SPACENEWS
BUSINESS | POLITICS | PERSPECTIVE
DECEMBER 2023



The 2023 Icon Awards

Startup of the Year | Deal of the Year
Commercial Space Achievement | Civil Space Achievement
Military Organization | Space Stewardship | Unsung Hero

MILLENNIUM SPACE SYSTEMS
A Boeing Company

ADVANCING RAPID RESPONSE SPACE DOMAIN AWARENESS

WWW.MILLENNIUM-SPACE.COM



RECORD-BREAKING RESPONSIVE LAUNCH

FIREFLY
AEROSPACE

On September 14, 2023, Firefly set a new industry standard, launching after a 24-hour notice for the U.S. Space Force VICTUS NOX mission, shattering the previous 21-day record. Congrats to the entire team!

DEPARTMENTS

03 **QUICK TAKES**

24 **COMMENTARY**
Robert Zubrin
Rethink the Mars program

26 **COMMENTARY**
Brian Chow
Deterring a Space Pearl Harbor through better discourse

29 **CONNECTING THE DOTS**
Jason Rainbow
Europe plots constellation manufacturing powerhouse

30 **ON NATIONAL SECURITY**
Sandra Erwin
Space Force chief tempers expectations: "Go government fast, not SpaceX fast"

32 **FOUST FORWARD**
Jeff Foust
Leaps of faith across an artificial divide in space security



FEATURES

08 **Starship flies again**

SpaceX launched its Starship/Super Heavy vehicle for a second time this year on Nov. 18. Jeff Foust reports on the progress the company demonstrated with that launch and NASA's concerns about the rate of that progress towards returning humans to the moon.

ABOVE: An artist's conception of NASA's OSIRIS-REx spacecraft collecting a sample from the asteroid Bennu. Credit:: NASA/Goddard/University of Arizona COVER: "An astronaut hosts a lavish awards banquet," a SpaceNews illustration created in Midjourney.

SPACENEWS

VOLUME 34 | ISSUE 12

CHAIRMAN
Felix H. Magowan
fmagowan@spacenews.com
Tel: +1-303-579-2892

CEO
Andy Pemberton
apemberton@spacenews.com
Tel: +1-303-532-6075

CTO
Greg Thomas
gthomas@spacenews.com
Tel: +1-571-356-9957

ACCOUNTING SPECIALIST
Pam Washburn
pwashburn@spacenews.com
Tel: +1-502-553-0728

EDITORIAL
EDITOR-IN-CHIEF
Brian Berger
bberger@spacenews.com
+1-571-356-9624

SENIOR STAFF WRITERS
Jeff Foust
jfoust@spacenews.com
Tel: +1-571-385-1483

Sandra Erwin
serwin@spacenews.com
Tel: +1-571-356-9022

Jason Rainbow
jrainbow@spacenews.com
Tel: +1-571-356-9531

CORRESPONDENTS
SILICON VALLEY
Debra Werner
werner.debra@gmail.com

HELSINKI
Andrew Jones
jones.andrew.w@gmail.com

WARSAW
Jarosław Adamowski
ajaroslaw@gmail.com

SEOUL
Park Si-soo
parksisoo@naver.com

ART DIRECTION
Robin McDowall
mcdowalldesign.com

ADVERTISING
VICE PRESIDENT OF BUSINESS DEVELOPMENT
Paige McCullough
pmccullough@spacenews.com
Tel: +1-571-278-4090

BUSINESS DEVELOPMENT MANAGERS
Kamal Flucker
kflucker@spacenews.com
Tel: +1-571-402-5706

OUTSIDE NORTH AMERICA SALES
Tony Kingham
tony.kingham@knmmedia.com
Tel: +44 (0) 20 8144 5934

Emmanuel Archambeaud
earchambeaud@outlook.fr
Tel: +336 1103 9652

CONTACT US
8609 Westwood Center Drive
Suite 110 PMB 1024
Tysons Corner, VA 22182
Tel: +1-571-421-2300

SUBSCRIBER SERVICES
Toll free in U.S.
Tel: +1-866-429-2199
Fax: +1-845-267-3478
SpaceNews@pcspublink.com

Outside U.S.
Tel: +1-845-267-3023
Fax: +1-845-267-3478

Go to
spacenewsmediakit.com
for more information

SPACENEWS (ISSN 2328-9376) is published monthly by SpaceNews Inc., 6032 Brian CT. Ferndale, WA 98248, USA. SpaceNews is not a publication of NASA. **ANNUAL SUBSCRIPTION RATES:** $219 U.S. Domestic mail; $239 Canada; $289 International mail. Periodicals postage paid at Ferndale, WA and at additional mailing offices. Postmaster: Send all UAA to CFS. (See DMM 207.4.11.5); **NON-POSTAL AND MILITARY FACILITIES:** send address corrections to SpaceNews, PO Box 460654, Escondido, CA 92046. SpaceNews is registered with the British Postal System and Canada Post International Publications Mail (Canada Distribution) Sales Agreement No. 546046. To order SpaceNews, to change an address or for subscription information, call our toll free number (in the U.S.) 866-429-2199, or write to SpaceNews, Customer Service, PO Box 460654, Escondido, CA 92046 or email SpaceNews@pcspublink.com. For changes of address, attach an address label from a recent issue. **TELEPHONE NUMBERS:** Main: 571-421-2300; Circulation: 866-429-2199, fax 845-267-3478; Advertising: 571-278-4090. **PHOTOCOPY PERMISSION:** For permission to reuse material from SpaceNews Inc., ISSN 1046-6940, please access www.copyright.com or contact the Copyright Clearance Center, Inc. (CCC), 222 Rosewood Drive, Danvers, MA 01923, 978-750-8400. CCC is a not-for-profit organization that provides licenses and registration for a variety of uses. For bulk reprint requests of more than 500, send to SpaceNews Attn: Reprint Department.



SIGNIFICANT DIGITS

$6.6B

Funding Japan's government plans to allocate over 10 years to boost the country's domestic space industry, including support for the Japan Aerospace Exploration Agency.

$900M

Viasat's write-off following issues with ViaSat-3 Americas, Inmarsat-6 F2's total loss, and canceling work on a future broadband satellite called ViaSat-4.

$160M+

Total value of contracts Astrolab secured from eight customers for a rover mission to the moon as soon as 2026. Five of the customers are early-stage companies working on lunar technologies. The other three will be unveiled closer to the launch.

600+

The number of SpaceX employee injured on the job since 2014, according to Reuters.

$138M

Funding rocket propulsion startup Ursa Major secured in an expanded Series D round to support a new solid rocket motor program as well as ongoing work on liquid engines for small space launchers and hypersonic vehicles.

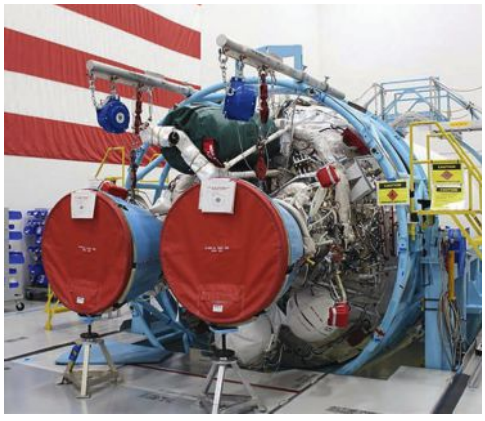


Ariane 6 on the launch pad following a seven-minute-long combined test hot-fire.

ESA - CNES - ARIANESPACE - ARIANEGROUP / OPTIQUE VIDÉO DU CSG - P. PIRON/AEROJET ROCKETDYNE

A PASSING GRADE FOR ARIANE 6

ESA completed a key test of the Ariane 6 rocket and set a mid-2024 date for its first launch. At a briefing Nov. 30, ESA announced that the inaugural Ariane 6 flight was scheduled for between June 15 and July 31 of next year, with a more precise date to come after qualification reviews in the spring. ESA set the date after reviewing data from a Nov. 23 hot-fire test of the core stage. That test was a success, ESA said, although the core stage shut down about 45 seconds short of its planned duration of 470 seconds because of a faulty sensor and "very conservative" test thresholds. The first Ariane 6 will carry a set of smallsats, with the second, slated for late 2024, to launch a French military reconnaissance satellite.



The Vulcan Centaur will fly with upgraded versions of the RL10 engines shown here.

60 years after original, a launch date for newest RL10 engine

A new version of the RL10 upper-stage engine will make its debut in 2025. At a briefing Nov. 27, executives with Aerojet Rocketdyne and United Launch Alliance said they expect the first use of the RL10C-X engine to be in 2025, on ULA's Vulcan Centaur rocket. The RL10C-X, which is the latest version of the RL10 engine first launched 60 years ago on an Atlas Centaur, includes greater use of additive manufacturing, among other upgrades, to improve performance and lower costs. ULA ordered more than 100 RL10C-X engines last year for use on Vulcan Centaur.

QUICK TAKES



Amazon launched prototype Kuiper satellites in October on a ULA Atlas 5 to conduct tests prior to initiating full-scale production of some 3,200 satellites expected to weigh more than 500 kilograms each.

Project Kuiper shifts into higher gear

Following a successful test of Amazon's two prototype Project Kuiper satellites, the company is ready to begin producing the rest of the constellation. Though Amazon hasn't shared specific details or data on the test run of the broadband satellites, the company announced that it's satisfied with the results and plans to begin production of the rest of the constellation in December. Then, an ambitious launch schedule is expected to commence in early 2024. **Meanwhile, Amazon announced Dec. 1 that it signed a contract with SpaceX for three Falcon 9 missions starting in mid-2025**, supplementing a multi-billion-dollar launch arrangement already in place with United Launch Alliance, Blue Origin, and Arianespace for deploying the majority of Project Kuiper's more than 3,200 satellites.



Jim Free at NASA event in May 2023.

Free to be NASA's newest No. 3

Jim Free, NASA's associate administrator for exploration systems development, is getting a promotion. NASA announced on Nov. 15 that Free will become associate administrator, the number-three position at the agency, at the end of the year. He will succeed Bob Cabana, who announced his retirement earlier this week. Free returned to NASA in the fall of 2021 after several years in the private sector to lead NASA's exploration efforts. His deputy, Catherine Koerner, will take over as associate administrator for exploration systems development.

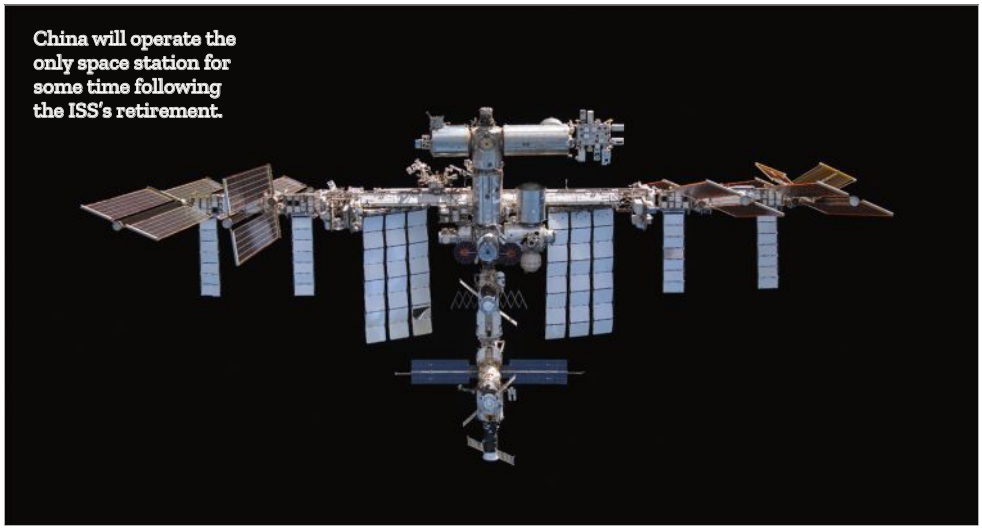


Perseverance leaves behind Mars sample capsules as it continues its journey.

