# There are around 12000 data centers currently around the globe, but SpaceX claims they are about to launch "1 million data centers in space". Is that plausible? If so, how much raw material would that require to be produced, and how long would it take?

July 19, 2026 | SnugLab Research

## Executive Summary

SpaceX's claim to launch "1 million data centers in space" is plausible as a long-term engineering goal for a distributed orbital compute network, but the proposed timeline of two to three years is highly optimistic and the one-million-unit target is likely a regulatory anchoring strategy rather than an immediate deployment plan. Such a constellation would require an enormous amount of raw materials, totaling one million metric tonnes for the initial deployment, and would necessitate a continuous annual launch of 333,000 to 500,000 tonnes of replacement satellites due to rapid AI chip obsolescence. The full deployment and sustained operation are projected to take a decade or more, extending well into the 2030s, rather than the aggressive timeline suggested by SpaceX.

## Key Findings

### Plausibility and Regulatory Strategy

SpaceX's target of one million orbital data centers is widely considered by experts to be a regulatory "opening bid" or "publicity stunt" rather than a strict immediate deployment goal [1, 11, 13, 16, 18, 19]. This strategy mirrors SpaceX's previous request for nearly 30,000 Starlink satellites, which resulted in an approval for 15,000 [11, 18]. Despite this, SpaceX has a formal engineering plan for a distributed architecture of up to one million satellites in low Earth orbit, relying entirely on the Starship launch vehicle [1, 2, 4, 7, 12]. The company's CEO, Elon Musk, has positioned this initiative as a step towards a Kardashev Type II civilization, capable of harnessing the sun's full power [2, 7, 12, 16].

### Raw Material Requirements

Deploying a constellation of one million satellites, each averaging one tonne, would require a total initial mass of one million metric tonnes [5, 12]. The bulk of this mass would consist of solar arrays, machine-learning accelerators, and heavy radiators [1, 4, 7, 10, 12, 21]. For instance, the AI Sat Mini concept features a 70-meter wingspan for a 150 kW solar array and 110-square-meter liquid radiator blocks [21].

Specific estimated raw material requirements for one million one-tonne satellites include:

- **Aluminum:** Approximately 320,000 metric tons for structural components and propellant tanks [3, 4, 12, 20].
- **Copper:** Approximately 75,000 metric tons for wiring and cables [15, 20].
- **Silicon:** Approximately 288,500 metric tons for solar array mass, which incorporates silicon cells [20].

Comparing these requirements to current global mining and refining outputs, the demand for critical minerals could strain supply chains. For example, global high-purity refined gallium production was estimated at approximately 320 metric tons in 2023 [24]. Even small, unquantified percentages of gallium within one million satellites could quickly approach or exceed this annual output [16, 19]. Global mine production of rare earths reached approximately 390,000 metric tons of rare-earth oxide equivalent in 2025 [22], providing a larger buffer, but specific heavy rare earth elements could still face shortfalls [23].

## Deployment and Replacement Timeline

SpaceX's projected timeline for achieving economic cost parity and initial deployment is two to three years, targeting 2028 to 2029 [4, 5, 21]. However, analysts consider this highly optimistic, estimating that commercial viability and full deployment will take a decade or more, extending well into the 2030s [4, 5, 11, 12, 21].

The deployment plan relies on Starship achieving an hourly launch tempo, with each launch carrying 200 tons [1, 16]. To deploy one million tonnes, 5,000 launches would be required. Over three years, this translates to roughly 4.6 launches per day (one every 5.3 hours), which is mathematically feasible with a single launchpad operating at a fraction of the targeted hourly cadence [1, 16]. However, Starship has only completed a handful of test flights and has not yet demonstrated the full two-stage reusability required to sustain such a high cadence [12, 21].

A significant factor extending the timeline and increasing material requirements is the need for continuous replacement. While orbital hardware has a 5-7 year operational lifespan, AI chip performance roughly doubles every two years [5, 10, 21]. To remain competitive with terrestrial data centers, the orbital compute would need refreshing every 2-3 years [5, 10, 21]. This accelerated refresh cycle necessitates launching 333,000 to 500,000 tonnes of satellites annually to maintain a steady 100 GW of competitive compute capacity [5]. This continuous manufacturing and launch demand places a heavy strain on ground infrastructure and raw material supply chains, effectively multiplying the annual material and launch burden by over two times compared to a standard hardware lifespan [5, 10, 21].

