protocols are strict and the stakes are high, as a single proposal can make or break a company's fiscal year.

BEYOND BASIC AUTOMATION

The technology goes far beyond simple document processing. Modern AI systems can scan vast databases of government solicitations on SAM.gov (the official U.S. government procurement portal) to identify contracts that align with a company's capabilities. They can break down complex Requests for Proposals (RFPs) into manageable tasks, and even help draft proposals highlighting a company's strengths — all while ensuring compliance with stringent government regulations.

For niche contractors in the space industry, for example, AI's ability to precisely target relevant opportunities eliminates countless hours of manual searching through federal databases, says Schurman. "It can be difficult for a commercial space company to figure out what Space

"It can be difficult for a commercial space company to figure out what Space Force contract to bid on, this technology helps them avoid wasting time chasing mismatched opportunities and focus specifically on their sweet spot." - Joe Schurman, a partner and principal at PricewaterhouseCoopers

Force contract to bid on," he explained. "This technology helps them avoid wasting time chasing mismatched opportunities and focus specifically on their sweet spot."

TRANSFORMING THE PROPOSAL PROCESS

The traditional response process to government RFPs has long been resource-intensive. Teams of writers, subject matter experts and compliance officers typically spend weeks parsing through hundreds of pages of requirements, ensuring every specification is met and every question answered. Some RFPs can have deadlines as short as 30 days, putting pressure on companies to deliver comprehensive proposals quickly.

"Now they cut the time down by at least 60 to 70% in removing those remedial tasks, and then leveraging these tools as accelerators to help them respond," Schurman said. The AI systems can automatically summarize entire RFPs, break them down into actionable items, and automate proposal responses.

One particularly powerful application is the ability to process massive government regulation documents. In discussions with a satellite provider, for example, PwC provided a proof of concept leveraging generative AI to better understand NASA's certification requirements, Schurman said AI not only broke down the gigantic set of documents but also helped prioritize which requirements needed to be completed first.

HUMAN ELEMENT REMAINS CRITICAL

Despite the efficiency gains, industry experts emphasize that AI isn't replacing human expertise. "Our stance as a firm is that AI is not a replacement tool. It's an acceleration tool," Schurman said. "You want your company's individuals and experts with that level of intellect and passion for the project to infuse their human-based creativity into a proposal response, but leverage generative AI services to remove the human-latent steps from the process."

This view is echoed by Sean Williams, co-founder and CEO of AutogenAI, a London-based startup that is expanding its AI-powered proposal writing services in the United States.

"Humans are much better at understanding logical context and the nuance of an argument," Williams said in an interview. "The AI generates ideas, but humans structure the response."

SECURITY COMPLIANCE

One of the biggest challenges in bringing AI into government contracting has been ensuring data security compliance. Commercial AI tools like ChatGPT are not permitted on the secure government cloud environments required for defense contractors. So any AI tools have to be built on authorized platforms.

Schurman said PwC's solution leverages Microsoft Azure OpenAI, one of the platforms approved for handling DoD proposal data that adheres to strict Pentagon and International Traffic in Arms Regulations (ITAR) security standards.

Amazon Web Services, Google Cloud and Oracle Cloud also have recently been authorized to host sensitive DoD workloads.

Cloud systems must meet DoD security requirements, known as "impact levels," which range from level 2 for public information to level 5 for highly sensitive mission-critical data. "To have these capabilities finally operating at DoD impact levels 4 and 5, and even at classified level, it's awesome," Schurman said. "You're going to see some huge breakthroughs."

The demand for AI-powered proposal development and writing tools has attracted some venture investment. AutogenAI's recent $39.5 million Series B funding round, co-led by Salesforce Ventures and Spark Capital, brings its total venture investments to $65.3 million.

It's becoming clear that this technology is poised to transform the time-consuming and highly complex bidding process, said Nowi Kallen, managing director of AI at Salesforce Ventures.

THE MILITARY'S PERSPECTIVE

The military itself is cautiously embracing AI in its procurement processes. Col. Heather Bogstie, who oversees space systems integration at the Space Force's Space Systems Command, points to the Department of the Air Force's recent rollout of NIPR-GPT, a generative AI program for use on the not-classified internet protocol router (NIPR) secure military network.

"It allows for more adoption and advocacy for using AI, and takes a lot of the stigma away," Bogstie said during >

The military aims to eventually use AI in evaluating industry proposals, which is currently an entirely manual process.

AI-ASSISTED DIGITAL ILLUSTRATION BY BRIAN BERGER FOR SPACENEWS

< > the recent MilSat Symposium in Mountain View, California.

The military aims to eventually use AI to evaluate industry proposals, which is currently an entirely manual process. "We would like to see more of it being used in the acquisition life cycle to help us with source selections, tech evaluations, proposals, RFPs, things of that nature so that we can speed up our business day-to-day jobs," Bogstie added.

AI LEARNS GOVERNMENT LEXICON

Some companies are already seeing benefits from AI adoption. Aalyria, a space communications technology firm spun out from Google's parent company Alphabet, uses large language models to tailor proposals to specific agencies' technical vernacular.

"In our industry, there's often like 10 different jargon words to say the same thing," explained Brian Barritt, Aalyria's chief technology officer. "We're finding AI is really helpful to support proposal response by training it on past writings and having it respond in the right language that the government expects."

The company has developed a system that can be trained on previously written proposals and agency-specific terminology, ensuring new submissions match the expected language and format. This attention to linguistic detail can be crucial in government contracting, where precise terminology can make the difference between winning and losing a bid.

FUTURE PROSPECTS AND CHALLENGES

There is still no concrete data on whether AI-assisted proposals win more contracts, said Williams, of AutogenAI. However, early feedback suggests that the technology is delivering results. "It's probably going to take us another 12 months of this to get the government procurements coming through, where we start to have a hard evidence base," he said, "But the early signs, the early anecdotal data, are very positive."

The technology continues to evolve rapidly. PwC's Schurman, however, emphasizes the continued importance of human oversight.

AI hallucinations are common, he explained. "So there always needs to be a human to handshake the AI, to meet the required levels of quality and compliance. The relationship between AI and humans, especially in aerospace and defense, is a delicate one. The balance of responsibility will shift as all relationships do. What we want to avoid is a one-sided one."

As more companies adopt these tools and the technology matures, he predicts the government contracting landscape may look very different in the future. AI can accelerate and enhance the proposal process, but human judgment remains essential in the business of government contracts. **SN**

WHITE HOUSE PUSHES DEFENSE AGENCIES TO ACCELERATE AI ADOPTION

The White House is urging defense and intelligence agencies to embrace artificial intelligence (AI) technologies to maintain a strategic advantage over global competitors like China.

President Biden issued a national security memorandum Oct. 24 that calls on the DoD and the intelligence community to integrate AI more swiftly into their operations. This directive is part of a larger strategy to sharpen U.S. technological and military competitiveness, though entrenched bureaucratic obstacles and cybersecurity demands threaten to slow progress.

The memorandum mandates the creation of a working group within 30 days to streamline the process of acquiring AI tools and establish guidelines for their use in national security applications. It signals a heightened urgency to leverage advancements in AI for defense purposes, specifically in areas such as data analysis, autonomous systems and threat detection. However, the administration remains cautious, emphasizing the importance of addressing inherent risks in AI deployment, including issues of safety, privacy and potential over-reliance on automation.

The Pentagon's AI efforts are managed by the Chief Digital and Artificial Intelligence Office (CDAO). Last November, the CDAO updated its approach to integrating AI, focusing on utilizing data and analytics to enhance operational effectiveness. Despite these advancements, AI adoption within the DoD has lagged, largely due to complex internal bureaucratic and security processes.

One of the most prominent AI projects in the DoD's portfolio is Project Maven, led by the National Geospatial-Intelligence Agency (NGA). Project Maven uses AI-driven algorithms to process massive volumes of video and satellite data, identifying personnel, vehicles and objects in near real-time — capabilities that would otherwise require hours of human analysis. This data can be critical in surveillance and tactical decision-making, but the program has faced recurring obstacles related to the DoD's intricate network infrastructure and security protocols.

Another AI initiative, the U.S. Army's Tactical Intelligence Targeting Access Node (TITAN), integrates data from ground, air and space sources to recognize and assess targets autonomously.

However, experts caution that the potential of AI is constrained by the DoD's fragmented data architecture, which is unprepared for the complexities AI brings.

In a recent report, Gregory Allen, who heads the Wadhwani Center for AI and Advanced Technologies at CSIS, pointed to the Defense Department's labyrinthine network infrastructure as a critical chokepoint for AI innovation. The challenge stems from navigating a complex web of 15,000 classified and unclassified networks spread across 46 DoD components, all safeguarded by 23 cyber security service providers.

A process known as Authority to Operate (ATO) — the Pentagon's security clearance system for software — typically takes six to 18 months, creating a barrier for program managers looking to develop and deploy AI systems.

