Strengthening America's space supply chain

Built for yesterday, igniting momentum for tomorrow

March 2026

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Introduction

Background and space market dynamics

The space market grapples with a new era of growth

The US space sector is launching into an era of accelerated growth driven by commercial, civil, and national security priorities. The US has elevated space supply chain resilience as a strategic priority. This white paper draws on public data and interviews with government agencies, prime contractors, and suppliers to assess current supply chain dynamics and develop targeted, actionable recommendations for strengthening the space industrial base.

3,708

objects were launched in the US in 2025 (4,510 globally).[1]

Demand growth is accelerating across the space ecosystem

Space activity is booming, placing unprecedented demand on launch systems, satellite manufacturing, ground infrastructure, and supporting suppliers. Unlike previous growth cycles that were driven by a single mission class or customer segment, today's expansion is happening across commercial, civil, and national security programs.

Some 3,708 objects were launched in the US in 2025 (4,510 globally), nearly ten times the tally in 2019.[1] Although earlier constellation programs in the 1990s temporarily increased launch cadence, today's surge reflects a broader structural shift toward deployment of a large number of small, low-cost satellites—known as proliferated low Earth orbit or pLEO architecture—across multiple customer segments including nascent ones like space-based data centers. Satellite miniaturization, decreased launch costs, low-cost electronically steered arrays, and propulsion advancements have enabled this shift, and the result is broader and faster demand than ever before.

Increased launch activity reflects the growing economic significance of the broader space economy, which accounted for approximately 0.5% of total US GDP in 2023 and supported more than 370,000 private-sector jobs according to the Bureau of Economic Analysis (BEA).[2] Beyond that direct footprint, academic research suggests that space sector expansion generates positive macroeconomic spillovers, contributing to productivity gains and technological innovation beyond the industry itself.[3] Take, for example, space-driven advances in lightweight materials as well as miniaturized electronics and radiation-hardened systems. They've all diffused into commercial aviation, telecommunications, and advanced manufacturing.

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[1] Our World in Data, ***Data Page: Annual number of objects launched into space***, from Edouard Mathieu and Max Roser, *Space Exploration and Satellites* (2022); data adapted from the United Nations Office for Outer Space Affairs, updated to 2025. The objects included in this data include satellites, probes, landers, crewed spacecrafts, and space-station flight elements.

[2] Bureau of Economic Analysis, ***New and Revised Statistics for the U.S. Space Economy, 2012–2023***, 2025.

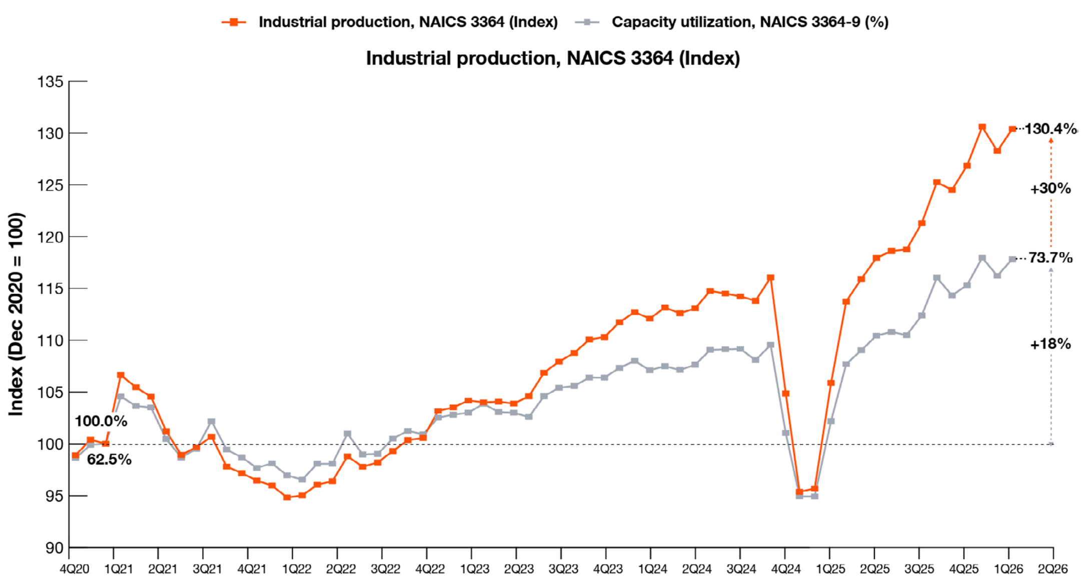
[3] Corrado, Luisa et al. (2023). "***The macroeconomic spillovers from space activity***." *Proceedings of the National Academy of Sciences of the United States of America*, 2023.