California goes to bat for bringing Mars rocks back

Several members of Congress from California are asking NASA to reconsider slowing down work on Mars Sample Return (MSR). Six members of the state's congressional delegation sent a letter to NASA Administrator Bill Nelson on Nov. 21, in which they argued that the agency overstepped its authority when it announced earlier last month it was temporarily ramping down work on MSR because of budget uncertainty. A House spending bill would give MSR its full request of $949.3 million in 2024, while a Senate bill provides only $300 million. The letter warned that slowing down work on MSR could cost jobs and prevent NASA from meeting a 2030 launch window. California's two senators, who signed that letter, also joined seven other senators in a separate letter to the leaders of the Senate Appropriations Committee, asking that they increase funding for MSR in its bill.

AMAZON/ NASA/KEEGAN BARBE/ NASA/JPL-CALTECH/ASU/MSSS



China could operate the only space station for some time following the ISS's 2030 retirement.

MIND THE GAP

NASA acknowledged there may be a short-term gap between the retirement of the International Space Station and introduction of the first commercial space stations. At an advisory committee meeting on Nov. 20, officials said they continue to work towards a continuous human presence in low Earth orbit, and that they aim to ensure an overlap of up to two years between the start of commercial space station operations and the retirement of the ISS in 2030. There are several contingencies for dealing with a delay, they said, including shortening the transition period or extending the ISS beyond 2030. If that is not possible, a gap could result, but they said it would not be "the end of the world" provided it was not a long gap. Any gap could also be mitigated, NASA said, by flying commercial crew vehicles on short-duration flights to perform some research in LEO.



NASA/ MAXAR TECHNOLOGIES/ BLUE ORIGIN

Illustration of Jupiter-3 in orbit.

Jupiter-3 spreads its wings

EchoStar's Jupiter-3 is performing as expected after deploying solar arrays and antennas in geostationary orbit. The Maxar-built spacecraft, launched in July on a Falcon Heavy, has reached its slot at 95 degrees west in GEO. L3Harris, which built the satellite's four large reflector antennas, announced on Nov. 20 that the antennas have deployed as planned. The nine-ton satellite, providing Ka-band broadband services, is slated to begin commercial operations by the end of the year.



Illustration of New Glenn on the launchpad.

Blue Origin's Martian escapade

NASA expects a Mars small-sat mission to be on the first launch of Blue Origin's New Glenn next year. At an advisory committee meeting on Nov. 20, NASA said that it expects to send ESCAPADE, a pair of SmallSats, to Mars, on the inaugural New Glenn launch within the next year. NASA acknowledged there is some risk New Glenn, years behind schedule, won't be ready in time, but declined to estimate the chances the launch will go off as scheduled. NASA selected Blue Origin earlier this year to launch ESCAPADE in an award valued at $20 million.

QUICK TAKES



Illustration of MDA satellites in orbit.

Buying constellations in secrecy

Canada's MDA has won a $131 million contract from an unidentified customer for a satellite constellation. MDA said the the contract will allow the company to start engineering work on the 36-satellite constellation for the unidentified customer, using a software-defined satellite design similar to that of Telesat's Lightspeed constellation. That design is different from the one MDA and Rocket Lab are providing for Globalstar. MDA said the contract value could quadruple if the company is selected to proceed with full-scale production of the satellites.



Illustration of a World View tourism flight in space.

World View aims for stratosphere sans SPAC

Stratospheric ballooning company World View has called off plans to go public through a SPAC merger. The company announced Nov. 17 it reached a mutual agreement with Leo Holdings Corp. II, the SPAC, to terminate a merger agreement announced in January. When the deal was announced, it was expected to provide World View with up to $121 million and close in the second quarter. The companies provided few updates on the progress of closing the deal in subsequent months, and Leo Holdings held a shareholder vote in October to give the SPAC an additional year to complete the deal. The companies did not provide specific details on why they were abandoning the merger, which will result in the liquidation of the SPAC. World View operates stratospheric balloons used for applications traditionally performed by satellites and has plans to use the balloons for tourist flights.

OHB fed up with public markets

OHB CEO Marco Fuchs announced during Space Tech Exo Europe last month he's taking the company private. Fuchs said small companies like OHB are undervalued in public markets, so the company struck a deal with the investment firm KKR, which agreed to purchase publicly-available shares for 44 euros ($47.70) each. KKR said Nov. 8 that 77.5% of the shares on the open market had been sold to KKR.



The Sierra Space Dream Chaser.

Sierra Space reverses hiring surge

Sierra Space confirmed it laid off 165 employees in what it termed as a "realignment" of the workforce. Those layoffs, announced on November 17, came after a surge of hiring of both employees and contractors in recent months to complete work on the first Dream Chaser vehicle. The company, though, is bringing on 150 employees from Sierra Nevada Corporation with clearances to work on new classified projects.

REST IN PEACE, STEVE JURCZYK



Steve Jurczyk on a panel in 2017.

Steve Jurczyk, a former NASA official who briefly led the agency as acting administrator in 2021, died of cancer at the age of 61 on Nov. 23. Jurczyk spent more than 30 years at NASA, serving as director of the Langley Research Center, associate administrator for space transportation, and associate administrator, the highest-ranking civil service position. He served as acting administrator for more than three months in early 2021 until current administrator Bill Nelson was confirmed and sworn in. He later co-founded and served as CEO of Quantum Space, a startup developing cislunar platforms. **SN**

MDA/ WORLD VIEW/ SIERRA SPACE/ NASA


Congratulations to the
2023 SpaceNews Icon Award
Honorees and Winners!
ALL.SPACE
TOTAL COMMUNICATIONS CONVERGENCE
www.all.space



Panoramic view of SpaceX's Starship taking flight for the second time in South Texas on Nov 18, 2023.

TREVOR MAHLMANN

Starship flies again

The plume had not yet dispersed from the second test launch of SpaceX's Starship/Super Heavy vehicle when the debates began about how to grade the outcome. Many hailed the Nov. 18 launch as a success, demonstrating advances over the first flight seven months ago. Others argued it was a failure, as both the Super Heavy booster and Starship upper stage were destroyed, with Starship falling far short of the planned 90-minute flight that would have taken it to a splashdown near Hawaii.

JEFF FOUST

Those debates, attempting to impose a binary success-or-failure criteria onto a more analog continuum of achievement, are not new: similar arguments erupted after the vehicle's first flight in April. What is clear is that while SpaceX has made progress since that first flight, it's less certain whether it's moving swiftly enough both for the company and its biggest customer, NASA.

One of the biggest signs of improvement was with Super Heavy. On



While it's clear SpaceX has made progress since the first flight of Starship/Super Heavy in April, it's less certain whether it's moving swiftly enough both for the company and its biggest customer, NASA.

the April launch, the booster suffered several failures of its Raptor engines, dooming the mission almost as soon as it lifted off the pad. SpaceX CEO Elon Musk said a couple months after that flight that the booster used a "hodgepodge" of older Raptors.

In a statement in September after the conclusion of a mishap investigation overseen by the FAA, SpaceX said that leaking propellant in the aft section of the booster created fires that severed connections with the primary flight computer. "This led to a loss of communications to the majority of booster engines and, ultimately, control of the vehicle."

On this flight, by comparison, there were no apparent failures of the 33 Raptors in the Super Heavy booster. If there were any problems with those engines, they were not serious enough to affect the rocket's trajectory.

A second major improvement was with the pad. The plume from those 33 Raptor engines tore up the concrete pad, sending debris up to ten kilometers from the pad, according to the U.S. Fish and Wildlife Service (FWS). SpaceX acknowledged that it had underestimated the effects of the plume on the concrete without any kind of flame trench or deluge system based on static-fire tests at lower thrust levels that left the pad intact.

SpaceX installed a "steel sandwich" water deluge system at the repaired pad intended to prevent damage. That system, though, required an additional environmental review from FWS that held up the issuance of a revised launch license for the second launch. (The review concluded that the water from the deluge system "is expected to be less than an average summer rainfall event" and "would be unlikely to alter water quality.")

That deluge system worked. Images of the pad showed no major damage after the launch. "Just inspected the Starship launch pad and it is in great condition!" Musk posted on X (formerly Twitter) on Nov. 19. "No refurbishment needed to the water-cooled steel plate for next launch."

Other than the changes to the booster and pad to correct the problems seen in the first launch, the biggest change for Starship/Super Heavy's second flight was a new stage separation system. Rather than a conventional approach of separating the stages and then igniting the upper stage engines—which never happened on the first flight because the vehicle failed before that point—SpaceX announced a change to a "hot staging" approach where the upper stage ignites its engines before separation. A new vented interstage section would allow the exhaust to escape during the few seconds between ignition and separation.

"This is the most risky thing, I think, for the next flight," Musk said of the new stage separation approach in an online interview in June. The reason for doing so, he said, was to improve payload performance by avoiding losses from that brief coast during stage separation. "There's a meaningful payload-to-orbit advantage with >

< > hot-staging that is conservatively about a 10% increase."

The staging itself appeared to work on flight two. The engines on Starship ignited and, a few seconds later, separated from the Super Heavy booster, a process that resulted in dramatic, almost ethereal images. Starship continued its ascent as Super Heavy started its return to Earth for a planned splashdown in the Gulf of Mexico.

However, about half a minute after separation, while performing a planned boostback maneuver, the booster suddenly broke apart, either on its own or after its flight termination system (FTS) was activated. SpaceX hasn't provided additional information on the loss of Super Heavy, although the hosts of the SpaceX webcast stated that one thing they wanted to test on the flight was how the booster would handle the stresses from hot staging.

Starship continued its ascent, but about eight minutes after liftoff, not long before its engines were scheduled to shut down, SpaceX lost telemetry from the vehicle. It was traveling more than 24,000 kilometers per hour at an altitude of 148 kilometers at the time.

"We think we may have lost the second stage," John Insprucker, principal integration engineer at SpaceX, said on the webcast. He later said that the FTS on Starship was triggered but didn't indicate why it happened. SpaceX ended the webcast and hasn't provided an update on the test flight since then.

That meant that Starship didn't complete the full flight profile, which, like the first flight, was to fly a "nearly orbital" trajectory that ended with a Starship reentry and splashdown in the Pacific Ocean near Hawaii 90 minutes after liftoff. However, the vehicle flew longer and achieved more milestones than the first flight, correcting the problems seen in the first one while revealing new ones to be fixed.



A super-telephoto view of 33 SpaceX Raptor engines powering Starship off the pad on Nov 18, in South Texas.

Musk, in a post Nov. 19, said the booster and ship for the third launch "should be ready to fly in 3 to 4 weeks." However, even if the vehicles and the pad are ready by then, the company will have to wait until it completes a mishap investigation and has it approved by the FAA. The updated launch license that SpaceX received from the FAA for the second flight was good for only a single flight. This means Starship can't fly again until the FAA updates that license after the mishap investigation.