The procedural gridlock is compounded by a risk-averse culture among authorizing officials. "It's much easier to damage your career by wrongly saying 'yes' to an ATO request than by wrongly saying 'no,'" a defense official told CSIS.

While the Pentagon's careful approach to cybersecurity is understandable given constant threats to its networks, Allen argued the current framework is hampering the DOD's ability to keep pace with rapid advancements in AI technology.

The stark assessment comes as China and other competitors race to integrate AI into their military operations, raising the stakes for U.S. efforts to maintain its technological edge. The 2022 National Defense Strategy explicitly highlighted this challenge, warning that adversaries are actively pursuing AI for military advantage. **SN**

SANDRA ERWIN

SPACEX

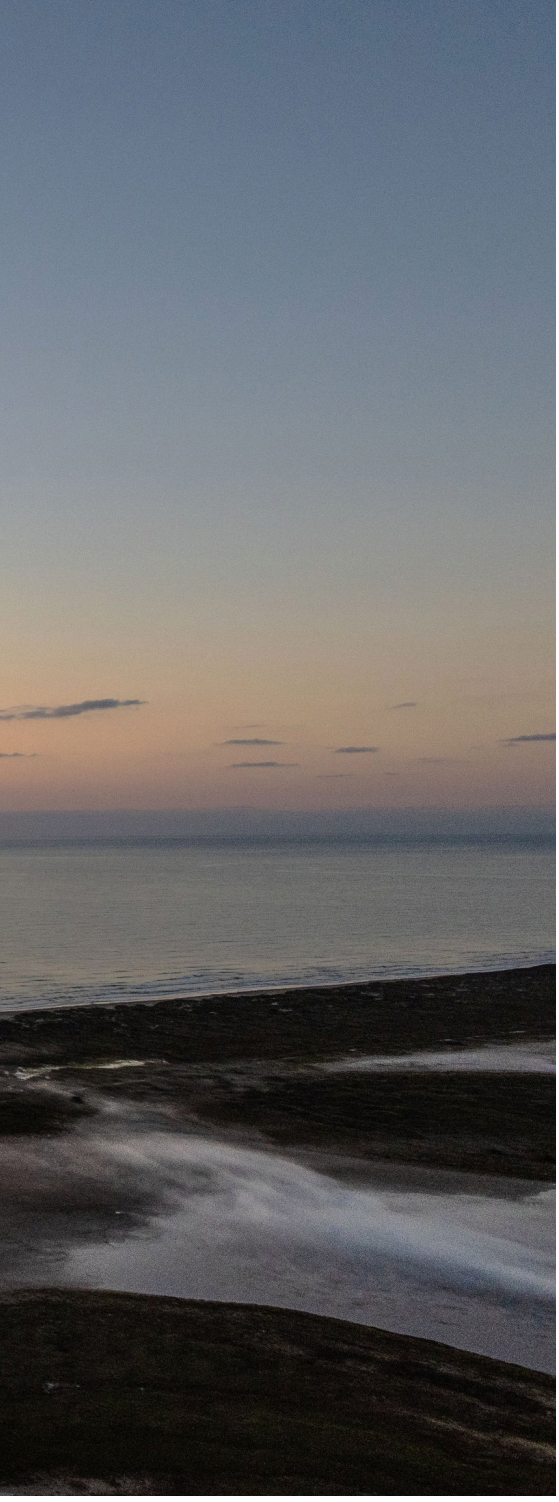
Expending the Expendables

More launch companies are betting their future on reusability

Almost no one thought SpaceX would make the catch, at least not on the first try.

On the fifth integrated test flight of Starship, launched Oct. 13 from the company's Boca Chica, Texas, site, the Super Heavy booster aimed to fly back to the launch tower, where massive mechanical arms — dubbed "chopsticks" — would grapple it. So many

JEFF FOUST



EXPENDING THE EXPENDABLES

Left: A long-exposure shot captures the return of SpaceX's Super Heavy booster to the launch pad, where mechanical "chopstick" arms at the tower secure the booster in place.

things could go wrong that most expected failure, much like SpaceX's early attempts to land Falcon 9 boosters a decade ago.

Inside the company, though, there was confidence. At a National Academies committee meeting just four days before the launch, Bill Gerstenmaier, SpaceX's vice president of build and flight reliability, noted that on the previous test flight in June, the Super Heavy booster "landed" with pinpoint accuracy — within half a centimeter of a target in the Gulf of Mexico. "So, we think we have a reasonable chance to go back to the tower."

That confidence was justified. On the Oct. 13 flight, the Super Heavy booster flew back to the same launch tower it lifted off from just minutes earlier. The chopsticks moved into position, cradling the booster. The catch worked.

That achievement is critical to SpaceX's plans to rapidly reuse Starship. In the company's long-term vision, Super Heavy boosters will return to the launch pad, and have a new Starship upper stage attached, and be ready for the next launch just days — or even hours — later.

The success of that catch illustrates the future of space access: not just SpaceX's unique approach with Starship, but a broader vision of vehicles reused rapidly and frequently. SpaceX is already proving this with Falcon 9, whose boosters have been reused more than 20 times, but Starship aims to push reusability even further. Other companies and countries are realizing that to keep pace with SpaceX, they too must embrace reusability, and fast.

"REUSABILITY IS MANDATORY"

At recent conferences from Milan to Mountain View, leaders of space agencies and companies have made it clear that the future of space access won't rely on expendable launch vehicles but on those that are at least partially reusable.

"I think all of you realize that reusability is mandatory for launchers," said S. Somanath, chairman of the Indian space agency ISRO, during a head-of-agencies plenary at the International Astronautical Congress (IAC) in Milan, held the day after the latest Starship flight.

He explained that the push for reusability is driven by the need to lower launch costs. "Access to space has to be affordable for us to expand the space program."

His comments came a month after the Indian government formally approved ISRO's Next Generation Launch Vehicle (NGLV) project to develop a reusable rocket. Designed to carry up to 30 tons to low Earth orbit — three times the capacity of India's largest current rocket, the LVM3 — it will do so at a cost just 50% higher than LVM3.

That cost savings will come from a reusable booster with a throttlable engine using liquid oxygen and methane propellants to enable powered landings, he said. Engine development will drive the NGLV schedule, with a first test flight projected in about six years.

The following week, at the Satellite Innovation conference in Mountain View, California, an industry executive echoed this view on the importance of reusability.

"If you don't have a reusable launch vehicle, I don't think you have a future as a launch company," said Adam Spice, chief financial officer of Rocket Lab, speaking on a panel with other launch executives. "Expendable rockets really don't have a path."

Rocket Lab has experimented with reusability on its Electron rocket, recovering stages and testing them. >

"If you don't have a reusable launch vehicle, I don't think you have a future as a launch company." — Adam Spice, CFO of Rocket Lab

Right: The New Glenn first stage en route to Cape Canaveral Launch Complex 36, carried atop a repurposed U.S. Army tank transporter.

< > While it has yet to refly a full Electron booster, it did reuse an engine. Reusability, however, is central to the company's larger Neutron rocket, with a first launch projected in 2025.

Others are following similar paths, developing reusable first stages like the Falcon 9. Among them is Blue Origin, with its much larger New Glenn rocket, slated for an inaugural launch by year's end. The company aims to land the first stage on a ship in the ocean on the first try.

"No one has landed a reusable booster on the first try. Yet, we're going for it, and humbly submit having good confidence in landing it," Dave Limp, chief executive of Blue Origin, said in a September social media post unveiling the name of the first New Glenn booster: "So You're Telling Me There's a Chance."

"For this first launch, I have two primary objectives: get to orbit and land the booster," said Jarrett Jones, senior vice president for New Glenn at Blue Origin, during a World Space Business Week panel in mid-September. "It's super-critical because we have to get that down pat and then get our reusability and then get to rate. We can't wait on it in 2025."

Stoke Space is going a step further, designing a two-stage vehicle where both stages are intended to be reused, similar to SpaceX's ultimate vision for Starship.

"If you look at the flight rate limiter for SpaceX," said Devon Papandrew, Stoke's vice president of business development, "it's production of the second stage." While SpaceX can reuse the Falcon 9 booster 20 or more times, each launch still requires a new second stage.

"Our thesis — or at least one of the ways that you can compete with >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EXPENDING THE EXPENDABLES

< > SpaceX in the long run — is full reusability," he said on the Satellite Innovation panel. This approach shifts space transportation from high manufacturing demands to challenges of operations and logistics. "You're getting your entire vehicle back, refitting it, refurbishing it, refueling it, and flying it again."

EUROPEAN REUSABILITY DREAMS

In Europe, the reaction to Starship was mixed. Josef Aschbacher, director general of the European Space Agency, acknowledged at IAC the technical achievement of the latest Starship test flight, stating, "I then have to think, what does it mean for Europe, and to see what would be the change in the landscape and the ecosystem, and what do we need to do."