Supply chain capacity is lagging behind growth

Across the space industrial base, companies have increased output primarily by intensifying use of existing facilities rather than expanding capacity. According to BEA fixed-asset data, the average age of private industrial structures within the aerospace industry reached 25.9 years in 2024, highlighting aging physical infrastructure and elevated requirements for maintenance and capital investments.[4]

These requirements are further amplified by the growth in launch cadence and satellite production. Recent industrial indicators illustrate this. As aerospace products and parts (NAICS 3364) manufacturing output grew 30% over the past five years, capacity utilization across the broader industry (NAICS 3364-9) also rose steadily, reaching 74% in December of 2025.[5, 6]

Change in industrial production and capacity utilization for aerospace and miscellaneous transportation equipment manufacturing, December 2020 to December 2025



Source: Federal Reserve Bank of St. Louis[5, 6]

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[4] Bureau of Economic Analysis, ***Table 3.9S: Current-Cost Average Age at Yearend of Private Structures by Industry***, 2024, "Other Transportation Equipment".

[5] Federal Reserve Economic Data, ***Industrial Production: Manufacturing: Durable Goods: Aerospace Products and Parts (NAICS 3364)***, January 2026.

[6] Federal Reserve Economic Data, ***Capacity Utilization: Manufacturing: Durable Goods: Aerospace and Miscellaneous Transportation Equipment (NAICS 3364-9)***, January 2026. Note: FRED does not report capacity utilization for NAICS 3364 separately.

While aggregate capacity use reached higher levels in the mid-2010s because of commercial aviation, space-related manufacturing has contributed to the recent utilization growth with high volume programs such as the Space Development Agency's Proliferated Warfighter Space Architecture (PWSA). The close alignment between production growth and rising utilization indicates that rising demand is increasing strain on existing assets, not prompting new capacity.

Our interviews across the supply chain indicate that many manufacturers hesitate to invest in new facilities, tooling, or workforce without long-term demand certainty. Space programs often lack the volume predictability and multi-year commitments required to support large capital investments, reinforcing a conservative approach among suppliers. While this strategy can accelerate asset degradation and limit productivity gains, federal budget volatility (accounting for more than 20% of total space economy[7]), program delays, and shifting priorities all increase the perceived risk that capacity built today may be underutilized tomorrow.

[7] Space Foundation, ***The Space Report 2025 Q2***, July 2025.