### Economic Viability and Latency

Orbital data centers leverage passive radiative cooling and abundant solar power, avoiding the water, air, and grid constraints of terrestrial facilities [4, 12]. However, they are currently far more expensive. An economic analysis indicates a 1 GW orbital facility costs approximately $51 billion over five years, compared to $16 billion for terrestrial combined-cycle gas turbine power, representing roughly 3.2 times the cost [11]. While SpaceX projects cost parity within two to three years, analysts and Google anticipate space-based compute will not become cheaper than terrestrial operations until the 2030s or 2035 [4, 5, 12, 21].

In terms of latency, low Earth orbit positioning enables sub-10 millisecond latency to ground stations, which is sufficient for parallelized AI inference workloads [4, 5, 10, 21]. However, space-based centers cannot match the sub-microsecond latencies and 400 to 800 Gbps bandwidth per GPU required for tightly synchronized AI training, meaning terrestrial infrastructure will remain necessary for those tasks [5, 21].

## Implications

The ambition to deploy one million orbital data centers represents a significant shift in the space industry, with profound implications for manufacturing, resource management, and global infrastructure. The space economy, valued at $613 billion in 2024, is largely driven by commercial activities, accounting for approximately 78% of the total [2, 7, 8]. Investment in space technologies has exceeded $70 billion in recent years [8, 10], and the industry was projected to exceed $630 billion in 2025 and is expected to surpass $1 trillion by 2040 [6, 13]. This growth, however, tends to concentrate wealth among those with capital to invest [7, 8, 9].

The proposed scale of orbital data centers would necessitate an unprecedented expansion of manufacturing capabilities for satellites and launch vehicles, far beyond current industry growth rates [5, 25, 26]. The continuous replacement cycle driven by AI chip obsolescence means that the manufacturing and launch demands would be ongoing, requiring sustained industrial output for decades [5, 10, 21]. This could lead to significant strain on global supply chains for critical raw materials, potentially driving up costs and creating geopolitical dependencies [23, 24].

Furthermore, the massive increase in orbital objects raises concerns about space debris and orbital congestion [17, 27, 28, 29, 30]. While current global ozone depletion from rocket launches is minimal (less than 0.1%), increased launch frequency could lead to greater localized ozone loss and stratospheric warming, necessitating improved monitoring and regulation [2, 6, 11, 14]. The economic viability of orbital data centers remains a key challenge, with current costs significantly higher than terrestrial alternatives, suggesting that widespread adoption will depend on substantial reductions in launch and operational expenses [11, 21].

## Limitations and Caveats

The assessment of SpaceX's plan is based on current projections and expert analysis, which inherently involve uncertainties regarding future technological advancements, regulatory approvals, and market dynamics. The "one million" satellite figure is widely considered a regulatory tactic, meaning the actual deployed number may be significantly lower. Starship's full reusability and sustained high launch cadence, critical to the proposed timeline, are yet to be fully demonstrated. Specific raw material breakdowns for the satellites are not exhaustively detailed in the available research, making precise comparisons to global mining output challenging. Economic viability projections vary, and the long-term cost parity with terrestrial data centers is still a subject of debate.

## Sources


[1] Spacex Aims To Launch 1 Million Ai Data Center Satellites - skyandtelescope.org - https://skyandtelescope.org/astronomy-news/spacex-aims-to-launch-1-million-ai-data-center-satellites/

[2] Spacex Files Plans For Million Satellite Orbital Data Center - spacenews.com - https://spacenews.com/spacex-files-plans-for-million-satellite-orbital-data-center-constellation/

[3] Spacex Formalizes Plan To Build 1 Million Satellite Orbital  - tomshardware.com - https://www.tomshardware.com/tech-industry/spacex-formalizes-plan-to-build-1-million-satellite-orbital-data-center-system-fcc-filing-sketches-out-plans-but-over-packed-orbits-could-be-limiting-factor

