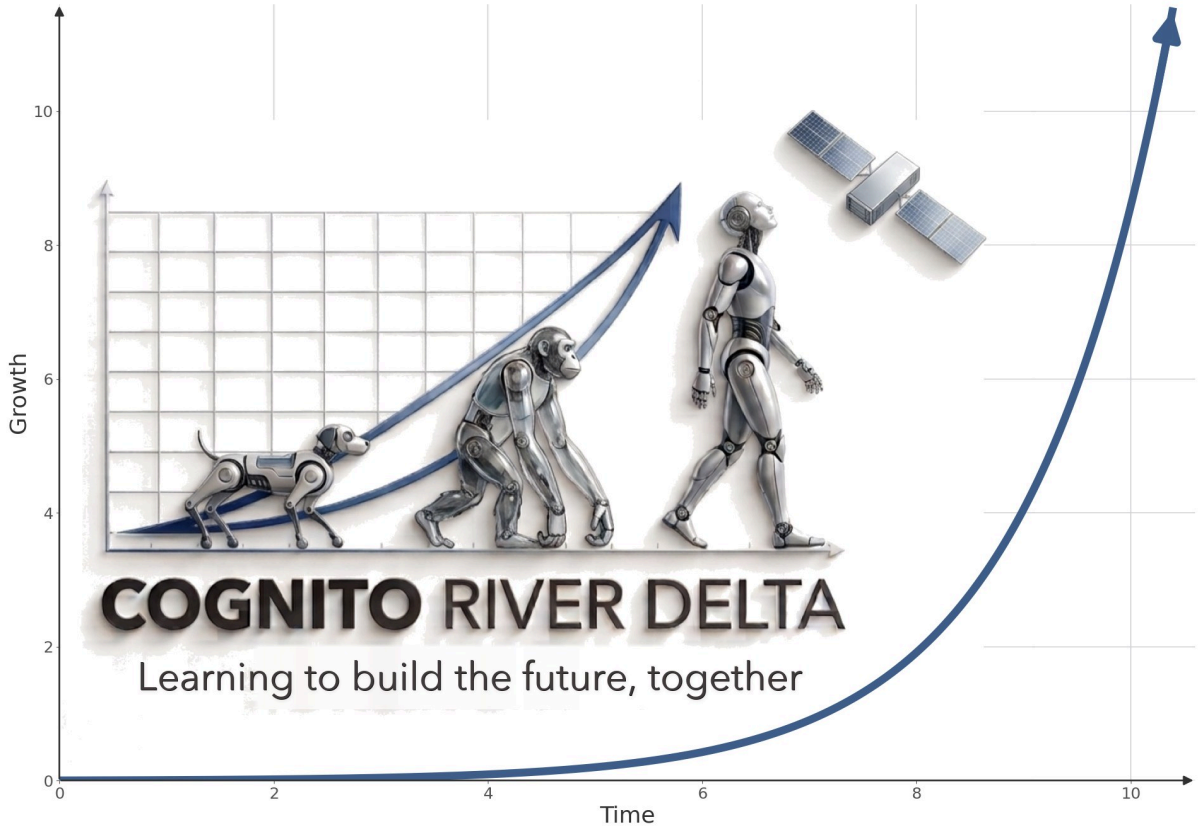


CATEGORY ROLLUP

Space-based compute & power - 2026-W46

Week of November 9, 2026

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Space-based compute & power

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Weekly Notebook: The Orbital Compute Race

Overview

This week marks a definitive pivot in the narrative of space-based infrastructure. We have moved past the era of speculative "what-ifs" and entered the era of hardware procurement and industrial-scale planning. The central storyline is the emergence of SpaceX's "StarMind" initiative, which is no longer a mere concept but a burgeoning industrial program characterized by specific hardware designs—the "Kessel" rack—major supply chain movements, such as the €60M+ SINGULUS solar deal—and an aggressive roadmap that seeks to decouple AI scaling from the increasingly volatile and politically sensitive terrestrial energy landscape.

