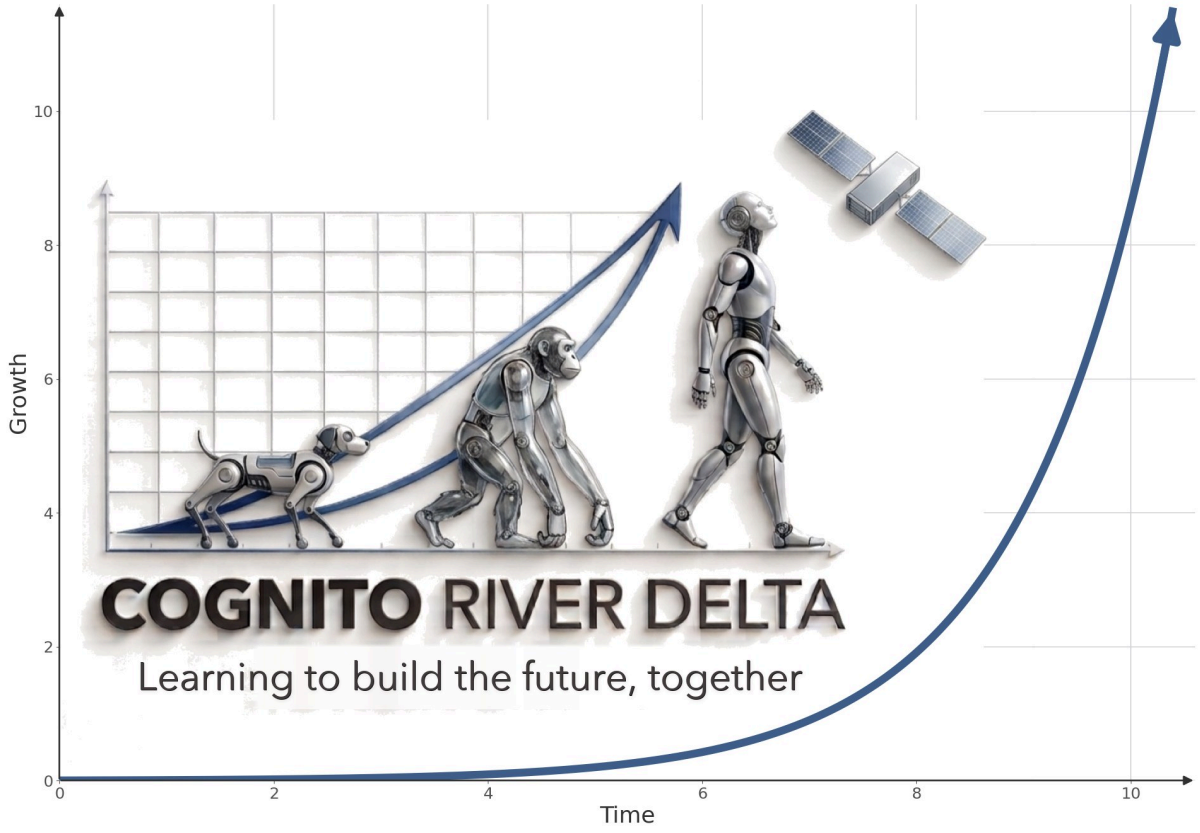


CATEGORY ROLLUP

Space-based compute & power - 2026-W45

Week of November 2, 2026

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Week of November 2, 2026 · 14 min read

Space-based compute & power

Space-based compute & power · week 2026-W45: Nov 02 - Nov 08, 2026 · 1 subtopic(s) covered · 2305 words · expanded

Overview

This week represents a fundamental paradigm shift in the orbital compute narrative. The conversation has moved from speculative "what-if" scenarios regarding space-based processing to the aggressive unveiling of industrial-scale hardware roadmaps. The central driver of this shift is the emergence of "StarMind"—a high-stakes collaborative effort between SpaceX and NVIDIA to develop purpose-built orbital computers designed for volume production by 2027. This is no longer a pursuit of experimental satellite functions; it is a concerted push toward terawatt-scale capacity designed to solve the two most existential threats to the continued scaling of artificial intelligence: the exhaustion of terrestrial power grids and the mounting political and regulatory resistance to land-based data center expansion.

