



**You are a space industry analyst preparing a report titled "Beyond Earth: Deep Research on the Most Important Breakthroughs and News in Space and Aerospace from the Past 7 Days." Today's theme is Beyond Earth, focusing on new technology and advancements over purely scientific discoveries. Your task:**

Use any global source.

Only research from credible sources (space agencies announcements, peer-reviewed aerospace journals, reputable space news outlets).

Only report on items found in multiple credible sources.

Only include items published or announced in the last 7 days.

May be any space or aerospace technology, not just planetary science discoveries.

Structure:

Introduction: State the theme "Beyond Earth" and emphasize technology/advancement focus.

Key Technological Breakthroughs: Describe new propulsion, spacecraft systems, materials, in-space manufacturing, or infrastructure developments.

Mission and Commercial Developments: Summarize private and public mission tech updates, satellite innovations.

Space Infrastructure: Note progress in orbital platforms, habitats, refueling, space logistics.

Challenges and Considerations: Address technical, regulatory, or safety aspects.

Future Outlook: Discuss possible near-term implementations and strategic implications.

Ensure findings are corroborated by multiple credible global sources in the last week.

Now I have comprehensive information covering the past 7 days. Let me create the detailed report.

**Beyond Earth: Deep Research on the Most Important Breakthroughs and News in Space and Aerospace from the Past 7 Days**

## Introduction

The period from October 24-31, 2025, showcased remarkable technological advances in space and aerospace under the theme "Beyond Earth." This week emphasized groundbreaking developments in spacecraft propulsion, orbital infrastructure, commercial space systems, and mission hardware—innovations that mark significant progress in humanity's expansion into space. From AI-driven spacecraft design to successful cargo resupply missions and revolutionary propulsion acquisitions, the past week demonstrated the accelerating pace of technological achievement in making space more accessible, sustainable, and operationally capable.

## Key Technological Breakthroughs

### AI-Driven Spacecraft Design Revolution

On October 27-28, 2025, Northrop Grumman unveiled a transformative collaboration with Luminary Cloud and NVIDIA that could fundamentally alter spacecraft development timelines. The partnership has produced a "Physics AI" foundation model capable of designing spacecraft thruster nozzles in seconds—a process that traditionally requires months or years. Unlike conventional generative AI, Physics AI uses only the laws of physics and researcher-provided data to generate detailed designs and simulations. [\[1\]](#) [\[2\]](#) [\[3\]](#) [\[4\]](#)

"Physics AI is the next level of complexity in AI and Northrop Grumman is bringing this technology to our design engineers to dramatically speed up hardware development," stated Han Park, vice president of artificial intelligence integration at Northrop Grumman Space Systems. "Using AI to make something small, like a spacecraft thruster, puts us on a path to do much bigger things, like using AI to design larger components or even an entire spacecraft". [\[2\]](#) [\[5\]](#)

The system leverages NVIDIA's PhysicsNeMo framework and Luminary Cloud's Physics AI platform to predict spacecraft thruster performance instantly, allowing engineers more time to optimize propulsion systems and experiment with different designs. This technology identifies potential issues or calculation errors long before manufacturing begins, potentially revolutionizing how the aerospace industry approaches component development and full spacecraft design. [\[3\]](#) [\[2\]](#)

### Electric Propulsion Consolidation

In a strategic move announced October 28, 2025, Voyager Technologies acquired ExoTerra Resource, a leading developer of electric propulsion systems. This acquisition brings critical capabilities in compact electric propulsion systems used for satellite maneuvering, directly addressing the growing need for "freedom of maneuver" in space operations. [\[6\]](#) [\[7\]](#) [\[8\]](#)

ExoTerra specializes in Hall-effect thrusters and solar electric propulsion modules, with its Halo thruster having demonstrated successful performance aboard DARPA's Blackjack ACES spacecraft in 2023. The company recently delivered 21 propulsion modules to York Space Systems for the Space Development Agency's Transport Layer satellites launched in September 2025. [\[7\]](#) [\[8\]](#)

"As freedom of maneuver becomes central to space control and deterrence, it's imperative that reliable propulsion systems are built, tested and qualified right here in the United States," emphasized Dylan Taylor, Chairman and CEO of Voyager Technologies. The acquisition positions Voyager for major initiatives including the Golden Dome homeland missile defense program while expanding domestic manufacturing capacity for flight-proven propulsion technologies. [\[8\]](#) [\[9\]](#) [\[7\]](#)