NASA CONCERNS

Starship, of course, is essential to SpaceX's future, from the deployment of a new generation of larger, more powerful Starlink satellites to its long-term ambitions for human missions to Mars. Starship, though, is also critical to NASA, which is counting on the lunar lander variant of Starship to return humans to the lunar surface on Artemis 3 in the middle of the decade.

In the months since Starship's first flight, NASA officials have shown some frustration with SpaceX's pace of development of Starship for the Human Landing System (HLS) program.

"They have a significant number of launches to go, and that, of course, gives me concern about the December of 2025 date" for Artemis 3, said Jim Free, NASA associate administrator for exploration systems development, at a June meeting of two National Academies committees. He later mentioned the "difficulties" SpaceX was having with Starship that concerned him about the schedule for Artemis 3. "You can think about that slipping probably into '26."

Asked about those comments at a NASA press conference two months later, Free suggested NASA might change the plans for Artemis 3 if Starship was delayed. "We may end up flying a different mission if that's the case," he said. "If we have these big slips out, we've looked at if can we do other missions."

He said then he had received an "updated schedule" from SpaceX about its Starship HLS work, but didn't disclose it, saying NASA needed "some time to digest it."

Two and a half months later, NASA was still digesting that schedule.

NASA is counting on Starship to carry astronauts to the lunar surface as part of the Artemis 3 mission targeted for December 2025.

TREVOR MAHLMANN

NASA says each Starship HLS mission could require nearly 20 launches, far more than the four to eight on-orbit fueling launches Musk estimated in 2021.



SPACEX

The Starship upper stage separates from the Super Heavy booster using "hot staging" on the Nov. 18 launch. In June, Musk said hot staging promises a 10% or better increase in payload performance.

"What I'm really happy about is that they've shown us that end-to-end focus," Free said at the American Astronautical Society's von Braun Space Exploration Symposium in Huntsville, Alabama, Oct. 25. He did not disclose details about that schedule and how it affected planning for Artemis 3.

At both that symposium and a meeting Nov. 17 of the NASA Advisory Council's human exploration and operations committee, Free appeared to dial back the pressure on SpaceX to come through on Artemis 3. "We have a whole bunch of new stuff that comes together for [Artemis] 3," he said at the committee meeting, including not just the HLS version of Starship but also modifications to Orion to allow for docking and new spacesuits under development by Axiom Space.

"Yes, the lander is absolutely important," Free said. "We can't go anywhere without it. But, we also can't go anywhere without the suits."

Even a fully successful Starship test flight, though, would be only the beginning of SpaceX's development efforts for a lunar lander. The company then needs to demonstrate cryogenic propellant transfer in orbit and the ability to launch Starships on a regular, rapid cadence to fill up a propellant tank in low Earth orbit that would then fuel the lunar lander Starship for its mission to the Moon.

At the Nov. 17 committee meeting, Lakiesha Hawkins, assistant deputy associate administrator in NASA's Moon to Mars Program Office, said the agency expected the total number of launches for each Starship HLS missions to be "in the high teens," far higher than what SpaceX has previously stated. Musk, back in 2021, said he believed no more than eight launches of tanker Starships would be required, and could be as little as four.

Those launches, she said, would take place on a "six-day rotation" involving both the Starbase launch site at Boca Chica as well as a new Starship launch pad SpaceX is building at Kennedy Space Center's Launch Complex 39A. While SpaceX has shown the ability to launch Falcon 9 rockets frequently — it carried out two such launches over the weekend just before and after the Starship launch — that cadence came after only many years of work by SpaceX. Artemis 3 is currently a little more than two years away.

Free, at the Huntsville conference, said he was looking ahead to the upcoming Starship test flight, sometimes designated OFT-2 for Orbital Flight Test 2. "We need OFT 2 to go, so I hope everybody in this room is cheering on OFT-2," he said. "We need that to be successful to get us that much further down the road."

But, like those debates from armchair analysts online after the Nov. 18 launch, he did not define what he considered it meant for the launch to be "successful." In a social media post after the launch, he wrote, "Looking forward to seeing what can be learned from this test that moves us closer to the next milestone." **SN**



SPACEX'S STARSHIP takes flight for the second time — 13 minutes after sunrise and 33 Raptor engines alight — on Nov. 18, 2023 from Boca Chica, Texas.

Launch photographer **Trevor Mahlmann** was in Texas for *SpaceNews* to capture this image using a sound-activated, remote camera tuned to just the right setting to activate as the rocket cleared the tower.

TREVOR MAHLMANN



SPACENEWS®
2023 ICON AWARDS

SpaceNews established the awards in 2017 to recognize and celebrate the people, programs and institutions shaping a rapidly evolving global space economy. Chosen by SpaceNews journalists with invaluable input from previous winners of these awards, the 2023 class of SpaceNews Icons include a mix of heavyweight champions, scrappy newcomers and long-serving stalwarts of an industry it has been a privilege to cover since our 1989 debut amid the dawn of the commercial space era.

with support from

ALL.SPACE

MILLENNIUM SPACE SYSTEMS
A Boeing Company

FIREFLY AEROSPACE

BLACK SKY

TERRAN ORBITAL

ROCKETLAB

American Astronautical Society

NORTHSTAR EARTH & SPACE

SPACENEWS
2023 ICON AWARDS

STARTUP OF THE YEAR

Isar Aerospace



An artist's rendering of the Spectrum rocket that Munich-based Isar Aerospace expects to debut in 2024.

Europe is in the midst of what officials there openly call a "launcher crisis." A combination of development problems, launch failures and geopolitical complications have temporarily deprived Europe of the ability to launch its own satellites. The Ariane 6, once planned to enter service in 2020, has been pushed back to 2024, after the retirement of the Ariane 5. The Vega C small launch vehicle has been grounded since a December 2022 launch failure and won't return to service until late 2024. Russia's invasion of Ukraine last year deprived Europe of access to the Soyuz rocket, which had backstopped both Ariane and Vega.

Amid the current problems, though, are signs of hope for the future. Several startups across the continent are working on small launch vehicles, developed with only modest government support. Those vehicles, expected to begin launches in 2024, will offer Europe both new ways to get to orbit and new solutions for its launcher crisis.

One of the companies at the vanguard of that effort is Isar Aerospace. Named for the river that flows through its home city of Munich, the company is nearing the first launch of its Spectrum rocket, designed to place up to one ton of payload into orbit. The company has been performing acceptance testing of engines for the rocket and, in November, inaugurated a launch pad for the rocket at Norway's Andøya Spaceport.

More impressive, perhaps, has been its ability to raise money. In March, Isar announced it raised $165 million in a Series C round from a group of European investors to help complete development and scale up production of Spectrum. The funding was one of the largest rounds raised by a space company in 2023 worldwide, and brings the total raised by Isar to date to $330 million — the most by a European space startup.

Remarkably, Isar raised the money even as other launch companies faced serious financial problems. Just a week after Isar closed its round, Virgin Orbit filed for bankruptcy, its assets later liquidated. Astra, which raised hundreds of millions going public through a SPAC merger in 2021, is now running low on cash and has delayed work on its new launch vehicle.

Isar has its own challenges as well. When it raised the Series C round, it expected to conduct its first Spectrum launch by the end of the year, but that has since slipped to sometime in 2024. It is also facing European competition from companies like HyImpulse, Rocket Factory Augsburg, and Skyrora, all planning first launches in the coming year.

The progress Isar Aerospace and others have made has helped reshape the European launch landscape. At the European Space Summit in November, ESA member states agreed to a package of financial support for Ariane 6 and Vega C, including a guaranteed number of institutional launches of each vehicle. However, they also agreed for the first time to open up some government missions to competition from other launch companies. That was only possible because of the progress, both technical and financial, that Isar Aerospace and others have made in providing new ways for Europe to reach space and helping get it out of its current launcher crisis. **SN**

ISAR AEROSPACE

SPACENEWS
2023 ICON AWARDS

DEAL OF THE YEAR

Eutelsat and Oneweb Merger Creates Multi-Orbit Champ



The post-merger combination of Eutelsat and OneWeb began trading as Eutelsat Group on the London Stock Exchange in early October.

Eutelsat and OneWeb's merger has created the only global operator with wholly owned satellites in low Earth orbit (LEO) and the geostationary arc, promising hybrid capabilities they believe will give them the edge on fierce competition in the broadband market.

The all-share deal combining French operator Eutelsat's 36 satellites in geostationary orbit (GEO) with U.K.-based OneWeb's LEO constellation of more than 600 spacecraft also came at a critical juncture for both companies.

Eutelsat was looking for ways to turbocharge a pivot into high-growth connectivity services as its legacy satellite TV business dwindled. At the same time, OneWeb sought a boost to take on the growing dominance of SpaceX's Starlink LEO network.

OneWeb had suffered multiple setbacks and only recently deployed enough satellites to enable global services before the end of this year. Launches using Russian Soyuz rockets were first put on hold after the pandemic pushed the company into bankruptcy in 2020. The British government and an Indian conglomerate rescued OneWeb from Chapter 11, only for Soyuz to be caught up in sanctions against Russia following its February 2022 invasion of Ukraine.

SpaceX's Falcon 9 came to the rescue this time, along with GSLV Mark 3 rockets from India that enabled OneWeb to resume launches seven months later.

But in the meantime, OneWeb was forced to watch from the sidelines as Starlink made gains in important enterprise markets, including aviation and maritime customers that many satellite operators are banking on for growth — including Eutelsat.

Eutelsat's established distribution channels around the world should help accelerate the commercialization of OneWeb satellites now in LEO, where broadband can be provided with lower latency compared with orbits much farther from Earth.

Low latency is important for many applications, from gaming to cloud-based networking. GEO satellites flying 35 times higher than LEO satellites, though, still have an advantage when it comes to delivering larger volumes of capacity to high-traffic areas, important for relieving congested networks at hotspots such as bustling airports.

The combined Eutelsat OneWeb group believes multi-orbit networks working in concert will be vital for meeting future connectivity needs as demand for bandwidth soars.

Other operators are also positioning their businesses for a multi-orbit future amid a shift toward hybrid networks pioneered a decade ago by SES, Eutelsat's European rival with satellites in GEO and medium Earth orbit (MEO).

Telesat, a Canadian GEO operator, has plans for a LEO constellation called Lightspeed that SpaceX is due to begin launching in 2026. Intelsat is supplementing its GEO network with services from OneWeb satellites as it plots a MEO constellation in 2027, and geostationary giant Viasat is considering non-geostationary options after acquiring Inmarsat in a $6.2 billion deal.

Key to Eutelsat OneWeb's success in this evolving landscape is the shape of a second-generation LEO network the group plans to deploy in 2027 to take advantage of its GEO backbone.

Eutelsat has estimated OneWeb Gen 2 would cost $4 billion. That's a heavy investment, but not one that deterred the more than 87% of Eutelsat shareholders voting at its general meeting in September in favor of the OneWeb merger.

Now, Eutelsat OneWeb just needs to show a fully owned and integrated GEO-LEO constellation can deliver the strategic advantage its constituents have been looking for. **SN**

EUTELSAT GROUP

SPACENEWS
2023 ICON AWARDS

COMMERCIAL SPACE ACHIEVEMENT OF THE YEAR

SpaceX Launch Cadence



SpaceX launched 90 times between Jan. 1 and mid-day Dec. 1, a total that included 84 Falcon 9 launches. At press time Dec. 1, SpaceX was counting down for its second Falcon 9 launch of the day, with a shot at getting the mission off before midnight.

