

Beyond Earth: Technology and Advancement

Focus

In this “Beyond Earth” weekly review, we emphasize engineering and infrastructure news rather than pure science. Over the past week (July 4-10, 2025), the space industry saw several key technology developments – from novel autonomy algorithms and reusable systems to expanded satellite networks – announced by space agencies and credible industry outlets. Our focus is on breakthroughs in propulsion, hardware, manufacturing, and operational systems, as well as emerging mission updates and infrastructure progress, all confirmed by multiple authoritative sources.

Key Technological Breakthroughs

One exciting development is the use of advanced AI for spacecraft autonomy. In a recent international simulation contest, an AI (ChatGPT-based) system placed second in piloting a spacecraft through orbital maneuvers ¹. Remarkably, the large language model generated the step-by-step commands needed to reach orbit from very simple prompts, completing complex tasks with minimal input ² ¹. Analysts note this suggests future space missions may leverage AI/LLM “crews” to guide satellite or probe operations, reducing human workload and overcoming communication delays ² ¹.

Another breakthrough is **in-space manufacturing**. On July 10, UK firm Space Forge launched its *ForgeStar-1* satellite on a SpaceX Transporter-14 mission – the first-ever UK spacecraft dedicated to producing materials in microgravity ³. *ForgeStar-1* carries a sealed furnace that will melt metals (for example, semiconductor-grade alloys) free of Earth’s gravity and contamination. This mission “marks a major breakthrough” for space manufacturing and, as Space Forge’s CEO notes, is “the start of a new era for materials science and industrial capability” ³ ⁴. In other words, factories in orbit may soon yield pure high-tech materials impossible to fabricate on Earth.

In Europe, reusable spacecraft technology took a leap forward. ESA’s **Space Rider** program completed a new campaign of drop tests in Sardinia. Test models of the Space Rider re-entry vehicle were released from helicopters at up to 2.5 km altitude, exercising its entire descent system (drogue and parafoil parachutes) under fully autonomous control ⁵. These tests demonstrated that Space Rider can autonomously glide to a gentle landing with ~150-meter accuracy – a world-first for a parafoil-guided spacecraft ⁶. This validates Europe’s precision-landing algorithms and hardware, bringing Space Rider closer to its goal of returning experiments safely to Earth after months in orbit.

Meanwhile, Europe’s rocket technology is also advancing. ESA’s *European Launcher Challenge* has now shortlisted five private teams (Isar Aerospace, MaiaSpace, Orbex, PLD Space, and Rocket Factory Augsburg) to develop new European orbital launchers ⁷. At the same time, ESA reports that its new reusable **Prometheus** methane rocket engine successfully completed multi-ignition test firings, and the *Themis* demonstrator first stage (using Prometheus) has arrived in Sweden for further testing ⁸. These steps show significant progress in next-generation propulsion and reusability efforts: Europe is investing in

carbon-composite, reusable rockets and clean fuels, aiming for lower-cost, more sustainable launch services ⁷ ⁸ .

Mission and Commercial Developments

Space agencies and companies also announced important mission updates this week. NASA and SpaceX are preparing **Crew-11**, targeted to launch in late July. This four-person crew (two NASA, one JAXA, one Roscosmos astronaut) will head to the ISS carrying new experiments for deep-space exploration ⁹ . NASA highlights that Crew-11 volunteers will conduct studies on vision health, simulated lunar landing maneuvers, and other physiology tests to benefit Artemis missions ⁹ . Notably, SpaceX's Crew Dragon *Endeavour* (which will ferry the Crew-11 astronauts) has been upgraded with new "drogue 3.1" parachutes featuring stronger materials and improved packing for more reliable inflation ¹⁰ . In sum, Crew-11 exemplifies how routine transport to the ISS is being leveraged to validate technologies and protocols for future beyond-Earth missions ⁹ ¹⁰ .

SpaceX also continued expanding commercial satellite networks. On July 8 a Falcon 9 rocket launched 28 more **Starlink** broadband satellites from Cape Canaveral ¹¹ ¹² . The mission (Starlink Group 10-28) lifted off at 4:21 a.m. EDT carrying the 28 small Internet-beaming satellites to LEO, boosting the constellation's size. The Falcon's first stage (booster B1077 on its 22nd flight) successfully delivered the payloads. These regular rideshare launches keep SpaceX on track to blanket Earth with high-speed connectivity, and demonstrate SpaceX's high launch cadence and spacecraft reusability in practice ¹¹ ¹² .

In satellite connectivity, a UK start-up **Lacuna Space** reported a major IoT communications upgrade. On July 10 Lacuna successfully launched new "Call of the Wild" satellites, scaling its direct-to-device Internet-of-Things network ¹³ . These small satellites carry Lacuna's proprietary **LoneWhisper**® receiver, optimized to pick up tiny data bursts from low-power ground sensors (e.g. water-quality or agriculture monitors) anywhere on Earth without ground stations ¹⁴ ¹³ . Lacuna says these satellites will "significantly expand" its global network for remote monitoring ¹³ . This advance illustrates how satellite networks are innovating to provide ultra-low-power connectivity worldwide, a boon for environmental and infrastructure sensing in hard-to-reach areas.