Some in Europe's space industry view Starship as a sign of how far behind they are compared to SpaceX. Rocket Factory Augsburg, a German developer of small launch vehicles, stated the day after Starship's flight, "It shows and confirms that Europe has completely lost touch. Can it still catch up? No chance. At least not the way things are going at the moment."

Critics note that Europe's Ariane 6 was developed before SpaceX demonstrated the feasibility and benefits of reusability, and there are no plans to retrofit the rocket for reuse. However, private efforts in Europe are emerging to develop reusable launchers. For instance, MaiaSpace, a startup spun out of ArianeGroup, is working on a small launch vehicle with a booster designed for vertical landing and reuse, similar to SpaceX's Falcon 9.

Another European company with grander reusability ambitions is PLD Space. At an Oct. 7 event marking the first anniversary of its Miura 1 suborbital launch, the Spanish startup outlined a decade-long roadmap of vehicle projects, beginning with its Miura 5 small launch vehicle.

Above: PLD Space's Miura Next Super Heavy rocket would feature four side boosters making simultaneous landings back at the launch site.

PLD Space aims to recover and reuse Miura 5's first stage. Initially, the company considered parachutes and an ocean splashdown — the same approach Rocket Lab has pursued with its Electron — but now plans to pursue propulsive landings similar to those of Falcon 9.

"If you see an airplane from Boeing or an airplane from Airbus, the way of landing is the same," Raúl Torres, chief executive of PLD Space, said in an interview. "We reached the conclusion that the only way to make a stage reusable is bringing it back in the same fashion that SpaceX or Blue Origin is doing."

Miura 5 is scheduled to begin launches in 2025 from French Guiana, with reusability to be gradually incorporated, flying reused boosters no earlier than 2028. PLD Space projects that reusability will double the profitability of the rocket but did not disclose the impact on payload performance.

PLD Space plans to extend reusability to a line of larger rockets called Miura Next. The baseline model would be a medium-class rocket with a booster capable of landing back at the launch site or on a downrange ship. One variant, Miura Next Heavy, will add two, similar to Falcon Heavy,

PLD SPACE

"Reusability is mandatory for launchers." — S. Somanath, Chairman of ISRO

while the Miura Next Super Heavy will include two more.

While the Miura Next vehicles can fly in expendable mode to maximize its payload capacity, the company plans to recover the booster on most missions, with the side boosters returning to the launch site. At its event, PLD Space presented an animation showing four side boosters from a Miura Next Super Heavy rocket making simultaneous landings.

Reusability, Torres said, is essential to the company's goals for both environmental sustainability and cost reduction. "If we can't bring it back," he said, pointing to an image of the four simultaneous landings, "this image is just a dream."

ULA GETS SMART

United Launch Alliance has adopted a different approach to reusability. The company contends that its Vulcan rocket's design — a "high-energy" booster that flies most of the way to orbit before stage separation — makes it infeasible to land it. Instead, it offered an alternative called Sensible Modular Autonomous Return Technology (SMART), which would recover only the engine section for reuse. That would be more technically feasible, it argued, while recovering the most valuable part of the booster.

As it worked on getting Vulcan to the launch pad, the company did not emphasize SMART reuse much. With Vulcan finally flying, however, ULA is spending more time talking about its plans to recover and reuse the engine section of the Vulcan booster.

In a briefing before Vulcan's Oct. 4 Cert-2 launch, ULA CEO Tory Bruno reported progress on SMART reuse, including a preliminary design review of the system early in the year. A key element of the project is an inflatable heat shield designed to decelerate the engine section from hypersonic speeds post-separation. This technology builds upon NASA's Low-Earth Orbit Flight Test of an Inflatable Decelerator (LOFTID), which successfully demonstrated a smaller-scale version during a November 2022 Atlas launch.

"For this first launch, I have two primary objectives: get to orbit and land the booster." — Jarrett Jones, SVP for New Glenn, Blue Origin

Bruno said ULA is on track to complete a critical design review of the recovery system by the end of the year. "Then we start manufacturing flight hardware," he said. "There's still more testing of that actual flight hardware before we fly it, but we would be probably, I would say, another one to two years away from the first flight."

He said the company would take an incremental approach to engine recovery and reuse. The first test on ensuring the engine section can cleanly separate from the booster. Only then will ULA test the inflatable decelerator, which Bruno noted would also serve as an "excellent raft" after a parachute-aided splashdown. ULA will collaborate with Blue Origin to examine the recovered BE-4 engines, though they won't be reused immediately.

"We may do that a couple of times until we feel really comfortable," he said of those recovery tests, before reusing the engines. Eventually he said the company will do the engine refurbishment and reinstallation work at Cape Canaveral. "That's a ways down the road, and I don't know exactly when that will happen."

REDUCED REUSE

While the launch industry is rapidly trending toward at least partial reuse, not everyone is on the reusability bandwagon just yet.

"I don't think reusability per se will equal survival," said Giulio Ranzo, chief executive of Italian launch vehicle company Avio, at the Satellite Innovation conference. His company makes the Vega C, a small solid-fuel rocket, with no plans to incorporate reusability.

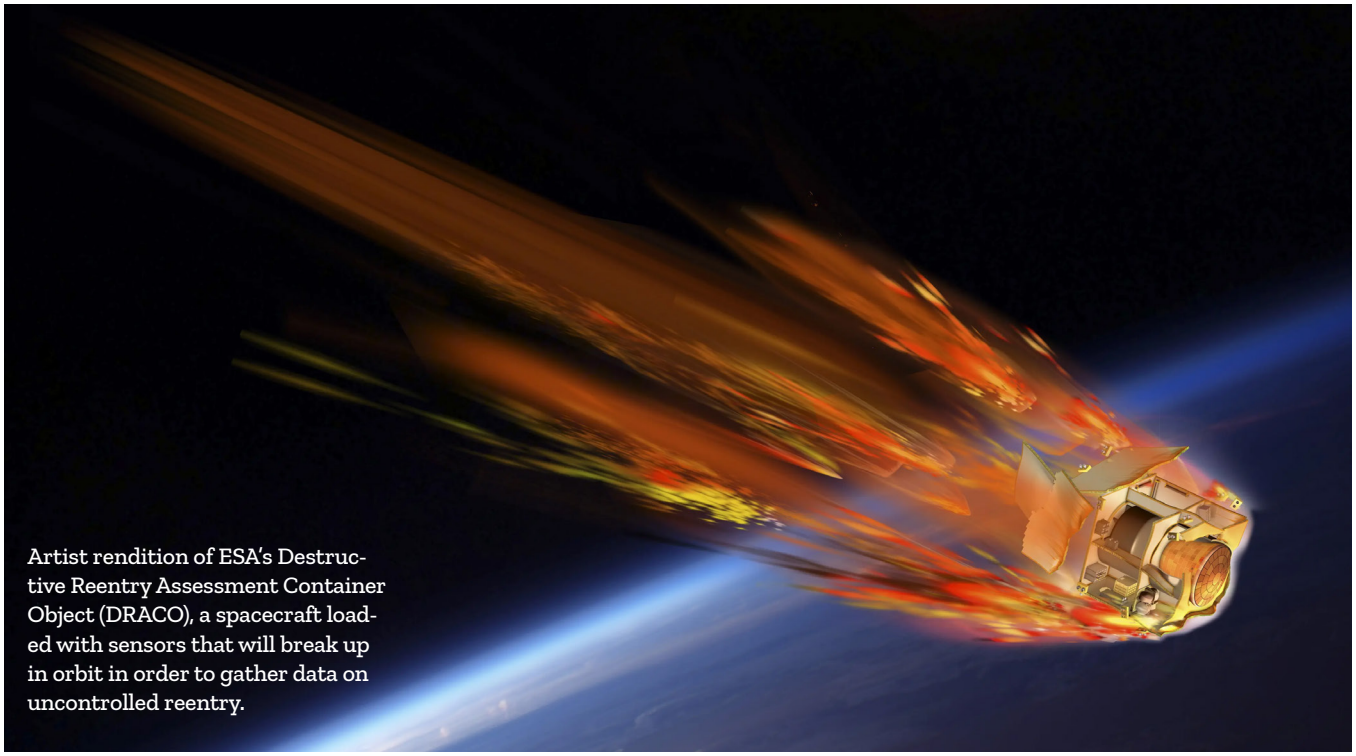
He argued that a key factor driving reusability is the high launch cadence it enables. For SpaceX, he noted, this is critical because of its large customer base in the U.S. government and its own Starlink constellation. "If you live in a part of the world with no such anchor customer, I don't know what you are going to do that cadence," he said.