Most launch companies announce their next missions days, weeks, or even months in advance. By contrast, in late November, SpaceX publicly announced its next launch just three hours before a Falcon 9 lifted off from Cape Canaveral, carrying a payload of Starlink satellites.

That limited advance notice reflects the rapid pace of launch activity at the company: There's little need to announce launches weeks in advance when SpaceX is launching two to three times a week. SpaceX announced plans early in 2023 to conduct 100 launches in the year, and as of the end of November, it had launched 83 Falcon 9 rockets, four Falcon Heavy rockets and two test flights of its Starship vehicle. By contrast, SpaceX launched 31 rockets, all Falcon 9 vehicles, in 2021.

The increased cadence is linked to SpaceX's mastery of reusability. Nearly all the Falcon 9 missions this year involved reused boosters that have flown, in some cases, up to 18 times each. The company also regularly reuses payload fairings, meaning a typical launch might only require a new upper stage. Improvements in ground infrastructure allow the company to conduct launches from the same pad just four days apart.

That high flight rate is essential for both SpaceX and the overall space industry. More than half of SpaceX's launches in 2023 have carried Starlink satellites as the company works to build out the constellation to serve a growing number of customers, as well as race Federal Communications Commission license milestones.

SpaceX's rapid launch cadence comes as much of the rest of the launch industry struggled to get off the launch pad in 2023. A combination of development delays, launch failures, and geopolitics have sharply reduced the supply of vehicles not named Falcon. Customers unwilling to wait several years have little choice but to go to SpaceX, where they have found plenty of near-term launch opportunities.

That's resulted in contracts that would have been considered unthinkable just a few years ago. Telesat announced in September it would launch its Lightspeed constellation, a competitor to Starlink, on Falcon 9 despite earlier having signed launch contracts with Blue Origin and Relativity Space. The European Space Agency launched its Euclid space telescope on a Falcon 9 in July, with two more missions to launch on that rocket in 2024. The European Commission said in November it was finalizing a contract for two Falcon 9 launches of Galileo navigation satellites in 2024.

SpaceX plans to continue increasing its launch rate. At a Senate hearing in October, Bill Gerstenmaier, SpaceX's vice president for build and flight reliability, said the company was planning to perform 12 launches a month in 2024, or 144 for the full year.

Tom Ochinero, SpaceX's vice president of commercial sales, suggested in March that the company could go to as many as 200 Falcon launches a year. "We have the hardware, we have the infrastructure, we can scale the staffing," he said. "There isn't any reason why we can't keep going." **SN**

SPACEX

SPACENEWS
2023 ICON AWARDS

CIVIL SPACE ACHIEVEMENT OF THE YEAR

OSIRIS-REx Sample Return

Sample return is at the apex of NASA's planetary science exploration strategy in terms of both its benefits and complexity. Bringing material back from another world allows it to be studied with instruments far more sophisticated than what can be sent on a spacecraft. Samples can also be preserved for analysis by future generations of scientists with more advanced equipment, as is the case today with lunar material returned by the Apollo missions. However, designing a spacecraft to carry out such a mission can be extremely difficult and expensive, as shown by NASA's current struggles with the Mars Sample Return program.

One NASA mission that demonstrated the benefits of sample return are worth the costs is OSIRIS-REx. On Sept. 24, a capsule landed in the Utah desert with about 250 grams of material from the near-Earth asteroid Bennu inside. The capsule's contents were whisked to the same curation facility at the Johnson Space Center that holds the Apollo samples, where scientists immediately started analyzing them.

To say those scientists were excited by their first look at the material from Bennu would be an understatement. "We picked the right asteroid and, not only that, we brought back the right sample," said Daniel Glavin, one scientist involved in the mission, at a briefing a couple weeks after the samples arrived. "This stuff is an astrobiologist's dream."

NASA selected the $1.16 billion mission — whose name is a convoluted acronym for Origins, Spectral Interpretation, Resource Identification and Security-Regolith Explorer — in 2011 as part of its New Frontiers line of planetary science missions. Scientists hoped that the samples would help them understand the formation of the solar system and the building blocks of life on Earth.

That initial analysis of the samples, showing them rich in carbon and hydrated minerals, appears to confirm those hopes. "We're already thrilled with the results," said Dante Lauretta, principal investigator for OSIRIS-REx at the University of Arizona.

OSIRIS-REx was not without its difficulties. When the spacecraft arrived at Bennu in 2018, scientists discovered the asteroid's surface was strewn with rocks, making it more difficult to find a spot to safely collect samples in a "touch-and-go" maneuver. When the spacecraft carried out that maneuver in October 2020, it found the surface was very porous — like a ball pit, scientists later said — and the spacecraft's sample arm plunged deeper into the surface than planned before pulling away, its sample head overflowing with material. The capsule was so full of material that, back on Earth, scientists have struggled to get it open: a literal embarrassment of riches.

The main OSIRIS-REx spacecraft, after releasing the sample canister in September, flew by Earth on a new extended mission called OSIRIS-APEX that will take it to another near-Earth asteroid, Apophis, in 2029. Long after that extended mission is over, scientists will likely still be examining the material OSIRIS-REx bought back from Bennu, proof that the value of sample return is worth the expense of getting those materials back to Earth. **SN**



NASA/GODDARD SPACE FLIGHT CENTER

OSIRIS-REx performs a "touch-and-go" maneuver in 2020 before heading back to Earth with 250 grams of material from the near-Earth asteroid Bennu on board. The sample capsule landed in the Utah desert on Sept. 24, 2023.

SPACENEWS
2023 ICON AWARDS

SPACE STEWARDSHIP

T.S. Kelso

If the skies were cloudy when NASA's Skylab space station passed over Kansas City shortly before reentering Earth's atmosphere in July 1979, the world might never have gained one of its most dedicated space safety and sustainability experts.

Watching Skylab pass overhead inspired T.S. Kelso to put his recently acquired desktop computer to use tracking artificial satellites. Forty-four years later, Kelso continues to keep tabs on satellites and orbital debris through CelesTrak, a free web-based service he established in 1985 to share orbital locations and analytical tools.

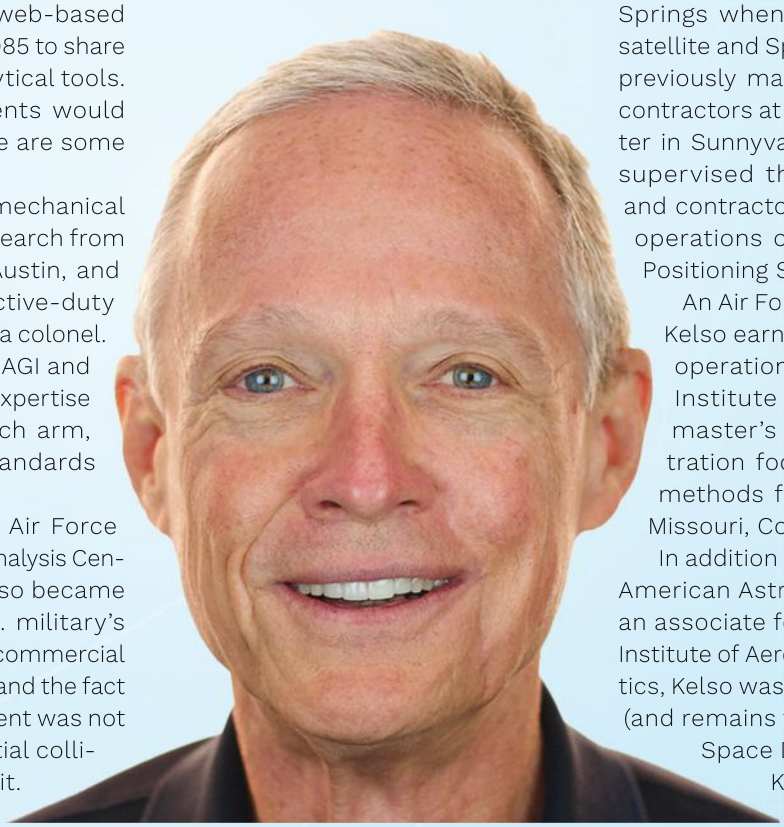
Kelso's accomplishments would fill many articles. But here are some of the highlights.

He earned a Ph.D. in mechanical engineering operations research from the University of Texas, Austin, and completed 31 years of active-duty military service, retiring as a colonel. During a 17-year career at AGI and Comspoc, Kelso provided expertise to the company's research arm, the Center for Space Standards and Innovation.

While leading the U.S. Air Force Space Command's Space Analysis Center in the early 2000s, Kelso became acutely aware of the U.S. military's overwhelming reliance on commercial communications satellites and the fact that the Defense Department was not screening them for potential collisions in geostationary orbit.

After retiring from the Air Force, he developed online tools to identify conjunctions and helped establish the Space Data Association, an international organization that enables satellite operators to share ephemeris data and maneuver plans securely, as well as the Space Data Center, which assesses collision risks and issues warnings.

During his lengthy career, Kelso taught extensively. At the Air Force Institute of Technology at Wright Patterson Air Force Base in Ohio, he served as an assistant professor of space operations and associate dean of the Graduate School of Engineering.



While in the Air Force, Kelso led the Department of Defense's analysis of the 2003 Space Shuttle Columbia accident, which provided evidence that helped explain why Columbia broke apart on reentry, killing the seven astronauts onboard.

Earlier in his career, Kelso established training for Air Force personnel assigned to the Consolidated Space Operations Center near Colorado Springs when it took over military satellite and Space Shuttle programs previously managed by government contractors at the Satellite Test Center in Sunnyvale, California. He also supervised the team of Air Force and contractor personnel managing operations of nine Block 1 Global Positioning System satellites.

An Air Force Academy graduate, Kelso earned a master's in space operations from the Air Force Institute of Technology and a master's in business administration focused on quantitative methods from the University of Missouri, Columbia.

In addition to being a fellow of the American Astronautical Society and an associate fellow of the American Institute of Aeronautics and Astronautics, Kelso was the inaugural recipient (and remains the namesake) for the Space Data Association's T.S. Kelso Award for Space Safety. SN

Forty-four years after witnessing Skylab's infamous reentry, T.S. Kelso continues to keep tabs on satellites and orbital debris through CelesTrak, a free web-based service he established in 1985 to share orbital locations and analytical tools.

COURTESY T.S. KELSO

SPACENEWS
2023 ICON AWARDS

UNSUNG HERO

Utah State University's Small Satellite Conference

Thousands of people travel to Logan, Utah, every August for the annual Small Satellite Conference at Utah State University.

Unlike other conferences where people frequently dash off to visit colleagues or customers, SmallSat participants tend to linger, remaining on campus throughout the day for technical sessions and side meetings, meals, coffee, and snacks.

"We do a lot of things here to promote interaction," said Pat Patterson, Utah State Space Dynamics Laboratory advanced concepts director and SmallSat conference chair.

SmallSat dates back to 1987, when a few dozen university research professors were looking for affordable ways to augment classroom instruction for aerospace engineering students. At the time, that meant pooling resources to build miniature satellites.

"You bring the sensor, I'll bring the power system, and maybe we can afford to build it," Patterson said. "The whole point was getting these folks to collaborate."

Nearly 38 years later, SmallSat remains true to its academic roots and spirit of collaboration. Researchers showcase their work through poster sessions. And the SmallSat Student Competition awards college scholarships for innovative satellite concepts, research and missions.

While the SmallSat Conference ballooned to 3,700 participating in 2023, attendees continue to share buffet lunches at long tables under a tent on the grassy quad.

