Science, Technology Assessment, and Analytics

SCIENCE & TECH SPOTLIGHT:

DATA CENTERS IN SPACE

GAO-26-109012, April 2026

WHY THIS MATTERS

Space-based data centers would place data processing and storage systems for AI and other computing needs into satellites. This could reduce the land, electricity, and water needed for data centers on Earth. Several companies have begun development of data centers in space, but there are engineering and economic barriers to deployment.

KEY TAKEAWAYS

» Placing data centers in space could reduce the demand for resources from these facilities on Earth.

» Data centers generate excess heat, but space does not cool computing hardware efficiently. This could be a major engineering challenge.

» A significant increase in the number of satellites in orbit could be difficult to manage and cause collisions.

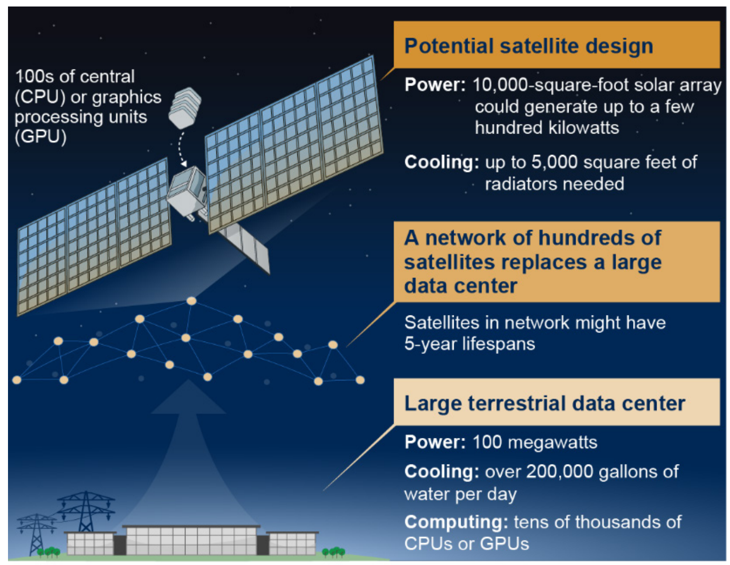
THE TECHNOLOGY

What is it? Data centers house computer servers, data storage systems, and network equipment that provide digital applications and services—such as artificial intelligence (AI) and cloud computing. Space-based data centers would house similar equipment in satellites to process data in space instead of on Earth (see figure).

How does it work? Most proposals for space-based data centers use satellites deployed to low Earth orbits. These orbits allow faster communication with Earth and cost less to reach than higher ones. Some low Earth orbits (e.g., sun-synchronous) could also provide satellites with near-continuous solar energy.

Some proposals envision constellations of thousands of new satellites working together to process data.

Figure 1. Terrestrial and Hypothetical In-Space Data Centers



Source: GAO analysis and illustration. | GAO-26-109012

These might supplement or replace the use of terrestrial data centers for energy-intensive tasks such as cloud computing services or training AI models.

How mature is it? Like existing satellites, space-based data centers need support systems that provide power, cooling, and communication. These basic components rely on mature technologies, but their deployment and operation to support data centers is unproven. Smaller data centers intended to process data generated in space may be closer to maturity than larger data centers built to train AI models in space.

Large data centers have power and cooling needs that will require further engineering development, such as solar arrays that are larger than any launched and assembled in space as of April 2026. Cooling solutions at this scale are also unproven. Large data centers produce waste heat that must be dissipated into space to prevent damage to computing systems. Such cooling is challenging because heat is not easily dispersed in the near-empty vacuum of space.

Space-based data centers may need more advanced data transfer systems. These systems could transmit larger amounts of data to Earth or between networked satellites for data-intensive tasks like training AI.

Public and private projects are testing high-performance computing hardware and communications technologies in space, with deployment of some data center satellites planned by the mid-2030s. Since January 2026, the Federal Communications Commission has received three applications from U.S. companies for large satellite constellations operating as data centers. Other projects are underway in China, the European Union, and Japan.

OPPORTUNITIES

- **Reduce AI resource demands.** The Department of Energy projects data centers will account for up to 12 percent of U.S. electrical demand by 2028, driven by AI development. Data centers in space might reduce demand for electricity, water, and physical infrastructure on Earth.
- **Process data collected in space faster.** Orbiting telescopes and observation satellites create large volumes of data that are currently sent to Earth for processing. Not all raw data are ultimately useful, and processing in space could reduce data transmission volume to Earth, and associated costs, and increase decision-making speed.

CHALLENGES

- **Economic viability.** Manufacturing and launching satellites is expensive. Reducing the cost of space-based data centers may depend on developing solutions to electricity, cooling, and communications needs that do not add excessive size or launch weight.
- **Crowded orbits.** More satellites in orbit could increase collision risks, including with crewed missions, and interfere with astronomical research. Federal agencies must coordinate demand nationally and internationally for radio frequencies for data communication.
- **Computing in space.** Space radiation can corrupt data unpredictably and degrade hardware. Mitigation may be costly or could reduce computing performance. A data center might benefit from in-space servicing by other satellites, but this capability is underdeveloped. As a result, data centers might be decommissioned more frequently than other satellites, potentially increasing space debris or risks from atmospheric reentry.

POLICY CONTEXT AND QUESTIONS

- To what extent does the U.S. have adequate launch and other facilities to support a potential increase in satellites?
- What information is needed to help policymakers balance growing commercial use of space with the long-term management of space as a resource?
- How might existing laws, treaties, and other international agreements covering space or using data apply to data centers in space?
- What research is needed to predict the safety, costs, and life cycles of novel data centers, including in space?

SELECTED GAO WORK

In-Space Servicing, Assembly, and Manufacturing: Benefits, Challenges, and Policy Options, GAO-25-107555.

Large Constellations of Satellites: Mitigating Environmental and Other Effects, GAO-22-105166.

SELECTED REFERENCE

Ablimit Aili, Jihwan Choi, Yew Soon Ong, and Yonggang Wen. "The development of carbon-neutral data centres in space." *Nature Electronics*, vol. 8, no. 11 (2025): 1016–1026. https://doi.org/10.1038/s41928-025-01476-1.

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For more information, contact: Karen L. Howard, PhD, at HowardK@gao.gov

Media Relations: Sarah Kaczmarek, Managing Director, Media@gao.gov

Congressional Relations: David A. Powner, Acting Managing Director, CongRel@gao.gov

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