## **Orbital Logistics Infrastructure**

Catalyx Space secured \$5.4 million in seed funding announced October 30, 2025, to commercialize what the company describes as the "complete back-end infrastructure for space". The San Francisco-based startup is addressing the "downmass problem"—the challenge of returning payloads from orbit—by creating scheduled return logistics for microgravity-manufactured products, research samples, and mission components. [\[10\]](#) [\[11\]](#) [\[12\]](#)

The funding, led by Outlander VC, follows Catalyx's successful capsule drop test completed within six months of their January 2025 pre-seed round. The company's platform integrates hardware, software, and operations, including reentry and recovery systems, lightweight spacecraft buses, and ground-station software. [\[11\]](#) [\[10\]](#)

"Catalyx is making orbit as accessible and programmable as the cloud, and that shift will unleash entirely new industries," stated Paige Craig, founder and managing partner of Outlander VC. The company targets defense, advanced manufacturing, and biopharmaceutical sectors where microgravity environments offer distinct production advantages. [\[12\]](#) [\[10\]](#) [\[11\]](#)

## **Modular Space Assembly Technology**

On October 27, 2025, Space Robotics Workers (SRW) selected Spacedock's intelligent interface for integration with its robotic Smart Truss system. The partnership will enable autonomous capture and structural connection between Smart Truss units, supporting berthing, docking, and transfer of power, fluid, and data between modular space components. [\[13\]](#) [\[14\]](#) [\[15\]](#) [\[16\]](#)

The companies plan a ground demonstration in early 2026 to validate the integration, marking a milestone toward SRW's roadmap for robotic construction of Commercial LEO Destination platforms, solar power stations, and other persistent orbital structures. Spacedock's universal interface system combines AI-powered hardware and software, with each unit functioning as a data node for diagnostics, cybersecurity, and optimization. [\[14\]](#) [\[15\]](#) [\[16\]](#)

"Our collaboration with SRW shows how Spacedock's intelligent interface accelerates the shift to a modular, serviceable, and sustainable space ecosystem," stated Negar Feher, CEO of Spacedock. "By making orbital systems upgradeable and maintainable, we're helping the industry protect billions in assets and extend mission lifetimes". [\[15\]](#) [\[14\]](#)

## **Mission and Commercial Developments**

## **JAXA's Advanced Cargo System Launch**

Japan successfully launched its HTV-X1 cargo spacecraft on October 26, 2025, aboard the H3-24W rocket from Tanegashima Space Center. This maiden flight of the HTV-X represents a significant technological leap in Japan's space logistics capabilities. The spacecraft successfully docked with the International Space Station on October 30, 2025, captured by the Canadarm2 robotic arm operated by JAXA astronaut Kimiya Yui. [\[17\]](#) [\[18\]](#) [\[19\]](#) [\[20\]](#)

The HTV-X is the successor to JAXA's Kounotori series, offering improved transport efficiency with the ability to carry larger payloads and supply power during flight, enabling transport of lab samples requiring low-temperature storage. The spacecraft is designed to remain connected to the ISS for up to six months and conduct technical missions for an additional three months after departure. [\[19\]](#) [\[21\]](#)

At 63 meters tall, the H3-24W configuration with four solid rocket boosters represents the tallest rocket launched by Japan to date. Beyond Gravity supplied the payload fairing and support structure, marking the first use of these components on the H3 rocket and underscoring close technological collaboration between Beyond Gravity, Mitsubishi Heavy Industries, and JAXA. [\[22\]](#) [\[23\]](#) [\[24\]](#)

## **Blue Origin's Mars Mission Preparation**

Blue Origin completed a critical 40-second static fire test of its New Glenn rocket on October 30, 2025, at Launch Complex 36 at Cape Canaveral Space Force Station. The test, which saw all seven BE-4 engines operating nominally with 22 seconds at 100% thrust, cleared one of the final milestones before the company's second orbital launch carrying NASA's ESCAPE mission to Mars. [\[25\]](#) [\[26\]](#)

The more than 320-foot-tall rocket will launch twin spacecraft—named Blue and Gold—on NASA's first multi-spacecraft orbital science mission to the Red Planet. ESCAPE (Escape and Plasma Acceleration and Dynamics Explorers) will study Mars' magnetosphere and how solar wind contributed to the planet's atmospheric loss over solar system history. [\[27\]](#) [\[28\]](#) [\[25\]](#)