"Lots of times where you'll have a colonel sitting next to professor and across from a student and somebody from Lockheed Martin," said Patterson, who attended the first SmallSat as a Utah State student in 1987, joined the SmallSat Committee in 1997 and has been overseeing the conference since 2000.



U.S. Space Force Col. Matt Allen, deputy director of the National Reconnaissance Office Advanced Systems and Technology, speaks at the 37th Annual Small Satellite Conference held in August.

SmallSat also promotes interaction through jam-packed exhibit halls where attendees line up for Aggie ice cream, an afternoon treat produced on campus with milk from Utah State's Caine Dairy.

Unlike other conferences where prime contractors can opt for expansive booths with meeting rooms and seating areas, SmallSat offers only single or double booths.

"That is intentional because we want the entire community to be here," Patterson said. "We want companies with three people to have just as much opportunity to showcase their wares on the floor as the big boys."

In spite of spearheading the event, which is expected to bring 4,000 people to Logan in 2024, Patterson deflects credit for its success to SmallSat committee members, staff and volunteers, who evaluate hundreds of single-page proposals for technical sessions, short talks called Swifties and poster sessions.

For SmallSat attendees, who wonder how long the expanding event can remain in Logan given the dearth of hotel rooms, Patterson has a message.

"If it moved to a big city, it would lose the character and the cost would skyrocket," Patterson said. "We've looked into a bigger venue several times. Everything just goes berserk when it comes to cost." **SN**

USU SMALL SATELLITE CONFERENCE

SPACENEWS
2023 ICON AWARDS

MILITARY SPACE ORGANIZATION OF THE YEAR

Space Systems Command's Commercial Space Office (COMSO)

As innovation in space technology rapidly accelerates globally, the U.S. Space Force finds itself at an inflection point. Mission success relies not just on building traditional military hardware but on leveraging advancements from the burgeoning commercial space industry.

Efforts to bring cutting-edge commercial space capabilities into the national security realm are being spearheaded by the Space Systems Command's Commercial Space Office (COMSO).



Under Col. Richard Kniseley, COMSO is bringing cutting-edge commercial space capabilities into the national security realm.

COMSO is being recognized for its work facilitating the adoption of new commercial space technologies across the Space Force. At a time when the space domain is growing more contested — and is becoming the latest front for U.S.-China strategic competition — COMSO leaders understand the importance of aligning entrepreneurial vigor with national defense priorities.

"In order to be successful, we really need to start migrating away from thinking that we have to build everything in-house," says U.S. Space Force Col. Richard Kniseley, senior materiel leader at Space Systems Command and head of COMSO.

"We need to shift to a mindset to start getting sufficient capability out there fast to the warfighter," Kniseley insists.

The Space Systems Command established COMSO in April 2023 as a "one-stop shop," combining a patchwork of commercial endeavors into a more streamlined organization. "That enables us to understand and tap into the robust commercial marketplace," says Kniseley. He explains that COMSO "openly engages industry to solve government challenges and opportunities."

The Space Force needs to be "constantly evaluating where we can go with commercial industry, and to regularly meet with companies to understand their capabilities going forward," Kniseley adds, noting that the mantra at Space Systems Command is to "build what we must and buy what we can."

Some of the commercial activities under COMSO existed before the office was created, such as the Commercial Satellite Communications Office, the SpaceWERX organization and the Space Enterprise Consortium. SpaceWERX awards small business innovation research contracts and serves as a strategic financing hub to help startups attract investors. The SpEC consortium manages prototyping projects where established defense contractors team up with nontraditional firms.

Other elements of COMSO are newer initiatives, such as a web portal called "front door," aimed at helping startups find contacts and sign up for meetings. COMSO also runs a space domain awareness marketplace that facilitates interaction and transactions between space data producers and consumers.

Its newest project is the commercial space reserve — a concept similar to the commercial reserve air fleet, where airlines agree to provide the government with airlift services during emergencies. The details of a commercial space reserve are still being worked out, and the Pentagon has expressed support for the program.

For all its early momentum, COMSO faces headwinds. Old procurement habits in the Pentagon die hard. And the preponderance of military space dollars still flows towards expensive, custom-built systems, not the commercial alternatives the office seeks to promote. Not everyone in the commercial space industry is convinced that COMSO can transform entrenched military procurement practices, as there are pockets of skeptics who instinctively distrust the reliability and security of commercial space services not purpose-built to strict military specifications.

However, COMSO is slowly exposing more Space Force members to cutting-edge commercial capabilities while educating private sector firms on specialized government needs.

An upstart in the military space-industrial complex, COMSO is postured to become a force for change in the defense procurement bureaucracy, step by step, contract by contract. **SN**

: U.S. AIR FORCE PHOTO BY CHERIE CULLEN

SPACENEWS
2023 ICON AWARDS

HONOREE ROLLCALL

The winners of the 2023 Icon Awards came from an impressive list of finalists. These companies, missions, organizations and individuals have accomplished major achievements in the last year and, in many cases, over many years. Below are brief summaries of these other honorees in the award categories.

Startups of the Year

IMPULSE SPACE

Led by none other than SpaceX founding rocket designer Tom Mueller, Impulse Space is making waves in the industry by raising an impressive $75 million since last year. What sets them apart? Impulse Space is on a mission to build an in-space transportation company, positioning itself to take full advantage of Starship's market-transforming rideshare capabilities. Their innovation has the potential to reshape the space transportation landscape..

KEPLER COMMUNICATIONS

Hailing from Canada, Kepler Communications has attracted widespread attention with its $92 million Series C funding round this year. This investment is fueling their expansion from low data rate IoT connectivity into optical data relay, a hot market driven by the U.S. Space Development Agency's keen interest in laser communications. Kepler Communications is playing a pivotal role in shaping the future of proliferated LEO communications and missile-tracking constellations.

THE EXPLORATION COMPANY

Established in 2021, The Exploration Company has achieved an extraordinary milestone by raising $44 million this year, a record Series A for a European space startup. While this sum might be overshadowed by larger Series A funding rounds in the United States, it marks a significant accomplishment for the European venture capital market. The Exploration Company is focused on resupplying the burgeoning array of commercial space stations in development. The venture plans to launch its first reentry demonstrator next year, likely on a Falcon 9.

Deals of the Year

VIASAT's INMARSAT ACQUISITION

Viasat's expansion beyond the North and South American broadband markets it has served from GEO for decades got a turbo boost from its acquisition of maritime-heavy Inmarsat and its fleet of 15 GEO satellites. Scale has its advantages in a consolidating market. The combined Viasat-Inmarsat, with 60% more revenue than Viasat alone, is better positioned to absorb the loss of ViaSat-3 Americas to a crippling deployment failure.

TELESAT's LIGHTSPEED PARTNER PIVOT

Telesat finally has funds for a LEO broadband network after pivoting from Thales Alenia Space to smaller but equally capable satellites from MDA. The Canadian operator booked SpaceX for 14 launches between mid-2026 and mid-2027 to fully deploy all 198 satellites Lightspeed needs to provide global coverage. While Telesat had hoped to start expanding out of GEO years earlier, the company expects the delays will be a blessing in disguise for a constellation now set to be $2 billion cheaper with MDA.

L3 HARRIS's AEROJET ROCKETDYNE ACQUISITION

The completion of L3Harris' $4.7 billion deal this summer to acquire Aerojet Rocketdyne capped a period of uncertainty for the storied rocket engine manufacturer. Lockheed Martin in 2020 sought to buy it for $4.4 billion. That acquisition was blocked by the Federal Trade Commission. The combination strengthens L3Harris' position in propulsion systems and the space market through expanded capabilities in technology for defense, civil and commercial applications. For Aerojet, being part of L3Harris provides greater financial scale and access to capital that can support and accelerate Aerojet's R&D and product development efforts.

Commercial Space Achievements

INTELSAT AND SES MEET C-BAND DEADLINES

Intelsat and SES are due a combined $7 billion windfall for returning publicly owned C-band to the FCC, on top of the $2 billion already received for helping make the spectrum available for U.S. telecom networks. The funding helps the companies as they navigate a shifting satellite communications market that will increasingly depend on non-geostationary satellite constellations. For Intelsat, that includes considering using its C-band windfall to develop a medium Earth orbit constellation.

VIRGIN GALACTIC's FIRST COMMERCIAL SPACESHIPTWO FLIGHTS

After years of development delays, including a fatal accident in a 2014 test flight, Virgin Galactic started commercial flights in June, and continued to fly about once a month into November. This allows the company to finally serve customers who, in some cases, bought tickets more than 15 years ago while working on a >

< > new generation of vehicles that promise more frequent and less expensive suborbital flights.

Civil Space Achievements

CHANDRAYAAN-3 LUNAR LANDING

India joined a small club of nations to have successfully landed on the moon. So far this century, no one besides China — and now India — has completed a lunar landing, although plenty have tried (excluding, notably, the United States). Underscoring the difficulty of this feat, Chandrayan-3's Aug. 23 landing near the moon's south pole followed on the heels of failed attempts by Japanese commercial venture ispace on April 25 and Russia on Aug. 19.

TROPICS

More than a decade went into the development of the 12-channel passive microwave radiometer small enough to fit into a 3U cubesat form factor. The mission overcame the obstacle of losing the first two on an Astra rocket failure in 2022, with the remainder launching on two Rocket Lab Electrons in May and commissioned in time for the start of the 2023 hurricane season.

NASA's PSYCHE LAUNCHES

NASA's Psyche mission to the metallic main-belt asteroid of the same name is back on track after software testing issues forced the mission to miss its original launch window in August 2022. Those problems prompted changes at the Jet Propulsion Laboratory, correcting institutional issues that could have imperiled other missions run by the lab.

ESA's JUPITER ICY MOONS EXPLORER (JUICE) LAUNCHES

The ESA-funded, Airbus-built JUICE mission launched in April on an eight-year voyage to Ganymede, Callisto and Europa, considered three of Jupiter's most tantalizing moons because of the possibility of liquid oceans hidden beneath their icy surfaces.

Unsung Heroes

SPACE ISAC

The Space ISAC was established in 2019 by aerospace, information technology and space companies to improve cybersecurity. The nonprofit facilitates collaboration among companies and government agencies in identifying and responding to physical and cyber threats to spacecraft and terrestrial infrastructure. At the Space ISAC Operational Watch Center in Colorado Springs, analysts monitor space-related data to detect anomalies.

JEFFREY MANBER, NANORACKS

Manber has been a pioneer in commercial space activities since his work with Russian space companies in the 1990s as they navigated the transition from Soviet-era control. He later founded Nanoracks, which became one of the first companies to make commercial use of the ISS, from launching cubesats to developing the Bishop airlock. The company is now at the forefront of efforts to develop commercial space stations to succeed the ISS. Manber received NASA's 2023 Distinguished Public Service Medal.

MARCIA SMITH, SPACEPOLICYONLINE.COM

With more than four decades of experience in space policy, Smith is an indispensable resource of clear and concise news, information and analysis about U.S. civil, commercial and military space programs. Smith, a founding member and past president of Women in Aerospace, spent 31 years working at the Congressional Research Service and three at the National Academies' Space Studies and Aeronautics and Space Engineering Boards. A fellow of the American Institute of Aeronautics and Astronautics and a fellow of the American Astronautical Society, Smith is the founder and editor of SpacePolicyOnline and editor of the quarterly journal, Space Policy.