He noted Avio is developing technologies — such as a rocket engine using liquid oxygen and methane propellants — that could support future reusable vehicles. "I think that cadence needs to be rightsized to the size of the market that you can actually reach," he said, "otherwise, you're going to do pretty much nothing with it."

Rocket Lab initially pursued reusability to boost Electron's launch rate without expanding its factory. However, demand has not met expectations: the company once projected 22 Electron launches this year but had only completed 11 through October.

"We're still working on the timing of introducing the reusable booster," said Spice, Rocket Lab's chief financial officer regarding the company's plans for Electron. He added that the company is prioritizing work on Neutron.

Reusability can even take a back seat at SpaceX. The day after the Starship test flight, the company launched a Falcon Heavy rocket carrying NASA's Europa Clipper mission. The demands of that Jupiter-bound spacecraft meant that SpaceX expended all three booster cores on that Falcon Heavy rocket to maximize performance. That, however, has increasingly become the exception to the rule. **SN**



Artist rendition of ESA's Destructive Reentry Assessment Container Object (DRACO), a spacecraft loaded with sensors that will break up in orbit in order to gather data on uncontrolled reentry.

ESA/D. DUCROS

A Cleaner Future for LEO

Space sustainability is attracting far more attention than in previous decades.

"Historically, just getting people to think about it has been a problem," said Marlon Sorge, executive director of the Aerospace Corp. Center for Orbital and Reentry Debris Studies. "As challenging as it is keeping track of what everybody's doing now, at least they're doing something."

Much of the increase in activity in low-Earth orbit, from 900 operational satellites in 2019 to about 10,000 today, has been driven by a single company: SpaceX.

DEBRA WERNER

"From an economics perspective, many of the risks are internalized to that company," said Jamie Morin, Aerospace Corp. vice president of defense strategic space. "We're about to go through a period where low-Earth orbit gets much more complex with probably two or three big [People's Republic of China] constellations, at least one more U.S. big constellation, possibly some European big constellations and maybe even some African big constellations."

Since no international agency oversees space traffic management, public and private organizations are devising their own sustainability strategies. Many were shared through papers and panel discussions at the International Astronautical Congress (IAC) in Milan in October, where the theme was Responsible Space for Sustainability.

DE FACTO STANDARD

Japan's Aerospace Exploration Agency JAXA is funding active debris removal.

Under a 12 billion yen ($78 million) JAXA contract awarded in August, Tokyo-based Astroscale is preparing to send a robotic spacecraft to low-Earth orbit in 2028 to grab the defunct H-2A upper stage that the company inspected during a precursor mission over the summer. The goal is to reach the rocket body and pull it into the atmosphere.

The Active Debris Removal by Astroscale-Japan 2 mission provides an opportunity to demonstrate new technology. It also may "set a de facto standard," encouraging others to remove space objects and create a new market, said Ikuko Kuriyama, visiting researcher at the University of Tokyo Institute for Future Initiatives and senior JAXA administrator.

Right: Space debris photographed in orbit by Astroscale's ADRAS-J spacecraft in June.

What's more, active debris removal "will help the whole of the space economy to exist and maybe not to not exist," said Hermann Ludwig Moeller, director of the European Space Policy Institute in Vienna.

ZERO DEBRIS

The U.K. Space Agency and the European Space Agency are also paying Astroscale UK and Switzerland's ClearSpace to conduct active debris removal missions. In addition, many of Europe's leading space organizations have joined ESA in signing the Zero Debris Charter, a non-binding agreement intended to prevent a net increase in space debris by 2030. To date, about 100 countries, companies and research organizations and international agencies have signed on.

"We issued an internal instruction for all ESA future missions to meet that goal," said Frederic Nordlund, head of ESA's European and External Relations Department. "It's a very tough one."

ESA's technical requirements for reducing debris will be revised annually to guide managers toward the 2030 goal. In a related effort, ESA will send a small satellite to low-Earth orbit in 2027 to break apart.

"Why are we doing that? Because in that satellite we have 200 sensors that will tell us about reentry behavior," Nordlund said. "We will share that information with everybody in order to meet the five-year reentry requirement."

NAME AND SHAME

Alongside space agencies, nonprofits are conducting space sustainability studies.

Mitre Corp. researchers presented a series of papers at IAC, including one that discussed how the lessons of behavioral economics could improve space security and sustainability.

"It's providing incentives to the space actors to take a different route when it comes to designing space architecture or sharing information," Zhanna Malekos Smith, professor for the United Nations Institute for Training and Research. "Our paper takes the position against heavy-handed regulation and encourages nudges, incentives, funding and public recognition."

Through forums like IAC, it's important to recognize "good actors for promoting international collaboration or sustainability as a way to reinforce positive norms," Malekos Smith said.

It's equally important to name and shame bad actors, said Mitre lead economist Thomas Groesbeck.

"Companies compare themselves to their peers," Groesbeck said. "If you're doing something that's somewhat expensive and your peers aren't doing it and they don't suffer, you feel like a sucker. It's important to either have some sort of honor for doing the right thing or some sort of shame for not doing it."

ORBITAL CARRYING CAPACITY

Another Mitre paper suggested altitude-based classes for low-Earth orbit along the lines of aviation airspace classes.

"Just in the last five years, we've gone from talking about a future with a few thousand operational satellites to one of tens or even hundreds of thousands," said Ruth Stillwell, executive director of consulting firm Aerospace Policy Solutions, who worked as an air traffic controller for 25 years. "The issue of carrying capacity has landed squarely in our laps, but it is important to recognize that LEO is not a homogenous domain."

The proposed orbital classification system would establish higher standards in areas of high demand.

"Like aviation, classification is not only a safety tool but can also be used as a means to increase carrying capacity of a defined orbital volume," Stillwell said. >

ASTROSCALE

NOTIONAL LEO CLASSIFICATION

Class	Altitude (Persistence)			Constellation Size Present			Debris Background Level (i.e., spatial density, objects/km^3)			Maneuverability Required					
	Low <400km	Med 400 - 600km	High >600km	Low >10	Med >100	High >1000	Low <1E-9	Med 1E-9 to 1E-8	High >1E-8	0	1	2	3	4	5
A - Congested	X					X	X								X
B - Persistent		X		X				X						X	X
C - Occupied		X		X				X					X	X	
D - Lightly Occupied	X		X								X	X			
E - Below Manned Spaceflight	X			X			X			X					

SOURCE: MITRE CORP. CREDIT: SPACENEWS

Above: A draft LEO classification system proposed by Mitre Corp. dividing LEO into different altitudes that would establish higher standards of entry for spacecraft operating in congested areas of higher demand or lower tolerance of risk for collisions.

< > The proposed model calls for constellations with more than 1,000 satellites operating at altitudes between 400 and 650 kilometers to have robust maneuvering capabilities. In contrast, no maneuvering requirements would be placed on constellations of fewer than 10 satellites flying below 400 kilometers.

"Like aviation, it creates a means to establish higher standards in areas of high demand, while ensuring there are still opportunities available for less capable users to operate," Stillwell said. "Another advantage of the airspace classification approach is that it is fully transparent, giving operators the opportunity to weigh the cost of increased capability against the benefit of airspace access in determining their mission profile."

CUBESATS AND CONSTELLATIONS

The idea that regulations should vary based on satellite or constellation size came up repeatedly at IAC.

Morin pointed out that a university's cubesat ejected from the International Space Station poses far less risk to space sustainability than a constellation of 10,000 commercial satellites.

"It makes a great deal of sense" that a constellation of 10,000 satellites "should be subject to significant scrutiny for the effects of those systems on sustainability," Morin said. "But we don't need to do that for everyone. If we did do that for the new entrants, we would essentially lock in the current participants and that's unlikely to be helpful for the long-term dynamism of space research or the space economy."

Moeller agreed that new requirements should be established to mitigate the risk that collisions pose to space systems and, in turn, to all the social and economic benefits people on Earth derive from space.

"We have the true requirement to put things into frameworks that you can only launch things if you comply with certain requirements," Moeller said. It's also important, he added, to ensure that any new requirements are "applied to the maximum extent possible across the oceans, in different world regions, so nobody is feeling handicapped."

GLOBAL RULES

Establishing and enforcing global rules may prove difficult since there is no space counterpart to the International Civil Aviation Organization.

Stillwell suggested that launch states, which are responsible for authorizing and continually supervising the space activities of nongovernmental entities under Article 6 of the 1967 Outer Space Treaty, could enforce an orbital classification system.

Even if states are not yet equipped to provide a high level of continuing supervision of satellite operators, "the concept can be developed within the existing treaty frameworks and grow to meet the demands of the industry it seeks to serve," Stillwell said. SN

COMMENTARY Grant Anderson

NASA/JOEL KOWSKY

Space policy for the new President — whoever it might be

Above: Vice President Kamala Harris delivers opening remarks at the first meeting of the National Space Council Dec. 1, 2021, at the United States Institute of Peace in Washington.