Blue Origin has expressed confidence in recovering the first-stage booster during this mission, with plans to reflly it on the third New Glenn mission carrying the Blue Moon Mark 1 lunar lander. "We fully intend to recover the booster during the upcoming flight," stated Pat Remias, Blue Origin's vice president of space systems development at the 2025 International Astronautical Congress. [\[29\]](#)

## **SpaceX's Continued Launch Cadence**

SpaceX maintained its exceptional launch tempo during the week, launching its 100th Starlink mission of 2025 on October 31, 2025. Earlier in the week, on October 28, the company launched 29 Starlink V2 Mini satellites from Cape Canaveral Space Force Station using booster B1083 on its 15th flight. This marked just the second time SpaceX opted to launch 29 of its current-generation satellites in a single batch, representing the maximum capacity for the Falcon 9 rocket. [\[30\]](#) [\[31\]](#) [\[32\]](#) [\[33\]](#)

The sustained launch activity demonstrates SpaceX's operational maturity and the increasing accessibility of space-based infrastructure. Booster B1083 successfully landed on the autonomous droneship "Just Read the Instructions," marking the 526th booster landing to date and the 139th landing on that vessel. [\[30\]](#)

## Space Infrastructure

### In-Orbit Refueling Demonstrations Advancing

Multiple in-orbit refueling demonstrations are progressing toward 2026 launches, representing a critical capability for sustained space operations. Astroscale U.S. is scheduled to perform two refueling operations of a U.S. Department of Defense satellite in geostationary orbit in summer 2026, marking the first-ever on-orbit refueling mission supporting a DoD asset. [\[34\]](#) [\[35\]](#)

The Astroscale U.S. Refueler, a 300-kilogram spacecraft carrying a refillable hydrazine tank, will conduct hydrazine refueling operations above GEO, demonstrating an end-to-end refueling ecosystem with client, servicer, and depot capabilities. "We're changing the reality of what's possible," stated Ron Lopez, President of Astroscale U.S. "This mission proves that in-space logistics does not have to be years away". [\[35\]](#)

Northrop Grumman was also selected for an in-space demonstration of refueling technologies under the Elixir program in April 2025. The company's GAS-T design will leverage an ESPASat-D satellite platform equipped with the Active Refueling Module (ARM), which interfaces with Northrop Grumman's Passive Refueling Module (PRM) for fuel transfer and receipt. Multiple PRM flight units are currently in production for the Space Force and will be integrated onto Northrop Grumman's next-generation Mission Robotic Vehicle, planned for launch in early 2026. [\[36\]](#) [\[37\]](#)

### In-Space Manufacturing Contracts

Momentum secured two NASA contracts worth \$7.6 million announced October 9, 2025, to demonstrate in-space manufacturing and advanced propulsion technologies. The first contract, valued at \$5.1 million through NASA's Flight Opportunities program, supports the Commercial Orbital System for Microgravity In-Space Crystallization (COSMIC) mission. [\[38\]](#) [\[39\]](#) [\[40\]](#)

Momentum will deploy its Vigoride orbital service vehicle to host COSMIC payloads from SpaceWorks Enterprises and Astral Materials, aiming to leverage microgravity conditions for improved crystal growth for pharmaceuticals, semiconductors, and advanced materials. The modular Vigoride design offers flexibility for future commercial production missions in orbit. [\[39\]](#) [\[40\]](#)

The second contract, worth \$2.5 million from NASA's Armstrong Flight Research Center, will demonstrate the Rotating Detonation Rocket Engine (RDRE) developed by Juno Propulsion. The compact RDRE thruster uses non-toxic, storable propellants—nitrous oxide and ethane—offering higher efficiency than traditional hydrazine-based systems. [\[40\]](#) [\[41\]](#) [\[39\]](#)

## Interplanetary Internet Progress

The ISS National Laboratory-sponsored research by Spatiam Corporation advanced technology for interplanetary internet announced October 30, 2025. The company developed a commercial platform for space communications based on Delay and Disruption Tolerant Networking (DTN), which stores data bundles at intermediate nodes until a path to the next node or destination is available. <sup>[42]</sup>

Vint Cerf, one of the "Fathers of the Internet" who co-led the development of DTN, contributed to understanding how Spatiam is helping shape the future of networking in space. This technology is crucial for future missions on commercial space stations, the Moon, and Mars, where long distances cause delays and planetary movement leads to signal disruptions. <sup>[42]</sup>