The week's developments reveal a profound tension between two competing visions of the future: the SpaceX "vertical integration" moonshot and the "terrestrial skepticism" represented by established cloud giants. While SpaceX is positioning itself as the sole provider of the critical infrastructure needed for an automated AI era—attempting to build a complete, vertically integrated stack from the launch vehicle (Starship) to the specialized AI hardware (Nvidia-integrated racks)—incumbent players like Google and AWS are signaling deep skepticism regarding the economic and technical viability of moving massive compute loads into orbit.

This tension is being driven by a convergence of three critical factors: the physical limitations of the terrestrial power grid, the growing political resistance to ground-based data centers (specifically the "NIMBY" pressure in regions like Texas), and the unprecedented cost-reduction curve of heavy-lift launch vehicles. Whether the "orbital cloud" becomes a reality depends on whether the logistical math of Starship—specifically its full reusability and "chopstick" catch success—can ever outrun the massive energy and thermal requirements of the next generation of AI models.

Space-based AI compute and power (orbital datacenters)

The transition from "proof of concept" to "industrial scale" is best exemplified by the technical specifics emerging this week regarding the StarMind program. StarMind is not merely a satellite project; it is a specialized architectural response to what analysts are calling the "terrestrial grid bottleneck." As AI models demand unprecedented levels of power, the mounting difficulty of scaling on Earth is driving a search for alternative environments where energy and compute can be decoupled from land-based constraints.

The Hardware: The "Kessel" Rack and Nvidia Integration The specifications being discussed for the StarMind system move well beyond traditional satellite bus designs. At the heart of this architecture is the "Kessel" rack, a custom-designed unit reportedly built to house the Nvidia Vera Rubin architecture. These racks are expected to be highly specialized, with reports indicating a 72-GPU configuration per rack to meet the extreme demands of AI inference and training. Analysts at Wccftech have even projected that by 2028, the industry could see as many as 10,000 of these Nvidia GPU racks deployed in orbit.

This level of compute density brings intense technical challenges, specifically regarding thermal management. Because space is a vacuum, traditional air cooling is impossible; the StarMind architecture must rely on advanced radiative cooling to manage the heat generated by high-density GPU clusters. The goal is to achieve massive scale, with some projections suggesting the StarMind system could eventually involve as many as 1 million orbital data center satellites to achieve "terawatt" scale capacity.

The Power: Solving the Energy Crisis via Space-Based Solar The "Power" component is the most critical and contested element of the orbital compute equation. For these datacenters to be viable, they require an astronomical energy input that the terrestrial grid is struggling to provide. SpaceX is moving aggressively into the procurement phase to address this, having reportedly signed a €60M+ deal with Germany's SINGULUS for solar cells.

The scale of these solar ambitions is staggering. Reports indicate an order for 100 gigawatts (GW) of solar equipment per year. This is intended to leverage the fact that solar power in space is significantly more consistent and efficient than on Earth. Elon Musk has made bold claims regarding this capacity, suggesting that 100GW of space-based solar capacity would match the output of approximately 800GW on Earth. This massive energy deployment is the primary answer to the "energy crisis" facing terrestrial AI developers, aiming to provide the continuous, high-density power required for sustained AI workloads.

The Competition: "Muscle" vs. the "Nervous System" The industry is dividing into two distinct strategic camps: those building the "muscle" (power and specialized racks) and those building the "nervous system" (connectivity and data transfer).

SpaceX is clearly the leader of the "muscle" approach, prioritizing massive solar power generation and specialized hardware like the Kessel rack to drive raw compute capacity. In contrast, Alphabet (Google) is pursuing its "Suncatcher" project, which appears to be a strategic play for high-speed, low-latency connectivity. Suncatcher is described as an 81-satellite cluster designed for extreme-proximity laser data exchange, with satellites positioned as close as 100-200 meters apart. The goal of Suncatcher is to solve the "data transmission bottleneck," aiming for link speeds in the tens of terabits per second. This suggests that while SpaceX wants to own the *capacity* to process, Google is focused on the *infrastructure to move* the resulting data.