Space Stewardship

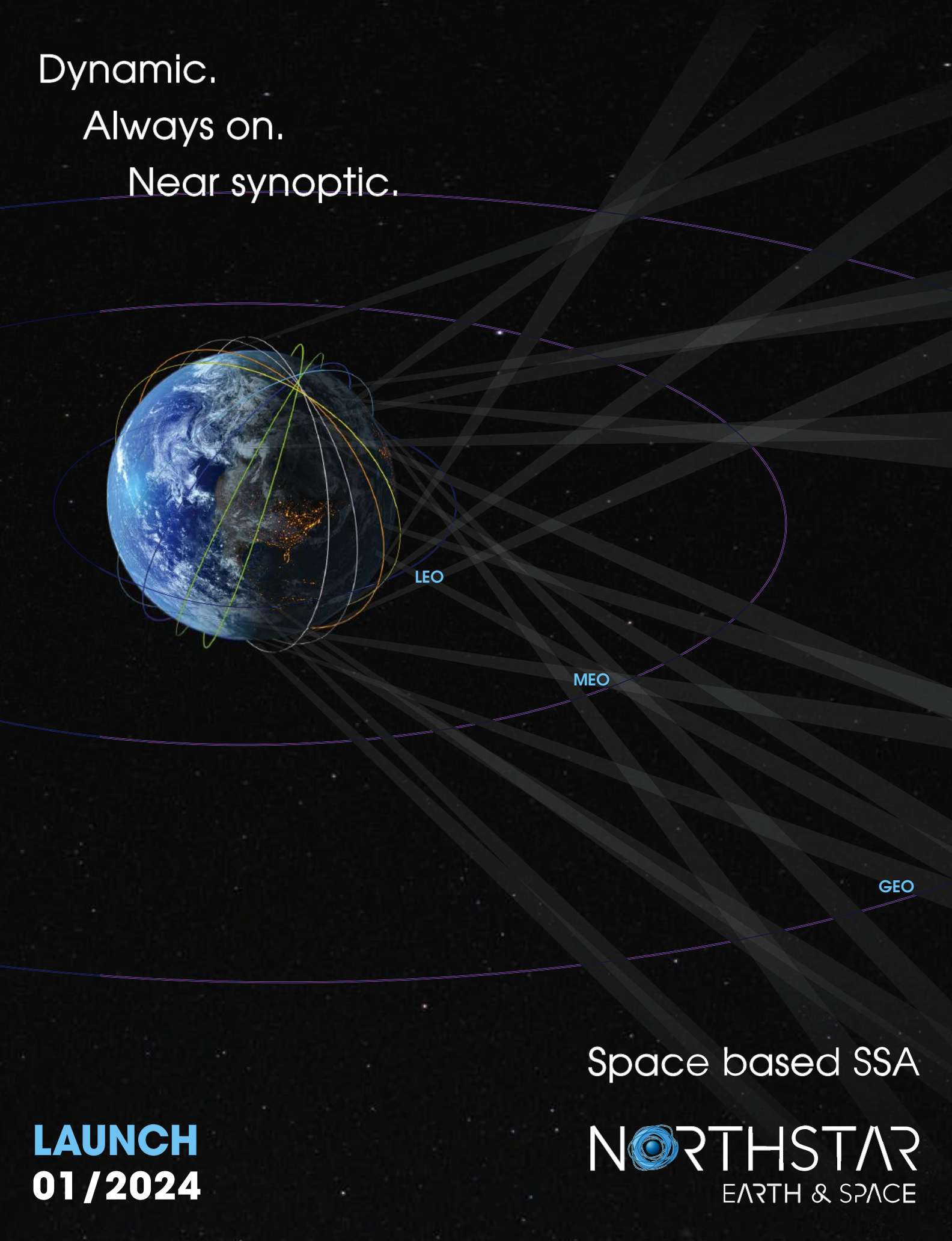
MORIBA JAH

An astrodynamicist with a Ph.D. in aerospace engineering, Jah is well known for promoting space environmentalism in both industry and academia. As a professor at the University of Texas at Austin, he and colleagues developed tools to merge datasets of space objects from academia, industry and government. The resulting catalogs plus visualization tools are available through free online platforms, ASTRIAGraph and Wayfinder. Jah is also co-founder and chief scientist of Privateer Space, a company working on space traffic management technologies. Jah received a MacArthur Foundation "Genius Award" in 2022.

CONFERS

The Consortium for Execution of Rendezvous and Servicing Operations
(CONFERS) was established with the support of DARPA to create an industry forum for discussing standards and best practices for the emerging satellite servicing field. In the last year, CONFERS has become an organization independent of DARPA as it continues its work to further technology, policy and communications issues about satellite servicing.practices for the emerging satellite servicing field. In the last year, CONFERS has become an organization independent of DARPA as it continues its work to further technology, policy and communications issues about satellite servicing. **SN**

Dynamic.
Always on.
Near synoptic.



Space based SSA

LAUNCH
01/2024

NORTHSTAR
EARTH & SPACE



COMMENTARY Robert Zubrin



NASA is delaying plans to move the Mars Sample Return program to its next phase of development after an independent review found serious issues with its technical readiness, cost and schedule.

Rethink the Mars Program

It's time to consider alternatives to sample return

NASA/JPL-CALTECH.

NASA's robotic Mars exploration program is in crisis. A recent review of the plan of its flagship Mars Sample Return (MSR) mission pegged its cost at $10 billion, a price tag that threatens to preclude funding any other exploration missions to the Red Planet for the next decade and a half.

While the decadal plan issued by a National Academy of Science committee identifies the MSR mission as the top priority for NASA's Mars exploration program, given the cost and schedule numbers now available, it is time for the rest of us to question whether the program of record still makes sense.

Let us consider the alternative. For the same $10 billion now projected to be spent on the MSR mission over the next 15 years, we could send 20 missions averaging $500 million each in cost. These could include landers, rovers, orbiters, drillers, highly capable helicopters, and possibly balloons or other more novel exploration vehicles as well. Instead of being limited to one exploration site, these could be targeted to 20 sites and carry a vast array of new instruments provided by hundreds of teams of investigators from around the world.

NASA claims that its Mars exploration program aims to search for life. However, the agency last flew a life detection experiment to Mars in 1976. With a robust program of this type, we could fly a dozen life detection missions to various locations and not only test the surface soil in various new ways for life but drill down to search much more life-favorable strata beneath the surface.

With a robust program of this type, we could do many other things. Helicopters of other aircraft could carry sniffers to search for methane vents, and study thousands of surface locations each time they land. Such craft could also scan the subsurface of the planet for caverns

What is the best Mars exploration program that the American people can buy for their $10 billion? All options should be on the table.

and hydrothermal systems using ground penetrating radars (GPR). The power of a radar return signal goes as the inverse fourth power of the distance from the transmitter to the target, providing an eight-order of magnitude advantage to aircraft over orbiters for this type of exploration. Most of Mars is underground. We should see what's there.

These are just a couple of examples. For every instrument flown on Curiosity or Perseverance, there were 10 other good ones proposed that had to be excluded for lack of payload capacity. With a robust program of this type, many more instruments would get a chance to be flown. Not only that, but with plentiful missions in the queue, it would be possible to use the information provided by early missions to improve the engineering design of the exploration vehicles and identify the best instruments and target locations for follow-up investigations.

The science return from such a rich and varied program of this type would vastly exceed that offered by returning a few samples from one location on Mars. The authors of the National Academies of Science committee report apparently disagree. But there is another issue: Mission risk.

To be remotely competitive with the varied program, the MSR needs to actually return the samples it collects to Earth. What is the chance that will occur?

Let's look at the numbers. In its history, NASA has flown 25 spacecraft to Mars, of which (if we include the Ingenuity helicopter in the count) 20 have been successful. That is a mission success probability of 0.8. The European Space Agency's Mars spacecraft track record is two out of four, for a mission success probability of 0.5. The MSR mission, as currently conceived, includes two new NASA spacecraft (the sample return lander and the ascent vehicle), and one ESA spacecraft (the orbiter that will collect the sample in Mars orbit and return it to Earth.) If any of those three spacecraft fails, the mission fails. That means that to calculate the probability of mission success, one must put the success probability of each into series, and multiply them together. That means that, based on the individual risk presented by each of the principal flight elements alone, the overall probability of mission would be 0.8 x 0.8 x 0.5 = 0.32 or about one in three.

That estimate, however, does not include the additional risk associated with the interface between the flight elements, most importantly the success of the autonomous rendezvous and dock and sample transfer in Mars orbit between the Mars ascent vehicle and the sample return orbiter, which has never been done. Furthermore, the 0.32 estimate for the probability of MSR mission success only includes technical risk. It ignores programmatic risk, which in the case of the ESA orbiter is extremely high, as that program could easily be canceled should any one of a dozen governments have a change of heart about funding it any time over the next decade. Indeed, even if the ESA orbiter is funded, the probability is extremely high that it won't arrive on time, as witnessed by the ongoing travails of ESA's Rosalind Franklin Mars rover, which, while originally planned for 2018 launch, is now scheduled for flight in 2028.

In short, the MSR program of record is extremely high risk. It could very well not produce any science at all.

In contrast, the success of the varied program is virtually guaranteed. With 20 independent missions, each with a success probability of 0.8, the odds are that at least 16 of the 20 will succeed – most probably more, since later missions can take advantage of lessons learned on earlier flights.

Given these realities, it would be irresponsible for NASA to unquestioningly accept the National Academies of Science recommendations and put all its Mars exploration program eggs in the single high-risk basket of the sample return mission. At the very least, a study should be done comparing both the scientific return and risk of the MSR program of record against that of the varied program, assuming both are funded at the same level.

What is the best Mars exploration program that the American people can buy for their $10 billion? All options should be on the table. Congress should insist that NASA provide the numbers. **SN**

ROBERT ZUBRIN IS AN AEROSPACE ENGINEER AND PRESIDENT OF THE MARS SOCIETY WWW.MARSSOCIETY.ORG. HIS NEXT BOOK, "THE NEW WORLD ON MARS: WHAT CAN WE CREATE ON THE RED PLANET," WILL BE PUBLISHED IN FEBRUARY BY DIVERSION BOOKS.

The Mars Sample Return program of record is extremely high risk. It could very well not produce any science at all.

COMMENTARY Brian Chow

Deterring a Space Pearl Harbor through better discourse



SPACENEWS/MIDJOURNEY ILLUSTRATION

In 2007, China succeeded in an anti-satellite (ASAT) test that alerted the U.S. about the broad vulnerability of its satellites. Since then, the Pentagon has focused on developing resilient solutions to space threats of the 2030s and beyond while neglecting the rendezvous spacecraft threat that could result in a Space Pearl Harbor in the 2020s. This article proposes a strategy for the Pentagon to improve its current public discourse for deterring this catastrophic attack.

In 2008, China started testing dual-use spacecraft capable of rendezvous and proximity operations. By January 2022, Beijing had successfully docked a rendezvous spacecraft with its own dead satellite in a geosynchronous orbit and maneuvered it to a higher orbit, less than two years behind the U.S. doing the same. The combination of China's rendezvous and robotic advances and rapid small-satellite manufacturing capability could yield about 200 rendezvous spacecraft capable of forcibly docking and disabling U.S. critical satellites as early as 2026; this army of agile spacecraft is well suited to serve as a "shock and awe" precursor to its military campaign to seize Taiwan.

In 2001, the Rumsfeld Commission issued a prescient warning: "Whether the U.S. will be wise enough to act responsibly and soon enough to reduce U.S. space vulnerability. Or whether, as in the past, a disabling attack against the country and its people—a 'Space Pearl Harbor'—will be the only event able to galvanize the nation and cause the U.S. Government to act."