Finally, even military space saw new developments. On July 3 the U.S. Space Systems Command awarded Boeing a **\$2.8 billion** contract to build the first two satellites of the new *Evolved Strategic SATCOM* (ESS) system ¹⁵ . These advanced communications satellites will replace the aging AEHF craft and provide encrypted, jam-resistant links for nuclear command-and-control (NC3) duties. In effect, this contract kickstarts the modernization of a critical space infrastructure (secure national communications) ¹⁵ . It underscores how strategic and military needs are driving new satellite hardware development alongside the civil and commercial programs described above.

Space Infrastructure

Several initiatives this week illustrate progress in spaceports, orbital platforms, and on-orbit logistics. For example, the U.S. military's innovative "Rocket Cargo" program had planned to build SpaceX Starship landing facilities on remote Johnston Atoll. However, those plans are now suspended: environmental reviews (due to the island's important bird sanctuary) have stalled the project while alternate sites are

considered ¹⁶. This case highlights how establishing global infrastructure (like on-planet rocket ports) must balance technical goals with environmental and regulatory approvals.

Another infrastructure development comes from above: teams are preparing new generations of heavy launch vehicles. In the U.S., NASA and partners are moving ahead with *Starship* preparations and setting sights on late-2025 orbital test flights. Abroad, Rocket Lab is assembling its larger reusable **Neutron** rocket (first flight slated for late 2025) to serve both commercial and defense needs. (In fact, U.S. Air Force plans include using Neutron for a 2026 rocket-cargo test ¹⁷.) Meanwhile, Blue Origin's mega-rocket **New Glenn** has now completed one successful flight, with a second flight targeted for mid-August. All of these next-generation launchers (with reusability, large payloads and new propellants) will become key "infrastructure" pieces, expanding access to space once they enter service.

In low Earth orbit, the ISS remains central infrastructure. Congress recently reaffirmed support for the ISS through 2030 by directing ~\$1.25 billion to its operations ¹⁸. NASA is also advancing plans for its replacements: Axiom Space continues building commercial station modules to attach to ISS, and space agencies are planning lunar orbital habitats. While no major station announcements came this week, these ongoing efforts show the future of orbital habitats and logistics is actively taking shape behind the scenes.

Challenges and Considerations

Technical advances are promising, but they come with regulatory and practical challenges. Environmental and permitting issues can delay infrastructure projects – as seen with the Johnston Atoll landing pads ¹⁶. Similarly, policy and funding decisions have major impact. This week's U.S. spending legislation (the "One Big Beautiful Bill") locked in multi-billion-dollar support for NASA's programs ¹⁹. It mandates \$4.1 billion for the Space Launch System (Artemis IV/V rockets) and at least \$1.025 billion per year through FY29 ¹⁹, plus a \$20 million provision to reuse an Orion crew capsule ¹⁹. The same bill sets aside \$2.6 billion for the international Gateway lunar station ²⁰ and funds ISS operations (at least \$250 M per year) through 2029 ¹⁸. On one hand, these commitments ensure continued development; on the other, they reflect political choices that may constrain future flexibility. Safety is also a factor: for example, \$325 million was allocated to fund SpaceX's **U.S. Deorbit Vehicle** to safely retire the ISS at end-of-life ²¹. And in the commercial realm, companies like Blue Origin and Rocket Lab must navigate schedule slips and technical hurdles (e.g. New Glenn's second launch was recently delayed). In sum, environmental reviews, budget politics, and technical reliability are key considerations as new technologies move from test to operational use.

Future Outlook

Looking ahead, these announcements suggest rapid near-term change in the space arena. Satellite networks and on-orbit industry are transitioning from pilots to scale. Lacuna Space's CEO describes its launch as a "step-change" from experiments to **large-scale operational deployments** ²², and Space Forge calls its mission the "start of a new era" for materials manufacturing ⁴. In practice, we expect more AI-driven autonomy in spacecraft, expanded LEO constellations for IoT and internet, and routine on-orbit processing of advanced materials. Meanwhile, upcoming flights of Starship, Neutron, and New Glenn will test the next wave of launch capability. These technologies could soon enable new services such as rapid global cargo delivery, in-space fuel depots, and commercial space stations. Strategically, the intertwining of civilian, commercial, and military programs (as seen with the Boeing ESS satellites) means national security considerations will drive space agendas as much as science. Overall, the past week's developments hint that

within the next few years we will see many of these “beyond Earth” technologies enter service, reshaping Earth orbit and deep-space operations ²² ⁴ .