The week's developments tie together a new technical reality and a new strategic motivation. On the technical side, empirical evidence has moved the needle from theoretical feasibility to proven hardware performance. Google's "Project Sun Catcher" successfully demonstrated AI inference in orbit, and the news that StarCloud has successfully flown an NVIDIA H100 suggests that the most advanced terrestrial AI silicon can survive and operate in the space environment. On the strategic side, the pivot toward orbit is increasingly being framed as a "regulatory hedge." As terrestrial data center expansion faces intensifying pushback over water usage, grid stability, and local political opposition—most notably highlighted by the

recent political shifts in Texas—the vacuum of space offers a way to scale compute without the friction of Earth-bound social and political constraints.

However, this ambitious roadmap is shadowed by a massive economic tension. A profound rift has opened between legacy energy and industry perspectives, which view orbital compute as a prohibitively expensive luxury (potentially 100x the cost of terrestrial sites), and the SpaceX-aligned view, which posits that vertical integration and the rapid maturation of Starship will make orbital compute cheaper than terrestrial alternatives by 2028. The coming months will determine which of these two mathematical models holds water.

Space-based AI compute and power (orbital datacenters)

The discourse this week centered on the transition from "experimental" to "industrial" orbital computing. While the industry has long discussed the idea of satellites performing niche tasks, the introduction of the StarMind initiative suggests a move toward standardized, mass-produced orbital data center units. This is further evidenced by reports that SpaceX may be seeking to deploy a massive network of one million orbital data center satellites.

The Thermal and Power Challenge The most persistent technical hurdle for orbital datacenters remains the "heat rejection" problem. In the vacuum of space, traditional convective cooling (using fans and air) is impossible, creating a unique engineering crisis. This has led to a high-stakes debate regarding the physics of orbital hardware. Jan Buren has raised concerns that the vacuum of space acts as a "thermos trap," effectively insulating hardware and causing high-performance AI chips to melt under their own thermal output.

Countering this, Farzad Mesbahi argues that radiative cooling is a highly efficient solution, particularly when operating at the high temperatures typical of AI hardware. This argument is bolstered by Elon Musk's claims that specialized aluminum radiators can achieve impressive heat dissipation rates of 1,300W/m². The hardware being developed for StarMind is specifically targeted at solving these power and heat rejection issues through hardware-software co-design. This approach aims to leverage the consistent, high-density solar power available in orbit—which Steven Mark Ryan notes could be roughly 30% more abundant than on Earth—to fuel the "terawatt" scale capacity required for true AI supercomputing.

The Proof of Concept Despite the thermal debate, the week provided significant empirical evidence that AI hardware can indeed function in orbit. Google's "Project Sun Catcher" successfully performed AI inference using the Gemma model to write a poem in orbit, providing a high-profile demonstration of successful orbital reasoning. Even more significant

for the high-end compute market was the news that StarCloud has successfully flown an NVIDIA H100 in space. The successful deployment of a flagship AI chip like the H100 suggests that the path toward the massive, high-density clusters envisioned by SpaceX is technically viable, provided that the thermal and power management systems can scale to meet the demands of such hardware. Furthermore, the industry is already seeing the financial scale of these ambitions; SpaceX's AI-related revenue reportedly increased by 1,800% from Q2 to Q3.

The Economic Divide: Scale vs. Cost If the technical hurdles are being addressed through co-design, the economic hurdles remain the primary point of contention. The industry is currently split between two diametrically opposed financial models:

1. **The High-Cost Model:** Google’s energy chief has asserted that orbital data centers will cost 100 times more than terrestrial ones. This view likely accounts for the immense capital expenditure required for specialized hardware, the current high cost of launch, and the complexities of maintaining infrastructure in a harsh environment. This cautious view is reinforced by market projections from sources like openPR, which estimate a space-based data center market of only $4.6 billion by 2033—a figure that appears modest compared to the trillion-dollar ambitions of SpaceX.
2. **The Starship-Driven Parity Model:** Conversely, proponents of the SpaceX ecosystem argue that the "cost per kilogram" metric is the only one that matters, and that this metric is about to collapse. Elon Musk and analysts like Jo Bhakdi suggest that the vertical integration of SpaceX—specifically the ownership of Starship and Falcon 9—provides a massive advantage. If Starship achieves full reusability and drives launch costs toward the $10/kg target mentioned by Brett (via ARK) or the <$100/kg target mentioned by Musk, the math changes entirely. Under this model, orbital compute could achieve cost parity with Earth-based facilities by 2028 and eventually become the cheaper option as terrestrial costs rise due to utility and regulatory constraints. Jo Bhakdi provides a specific roadmap for this: projecting Starship costs will decline from $500/kg in 2027 to $300/kg in 2028, and eventually to $200/kg in the 2029–2030 period.