02

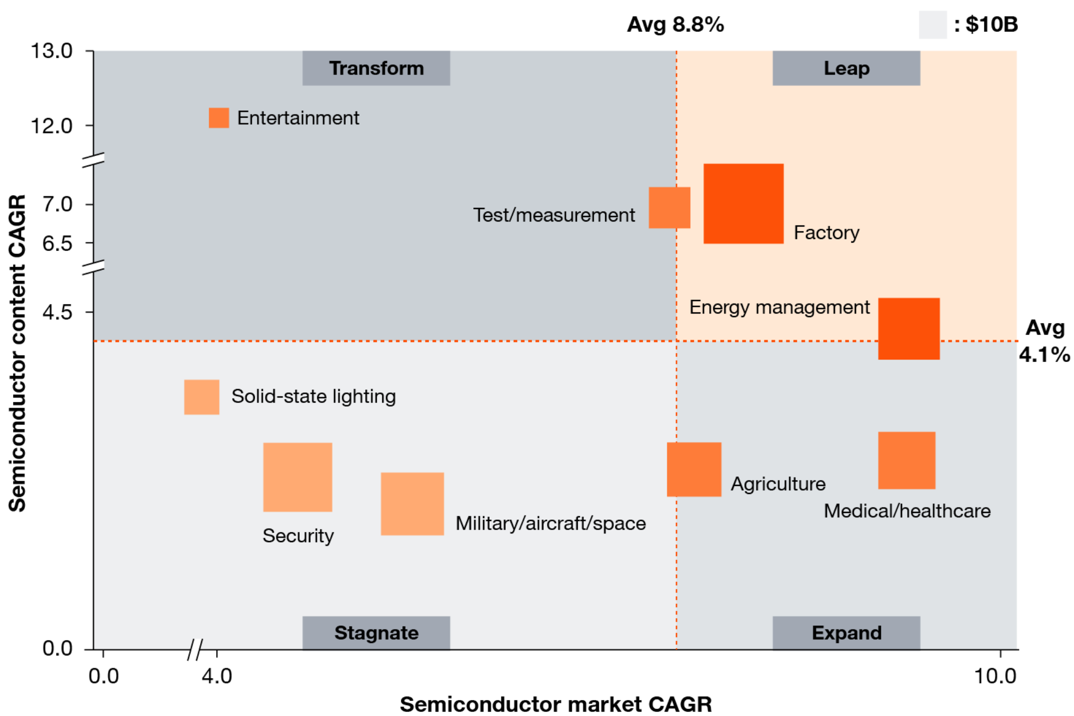
Why supply isn't keeping up

01 Competition with other industries makes the space supply chain vulnerable

Automotive, energy, data centers, and other industrial manufacturing are experiencing parallel growth in demand, competing alongside space for limited production capacity. Space, a smaller volume industry with slower component market growth for in-demand products, is structurally disadvantaged among suppliers who look to prioritize contracts with high-volume and high-growth potential.

Semiconductors make up one example of a high-demand, core component of many space subsystems such as avionics, communications systems, power systems, sensors, and actuation control. When compared to semiconductor demand in other industries, the space industry is unable to compete with the levels of growth seen in parallel use cases such as factory and energy management, as shown in the figure below.[8] As a result, this increasing demand within space appears stagnant. Since suppliers tend to favor more predictable, higher-volume demand, they're less inclined to provide or invest in capacity dedicated to space programs.

Projected semiconductor demand by application, with space showing slower component growth relative to other industries, 2030



Source: PwC Global Semiconductor Industry Outlook 2026[8]

[8] PwC Global, ***Semiconductor and beyond: Global semiconductor industry outlook 2026***, September 2025.

Suppliers have weakened confidence in traditional space programs due to frequently variable demand profiles and budget dynamics, which are less common in other industries. Within space, only final funding determines if planned missions proceed on schedule, are deferred, or even cancelled. This particularly raises uncertainty for suppliers of specialized hardware that become reliant on a small subset of programs, causing them to be hesitant to invest in additional capacity. During recent calls for a close to 25% cut to the NASA budget, suppliers raised concerns around continuity of demand for program-specific and other highly customized components.[9]

Our interviewees also noted that many suppliers have been declining to bid on space work entirely, citing high complexity requirements and low return on effort. In one case, a legacy supplier declined to rebid on composite overwrapped pressure vessels (COPVs), used to store high pressure gases, as space-specific production consumed more than 30% of their engineering team's time while generating only low single-digit revenue. Oftentimes, the same equipment can be used to fulfill larger and more predictable orders in other industries. Large-diameter machining, for instance, has scarce capacity and long setup times for small quantities. A machine shop supporting the aerospace industry with batch production runs of large-diameter parts has significant machine changeover and setup times. In this production environment, machine setup times can be an hour to run batches of only 12 to 15 parts, resulting in a more than 10% loss in production run time for a standard shift. In addition, while adjacent industries may call for similar quality standards, space programs often impose space-specific requirements such as extensive thermal, vacuum, vibration, shock, radiation, and mission-specific qualification, all of which drive long lead times and high nonrecurring costs. These low program risk tolerances coupled with International Traffic in Arms Regulations (ITAR) constraints and domestic sourcing preferences to support national security narrow the eligible supplier base. As a result, traditional space programs have to compete for the same machines, materials, and workforce as much larger industries but without comparable scale or demand stability.

[9] The White House, ***Fiscal Year 2026 Discretionary Budget Request***, May 2025.

This imbalance may deepen in the near term as artificial intelligence drives interest in space-based data centers. Major launch providers, cloud and technology companies, and foreign governments such as China have proposed large constellations of solar-powered, AI-enabled satellites to support high-density computing and data storage. If pursued at scale, these architectures would draw heavily on the same constrained pool of space-qualified electronics, power systems, thermal hardware, structures, launch services, and test infrastructure as traditional space missions. AI-driven constellations would also likely require extensive optical inter-satellite link (OISL) networks to move large volumes of data between satellites, increasing demand for specialized optical and photonic components produced by a narrow set of qualified suppliers. Such demand shocks could amplify existing bottlenecks and intensify competition for limited production slots. While sustained capital inflows from AI-driven programs may support investment in new facilities, encourage supplier expansion, and increase industrial scale in the long term, the near-term surge in demand may strain an already capacity-constrained supply base, risking redirecting limited industrial bandwidth toward well-capitalized AI programs rather than expanding overall production capability. Hyperscalers and other major tech companies are often better positioned to secure long-term agreements or pre-purchase capacity, potentially crowding out space programs with smaller, uncertain demand and traditional space companies that are more budget-sensitive. As a result, the traditional space supply chain faces risks both internal and external to the industry.