The 2024 election cycle is lurching into the final stretch, with campaigns for the White House, Congress and other offices across the nation in high gear. Candidates are making their appeals, making themselves heard, and some are making waves. But while American citizens are being asked to pick and choose one person, party or campaign promise over another, what is sometimes missing from the political discussion is actual concrete policy proposals. Policy, when addressed, seldom gets into deep detail, and is presented only in broad strokes with soundbite talking points — lacking real granularity or even credibility.

This is especially the case with policy that is highly complex, nuanced or heavy on technical details, whether it relates to foreign affairs, energy policy or national defense. Unfortunately, our future in space is another policy area that seems to receive limited attention or discussion during campaign years. Given how vital space is to our economy, to national security and to our modern way of life, whoever occupies the White House in January 2025 may want to consider elevating space in the hierarchy of policy topics. Several core concerns illustrate the criticality of space to the future of the United States.

At the top — we must continue to support human spaceflight endeavors to low-Earth orbit (LEO), the moon and, yes, even Mars. This should be a mission priority that both Democrats and Republicans can agree on. Whoever ends up occupying the Oval Office in January should keep us on the track for a future where U.S. businesses develop the LEO economic >

Pacing competitors like China are serious about similar objectives in space; we cannot be left behind or we will risk delegating future American generations to second-tier status.

< > ecosystem and NASA pioneers the moon and Mars ecosystem. On a practical and direct level, the U.S. has an imperative to keep pressing on these goals. Pacing competitors like China are serious about similar objectives in space; we cannot be left behind or we will risk delegating future American generations to second-tier status. On a more philosophical level, we need to have a grand national goal that brings clarity and unity, and that inspires new generations of technology leaders while keeping with our culture of boundary-breaking and achievement.

A second political priority should be the continued development of the space economy as an engine of great opportunity for our citizenry, and as an area of awe-inspiring technological accomplishment and expanding prosperity for states, communities and individuals. Space is a part of our economy that not only combines high-tech manufacturing, science, engineering and imaginative creativity towards a positive purpose, but it directly contributes to the national needs and priorities of the nation. As the government looks for more solutions to address swift-moving issues, our space economy can serve as a resource with limitless promise.

If we are to encourage growth in the space economy, we need to bolster the space component of our defense industrial base. The space industrial base, and its needs and importance, cannot be neglected or marginalized as the U.S. works to navigate an increasingly unstable world, and as we seek to reconstitute and rebuild key components of our defense industrial base to shore up our overall preparedness and production flexibility. This is particularly important when considering the ability to source rare but vital raw materials for sophisticated technological production — or ensuring we have enough skilled labor and technical acumen in our workforce in order to study, engineer and produce the highly-capable platforms and components we need in space to support our national security needs. To start, we may need a refreshed look at what one could call a space industrial policy.

Whoever ends up occupying the Oval Office in January should keep us on the track for a future where U.S. businesses develop the LEO economic ecosystem and NASA pioneers the moon and Mars ecosystem.

And finally, we need to keep a laser-beam focus on the increasing seriousness of space as a defense domain. While the U.S. and much of the modern free world has worked diligently to keep space a domain of peace, cooperation and positive human advancement, the hard truth is that other nations have — by many different actions and behaviors — worked against that effort.

Whether a country blatantly disregards accepted norms on the issue of space deconfliction or advances space-based weapons for the express purpose of intimidating the world, we can simply no longer ignore the fact that despite our best wishes and actions, other nations wish to offensively militarize space. Fortunately, our national leaders — on both sides of the aisle — have recognized the severity of these concerns and have worked to enhance our ability to defend our interests in space; from the creation of the U.S. Space Force (and now, perhaps, a Space National Guard) to consistently funding national efforts to build deterrence, early warning, situational awareness and resilience in space. This is a growing set of complex issues that the next President and the next Congress should continue to work on together. The threats to present and future U.S. security are too large to disregard.

All of this is to say that among the myriad challenges facing our nation — and I readily recognize there are many — the future of space and our civil, commercial and defense interests in space requires continued and educated attention. Space, and our reliance on it, is too important to be kept on the bottom of the policy pecking order. Policymakers in Washington, DC, certainly have their role in setting objectives for the nation in space — but they are not alone. Industry leaders in the space economy, engineers, scientists and citizens with deep knowledge about programs, policy, technology and history — all of whom remain passionate about space — stand ready to help decision-makers in DC understand key issues and concerns while providing ways and means to advance our interests in space — regardless of who wins on election night. **SN**

GRANT ANDERSON, P.E. IS THE PRESIDENT & CEO OF PARAGON SPACE DEVELOPMENT CORPORATION, WHICH DEVELOPS LIFE SUPPORT AND THERMAL CONTROL FOR EXTREME ENVIRONMENTS. HE HOLDS A B.S. IN MECHANICAL ENGINEERING AND AN M.S. IN AERONAUTICAL & ASTRONAUTICAL ENGINEERING FROM STANFORD UNIVERSITY.


COMMENTARY Clayton Swope and Audrey Schaffer

Left: Donald Trump signs an Executive Order to reestablish the National Space Council on June 30, 2017.

NASA/AUBREY GEMIGNANI

Looking to the next four years: Strengthening America's space leadership

Since the dawn of the space age, 14 successive United States presidents have been committed to developing space for the betterment of humankind and to advance our national interests. Today, the U.S. is the undisputed global leader in space. But space has become a more competitive, complex and congested environment. To retain the American edge and build a global space economy driven by U.S. innovation, the next president should emphasize protecting U.S. space interests from growing threats, shaping space governance frameworks according to U.S. norms and values and maintaining U.S. leadership in space exploration and discovery.

Up until the late 1970s, only five nations were capable of launching a satellite into space, with space activities falling solely under the domain of government agencies. Today, about 13 nations and dozens of companies from around the world have the ability to launch spacecraft into orbit, and over 80 countries operate satellites in space. Over the last several years, the space power of America's historic rival, Russia, has waned, while China has made great strides and begun to challenge U.S. civil, commercial and national security space leadership.

Chinese space companies are seeking to replicate the global commercial success of Chinese telecommunications giants Huawei and ZTE and compete with the U.S. in areas like space launch and satellite broadband. In civil space exploration, China competes with the U.S. as a matter of national pride. Beijing also understands the soft power benefits of space and uses space as a diplomatic tool to grow its global influence and supplant the U.S. as the partner of choice for international collaboration.

China also poses a security threat to the U.S. in space, maintaining a portfolio of ground-based and space-based weapons that can disable, damage or destroy satellites. China recognizes the immense value U.S. military forces have gained from space-enabled services like overhead reconnaissance, satellite communications and precision-guided munitions, and is aggressively fielding its own military space systems purpose-built for 21st century warfare.

But Beijing does not hold a monopoly on the ability to exploit space for its own military advantage. Russian plans to deploy a nuclear weapon in space signal a dangerous and indiscriminate approach to space warfare, which would put at risk the entire global economy — not just U.S. and allied space capabilities. On more than one occasion, Russia has warned that it will treat U.S. commercial satellites as legitimate military targets.

Looking forward, the U.S. should continue to emphasize defending and protecting U.S. satellites while strengthening the resilience of U.S. space forces. Legacy U.S. space systems are highly vulnerable to emerging threats, with very few ways to defend themselves. In the opening days of any conflict, U.S. adversaries would almost certainly target our most important satellites.

To prevent a devastating loss of space capability from an adversary's first strike, the next administration should double down on efforts to diversify those space systems that support U.S. national defense — by migrating away from single points of failure and toward a robust space architecture that integrates the capabilities of the U.S. government, commercial companies and allied nations. More resilient architectures should be paired with credible U.S. counterspace capabilities that can defend U.S. space systems and also deny adversary kill chains that are increasingly enabled by space systems. Openly discussing such >

< > capabilities, like France has done, will help normalize space as a warfighting domain and make clear to potential adversaries that the U.S. will protect and defend its interests in space, just as it does in every other domain.

Efforts to protect vital U.S. interests in space cannot be limited to just government satellites but must also include commercial ones because of the critical role they play in our security, economic prosperity and way of life. Furthermore, for combined space operations with allies and partners to most effectively contribute to our national defense, the U.S. must continue advancing combined planning and capability interoperability with space-capable allies and security partners. The U.S. fights alongside coalition partners in every other domain; space should be no different.

To retain U.S. commercial space leadership, domestic and international regulatory and governance frameworks should be calibrated to best reflect American free-market principles. With respect to U.S. regulation of space activities and mission authorization, that means creating an approach that minimizes red tape and barriers for innovative new space businesses and centralizes and streamlines government oversight of commercial space activities, ensuring U.S. companies can compete with international peers, especially ones from China. The most efficient arrangement involves providing one government agency oversight authority for commercial space activities, narrow grounds on which the government can deny an application for a private sector space mission, and a shot-clock time limit for government action, with the default action being mission approval when regulatory requirements are met.

