

Planning for Data Centers in Low Earth Orbit in the USA and China

The basic idea behind Elon Musk's "in-orbit data center" plans is to move large amounts of AI computing off Earth and into space, using solar-powered satellites as orbital compute clusters. [1]

The Core Concept: According to recent filings and public comments, [SpaceX](#) wants to deploy huge constellations of satellites that would function as AI data centers in low Earth orbit. The satellites would:

- Run AI workloads in space
- Use solar power instead of terrestrial electrical grids
- Use radiative cooling in vacuum rather than water-heavy cooling systems
- Potentially interconnect using laser links similar to Starlink

Musk has argued that AI is becoming constrained by electricity and cooling availability on Earth, and that orbital systems could eventually scale more cheaply. ([TechCrunch](#))

The Federal Communications Commission (FCC) filing : One of the clearest concrete developments is a reported FCC filing from early 2026. SpaceX reportedly requested approval for:

- up to 1 million satellites
- operating between roughly 500–2,000 km altitude
- intended to provide "orbital data center" computing capacity for AI applications. ([sdxcentral.com](#))

That scale would dwarf today's Starlink constellation.

Connection to xAI: The project appears tightly connected to SpaceXAI. Formerly called xAI, now SpaceXAI is a US company founded by Elon Musk in 2023. Multiple reports say the SpaceX–xAI merger/restructuring was partly intended to align launch capability, AI infrastructure, and financing around orbital compute systems. ([TechCrunch](#))

The logic is vertically integrated:

- SpaceX launches the hardware
- xAI consumes the compute
- Starlink-style networking connects it
- Tesla may contribute power and manufacturing systems

Musk's Timeline: Musk has made extremely aggressive predictions:

- orbital AI becoming economically attractive by around 2028
- space AI compute eventually exceeding Earth-based compute growth. ([TechCrunch](#))

That timeline is widely viewed as optimistic. Even Jeff Bezos recently said Musk's proposed 2–3 year timeline is "probably not right," while still agreeing that space-based infrastructure could eventually happen. ([MarketWatch](#))

Why companies are interested: The attraction is mostly about energy economics. AI data centers on Earth are running into:

- grid power shortages
- cooling limitations
- land constraints

- political opposition over water and electricity usage

Orbital systems theoretically offer:

- near-constant sunlight
- no land costs
- abundant passive heat radiation
- global placement flexibility. ([KPBS Public Media](#))

This is why several firms besides SpaceX are exploring similar ideas.

Other companies pursuing orbital compute: A growing ecosystem is forming around “space compute” or “orbital AI infrastructure,” including:

- Starcloud
- Blue Origin
- NVIDIA
- startups working on autonomous assembly and space cooling systems. ([TechCrunch](#))

Some startups have already launched experimental GPU satellites carrying Nvidia hardware. ([TechCrunch](#))

The biggest technical problems: Experts consistently point to several major obstacles:

1. Launch cost

Even with reusable rockets, sending massive GPU clusters into orbit is expensive.

2. Heat rejection

Space is cold, but vacuum makes cooling tricky. Heat must be radiated away through large radiator structures rather than removed by air or liquid convection.

3. Hardware failures

A failed GPU in orbit is much harder to replace than one in a terrestrial data center.

4. Radiation

Cosmic radiation damages electronics over time.

5. Networking limitations

AI training clusters require enormous bandwidth and ultra-low latency between chips.

6. Space debris

Huge constellations increase orbital congestion and collision risks. ([Fortune](#))

What seems realistic right now is probably: Probably relatively small orbital experimental compute nodes will be installed for :

- processing satellite imagery or edge AI tasks in space
- specialized workloads rather than giant ChatGPT-scale training clusters

Several analysts think truly hyperscale orbital data centers are more likely a 2030s+ development, dependent on:

- frequent low-cost SpaceX Starship operations

- autonomous robotic assembly in orbit
- major advances in radiation-hardened AI hardware. ([TechCrunch](#))

Bottom line: Musk's orbital data center vision is no longer just a sci-fi idea — there are FCC filings, startup funding rounds, prototype compute satellites, and serious industry discussion behind it. But there is still a large gap between:

- small experimental orbital compute systems and
- economically competitive AI megadata centers in space.

Right now, the plans are technically plausible in principle, but commercially and operationally unproven.

Interestingly China is pursuing also innovative ecosystems for space computing centers as the following article from the Chinese Zhongguancun Forum (ZGC-Forum) in Beijing, March 2026 shows.

ZGC-Forum 2026: Building an Integrated Innovation Ecosystem for Space-based Computing Power [2]



Beijing is currently advancing the development of space-based computing capabilities. This year marks a critical phase in the first stage of a three-step development plan. The focus is twofold: on the one hand, resolving key technological challenges through scientific innovation to establish a solid foundation; on the other, leveraging industrial innovation to build high-performance project teams and implement concrete application scenarios. Under the organizational leadership of the Beijing Municipal Science and Technology Commission and the Zhongguancun Administrative Committee, the Beijing Institute of Space Future Technology and its holding company, Beijing Orbital Chenguang Technology Co., Ltd., are actively fostering the integrated development of technology and industry in this sector.

Zhang Shancong, head of the institute, emphasizes that a space-based computing system aims to shift large-scale AI computing capabilities into orbit. This entails overcoming challenges similar to those faced by large terrestrial data centers—such as power supply, heat dissipation, computing performance, and communication—alongside complex issues regarding the assembly and maintenance

of extensive space systems. The technological breakthroughs required for this span an unprecedented breadth and depth of industrial sectors. At the same time, the definition of development goals consistently prioritizes cost control, scalability, and industrial mass production in order to move beyond the traditional "research first, implementation later" model. Furthermore, integration into an innovation consortium plays a pivotal role in selecting participating stakeholders, with the aim of developing a complete value chain and strategically strengthening new industries.

Zhang Zheyu, General Manager of Beijing Orbital Chenguang Technology Co., Ltd., explains that large-scale space-based computing systems will serve as a novel information infrastructure and act as a driving force for industrial development. The goal is to establish a commercial ecosystem based on elements such as constellations of computing satellites and reusable launch systems. This could give rise to new industrial value chains as well as innovative applications, products, and service models. With the support of relevant authorities and the Zhongguancun Science City Administrative Committee, an innovation consortium has been formed, bringing together leading players from the commercial space and artificial intelligence sectors. On this platform, government, industry, academia, research institutions, and end-users collaborate closely to systematically address key technological challenges and create sustainable solutions for the development of space-based computing capabilities.

References

[1] USA section by chatGPT, edited by J. Kehr

[2] ZGC Forum 2026: http://german.china.org.cn/txt/2026-03/20/content_118392958.htm

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