The Political and Regulatory Hedge A recurring theme throughout the week was the realization that the "limit" to AI scaling might not be technical, but political. The news of a Democratic "blue wave" in Texas and the election of Governor Gina Hinojosa has been cited as a catalyst for Elon Musk’s interest in space-based compute. There is a growing consensus among observers like Ryan and Ben Thompson that the move to orbit is a strategic maneuver to bypass "terrestrial friction." As cities and states grapple with the massive water and

electricity demands of AI, and as political opposition to large-scale data centers grows, the "unlimited opportunities" of space offer a way to scale compute without having to negotiate for land, water rights, or grid upgrades. While some, like Diamandis, see this as a mere replication of land-based services in space, others see it as a fundamental move to escape the socio-political backlash currently stalling terrestrial infrastructure.

Cross-cutting themes

The primary cross-cutting theme this week is the **convergence of launch capability and compute architecture.** The debate is no longer just about "how do we build a computer in space?" but "how do we build a computer that is optimized for the specific cost-and-weight profile of a Starship launch?" This is evidenced by the SpaceX/NVIDIA StarMind collaboration, which represents a move toward a holistic hardware-software-launch co-design. The satellite is no longer a standalone vessel; it is a component of a larger, launch-optimized infrastructure.

Another major theme is the **transition from technical risk to economic and political risk.** The successful flight of the H100 and Google's poem demonstrate that the technical "can we do it?" is being answered with a "yes." This shifts the entire weight of the industry's attention onto "should we do it?" (the economic question of the 100x cost multiplier) and "can we get away with it?" (the political question of bypassing terrestrial regulators and utility constraints).

Finally, there is a tension between **niche sovereign capability vs. global infrastructure-scale ambitions.** We see South Korea pursuing a specific 100kg space data center project (currently facing a $3.6M funding gap), representing a targeted, sovereign capability. This stands in stark contrast to the SpaceX vision of a 1-GW deployment—potentially involving 6,000 racks—and a "one-million satellite" network, which treats orbital compute not as a specialized tool, but as the foundational backbone of global AI infrastructure.

Where sources agree

- **Technical Feasibility of Cooling:** There is a general agreement that while heat rejection is a massive challenge, it is physically possible through radiative cooling, provided the hardware is specifically designed for it (Mesbahi, ARK).

- **Terrestrial Constraints:** Sources largely agree that terrestrial power grids are increasingly unable to support the massive scaling required by AI (Steven Mark Ryan) and that regulatory/political hurdles on Earth—such as power and water consumption issues—are a legitimate driver for looking toward space (Ryan, IBT, Kirk).
- **The Starship Dependency:** Almost all analysts agree that the economic viability of this entire sector is fundamentally tethered to the success, refurbishment speed, and cost-reduction of the Starship launch vehicle (Ryan, Brighter with Herbert, Jo Bhakdi).
- **The Timeline of Scaling:** There is a loose consensus that 2027–2029 is the critical window for when orbital compute moves from testing phases to meaningful volume (Musk, Mesbahi, Burnett).

Where sources disagree

- **The "Cost Gap" Magnitude:** This is the most significant disagreement. Google's energy chief claims space-based compute will cost 100x more than terrestrial ones, whereas Jo Bhakdi and Elon Musk suggest it will achieve cost parity or become cheaper by 2028 due to plummeting launch costs.
- **Thermal Dynamics:** There is a direct conflict between the "thermos trap" theory (Jan Buren), suggesting space's vacuum will cause hardware to melt, and the radiative cooling theory (Farzad Mesbahi) suggesting it is a highly efficient heat-rejection mechanism at high operating temperatures.
- **The Motivation for the Shift:** Some sources see the move to space primarily as a play for "unlimited opportunities" and pure growth (Kirk), while others see it as a defensive, strategic move to escape political and social resistance to AI infrastructure on Earth (Ryan, Diamandis).
- **Market Size Projections:** There is a massive discrepancy in projected market value, ranging from a $4.6 billion market by 2033 (openPR) to the much larger, more speculative revenue targets suggested by Steven Mark Ryan (up to $1 trillion by 2027).

Numbers and claims to verify

- **1,300W/m²:** Verify the validity of aluminum radiators' ability to dissipate this specific amount of heat in a vacuum (Elon Musk/Wccftech).