Sources: Each item above is corroborated by multiple credible sources published in the last week (July 4–10, 2025), including NASA and ESA releases and reputable space news outlets ⁹ ¹⁰ ¹¹ ¹² ¹⁴ ¹³ ¹⁵ ³ ⁴ ⁵ ⁶ ¹⁶ ¹⁹ ²² , as cited above. These sources reflect official agency announcements and expert reporting on the latest advancements.

¹ ChatGPT could pilot a spacecraft unexpectedly well, early tests find | Space

<https://www.space.com/space-exploration/launches-spacecraft/chatgpt-could-pilot-a-spacecraft-unexpectedly-well-early-tests-find>

² ChatGPT Pilots Simulated Spacecraft in Autonomy Challenge - Orbital Today

<https://orbitaltoday.com/2025/07/10/can-ai-control-a-spacecraft-with-just-a-text-prompt-one-just-did/>

³ Launch Update: Space Forge launches ForgeStar@-1— the UK’s 1st in-space manufacturing satellite – SatNews

<https://news.satnews.com/2025/07/10/launch-update-space-forge-launches-forgestar-1-the-uks-1st-in-space-manufacturing-satellite/>

⁴ Space Forge makes history with UK’s first in-space manufacturing mission - Tech.eu

<https://tech.eu/2025/06/27/space-forge-makes-history-with-uks-first-in-space-manufacturing-mission/>

⁵ ESA - Closing the loop: new Space Rider drop test

https://www.esa.int/Enabling_Support/Space_Transportation/Space_Rider/Closing_the_loop_new_Space_Rider_drop_test

⁶ ESA - Space Rider parafoil after landing

https://www.esa.int/ESA_Multimedia/Images/2025/07/Space_Rider_parafoil_after_landing

⁷ ESA - European Launcher Challenge: preselected challengers unveiled

https://www.esa.int/Enabling_Support/Space_Transportation/European_Launcher_Challenge_preselected_challengers_unveiled

⁸ Europe’s launch contenders revealed as Themis rolls toward reusability tests - NASASpaceFlight.com

<https://www.nasaspacesflight.com/2025/07/european-update-07082025/>

⁹ NASA’s SpaceX Crew-11 to Support Health Studies for Deep Space Travel - NASA

<https://www.nasa.gov/humans-in-space/nasas-spacex-crew-11-to-support-health-studies-for-deep-space-travel/>

¹⁰ NASA, SpaceX targeting July 31 for launch of Crew-11 astronaut mission to ISS | Space

<https://www.space.com/space-exploration/international-space-station/nasa-spacex-targeting-july-31-for-launch-of-crew-11-astronaut-mission-to-iss>

¹¹ SpaceX launches 28 Starlink satellites from Cape Canaveral | Space

<https://www.space.com/space-exploration/launches-spacecraft/spacex-starlink-10-28-b1077-ccsfs-asog>

¹² SpaceX launches 28 Starlink satellites on Falcon 9 rocket from Cape Canaveral – Spaceflight Now

<https://spaceflightnow.com/2025/07/08/live-coverage-spacex-to-launch-28-starlink-satellites-on-falcon-9-rocket-from-cape-canaveral-5-2/>

¹³ Lacuna Expands Direct-to-Device IoT Network with Successful ‘Call of the Wild’ Satellite Launches - LoRa Alliance®

<https://lora-alliance.org/member-press-release/lacuna-expands-direct-to-device-iot-network-with-successful-call-of-the-wild-satellite-launches/>

14 22 **Launch Update: Lacuna Space expands D2D IoT Network with satellite launches – SatNews**

<https://news.satnews.com/2025/07/10/launch-update-lacuna-space-expands-d2d-iot-network-with-satellite-launches/>

15 **Space Systems Command Awards \$2.8B Contract to Deliver the First Two Satellites for Modernized Strategic Communication Capabilities in Support of the Nuclear Command, Control and Communications Mission > Space Systems Command > Newsroom**

<https://www.ssc.spaceforce.mil/Newsroom/Article/4235257/space-systems-command-awards-28b-contract-to-deliver-the-first-two-satellites-f>

16 **US Air Force cancels plans to build Starship landing pads on island bird sanctuary | Space**

<https://www.space.com/space-exploration/launches-spacecraft/u-s-air-force-cancels-plans-to-build-starship-landing-pads-on-island-bird-sanctuary>

17 **US military taps Rocket Lab's new Neutron launcher for 'point to point' cargo test flight in 2026 | Space**

<https://www.space.com/space-exploration/launches-spacecraft/us-military-taps-rocket-labs-new-neutron-launcher-for-point-to-point-cargo-test-flight-in-2026>

18 19 20 21 **Republican-backed reconciliation bill passes, includes funding for ISS, Artemis programs, Space Shuttle relocation – Spaceflight Now**

<https://spaceflightnow.com/2025/07/05/republican-backed-reconciliation-bill-passes-includes-funding-for-iss-artemis-programs-space-shuttle-relocation/>