Now that such an attack could turn

the free world into a hellscape under the thumb of an authoritarian regime in a few years, how well has the Pentagon assured the U.S. public, as well as the international public, that the U.S. will have the capability in time to deter and defend against this fateful assault?

In a discussion with retired Gen. Kevin Chilton on June 12, Vice Chief of Space Operations Gen. David D. Thompson was asked how the Space Force plans to avoid a Space Pearl Harbor. Thompson said that the Space Force has several capabilities to handle an adversary, including an operating "space intelligence enterprise" to analyze "space-based and counterspace threats"; "a broad understanding of space domain awareness" that "focuses on possible threats rather than 'managing the traffic'"; "joint cyber defense forces" that should prevent surprises from adversaries; and an "emerging ground moving target indicator capability" for the Space Force to "observe and call out bad behavior anywhere on or above the planet."

In addition to these observational capabilities that warn Washington of an imminent attack, there must be defensive capabilities that prevent any attack from seriously degrading the functions performed by the targeted satellites. Gen. Thompson highlighted "satellite proliferation as key to preventing a devastating surprise attack." However, I have shown that while proliferated constellations can significantly contribute to space resilience in the 2030s and beyond, production will not be fast enough to replace or supplement many vulnerable legacy constellations and their legacy-like follow-ons during the 2020s.

Lt. Gen. DeAnna Burt, Deputy Chief of Space Operations, Cyber and Nuclear, shares Gen. Thompson's sentiments and explained in an interview, reported by *SpaceNews* on July 11, that if the U.S. wants to prevent a Pearl Harbor-style attack in space, the Space Force has to attribute any nefarious actions, provide warnings, have resilient architectures, and conduct responsible counter-space campaigns that, for example, minimize debris creation.

It is hard to recall any senior space officer, now or in the past, who had openly said more about the plan to counter a Space Pearl Harbor than the two mavericks above recently did. That is to say, in its communications with the public, the DoD has long been focused on the impacts of this aggression but little on how to prepare for it. By talking about the horrors of a looming Space Pearl Harbor without offering the public a basic understanding of its preparedness, the DoD could be creating public fear and losing all-important public support for military spending and actions. Both of these would "undermine the Department's effort to remain a good steward of the public trust."

Beyond creating public fear and reducing public support, the repercussions of the DoD's opacity about its plan could be far worse. Rendezvous spacecraft are a new kind of threat with unfamiliar nuances, and far from adequate data exists from traditional analyses and counters. Fortunately, since 2015, many credible, open articles have made specific suggestions on addressing this rapidly emerging threat. Yet, the DoD has hardly commented on these recommendations publicly, and the preparedness plan disclosed to the public does not reflect that these ideas have been adequately considered. Thus, the DoD's undisclosed plan remains unchallenged by outside expertise. The DoD and Americans may realize too late that our preparedness was insufficient and slow to counter a Space Pearl Harbor. This is far from a groundless worry. As Gen. John Hyten, then Vice Chairman of the Joint Chiefs of Staff, said in 2021, "although we're making marginal progress, the DoD is still unbelievably bureaucratic and slow" in its response to China's rapidly advancing space weapons. Instead, the DoD should proactively involve these expert authors as sources of ideas or additional sets of eyes to assure that the U.S. is on the right path to timely preparation.

Moreover, better unclassified dialogue and collaboration may well be sufficient for the Pentagon to attain timely preparedness for a Space Pearl Harbor and assure the public of its safety, provided that these efforts start as soon as possible.

WHAT MORE THE PUBLIC NEEDS TO KNOW NOW

The Pentagon has long been using unclassified scenarios and wargames to concretely inform the public as well as itself about planning for readiness. While there are informative wargames relevant to a Space Pearl Harbor that happens as early as 2026, they should be supplemented by frequent interactions and collaboration with individuals who publish openly on issues pertaining to a timely solution to counter such an attack. These activities include on-the-record >

By talking about the horrors of a looming Space Pearl Harbor without offering the public a basic understanding of its preparedness, the DoD could be creating public fear and losing all-important public support for military spending and actions.

Americans may realize too late that our preparedness was insufficient and slow to counter a Space Pearl Harbor. This is far from a groundless worry. As the Vice Chairman of the Joint Chiefs of Staff said in 2021, "although we're making marginal progress, the DoD is still unbelievably bureaucratic and slow" in its response to China's rapidly advancing space weapons.

< > discussions with these analysts with openly accessible transcripts. There are plenty of patriotic individuals — I include myself among them — who would feel honored to donate their services to help the Pentagon deter this looming disaster.

Gen. Thompson, Lt. Gen. Burt, or the Pentagon can initially address three sets of questions. Following the spirit of scenarios, these questions are specific so that the discussants can, instead of talking past each other, constructively criticize each other and seek common ground. If compromise still cannot be attained, the different camps will write their own positional papers.

Scenario 1: A Space Pearl Harbor within this decade via the use of China's rendezvous spacecraft. How likely does the Pentagon project this scenario to be? How does the Pentagon plan to be ready to deal with 200 rendezvous spacecraft attackers as early as 2026? Or, for planning purposes, does the Pentagon use a different number of rendezvous attackers and a different date for readiness?

Scenario 2: A Space Pearl Harbor within this decade or later via a different mechanism. If Gen. Thompson and Lt. Gen. Burt have different threat(s) in mind that China may use to generate this game-changing attack, roughly estimate the number of attackers and the soonest date that China is capable of launching such an attack via these alternative or additional means. How does the Pentagon plan to be ready for such threat(s) and what is its target readiness date?

Scenario 3: China creates an imminent threat by prepositioning its rendezvous spacecraft within attacking range. Since 2018, at least 11 high-level space officers and intelligence agencies, without any notable dissent, have publicly stated concerns that rendezvous spacecraft could be used to threaten U.S. critical satellites from close range. As stated above, proliferated constellations cannot be implemented in time to have appreciable effects on space resilience within this decade. What other defensive measures, such as bodyguard spacecraft, is the Pentagon developing and implementing to protect these critical but vulnerable satellites during the second half of the 2020s?

WHY THE DOD SHOULD SEEK MORE HELP FROM CREDIBLE UNCLASSIFIED SOURCES

In space, the DoD has been providing a bird's eye view of space policy, space strategy, space threats, and space defense programs to the public. As for the design, development, and implementation of solutions to specific space threats, the DoD relies on in-house works supported by federally funded R&D centers, the defense industrial base and others. Such a U.S. defense enterprise might be adequate for the first half-century of the space age. The same can no longer be said, as the DoD has been, since 2007, playing catch-up to repair its long neglect of satellite resilience. Moreover, adversaries' rapid advances in space technologies and weapons, especially those pertaining to ASAT operations, have kept DoD's hands more than full.

In addition, First Chief of Space Operations Gen. John W. Raymond emphasized that "recent resurgence in deployment of modern direct assent [sic] and co-orbital ASAT capabilities require us to develop and deliver offensive and defensive options in the near-term, while we transition to a resilient architecture able to mitigate attack, assure capabilities, and rapidly reconstitute in the mid- to long-term." Yet, the Space Warfighting Analysis Center has been pursuing space resilience for the mid- to long-term but has done inadequately for near-term resilience, especially against "co-orbital ASAT capabilities" (e.g., rendezvous spacecraft threat).

With excessive workloads and already apparent signs of inability to counter space threats of the 2020s, the DoD must seek help. Fortunately, unclassified studies published in credible sources that the DoD has not been taking advantage of are mostly free to the DoD, and the intellectual capital of these authors is an invaluable American resource waiting to be fully utilized.

It is unconscionable not to seek this help in this critical time window to ensure the Pentagon, the U.S., and the free world are prepared for a looming Space Pearl Harbor. **SN**

BRIAN CHOW IS AN INDEPENDENT POLICY ANALYST WITH MORE THAN 170 PUBLICATIONS. HE CAN BE REACHED AT BRIANCHOW.SP@GMAIL.COM.



CONNECTING THE DOTS Jason Rainbow

Europe plots constellation manufacturing powerhouse

Thales Alenia Space (TAS) is laying groundwork for a small satellite factory in Italy that it hopes will be at the forefront of constellation manufacturing in Europe, bringing the continent closer to mass production capabilities across the Atlantic.

The joint venture between Thales of France and Leonardo of Italy aims to have the "Space Smart Factory" up and running by mid-2025 in Rome, three kilometers from where the company integrates 700-kilogram-plus Galileo navigation satellites in a facility geared for larger spacecraft.

Although the new 21,000-square-meter facility could also be used for large satellites, Massimo Comparini, head of the company's Italian operations, said the main goal is to churn out a couple of 200-kilogram satellites a week if it can find the customers.

More than 100 million euros ($110 million) is being invested to set up the factory, supported by funds the Italian government set aside for boosting the country's economy following the pandemic.

Less than a third of this investment is coming from Italy's National Plan for Recovery and Resilience, Comparini told *SpaceNews*, with the company stumping up the rest. "It's quite a large investment," he said, but "it's going to boost our competitiveness and our production capacity in the coming years."

The facility will include 5,000 square meters of clean rooms. That's a third of what TAS has at facilities in Cannes, France, where it also assembles satellites. However, Comparini said the new plant would incorporate more advanced technologies, and leverage collaborative workspaces to support small and medium-sized businesses that have partnered on satellite projects.

Alongside advanced manufacturing tools using the latest breakthroughs in artificial intelligence to accelerate production, Comparini said the Space Smart Factory would manage workflow information more efficiently to guard against supply chain disruption.

COVID-19 hit the space industry hard in 2020, delaying satellite projects and increasing costs across the sector. Blaming supply and funding issues stemming from the pandemic, Canada's Telesat recently switched from TAS to domestic satellite maker MDA to build its Lightspeed constellation of at least 198 satellites.

Lightspeed's loss was another blow for the European space giant's ambitions to get more constellation business after successfully delivering them for Globalstar and Iridium of the United States. TAS also built first-generation O3b Network satellites for Luxembourg-based SES, which pivoted to U.S.-based Boeing for the second-generation currently being deployed in orbit. MDA and Rocket Lab are providing the latest generation of satellites for Globalstar.

TAS not only faces tough competition internationally, but also from its main rival Airbus closer to home. There are also younger upstarts to contend with, such as NanoAvionics, the Lithuania-based small satellite maker recently bought by Norway's Kongsberg Defence & Aerospace.

TAS, though, benefits from expansive infrastructure across Europe. Its work for constellations has produced satellite platforms in Cannes, payloads from Toulouse also in France, and integrated them at the existing facility in Rome.

Small satellites TAS is building for Italy's IRIDE Earth constellation will be among the first to be developed in the new facility. TAS has an initial 142 million euro contract funded entirely through pandemic relief funds to provide six satellites for the constellation, and Comparini said all but the first two would likely be built at the Space Smart Factory.

Launches for IRIDE, or International Report for an Innovative Defence of Earth, are slated to begin in late 2025.

Another mission TAS hopes to get its hands on is the European Commission's Iris2 broadband constellation. TAS has joined forces with Airbus and European satellite operators in a consortium jointly bidding for work on the project, which Europe aims to finalize by early next year.

Airbus is currently the only European company to have mass-produced a large constellation, albeit at a factory based in Florida and in partnership with OneWeb, now part of Eutelsat of France. The Airbus OneWeb Satellites factory produced up to two satellites a day when it was in full swing for OneWeb's first generation of more than 600 satellites.