Economic and Political Drivers The economic viability of these projects remains the industry's greatest "fault line." There is a massive disconnect between the optimistic projections of SpaceX supporters and the warnings from terrestrial incumbents. On one side, analysts like Jo Bhakdi argue that space-based compute will be cheaper than terrestrial options by 2028, provided Starship launch costs drop toward the $100/kg mark. On the other side, Google's energy leadership has issued a stark warning: space-based data centers could ultimately cost 100 times more than their Earth-based counterparts.

This economic debate is being accelerated by a shift in the political landscape. In the United States, the election of Governor Gina Hinojosa in Texas has brought rising political opposition to the construction of massive, energy-hungry terrestrial data centers. This "NIMBY" (Not In My Back Yard) pressure—and the threat of potential regulatory moratoriums—is acting as a massive tailwind for the orbital compute movement. If the path to scaling AI on Earth is blocked by local politicians and grid constraints, the "high ground" of orbit becomes a strategic necessity.

Finally, this is an international race. The transition to space is becoming a cornerstone of national AI strategies globally. South Korea has announced plans for its own orbital AI data center tests by 2028, and China's "Threebody" constellation is reportedly already deploying AI processing capabilities in orbit, with claims of reaching 5 Peta-operations per second.

Cross-cutting themes

The most significant cross-cutting theme this week is **the convergence of the "Energy-Compute-Transport" Triad.** In traditional industrial sectors, energy, computing, and logistics are treated as separate value chains. In the orbital compute sector, these are being fused into a single, verticalized stack. To build an orbital datacenter, a provider cannot simply purchase a chip; they must simultaneously solve for power generation (via SINGULUS solar procurement), thermal management (radiative cooling), high-density hardware (Kessel/Nvidia racks), launch logistics (Starship reusability), and high-speed connectivity (Suncatcher/laser links). This level of vertical integration is the hallmark of the SpaceX approach and is likely the only way the economics could ever approach parity with Earth.

Another major theme is **the shift from "Resource Scarcity" to "Deployment Speed" as the primary competitive metric.** On Earth, the primary bottlenecks for AI are the availability of land and the capacity of the power grid. In the orbital sector, the bottleneck shifts entirely to "Launch Cadence" and "Deployment Scale." The viability of the entire sector is now tethered to the success of the SpaceX Starship program. If Starship achieves full reusability and the "chopstick" catch success, the cost of deploying compute drops precipitously. In this new paradigm, the winner is not necessarily the company with the best algorithm, but the company that can achieve the highest launch frequency to deploy hardware at scale.

Where sources agree

- **The Terrestrial Grid Crisis:** There is a broad consensus across analysts and industry leaders that the terrestrial power grid, combined with mounting political and regulatory constraints (NIMBYism), is becoming a fundamental obstacle to the continued scaling of AI.
- **The Starship Dependency:** Almost all sources agree that the economic feasibility of orbital compute is fundamentally contingent on the success, reusability, and cost-reduction of the SpaceX Starship launch vehicle.

- **The Solar Advantage:** Sources agree that the ability to leverage high-capacity, continuous solar energy in space—unhindered by atmospheric interference—is a primary driver for moving compute out of the atmosphere.
- **The Internationalized Race:** There is agreement that the race for orbital compute is a global endeavor involving significant activity from the US, China, and South Korea.
- **The Strategic Necessity of Vertical Integration:** Analysts agree that the move to space is being driven by a need to bypass the physical and political constraints currently choking terrestrial AI expansion.