This also means modernizing U.S. export rules — something that has been long promised but not achieved — that serve as a barrier to U.S. commercial space competitiveness abroad. Continuing to treat satellites and their components as extensions of missile technology is an outdated approach to export controls that ignores the many reasons countries around the world pursue space programs and serves only to harm leading U.S. companies from capturing international market share.

At the same time, the U.S. should demonstrate global leadership in the responsible and safe use of space and lead development of a pragmatic international framework governing space activities. With an increasing number of countries aspiring to field large constellations and extend the benefits of space to more of humanity, rules and norms that limit the creation of harmful space debris and provide clear guidance on space traffic coordination should be top priorities.

Developing and implementing such an approach requires engagement with China because most space activities are and will be conducted by the U.S. and China for the foreseeable future. While neither nation can unilaterally set the rules, U.S. leadership can shape those rules to align with U.S. values, setting the conditions for U.S. companies to thrive in a U.S.-led space economy. At the same time, engagement with China can also support developing a framework that encourages broad international adherence, as rules are only useful when everyone follows them.

Finally, because we are a nation of explorers, we should remain focused on leading the world in space exploration and science. Specifically, the U.S. should remain firmly committed to the Artemis program — NASA's initiative to return to the moon — and use this investment to lay the foundation for the future space economy. By extending space-based infrastructure — communications, navigation, and situational awareness — out to the moon, NASA can enable international and commercial partners to join in the next era of space exploration and commercialization. Additionally, NASA should lead the way in the exploration of Mars and prioritize the Mars Sample Return mission; otherwise China may become the first nation to bring back samples of the Martian surface to Earth.

Embarking on the moon race, President Kennedy said in 1962, "We set sail on this new sea because there is new knowledge to be gained, and new rights to be won, and they must be won and used for the progress of all people." In 1984, when announcing America's commitment to building a space station, President Reagan observed much the same: that "America has always been greatest when we dared to be great. ... We can follow our dreams to distant stars, living and working in space for peaceful, economic, and scientific gain."

These sentiments and goals transcend politics and have stood the test of time. The next four years present opportunities for the next administration in space. We must remain laser focused on the prize — maintaining U.S. leadership in civil, commercial and national security space for the benefit of our security and our society. Above all else, we must continue to dare to be great in space. **SN**

CLAYTON SWOPE IS THE DEPUTY DIRECTOR OF THE AEROSPACE SECURITY PROJECT AND A SENIOR FELLOW IN THE INTERNATIONAL SECURITY PROGRAM AT THE CENTER FOR STRATEGIC AND INTERNATIONAL STUDIES IN WASHINGTON. HE PREVIOUSLY SERVED AS A CONGRESSIONAL STAFFER AND WORKED AT THE CIA. **AUDREY SCHAFFER** IS A SENIOR ASSOCIATE (NON-RESIDENT) AT CSIS AND THE VICE PRESIDENT OF STRATEGY AND POLICY AT SLINGSHOT AEROSPACE. SHE PREVIOUSLY SERVED IN THE U.S. GOVERNMENT FOR OVER 15 YEARS, INCLUDING ON THE NATIONAL SECURITY COUNCIL STAFF AND AT THE DEPARTMENT OF DEFENSE.

COMMENTARY Christopher Cokinos

NASA/BILL INGALLS

Left: The beginning of a complete lunar eclipse on Dec. 21, 2010.

Planning our lunar return? Get a telescope

Perhaps you're a propulsion engineer making lunar landers as part of NASA's CLPS program. Perhaps you're a lawyer specializing in the OST. Or you are a chemist cracking the codes of lunar ISRU.

If you are any of these things or even if you just know what those acronyms mean, you're part of the lunar revival: our return to the dramatic wilds of the moon, a return for science and industry and, just maybe, helping to make life multi-planetary.

I absolutely support those goals, but I also have a telescope. Anyone planning our lunar future should have one, too or, at least, regular access to one. Why? Because we won't have a lunar future worth having if we don't really see the moon. And if we don't really see the moon, we'll miss how its beauty can guide us when we return.

I thought about that one recent predawn morning, huddled over my 10-inch telescope with a cup of coffee and a view of the moon. Puffy jacket on, ducks chortling in the nearby canal that runs through our neighborhood, I magnified the badlands between Lacus Mortis and the twin complex craters Aristoteles and Eudoxus. This rough region fairly glittered with sun-tipped terrain as I looked from the bottom of a twitchy atmosphere. Then I stared for a long time at the gloomy majesty of the Arago volcanic domes as lunar sunset loomed at the terminator, the sharp divide between day and night on the moon, low wrinkle ridges to the east like subtle reminders. And I flew above the heavily impacted Southern Highlands, my eye heading toward the south polar limb.

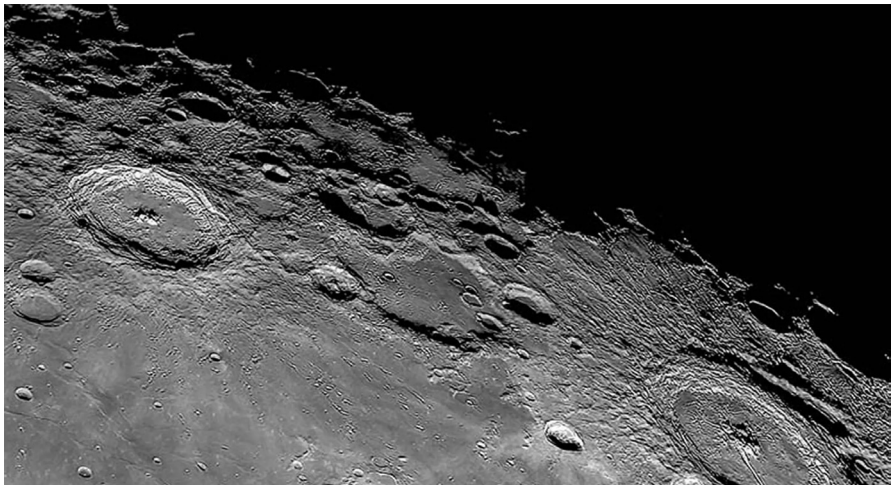
That's where we're going. To the permanently shadowed regions that harbor water ice.

For several years, while working on a book about the moon, I used my telescope, a map and some atlases, not to just glance at craters but to explore and learn the lunar surface. I fell quickly in love with that austere and sublime landscape, at once alien and somehow akin to parts of the American West. In fact, science writer Walter Sullivan once compared the famous Lunar Orbiter oblique view of Copernicus crater to western front of the Wasatch. That's my mountain range here in Utah.

I have looked at the moon from backyards and deserts and canyons in Arizona and Utah. Now I can find my way around without maps. I love seeking out tiny details — like that hard-to-see volcano in Petavius — and I understand the physical manifestations of the moon's geology. Such views brought me to a journey with that world's importance to global cultures, the birth of modern science, dreams of lunar life (alas, dashed) and even the positive neurochemistry of awe. I once made a pilgrimage to Mt. Wilson's historic 60-inch reflector to see the moon in shocking hugeness.

I don't expect most people — even lunar scientists who know the moon's cosmochemistry but who couldn't find the dark sheen of Endymion if their lives depended on it — to go as deep as I have.

You don't have to. Just looking at the moon provokes one into quiet, personal exploration. Beyond what can become >



Left: The lunar craters Langrenus and Petavius photographed from Earth.

< > a numbing profusion of holes (there are a lot of craters!) lunar looking and just a bit of knowledge becomes a way of seeking wilderness and cosmic context from one's own comfort. It's a sweet and instructive paradox to travel to an airless world while breathing in a cold, autumn morning.

It's one thing to know the moon from spreadsheets, diagrams, PowerPoints and white papers. It's another thing to experience it as though you yourself are in close orbit. Yet another to do so with some historical depth. We've done a lot of damage to Earthly places by abstracting them — by not seeing or knowing them as literal places. Applied from a distance, what could be well-crafted exploration and use often becomes blunt force.

The great 20th-century conservationist Aldo Leopold once wrote, "We abuse land because we see it as a commodity belonging to us. When we see land as a community to which we belong, we may begin to use it with love and respect." That same applies to the moon, as astronomer Jessica Heimand and others are arguing in their research and papers. Leopold isn't saying the land is beyond use. He's suggesting that a sensory and intellectual relationship to it — in this case, the moon — lays the necessary foundation for careful and caring use.

I want us to return to the moon, this time to stay. To sustainably utilize its gifts of water ice to craft a vibrant lunar community and to help us explore the rest of the solar system. To spread, where appropriate, the electrical net of a radio telescope to probe the origins of the universe. To study the moon's composition to help us understand its formation and its role in the early solar system. To look deep and to look far.