[4] [blog] Spacex 1 Million Orbital Data Centers Fcc Filing 2026 - introl.com -

https://introl.com/blog/spacex-1-million-orbital-data-centers-fcc-filing-2026
[5] [blog] Orbital Data Centers Part Ii Spacexs Million Satellite Bet C - medium.com - https://medium.com/@marc.bara.iniesta/orbital-data-centers-part-ii-spacexs-million-satellite-bet-cfd4e2bdcf66
[6] Special Feature Spacex Ipo Puts Spotlight On Musks Orbital D - w.media - https://w.media/special-feature-spacex-ipo-puts-spotlight-on-musks-orbital-data-center-plans-and-ai-ambitions/
[7] Spacex Fcc Million Data Center Satellites - geekwire.com - https://www.geekwire.com/2026/spacex-fcc-million-data-center-satellites/
[8] Space X Space Based Ai Data - sesamedisk.com - https://sesamedisk.com/space-x-space-based-ai-data/
[9] Spacex Aims For Data Centers In Orbit As Ai Strains Infrastr - pymnts.com - https://www.pymnts.com/news/artificial-intelligence/2026/spacex-aims-for-data-centers-in-orbit-as-ai-strains-infrastructure/
[10] Releases - sciencedaily.com - https://www.sciencedaily.com/releases/2026/06/260618041501.htm
[11] Spacex Files For 1m Satellites Ai Data Centers In Space - byteiota.com - https://byteiota.com/spacex-files-for-1m-satellites-ai-data-centers-in-space/
[12] Spacex Files For Million Satellite Orbital Ai Data Center Me - datacenterdynamics.com - https://www.datacenterdynamics.com/en/news/spacex-files-for-million-satellite-orbital-ai-data-center-megaconstellation/
[13] Spacex Fcc 1 Million Solar Powered Data Centers Satellites O - theverge.com - https://www.theverge.com/tech/871641/spacex-fcc-1-million-solar-powered-data-centers-satellites-orbit
[14] [news] Cyv5l24mrjmo - bbc.com - https://www.bbc.com/news/articles/cyv5l24mrjmo
[15] [wiki] Starlink - en.wikipedia.org - https://en.wikipedia.org/wiki/Starlink
[16] 2514106 Why Did Spacex Just Apply To Launch 1 Million Satell - newscientist.com - https://www.newscientist.com/article/2514106-why-did-spacex-just-apply-to-launch-1-million-satellites/
[17] Spacexs 1 Million Orbiting Ai Data Centers Could Ruin Astron - space.com - https://www.space.com/space-exploration/satellites/spacexs-1-million-orbiting-ai-data-centers-could-ruin-astronomy-scientists-say
[18] Spacex Wants To Launch A Constellation Of A Million Satellit - engadget.com - https://www.engadget.com/science/space/spacex-wants-to-launch-a-constellation-of-a-million-satellites-to-power-ai-needs-175607771.html
[19] Spacex Data Centre One Million Satellites 9.7117772 - cbc.ca - https://www.cbc.ca/news/science/spacex-data-centre-one-million-satellites-9.7117772
[20] The Orbital Data Center Power Problem And How To Solve It - star-catcher.com - https://www.star-catcher.com/news/the-orbital-data-center-power-problem-and-how-to-solve-it
[21] [blog] Spacex Orbital Datacenters Economics - endtropy.substack.com - https://endtropy.substack.com/p/spacex-orbital-datacenters-economics
[22] [gov] Mcs2025 Rare Earths - pubs.usgs.gov - https://pubs.usgs.gov/periodicals/mcs2025/mcs2025-rare-earths.pdf?utm_campaign=the+albertan%3A+outbound&
[23] Reports - everycrsreport.com - https://www.everycrsreport.com/reports/R41347.html
[24] [gov] Mcs2024 Gallium - pubs.usgs.gov - https://pubs.usgs.gov/periodicals/mcs2024/mcs2024-gallium.pdf
[25] Satellite Manufacturing in the Era of Mass Production - https://www.satellitetoday.com/manufacturing/2021/08/19/satellite-manufacturing-in-the-era-of-mass-production-september-2021/
[26] Mass manufacturing of satellites - https://space.stackexchange.com/questions/32880/mass-manufacturing-of-satellites
[27] [peer-reviewed] Review on orbital debris mitigation: Techniques for ... - AUTHORS UNAVAILABLE - https://www.sciencedirect.com/science/article/pii/S0094576525004102
[28] [gov] ARES | Orbital Debris Program Office | Debris Mitigation -

https://orbitaldebris.jsc.nasa.gov/mitigation/
[29] 7 Mitigation of Orbital Debris - https://www.nationalacademies.org/read/13244/chapter/9
[30] Mitigating Orbital Debris - Aerospace Research Central -
https://arc.aiaa.org/doi/pdf/10.2514/6.2025-99643