## Commercial Space Station Development

Vast completed the final weld on Haven-1's primary structure on October 8, 2025, followed by painting, marking significant progress toward the world's first privately built space station. The 31,000-pound station is designed to launch on a SpaceX Falcon 9 no earlier than May 2026, becoming the largest spacecraft to lift off atop the rocket. <sup>[43]</sup> <sup>[44]</sup>

Haven-1 will host up to four short-duration astronaut missions during its three-year lifespan, with crews spending up to 30 days aboard the station. With 45 cubic meters of habitable volume, the station will rely on Crew Dragon for long-term missions by using its life support systems, providing 24/7 communication facilities, up to 1,000 watts of power, and science research opportunities. <sup>[44]</sup> <sup>[43]</sup>

"If we stick to our plan, we will be the first standalone commercial LEO platform ever in space with Haven-1, and that's an amazing inflection point for human spaceflight," stated Drew Feustel, Vast's lead astronaut and former NASA astronaut. <sup>[43]</sup>

## Challenges and Considerations

### Space Debris Management

The ESA Space Environment Report 2025, published October 20, 2025, revealed that approximately 40,000 objects are now tracked by space surveillance networks, with about 11,000 being satellites. The report emphasized that even without additional launches, the number of space debris would continue growing because fragmentation events add new debris objects faster than debris can naturally re-enter the atmosphere. <sup>[45]</sup>

Several major fragmentation events in 2024, along with many smaller ones, added thousands of new debris objects, underlining the need for prevention through passivation and reduced orbit lifetime measures. "To prevent this runaway chain reaction, known as Kessler syndrome, from escalating and making certain orbits unusable, active debris removal is required," the report concluded. <sup>[45]</sup>

Orbotic Systems won a NASA Phase II SBIR contract announced October 16, 2025, to develop its autonomous RIDDANCE space debris removal system. The system uses a net-and-tether

architecture combined with passive reentry technology to safely eliminate non-cooperative orbital debris without propellant-based thrusters. [\[46\]](#)

## **Regulatory Modernization**

The FCC designated October 2025 as "Space Month," announcing proposals to modernize the agency's regulatory framework for space innovation. A Notice of Proposed Rulemaking would replace the existing Part 25 rules governing satellite services with new Part 100 rules, creating an expedited "licensing assembly line" based on clear, bright-line criteria. [\[47\]](#) [\[48\]](#)

Key reforms include extending license terms for most space stations and earth stations to 20 years (up from 15 years), expanding the list of modifications that can be made without prior FCC approval, and establishing predominantly nationwide blanket licenses for earth stations to support the ground-station-as-a-service business model. The FCC scheduled an open meeting on October 28, 2025, to vote on the proposed items. [\[48\]](#) [\[47\]](#)

## **Technical Challenges in Propulsion**

NASA's Psyche mission encountered a pressure drop in its electric propulsion system on April 1, 2025, when the line feeding xenon gas to the thrusters decreased from 36 psi to about 26 psi. The spacecraft, which relies on solar electric propulsion using four electric thrusters that expel charged xenon atoms, powered off the thrusters as designed in response to the decrease. [\[49\]](#)

The mission team deferred thrusting while engineers work to understand the pressure decrease, with the mission design supporting a pause until at least mid-June before affecting the spacecraft's trajectory. The electric propulsion system has two identical fuel lines, and the team may decide to switch to the backup fuel line to resume thrusting. [\[49\]](#)

## **Sustainability in Lunar Operations**

Blue Origin announced on October 9, 2025, that its Blue Alchemist in-space resource utilization system successfully completed its Critical Design Review, marking a transformative milestone toward permanent lunar infrastructure. The breakthrough technology aims to turn lunar regolith into solar power systems, breathable oxygen, propellant-grade oxygen, metals, and construction materials. [\[50\]](#) [\[51\]](#)

"Blue Alchemist changes everything about how we approach space," stated Pat Remias, Blue Origin's Vice President of Advanced Concepts and Enterprise Engineering. "Each kilogram of oxygen we make on the lunar surface is one less that we have to launch from Earth, making it a giant leap toward permanent settlements". [\[51\]](#) [\[50\]](#)

The system is ready for autonomous demonstration in a simulated lunar environment in 2026, with the potential to make lunar landings up to 60% cheaper and reduce fuel cell/battery masses by up to 70% through regolith-derived oxygen production. [\[50\]](#)