Where sources disagree

- **The Economics of Space:** There is a massive, unresolved disagreement regarding the cost-efficiency of orbital vs. terrestrial compute. Some analysts, such as Jo Bhakdi, argue space will be cheaper by 2028; conversely, Google's energy head asserts that space-based centers will be 100x more expensive than Earth-based ones.
- **Deployment Timelines:** Timelines for "meaningful" deployment are wildly inconsistent. Estimates range from highly optimistic (Q3 2027 or as early as 2028) to deeply skeptical projections that suggest meaningful deployment won't occur until 2040 or 2050.
- **The Scale of Ambition:** Sources differ significantly on the projected scale of the industry. Some analysts focus on specific hardware counts (e.g., 10,000 GPU racks by 2028), while others discuss astronomical scales, such as the "Starmind" proposal for 1 million satellites or Jeff Lutz's prediction that 99.99% of all digital compute will move to space within 10 years.
- **The Valuation Impact:** Analysts are divided on how much this affects the parent companies. While Larry Goldberg claims that 80-90% of SpaceX's current valuation is tied to orbital data centers, other analysts view the program as just one of several major revenue drivers.

Numbers and claims to verify

- **100x cost increase:** The claim from Google's energy head that orbital data centers will cost 100x more than terrestrial ones.
- **1 million satellites:** The claim by Farzad Mesbahi regarding the scale of the "Starmind" system.

- **100GW solar capacity:** The claim regarding the scale of the SINGULUS/SpaceX solar equipment orders.
- **100GW space solar matches 800GW on Earth:** Elon Musk's claim regarding the comparative energy output of space-based solar.
- **<$100/kg launch cost:** The target launch cost that would serve as the economic catalyst for the sector.
- **99.999% reliability:** The technical reliability claim for orbital compute.
- **10,000 NVIDIA GPU racks by 2028:** The specific capacity projection from Wccftech analysts.
- **5 Peta-operations per second:** The technical specification for China's "Threebody" constellation.
- **$4.22 billion market reach by 2035:** The market sizing projection from openPR.com.
- **9-10 GW computing capacity by 2027:** The capacity projection from BestInTESLA.

Investment and strategic implications

The transition to orbital compute represents a fundamental shift in the definition of AI infrastructure. If successful, the "moat" for the next generation of AI companies will move from proprietary algorithms to the ownership of the physical, orbital assets that power them. For investors, this means that the "compute race" is increasingly becoming a "launch and energy race."

Strategically, companies are looking at space-based compute as a "hedge" against terrestrial instability. As power grids face increasing strain and political opposition to data centers grows—particularly in critical tech hubs like Texas—the ability to move compute to an environment with high energy density and minimal regulatory friction becomes a strategic necessity.

However, the extreme cost disparity noted by terrestrial incumbents (the "100x" problem) suggests that this remains a high-risk "all or nothing" play. The winners will likely be those who can achieve total vertical integration—controlling everything from the launch vehicle and the solar procurement to the specialized GPU rack design—to drive costs down faster than the terrestrial grid can be upgraded. This creates a potential "unassailable monopoly" for any player that can successfully master the Starship-to-StarMind pipeline.

What to watch next week

- **Starship Flight Milestones:** Any updates regarding the "chopstick" catch or Starship reusability testing will have immediate implications for the "orbital compute" economic model and the feasibility of the $100/kg target.
- **Supply Chain Movements:** Further news regarding the €60M+ SINGULUS solar deal or other massive procurement orders will serve as a proxy for how much SpaceX is actually investing in the StarMind program's immediate phase.
- **Alphabet/SpaceX Relations:** Given the reported conflict of interest and the recent exit of Google from the SpaceX board, watch for any further signs of tension or direct competition between the Suncatcher (connectivity) and StarMind (compute) initiatives.
- **Regulatory Signals:** Any new developments regarding data center moratoriums or political opposition in Texas will provide critical context on the "political driver" behind the move toward space-based infrastructure.

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