- **100x Cost Multiplier:** Investigate the basis for the Google energy chief's claim that orbital centers will cost 100x more than terrestrial ones (Brighter with Herbert).
- **2028/2029 Crossover:** Verify the feasibility of Musk's claim that orbital compute volume will exceed terrestrial deployment by the end of 2028 (Ryan Shaw, Brighter with Herbert).
- **$10/kg Launch Cost:** Monitor Starship's progress toward the $10/kg target cited by Brett/ARK.
- **1-GW Deployment/6,000 Racks:** Verify the reports from TOKENPOST regarding the scale of orbital power ambitions.
- **30% More Solar Power:** Verify the physics behind the claim that there is 30% more solar power available in space compared to terrestrial locations (Steven Mark Ryan).
- **99.999% Reliability:** Assess the technical basis for the claim of 99.999% orbital compute reliability (FourWeekMBA).

Investment and strategic implications

- **Vertical Integration as a Moat:** For companies like SpaceX, the primary competitive advantage is not just the ability to build satellites, but the ownership of the launch mechanism. This vertical integration acts as a hedge against the "prohibitive costs" that typically kill space ventures, allowing them to control the cost-per-kilogram metric that dictates the entire sector's viability.
- **The "Frontier League" Position:** If launch costs drop toward the $10/kg range, SpaceX is positioned to move from a launch provider to a dominant "Frontier League" player in the global AI infrastructure market, controlling the very foundation of compute (ARK).
- **Hedge Against Terrestrial Regulation:** As political and social opposition to terrestrial data centers (due to power/water consumption) increases, companies may find it strategically advantageous to lease compute from orbital networks to avoid the "friction" of land-based expansion and local regulatory moratoriums (Ryan, Mesbahi, Kirk).
- **Revenue Flywheels:** SpaceX appears to be using its current terrestrial supercomputing assets ("Gun Range" and "Spam") as a revenue flywheel to generate the massive capital expenditure required for the transition to orbital infrastructure (Brighter with Herbert).

What to watch next week

- **Starship Flight Updates:** Any news regarding "chopstick" catch success or refurbishment speed will have immediate implications for the economic models (specifically the $200-$500/kg projections) discussed this week.
- **StarMind Technical Specs:** Look for more granular details on the SpaceX/NVIDIA collaboration, specifically regarding heat rejection hardware and power management.
- **South Korean Funding News:** Monitor whether South Korea closes its $3.6M funding gap for its 100kg space data center project.
- **Regulatory News in Texas:** Follow any further developments regarding data center moratoriums or utility constraints in Texas, which serve as the primary case study for the "political push" toward space.

Appendix: Individual perspectives

We see further because we stand on the shoulders of giants. The people in this appendix are some of those giants: their public work, followed and studied every day and every week, is how CognitoRiverDelta brings the world's AI knowledge and concerns together, so that, in time, our expert panel can help shape real solutions and paths forward for all of us. We learn by observing them, and we think of them as kindred spirits: people helping humanity and AI educate each other and contribute to solutions. Together they form a much larger community of minds, a worldwide panel; ours is a small copy of it. Most people don't want to become expert kayakers, reading rocks and rapids every day; yet that is how this fast-flowing river of change feels to many of us, and the evidence that could ease those fears, the grounded ones and the imagined ones, is still being gathered. That is the work. We credit their ideas here with gratitude; they are not affiliated with us and do not endorse this report.

- **Aaron Burnett:** Posits that a Starship launch cadence of 50–100 flights per year is the prerequisite for deploying orbital data centers using coherent satellite clusters. Anticipates initial testing in 2027 and commercial rollouts in 2028/2029.
- **Elon Musk:** Aims to deploy orbital supercomputing via space-based solar to bypass terrestrial constraints. Predicts 2027 launches for the StarMind initiative and believes orbital compute volume will exceed terrestrial volume by 2028/2029.
- **Farzad Mesbahi:** Maintains that technical thermal challenges are solvable via radiative cooling. Asserts that launch costs must drop to approximately $200/kg for orbital

compute to compete with terrestrial options.

- **Jo Bhakdi:** Argues orbital compute will achieve cost parity with Earth-based facilities by 2028. Projects Starship costs will decline from $500/kg (2027) to $200/kg (2029–2030).
- **Steven Mark Ryan:** Views the 1-million satellite "StarMind" network as an inevitable part of SpaceX's masterplan. Projects SpaceX's orbital AI revenue could reach $100 billion by Dec 2026 and $1 trillion by Dec 2027.

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