## Future Outlook

### Near-Term Mission Implementations

China prepared to launch its Shenzhou-21 crewed mission on October 31, 2025, sending three taikonauts—Zhang Lu (commander), Wu Fei (flight engineer), and Zhang Hongzhang (payload specialist)—to the Tiangong space station. The mission will conduct 27 new experiments, including China's first study of rodent mammals in orbit, with four mice accompanying the crew to study microgravity effects. <sup>[52]</sup> <sup>[53]</sup> <sup>[54]</sup> <sup>[55]</sup>

Wu Fei, at 32 years old, will become the youngest Chinese astronaut to reach space. The crew will spend approximately six months aboard Tiangong, conducting experiments covering space life sciences, biotechnology, space medicine, materials science, microgravity fluid physics, and new space technologies. <sup>[54]</sup> <sup>[55]</sup>

### Strategic Implications for Space Control

The rapid pace of technological advancement in propulsion, manufacturing, and orbital servicing capabilities has significant strategic implications. The consolidation of electric propulsion capabilities through acquisitions like Voyager-ExoTerra, combined with AI-driven design acceleration at major defense contractors, positions the United States to maintain technological leadership in space operations. <sup>[7]</sup> <sup>[8]</sup>

The development of in-orbit refueling capabilities scheduled for demonstration in 2026 will enable satellites to maneuver "without regret" to adapt to increasingly contested space environments. Space Force leaders have emphasized that once spacecraft run out of fuel, their service life is functionally over, making refueling infrastructure critical for sustained operations. <sup>[56]</sup> <sup>[34]</sup>

### Commercial Space Infrastructure Evolution

The convergence of multiple technological capabilities—automated docking interfaces, in-space manufacturing, orbital logistics, and modular construction—is creating the foundation for a sustainable space economy. Catalyx Space's orbital logistics platform, combined with Spacedock's intelligent interfaces for modular assembly, represents a shift from one-off missions to scheduled, infrastructure-based space operations. <sup>[10]</sup> <sup>[14]</sup>

The transition from government-led to commercially-operated space stations, exemplified by Vast's Haven-1 development, signals a fundamental change in how humanity accesses and utilizes low Earth orbit. These private platforms will serve as testbeds for technologies and operational procedures needed for permanent settlements on the Moon and Mars. <sup>[44]</sup> <sup>[43]</sup>

### Acceleration Through Artificial Intelligence

The application of Physics AI to spacecraft design represents a paradigm shift comparable to the introduction of computer-aided design decades ago. By condensing years-long design processes to months or weeks, this technology will enable more rapid iteration, innovation, and response to emerging threats or opportunities in space. <sup>[4]</sup> <sup>[5]</sup> <sup>[2]</sup> <sup>[3]</sup>

Northrop Grumman's collaboration with Luminary Cloud and NVIDIA demonstrates how the integration of AI, high-performance computing, and decades of aerospace expertise can transform not just individual components but potentially entire spacecraft design processes. This acceleration in design-to-deployment timelines will be crucial as space operations become more dynamic and responsive. [5] [3]

## International Cooperation and Competition

The week's developments reflected both collaborative international efforts and intensifying competition. JAXA's successful HTV-X1 launch demonstrates Japan's commitment to ISS support and future lunar Gateway missions. China's continued Tiangong operations and increasingly sophisticated space science program position it as a major spacefaring nation. [21] [55] [17] [52]

The emphasis on domestic manufacturing of critical propulsion and space systems, particularly in the United States, reflects growing recognition that space capabilities are strategic national assets requiring protected supply chains. This trend toward supply chain resilience and domestic production will likely accelerate as space becomes increasingly contested. [8] [7]

The technological breakthroughs and mission developments of October 24-31, 2025, demonstrate that the transition from space exploration to space utilization is well underway. From AI-accelerated spacecraft design to operational in-orbit refueling, modular space construction, and advanced cargo systems, the infrastructure for a sustainable human presence beyond Earth is rapidly taking shape. As these capabilities mature and converge over the coming years, they will fundamentally transform humanity's relationship with space—from occasional visitor to permanent resident, from passive observer to active developer of space resources and infrastructure.