Eutelsat OneWeb is currently deciding on a manufacturer for a second-generation low Earth orbit network, and there's a chance Airbus could be building at least part of it in Europe.

MDA also aims to produce two satellites a day at facilities in Montreal as the Canadian manufacturer repositions itself for the constellation market.

Still, these rates are easily overshadowed by what SpaceX's in-house production is capable of for its fully-owned Starlink LEO broadband network. A SpaceX executive was quoted in March saying the company was manufacturing six satellites per day at its facility near Seattle. **SN**



ON NATIONAL SECURITY Sandra Erwin

Space Force chief tempers expectations: "Go government fast, not SpaceX fast"

Since its inception four years ago, the U.S. Space Force has faced congressional scrutiny and received numerous directives to transform the military's space capabilities at warp speed.

Lawmakers have pointed to delays and cost overruns plaguing legacy space programs and have called on Space Force leaders to take swift action to deliver the next generation of satellites, weapon systems and infrastructure seen as vital to the projection of unrivaled space dominance.

In 2021, the Space Force's first chief of space operations, the since-retired Gen. Jay Raymond, was asked at a National Press Club event what kept him up at night. "Our ability to go fast" was his answer. The previous spring, in a speech to Air Force Academy graduates about to be commissioned into the Space Force, Raymond urged them to "build the Space Force as the first digital service, and lay the foundation of a service that is innovative and can go fast." With speed in mind, the service established the Space Systems Command in 2021 to accelerate procurement and delivery of next-generation technologies.

Gen. Chance Saltzman assumed command of the Space Force a year ago and has since laid out an ambitious plan to boost U.S. capabilities for strategic competition against China and Russia. But as he begins his second year at the helm, Saltzman also wants to balance expectations with a healthy dose of reality.

"I do feel a sense of urgency, and I feel like we have a plan," Saltzman said Nov. 15 at a defense industry event hosted by the Atlantic Council.

But Congress can't expect the Space Force to mimic the pace of the private sector, Saltzman said, noting that the government machinery shifts slowly by design, not by fault.

"I've been in the Pentagon long enough to know this," he said. "You think, 'Hey, we've got a good idea, let's just turn on a dime and make this happen,' but it's just not the way the U.S. government works."

Meanwhile, on Capitol Hill, Congress has reinforced demands for rapid modernization, standing up a powerful new civilian overseer to consolidate fragmented authorities scattered across offices and agencies.

The first assistant secretary of the Air Force for space acquisition and integration, Frank Calvelli, is a former National Reconnaissance Office executive handpicked to accelerate acquisitions. One of his first acts was laying out what he called a "simple formula to go fast" to help the Space Force adopt the more agile procurement methods that his former agency perfected.

SAND IN THE GEARS

Notably, while Congress has urged speed, the erratic government funding process over the past several years has thrown sand in the gears of Pentagon modernization, setting next-generation programs back significantly, according to Air Force Secretary Frank Kendall.

A lack of timely appropriations, Kendall said Nov. 13, continues to actively undermine space programs. The Pentagon can meet day-to-day commitments on temporary funding, he said, but needs long-term budgets to properly plan the way forward.

The most visible display of speed in the Space Force today is the Space Development Agency's push to deploy a sprawling constellation of up to 400 low Earth orbit satellites by 2026. If achieved, this would be a feat rarely seen in national security programs accustomed to one-of-a-kind, exquisitely complex systems designed and built over decades.

SDA, however, is the outlier and not the mainstream.

"Government is designed to be plodding. It's designed to be slow and methodical. It's not designed to be entrepreneurial with taxpayer dollars," said Saltzman. "And you just have to recognize that."

When people say "go fast," he added, "what I have to hear in my head is 'go government fast, not SpaceX fast, not Google fast.' That's not realistic for me."

A more attainable goal, he said, is improving how the Space Force works alongside ground, air and naval forces. "Space as a contested domain is a relatively new acknowledgement. So now I've got to up my game to make sure that our guardians are trained and ready, so they can be a part of that joint force in the same integrated way as all the other services."

Besides that, said Saltzman, "I need to do a lot better with expectation management." SN

ON THE HORIZON

FEBRUARY

DATE	EVENT	PLACE
14-15	**ASCENDxTexas** www.ascend.events	Houston, TX
22-24	**SpaceCom** spacecomexpo.com	Orlando, FL

MARCH

DATE	EVENT	PLACE
6-7	**Space-Comm Expo** space-comm.co.uk	United Kingdom
12-13	**Paris Space Week** paris-space-week.com	France
18-21	**Satellite 2024** satshow.com	Washington, DC

APRIL

DATE	EVENT	PLACE
8-11	**39th Space Symposium** spacesymposium.org	Colorado Springs, CO

MAY

DATE	EVENT	PLACE
13-15	**Space Tech Expo USA** spacetechexpo.com	Long Beach, CA

JULY

DATE	EVENT	PLACE
30-1	**ASCEND** spacetechexpo.com	Las Vegas, NV

AUGUST

DATE	EVENT	PLACE
3-8	**Small Satellite Conference** smallsat.org	Logan, UT

SpaceNews Statement of Ownership

1. Publication Title: SpaceNews
2. Publication No.: 2328-9376
3. Date of Filing: November 2023
4. Frequency of Issues: Monthly
5. No. of Issues Published Annually: 12
6. Annual Subscription Price: $219
7. Location of Known Office of Publication: 6032•Brian CT. Ferndale, WA 98248
8. Complete Mailing Address of Headquarters General Business Office of Publisher: Multiverse Media, 100 Fillmore St., 5th FL Denver, CO 80206
9. Names and Addresses of Publisher and Editor: Greg Thomas, CTO, Brian Berger Editor in Chief; 6032•Brian CT. Ferndale, WA 98248
10. Owner: Multiverse Media 100 Fillmore St., 5th FL Denver, CO 80206
11. Known Bondholders, Mortgagees, and Other Security Holders Owning or Holding 1 Percent or More of Total Amount of Bonds, Mortgagee, or Other Securities: None
12. Tax Status has not changed during proceeding 12 months
13. Publication Title: SpaceNews
14. Issue Date for Circulation Data: October 2, 2023

15. Extent and Nature of Circulation	**Average No. Copies Each Issue During Preceding 12 Months**	**No. Copies of Single Issue Published Nearest to Filing Date**
a. Total Number of Copies (Net press run)	3029	3077
b. Paid circulation by mail		
1) Mailed Outside-County Paid Subscriptions	1190	1198
2) Mailed In-County Paid Subscriptions	0	0
3) Paid Distribution Outside the Mails	763	777
4) Paid Distribution by Other Classes of Mail Through the USPS	0	0
c. Total Paid Distribution	1953	1975
d. Free or Nominal Rate Distribution		
1) Free or Nominal Rate Outside-County Copies	0	0
2) Free or Nominal Rate In-County Copies	0	0
3) Free or Nominal Rate Copies Mailed at Other Classes Through the USPS	1076	1102
4) Free or Nominal Rate Distribution Outside the Mail	1076	1102
e. Total Free or Nominal Rate Distribution	3029	3077
f. Total Distribution	25	25
g. Copies not Distributed	3054	3102
h. Total	64%	64%
i. Percent Paid		
16. Electronic Copy Circulation		
a. Paid Electronic Copies	853	857
b. Total Paid Print Copies + Paid Electronic Copies	2806	2832
c. Total Print Distribution + Paid Electronic Copies	3882	3934
d. Percent Paid (Both Print & Electronic Copies)	72%	72%

I certify that 50% of all my distributed copies (electronic and print) are paid above a nominal price.



FOUST FORWARD Jeff Foust

Leaps of faith across an artificial divide in space security

At first glance, a United Nations working group established to develop norms of responsible behavior in space was a failure. The group, formally known as the Open-Ended Working Group (OEWG) on Reducing Space Threats, was charged by the U.N. General Assembly with crafting a consensus report on "possible norms, rules and principles of responsible behaviors" in space. However, the group wrapped up its final meeting at the beginning of September without approving a report, largely because of opposition from Russia and China. No consensus, no report.

"This was very disappointing," said Cláudio Medeiros Leopoldino of Brazil's Ministry of Foreign Affairs during a panel discussion organized by the Secure World Foundation nearly two months later. It was a similar outcome, he said, to a 2019 U.N. effort, a Group of Governmental Experts, on preventing an arms race in outer space. "Both of these results demonstrate there is a profound deficit of trust between major actors in the space domain."

But the failure of the group to produce a report was not a failure of the overall effort, he and other panelists argued. "The OWEG has been an extremely useful exercise even though it was not able to agree to a final report," he said, bringing together a diverse set of nations to discuss space security.

"I don't think the failure to reach a report was a failure of the work of the group," said Almudena Azcárate Ortega of the U.N. Institute for Disarmament Research. "The discussions of the group were highly successful."

That included, she said, a report by the working group's chairman, Chilean diplomat Hellmut Lagos, that served as an unofficial replacement for the failed consensus report. His report included nine recommendations that ranged from refraining from conducting destructive ASAT tests to increased transparency on space activities and policies.

But the lack of formal outcomes from that working group or other recent efforts illustrates what seems like an unbridgeable gap in efforts to advance space security. One camp, which includes the United States and many other Western nations, advocates for non-binding agreements that can be developed relatively quickly. The other, which includes China and Russia, prefers legally binding instruments, like a treaty those two countries have long proposed to ban the placement of weapons in space.

That gap is an "artificial divide," argued Izumi Nakamitsu, under-secretary general and high representative for disarmament affairs at the United Nations, in a speech at a Stimson Center event on space governance in November. "It is already apparent that these two supposedly competing approaches will likely converge on a single set of measures," like preventing deliberate destruction of space objects or the use of space objects as weapons.

The U.N.'s approach to dealing with that divide is to double down — literally — on working groups. The U.N. is planning to set up two new open-ended working groups, one that would continue the work of the earlier one on norms and other on-binding tools, and another that would study legally binding agreements.

"We will try to make sure that these two processes will not go their separate ways but that they will be complementary and have a certain type of synergy," Nakamitsu said. Norms that are not legally binding, she argued, could eventually become the basis for an agreement like a legally binding treaty.

There are, she acknowledged, challenges to that approach, particularly the capacity of many nations that are not major space powers to participate in two parallel efforts. The U.N. is investing in capacity-building efforts with countries that are not traditional spacefaring nations to impress upon them the importance of these discussions.

"What we need, in our view, is for states to take a leap of faith," said Cláudio Medeiros Leopoldino at the Secure World panel, such as countries that had advocated for non-binding norms to at least consider binding agreements. "This would make a tremendous difference in how those discussions move forward." It may require a tremendous leap, though, to cross an artificial, but very real, divide in space security. **SN**



Es'hailSat delivers satellite services for broadcast, broadband, mobility, corporate and government services across the Middle East and North Africa, and beyond.

Es'hailSat سهيل سات

Qatar Satellite Company الشركة القطرية للأقمار الصناعية

Space to deliver your vision

Our Products and Services include:

Video Services

- Direct-to-Home
- Broadcast Distribution
- Contribution and Occasional Use Services
- Playout

Telecom Services

- VSAT Networks
- Cellular Backhaul
- Maritime / Oil&Gas
- IP Trunking

Teleport Services

- Antenna Hosting
- Private Data Center Suite
- Partial Cabinet
- Full Rack

www.eshailsat.qa

MILLENNIUM SPACE SYSTEMS
A Boeing Company

WWW.MILLENNIUM-SPACE.COM

MULTI-MISSION MULTI-ORBIT