I'd like to think that our lunar return will help us forge an aspiration, even if impossible, to try to solve problems without creating new ones. Or, at least, build scientific and industrial infrastructure that isn't ugly. That would be a start. Perhaps we'll agree to bury waste instead of dumping it in the open. Perhaps we'll even agree to leave swaths of the moon alone because not every patch of moondust needs a bootprint. Perhaps we'll commit to treating each other with more dignity than we do now, given the anonymity and rapid-fire reactivity of our 24/7 online world.

And rather than consider these questions from abstractions, why not take a few minutes each month and magnify the very real moon through the eyepiece of a decent telescope? The views may be choppy. They won't be high-def like the astounding Lunar Reconnaissance Orbiter photos. Clouds will interfere. Texts will ping, demanding attention. Our lives are not designed for this kind of quiet or reflection. But, if for nothing other than well-being, we can carve it out. And if you don't have a telescope, hundreds of public libraries have them to lend. Who knows, maybe, like me, you'll work through a lunar-observing program like the ones offered by the Astronomical League, a way to meld exploration with personal growth and a sense of balance. That sense of wonder so many of us find in science fiction, it's above us every month.

Places don't care. But places deserve care. Places deserve care because we deserve care. The moon's beauty is as much a resource as water ice.

Not long ago, I noticed a crater, Lilius, that I'd never paid attention to before. Lilius is worn down but fresh enough that it sports a central peak. Most of the crater was in the cave-dark lunar night. But the mountaintop was sunlit. I imagined standing there, seeing the strong curve of the horizon, then following down a marked trail, helmet lights switched on, to one of a handful of pressurized huts the Lunar Tourist Authority allows, marveling that the thousands and thousands of square miles we'd left alone were testament to the fact that we'd arrived and that, because we want things to last, we were practicing temperance. **SN**

CHRISTOPHER COKINOS IS THE AUTHOR OF "STILL AS BRIGHT: AN ILLUMINATING HISTORY OF THE MOON FROM ANTIQUITY TO TOMORROW." HIS ACCOUNT OF AN ALL-ARTISTS LUNAR SURFACE ANALOG MISSION AT BIOSPHERE 2 WAS PUBLISHED IN ESQUIRE. HIS FEATURE ON FIGHTING LIGHT POLLUTION WAS THE JULY COVER STORY FOR ASTRONOMY MAGAZINE.

ROBERT REEVES

CONNECTING THE DOTS Jason Rainbow

More data storage, more space AI

Expanding data storage in space is crucial for enabling more powerful artificial intelligence systems to process larger volumes of information directly from orbit.

More capable hard drives would facilitate faster and more insightful analysis from space by reducing the need to download data to the ground for processing.

"It's useful both with AI training and with inference," said Jon Trantham, principal technologist at data storage specialist Seagate.

"Having a large pool of data available, and then potentially having it augmented with AI processing hardware, we think is … a new application for space."

Inter-satellite links, which allow spacecraft to relay data among themselves, are also key to accelerating communications with the ground, enabling low Earth orbit (LEO) satellites to transmit information without waiting to pass over an approved ground station.

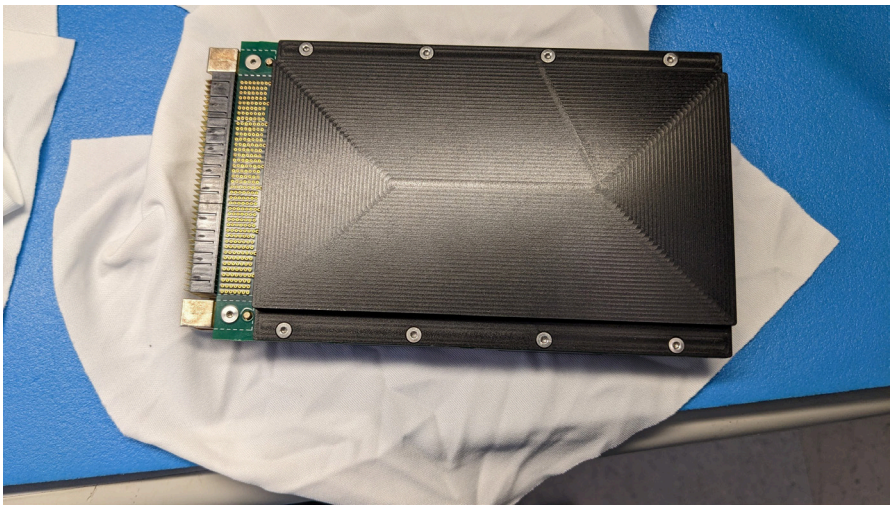
Trantham is Seagate's technical lead for a mission testing a four-terabyte, solid-state drive attached to the outside of the International Space Station for the past two months.

The storage device, slightly larger than a standard computer hard disk drive, is housed in a small satellite provided by partner and potential customer BAE Systems.

It is Seagate's first storage device specifically designed for the rigors of space, although the company supplied hard drives that have been on the ISS for more than two decades.

"The main news out of the telemetry is the environment actually is more benign than what we had feared," Trantham said.

"For solid state drives, cold temperatures can be really stressful."



The storage device currently undergoing dress tests outside the ISS.

SEAGATE

Although stress tests continue, he said the company plans to refine the device next year before its commercial release for LEO operators in 2026.

Seagate aims to strike a balance between a cheap, less rugged, off-the-shelf storage device and more expensive military-grade hardware.

"It's much larger than most of the alternatives that are out there today," Trantham added. "A lot of them are [in the] gigabyte capacity sort of range. Terabyte is relatively new here, so that should enable new use cases."

While those new use cases are uncertain at this point, Trantham anticipates demand for climate data, imagery and video processing applications.

ONBOARD AUTONOMY

In addition to the real-time use of space data, deploying AI onboard spacecraft is important for missions requiring high levels of autonomy in support of real-time operations, said Michele Faragalli, chief technology officer of Canadian software startup Mission Control.

Onboard autonomy is essential when communication with operators is delayed or limited, and when data volumes exceed affordable downlink capacity. Timely action is necessary for perishable data, and when complex operations demand quick and precise decisions.

"Onboard AI can, therefore, benefit a range of space mission classes, from robotic exploration to disaster response using Earth Observation satellites," he continued.

Faragalli emphasized that advancements in onboard autonomy, driven by AI, could pave the way for new types of space missions.

These include robotic subsurface exploration of Europa and the autonomous coordination of multiple space-based assets for extensive area observation, using a method known as "tip and cue," where one sensor identifies an area of interest (tip) and directs other sensors to investigate further (cue). SN

ON NATIONAL SECURITY Sandra Erwin

Pentagon sends mixed signals on space innovation

ENTRENCHED PROCUREMENT PRACTICES PERSIST DESPITE A $13 BILLION COMMITMENT TO COMMERCIAL SPACE

The Pentagon is putting $13 billion behind its talk of embracing commercial space, committing serious money to low-Earth orbit satellite services.

This marks a dramatic increase in spending on commercial satellite services, with the so-called PLEO (Proliferated Low Earth Orbit) contract jumping from $900 million to $13 billion over a decade. Unlike the military's typical procurement approach, the PLEO contract gives vendors greater flexibility to tailor services to customer needs rather than following rigid government specifications.

Companies across the industry are eager to see this model expand to other military space programs. But entrenched procurement habits die hard, and while integration of commercial space capabilities is progressing, practical challenges remain.

Across the space sector, executives continue to lament a persistent gap between the military's stated commitment to commercial technology and the procurement practices that undermine it.

'CONSTANT REQUIREMENTS CREEP'

In late 2022, Assistant Secretary of the Air Force for Space Acquisitions Frank Calvelli called for streamlined procurement through fixed-price contracts and standardized commercial production lines. In practice, however, DoD buyers still request customized satellite configurations — even for fixed-price contracts, said executives at the recent MilSat Symposium in Mountain View, California.

"What we see is a constant requirements creep" that undermines the very efficiencies DoD seeks, said Debra Facktor, head of Airbus U.S. Space Systems. The result is delayed deliveries and financial burdens, as change requests under fixed-price deals force suppliers to absorb the costs.

Jonny Dyer, CEO of the satellite startup Muon Space, highlighted a cultural divide between the defense sector's risk-averse procurement mindset and the commercial space industry's iterative approach. Government buyers often assume companies favor cost-plus contracts for stable profit margins and flexibility.

But truly commercial firms prefer to sell to the government under fixed-price agreements, just like any other customer, says Dyer. "Cost-plus drives a completely different mindset" that does not promote speed and efficiency. The regulatory burdens and incentives of traditional contracting models, he said, actively work against the Pentagon's stated goal of tapping into commercial innovation.

MORE SPECIFIC WISH LISTS

Another problem companies encounter is understanding the military's demand signals.