1. <https://news.satnews.com/2025/10/28/northrop-grumman-collaborates-on-ai-designed-spacecraft-propulsion-element/>
2. <https://www.washingtontimes.com/news/2025/oct/30/northrop-grumman-partners-ai-startup-speed-spacecraft-design/>
3. <https://www.spaceconnectonline.com.au/manufacturing/6808-northrop-grumman-luminary-cloud-partner-on-ai-designed-satellite-propulsion-element>
4. <https://www.airandspaceforces.com/northrop-ai-startup-design-spacecraft/>
5. [https://www.spacedaily.com/reports/AI\\_driven\\_propulsion\\_design\\_advances\\_spacecraft\\_engineering\\_at\\_Northrop\\_Grumman\\_999.html](https://www.spacedaily.com/reports/AI_driven_propulsion_design_advances_spacecraft_engineering_at_Northrop_Grumman_999.html)
6. <https://voyagertechnologies.com/press-releases/voyager-acquires-exoterra-bolstering-american-propulsion-capabilities/>
7. <https://www.satellitetoday.com/technology/2025/10/28/voyager-acquires-spacecraft-electric-propulsion-supplier-exoterra/>
8. <https://www.govconwire.com/articles/voyager-exoterra-propulsion-acquisition>
9. <https://www.exterrajsc.com/p/exoterra-resource-acquired-by-voyager>
10. <https://www.prnewswire.com/news-releases/catalyx-space-secures-5-4-million-seed-round-to-build-for-the-next-era-of-orbital-logistics-302600240.html>

11. <https://technews180.com/funding-news/catalyx-space-raises-5-4m-seed-for-orbital-logistics/>
12. <https://www.copernical.com/news-public/item/54535-2025-10-31-05-55-23>
13. <https://www.morningstar.com/news/pr-newswire/20251027sf06848/spacedock-interfaces-to-link-space-robotics-workers-smart-truss-for-modular-in-space-assembly>
14. <https://www.prnewswire.com/news-releases/spacedock-interfaces-to-link-space-robotics-workers-smart-truss-for-modular-in-space-assembly-302595542.html>
15. <https://aijourn.com/spacedock-interfaces-to-link-space-robotics-workers-smart-truss-for-modular-in-space-assembly/>
16. <https://www.citybuzz.co/2025/10/27/space-robotics-workers-partners-with-spacedock-for-modular-space-assembly-technology/>
17. [https://global.jaxa.jp/press/2025/10/20251026-2\\_e.html](https://global.jaxa.jp/press/2025/10/20251026-2_e.html)
18. <https://www.youtube.com/watch?v=EBEq84QrSEA>
19. <https://www.wingsmagazine.com/japan-successfully-launches-new-cargo-spacecraft-to-deliver-supplies-to-international-space-station/>
20. [https://global.jaxa.jp/press/2025/10/20251030-1\\_e.html](https://global.jaxa.jp/press/2025/10/20251030-1_e.html)
21. <https://www.nasaspaceflight.com/2025/10/jaxas-htv-x1-launch-h3-rocket/>
22. [https://en.wikipedia.org/wiki/List\\_of\\_spaceflight\\_launches\\_in\\_October–December\\_2025](https://en.wikipedia.org/wiki/List_of_spaceflight_launches_in_October–December_2025)
23. <https://www.terrajasc.com/p/jaxa-launches-new-cargo-vehicle-to>
24. <https://www.beyondgravity.com/en/news/beyond-gravity-rocket-nose-cone-celebrates-premiere-japans-h3-rocket>
25. <https://spacelightnow.com/2025/10/31/blue-origin-completes-new-glenn-static-fire-test-preparing-for-nasas-escapade-mission-launch/>
26. <https://aviationweek.com/space/launch-vehicles-propulsion/blue-origin-completes-new-glenn-static-hot-fire>
27. <https://www.skyatnightmagazine.com/news/nasa-escapade-mission>
28. <https://science.nasa.gov/mission/escapade/>
29. <https://spacelightnow.com/2025/10/08/blue-origin-transport-new-glenn-booster-to-launch-site-ahead-of-mars-bound-mission/>
30. <https://spacelightnow.com/2025/10/28/live-coverage-spacex-to-launch-29-starlink-satellites-on-falcon-9-rocket-from-cape-canaveral/>
31. <https://www.space.com/space-exploration/launches-spacecraft/spacex-100th-starlink-satellite-launch-2025>
32. <https://www.youtube.com/watch?v=iiHtNRRzyW4>
33. <https://spacelightnow.com/2025/10/>
34. <https://www.airandspaceforces.com/space-force-satellite-refueling-demos/>
35. <https://www.spacefoundation.org/2025/04/08/astrocale-u-s-to-lead-the-first-ever-refueling-of-a-united-states-space-force-asset/>
36. <https://news.satnews.com/2025/04/03/northrop-grumman-selected-for-in-space-demo-of-refueling-technologies/>
37. <https://currently.att.yahoo.com/att/falling-satellite-servicing-costs-launching-123046158.html>
38. <https://orbitaltoday.com/2025/10/10/momentus-secures-nasa-contracts-to-test-space-manufacturing-and-propulsion-tech/>

39. <https://www.spaceconnectonline.com.au/industry/6773-momentum-secures-dual-nasa-contracts-worth-7-6m-to-advance-space-manufacturing-and-propulsion-tech>
40. [https://www.spacedaily.com/reports/Momentum\\_Expands\\_NASA\\_Partnership\\_with\\_Dual\\_Contracts\\_for\\_In\\_Space\\_Manufacturing\\_and\\_Propulsion\\_Demonstrations\\_999.html](https://www.spacedaily.com/reports/Momentum_Expands_NASA_Partnership_with_Dual_Contracts_for_In_Space_Manufacturing_and_Propulsion_Demonstrations_999.html)
41. <https://www.satellitetoday.com/space-economy/2025/10/10/momentum-wins-2-nasa-contracts-to-fly-tech-demonstrations-on-vigoride-missions/>
42. <https://issnationallab.org/press-releases/advancing-technology-for-interplanetary-internet/>
43. <https://www.space.com/space-exploration/human-spaceflight/vast-gearing-up-to-launch-its-haven-1-private-space-station-in-2026>
44. <https://en.wikipedia.org/wiki/Haven-1>
45. [https://www.esa.int/Space\\_Safety/Space\\_Debris/ESA\\_Space\\_Environment\\_Report\\_2025](https://www.esa.int/Space_Safety/Space_Debris/ESA_Space_Environment_Report_2025)
46. <https://news.satnews.com/2025/10/16/orbital-systems-recently-won-a-nasa-phase-ii-award-for-an-advanced-active-space-debris-removal-system/>
47. <https://www.insideglobaltech.com/2025/10/10/fcc-launches-space-month-agenda/>
48. <https://www.akingump.com/en/insights/blogs/interconnected-tmt/fcc-announces-tentative-space-month-agenda-for-october-2025-open-meeting>
49. <https://science.nasa.gov/blogs/psyche/2025/04/29/nasas-psyche-mission-looking-into-propulsion-system/>
50. <https://www.blueorigin.com/news/blue-chemist-hits-major-milestone-toward-permanent-sustainable-lunar-infrastructure>
51. <https://moonvillageassociation.org/blue-chemist-hits-major-milestone-toward-permanent-and-sustainable-lunar-infrastructure/>
52. <https://www.nasaspaceflight.com/2025/10/shenzhou-21/>
53. [https://english.www.gov.cn/news/202510/30/content\\_WS6902cf73c6d00ca5f9a072d8.html](https://english.www.gov.cn/news/202510/30/content_WS6902cf73c6d00ca5f9a072d8.html)
54. <https://www.space.com/space-exploration/human-spaceflight/china-shenzhou-21-astronaut-launch-webcast>
55. [https://english.cas.cn/newsroom/cas\\_media/202510/t20251030\\_1095170.shtml](https://english.cas.cn/newsroom/cas_media/202510/t20251030_1095170.shtml)
56. <https://aviationweek.com/space/satellites/orbit-refueling-planned-next-space-surveillance-satellites>
57. <https://www.kratospace.com/constellations/podcasts/on-orbit-refueling-hybrid-architecture-and-dynamic-space-operations>
58. <https://news.metal.com/newscontent/103599690/Shenzhou-21-Crew-to-Perform-Chinas-First-On-Orbit-Rodent-Mammal-Experiment>
59. <https://www.vpm.org/npr-news/npr-news/2025-10-13/spacex-launches-11th-test-flight-of-its-mega-starship-rocket-with-another-win>
60. <https://www.weforum.org/stories/2025/02/space-12-transformative-technologies/>
61. <https://aiaa.org/news/industry-news/>
62. <https://www.seti.org/news/space-in-2025-what-to-expect/>
63. [https://www.sciencedaily.com/news/matter\\_energy/aerospace/](https://www.sciencedaily.com/news/matter_energy/aerospace/)
64. <https://payloadspace.com/quantum-space-acquires-phase-four-propulsion-tech/>
65. <https://www.airport-technology.com>
66. [https://www.spacedaily.com/reports/Voyager\\_completes\\_ExoTerra\\_acquisition\\_advancing\\_US\\_space\\_propulsion\\_systems\\_999.html](https://www.spacedaily.com/reports/Voyager_completes_ExoTerra_acquisition_advancing_US_space_propulsion_systems_999.html)