While DoD and the Space Force have published high-level strategy documents for commercial space integration, they lack the specific guidance companies need to confidently align their development roadmaps. Without clearer guidance, commercial firms struggle to develop dual-use technologies that serve both military and civilian markets, leaving private investors uncertain about the long-term potential.

Retired Space Force Gen. David "DT" Thompson, former Vice Chief of Space Operations, stressed the need for "clear statements and more definitive plans about where we're going in the future — and how we're going to use certain things." Without this alignment, he told *SpaceNews*, the commercial space industry will hesitate to commit the resources required to meet evolving military needs.

Recognizing these challenges, Space Force officials have started fresh discussions with venture capitalists to better understand private sector concerns. Meanwhile, the Defense Innovation Unit (DIU), established nearly a decade ago to bridge the commercial-military divide, is stepping up efforts to push commercial solutions in defense programs.

One proposed path forward is the "anchor tenancy" strategy suggested by policy analyst Sam Wilson of the Aerospace Corporation. By committing as a primary customer for a company's product or service, the Pentagon could guide development while still leveraging commercial efficiencies — a middle ground allowing the military to tap into private-sector innovation without losing operational control.

Ultimately, the Pentagon must be willing to evolve its longstanding procurement habits. The PLEO contract is an important step, but entrenched cultural biases remain. In a domain as competitive and critical as space, the U.S. can't afford to let innovation slip through bureaucratic fingers. **SN**

ON THE HORIZON

DATE	EVENT	PLACE
NOVEMBER		
4-7	**Global MilSatCom** smgconferences.com/defence/uk/conference/global-milsatcom	United Kingdom
19-21	**Space Tech Expo Europe** spacetechexpo.eu	Germany
DECEMBER		
6	**SpaceNews Icon Awards** spacenewsawards.com	Washington, DC
MARCH		
10-13	**Satellite 2025** satshow.com	Washington, DC
11-12	**Space-Comm Expo** space-comm.co.uk	United Kingdom
APRIL		
7-10	**Space Symposium** spacesymposium.org	Colorado Springs, CO

FOUST FORWARD Jeff Foust

Is there a business case for the moon?

Enough commercial activity is heading to the moon in the next few months to create a traffic jam. Firefly Aerospace, ispace and Intuitive Machines are all launching commercial lunar lander missions by early 2025, all on Falcon 9 rockets. That surge of missions makes it uncertain who exactly will be launching when. At a meeting of the Lunar Exploration Analysis Group in Houston Oct. 29, Firefly's Joseph Marlin declined to offer a more specific launch date for its Blue Ghost 1 lander than some time in the fourth quarter of this year. "SpaceX is still sorting out its schedule," he said.

At first glance, that surge in activity would appear to be a sign of an expanding market for commercial activities at the moon. But both Blue Ghost 1 and Intuitive Machines' IM-2 missions have NASA as its largest customer by far, accounting for most of the payload and most of the revenue for them through the agency's Commercial Lunar Payload Services (CLPS) program. The ispace lander for its M2 mission does not have NASA as a customer, but its manifest of payloads is relatively modest, ranging from the company's own rover to "Moonhouse," a small model house by a Swedish artist.

While CLPS was intended to help stimulate commercial lunar capabilities, that has not resulted in a surge of commercial demand for the landers it has enabled. That was the conclusion of a recent report by the Center for Strategic and International Studies (CSIS) that offered a critical examination of lunar activities.

COMMERCIAL LUNAR DREAMS REMAIN GROUNDED

"There is no indication of a lunar gold rush because there are no strong revenue-generating businesses centered around cislunar activities anchored by commercial customers," the report stated. The activity seen today, it noted, has government agencies, like NASA, as primary customers.

"Truly commercial uses of the moon remain a chimera, with no obvious sign this could change in the next several years," the report concluded.

"Pretty much all the activity is tied to the government as a customer," said Clayton Swope, deputy director of the Aerospace Security Project at CSIS and lead author of the report, during an Oct. 25 webinar about the study.

He said that could change if the industry reaches a "pivot point" where there are activities that have economic value in space or on Earth. "That probably happens when we get to a critical mass of activity at the moon, in space," he said but didn't estimate how long that would take.

There are companies that are planning such activities. Interlune, a startup led by former Blue Origin president Rob Meyerson, has plans to prospect for and eventually extract from the moon helium-3, a potential fuel for fusion reactors. Those reactors don't exist yet, but the company believes there are nearer-term applications for helium-3, like quantum computing, that could make such missions economically viable.

"There's no doubt that, at some point, we're going to get to certain types of businesses that might be significant," said Alex MacDonald, NASA chief economist, during the webinar. That could be as simple, he suggested, as a commercial mission to return lunar rocks to sell on the open market, noting interest in lunar meteorites and illicit sales of Apollo samples. (The idea is not new: a quarter-century ago a startup called Applied Space Resources proposed missions to return lunar samples to sell commercially but failed to make much progress before fading away.)

He acknowledged, though, that the "predominant driver" for now is government activities like NASA's Artemis campaign. "It is sufficient, at this time, to drive a lot of the innovation we are seeing in the economic ecosystem," he concluded.

When that transition to more purely commercial activities takes place, and how that happens, remains uncertain. Victoria Samson, chief director of space security and stability at the Secure World Foundation, noted it took many years for commercial markets to develop in Earth orbit beyond commercial GEO communication satellites. "It's going to be a while" before a commercial economy emerges at the moon, she estimated. "Decades, maybe."

"But maybe only decades," MacDonald added. **SN**

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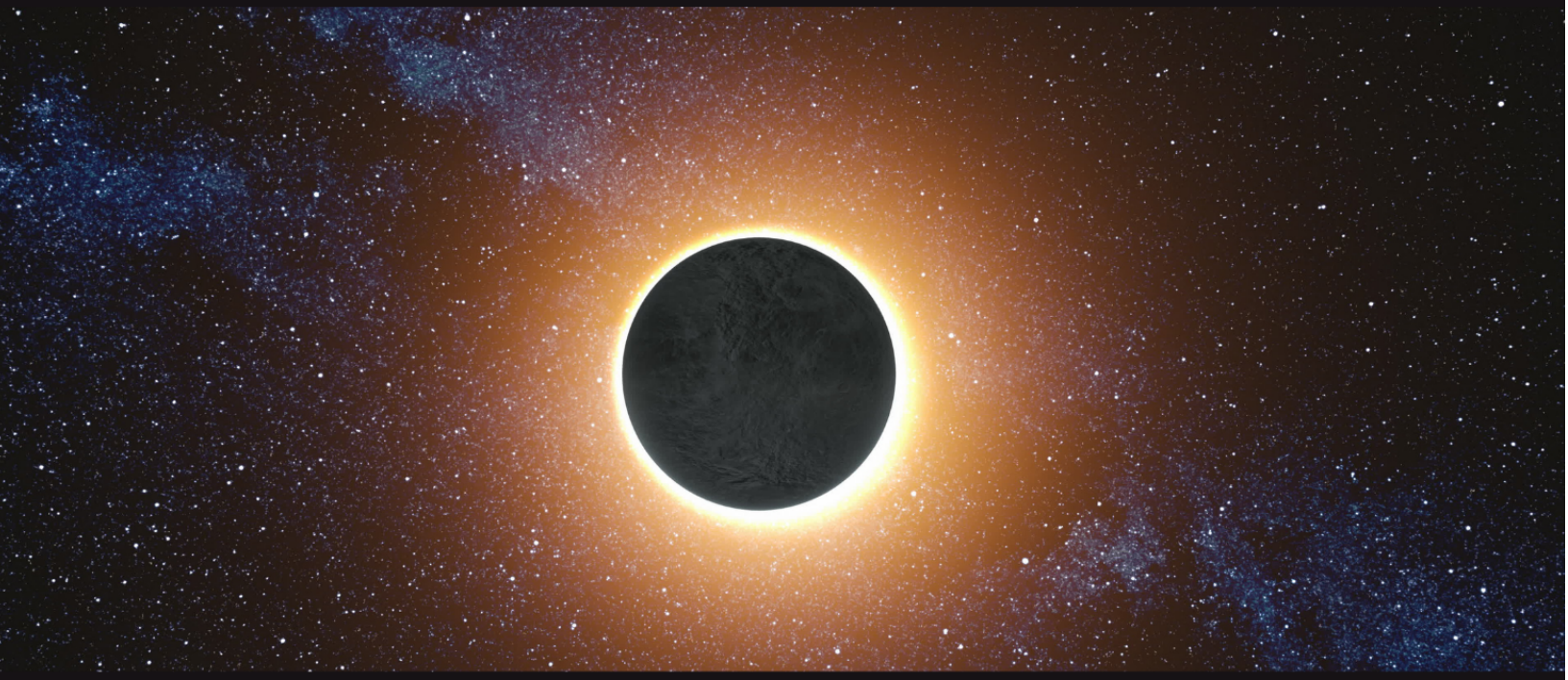

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