67. <https://science.nasa.gov/learning-resources/science-activation/helio-highlights-october-2025/>
68. <https://aviationweek.com/AWST>
69. <https://science.nasa.gov/solar-system/whats-up-october-2025-skywatching-tips-from-nasa/>
70. <https://www.reuters.com/business/aerospace-defense/>
71. <https://www.nasa.gov/2025-news-releases/>
72. <https://news.ucsc.edu/2025/10/save-nasa-science/>
73. <https://www.flightglobal.com/news>
74. <https://www.azorobotics.com/Article.aspx?ArticleID=782>
75. <https://www.aerotime.aero>
76. <https://www.openaccessgovernment.org/world-space-week-2025-three-hadea-projects-supporting-life-in-space/199617/>
77. <https://www.space.com/space-exploration/launches-spacecraft/spacex-starlink-10-37-b1082-ccsfs-jrti>
78. <https://www.space.com/news/live/spacex-starship-missions-updates>
79. <https://www.spacescout.info/2025/06/where-are-americas-commercial-space-stations-in-2025/>
80. <https://www.youtube.com/watch?v=4sLKqEgYyYo>
81. <https://www.space.com/32286-space-calendar.html>
82. [https://www.youtube.com/watch?v=\\_SNXCPzFYQE](https://www.youtube.com/watch?v=_SNXCPzFYQE)
83. <https://www.rocketlaunch.live/launch/starship-flight-10>
84. <https://spacepolicyonline.com/news/whats-happening-in-space-policy-october-26-november-1-2025/>
85. <https://spaceflightnow.com/2025/08/27/spacex-successfully-launches-super-heavy-starship-on-critical-test-flight/>
86. <https://www.spacex.com/launches>
87. <https://www.nasa.gov/missions/station/iss-research/international-space-station-launching-nasa-and-humanity-into-deep-space/>
88. [https://en.wikipedia.org/wiki/Starship\\_flight\\_test\\_10](https://en.wikipedia.org/wiki/Starship_flight_test_10)
89. <https://nextspaceflight.com>
90. <https://www.akingump.com/a/web/u68EgHFMXWR9o7MwD9oV9E/aRov5M/space-law-regulation-and-policy-update-october-3-2025.pdf>
91. <https://www.youtube.com/watch?v=OfOgVQ1jVNQ>
92. <https://www.nasa.gov/events/>
93. [https://www.cryogenicsociety.org/index.php?option=com\\_dailyplanetblog&view=entry&category=industry-news&id=278%3A-first-ever-cryogenic-refueling-space-mission-announced](https://www.cryogenicsociety.org/index.php?option=com_dailyplanetblog&view=entry&category=industry-news&id=278%3A-first-ever-cryogenic-refueling-space-mission-announced)
94. <https://payloadspace.com/spaceworks-astral-materials-to-demo-in-orbit-manufacturing-in-2026/>
95. <https://etd.gsfc.nasa.gov/capabilities/in-space-servicing-assembly-and-manufacturing/>
96. <https://www.space-startups.org/top/manufacturing/>
97. <http://southeast.newschannelnebraska.com/story/53196705/in-orbit-servicing-robotics-market-trends-and-analysis-by-application-vertical-region-and-segment-forecast-to-2029>
98. <https://news.satnews.com/2025/07/13/government-accountability-office-in-space-servicing-assembly-manufacturing-benefits-challenges-policy-options/>
99. <https://www.instagram.com/p/DQUTfM0DKML/>

100. <https://ntrs.nasa.gov/citations/20250008988>

101. <https://payloadspace.com/orbit-fab-takes-two-steps-toward-xenon-refueling/>

102. [https://www.morningstar.com/news/pr-newswire/20251030io11428/catalyx-space-secures-54-million-s  
eed-round-to-build-for-the-next-era-of-orbital-logistics](https://www.morningstar.com/news/pr-newswire/20251030io11428/catalyx-space-secures-54-million-s-eed-round-to-build-for-the-next-era-of-orbital-logistics)