02 Global disruptions undercut an already fragile space supply chain

The space supply chain is particularly vulnerable to broader disruptions because of its need for specialized, sole-sourced, and long-lead components. While most materials are typically limited to US suppliers, some materials have to be sourced overseas and are sensitive to geopolitical turmoil. Titanium sourcing, for example, has been disrupted by the conflict between Russia and Ukraine. Our interviewees expressed particular concerns around rare earth elements and magnetic items from China. China's dominance in global production mixed with recent tariffs that have further constrained access have forced our interviewees to rebuild their supply chains with limited available alternatives, prompting production halts.

Interviewees also cited a wide variety of components that have been snagging their supply chain due to market-wide long lead times. Carbon-fiber composites, critical for lightweight, high-strength structural components such as satellite bus panels, payload fairings, motor casings, and pressure vessels, are limited to just three major US aerospace grade suppliers. Electronics and avionics components were also cited for long lead times due to demand by the AI industry, with space-grade power distribution components such as switchgears holding lead times of up to 27 months. Unlike a household circuit breaker that relies on a simple mechanical switch, satellite switchgears cannot have any moving parts while being qualified to withstand extreme temperature swings and an enhanced radiation environment. These specialized requirements limit the supplier base and significantly extend production timelines. Interviewees also said market-wide skilled labor shortages are hobbling their efforts. Space manufacturing is uniquely affected by citizenship and security clearance requirements, which limit the available talent pool and reduce flexibility in responding to demand surges.

03 Legacy regulations and processes stymie technology modernization

The modern space supply chain remains deeply rooted in designs and intellectual capital that trace back to the Apollo era. While technological modernization has continued to advance, interviewees noted that legacy designs persist because their companies lack incentive to change. Qualifying a new supplier or design requires extensive testing and documentation, all of which adds time and millions in expense without immediate returns.[10] As a result, these companies tend to default to existing configurations and processes rather than pursue modernization.

[10] National Institute of Standards and Technology, ***Additive Manufacturing Part Qualification***, March 2025.

This inertia creates compounding supply chain risk. Older component designs become increasingly difficult to source as technology changes and fewer suppliers maintain backlogs of parts. This is particularly true for complex parts with a small aerospace-qualified supplier base such as valves used in satellite propulsion systems and launch vehicle engines as well as optical inter-satellite link (OISL) communication systems for satellite-to-satellite data transfer in proliferated constellations. Similarly, wire harness production faces bottlenecks due to a shrinking pool of skilled technicians. In both cases, legacy qualification requirements limit opportunities to introduce alternative suppliers.

Workforce demographics exacerbate these challenges. Critical institutional knowledge can be concentrated among a limited number of experienced personnel, and talent pipelines don't support new process transition. Nearly 40% of NASA's technical workforce was over 55 as of 2023, compared to an average of 28 in Mission Control in the 1969 Apollo era.[11, 12] This concentration of the workforce demographics increases knowledge transfer risk and slows adoption of new design and manufacturing approaches.

As a result, companies show an aversion to change. Innovation lags as legacy companies hang on, not wanting to be the first to fail. While some newer space companies have embraced a prototyping approach, as seen with major launch providers willing to absorb significant hardware losses in pursuit of innovation, most companies default to familiar suppliers and designs to curb risk and maintain status quo. Over time, this dynamic reinforces supplier concentration and limits competitive entry.

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[11] NASA Office of Inspector General, ***NASA's Efforts to Increase Diversity in Its Workforce***, April 2023.

[12] Smithsonian Institution: National Air and Space Museum, ***Who is Houston?***, September 2022.

04 Not enough investment in the space supply chain stalls innovation and capacity

While total space spending has risen in nominal value, public and private investment has fallen short of fully supporting the underlying industrial space supply chain. The relative funding of the government to the space sector has declined significantly since the Apollo era. In the mid-1960s, NASA's budget peaked at roughly 4% of total federal spending, while in recent years it has accounted for <0.4% of the federal budget, among the lowest shares in the agency's history.[13] Federal spending historically plays a critical role in underwriting long-horizon, capital-intensive investments that private markets snub because of long payback periods and high technical risk. Private investors tend to favor companies with higher price-to-development (PDE) ratios which are typically associated with asset-light business models and clearer, faster paths to monetization.

For investments in the space sector, this results in more investments going into downstream segments such as satellite services, earth-observation data, and software enabled applications rather than upstream and midstream segments, which include capital-intensive component manufacturers and production infrastructure. While a handful of newer generation space companies have raised unprecedented levels of capital, this funding has largely been concentrated in a small number of primes rather than broadly distributed across the upstream supplier ecosystem. As a result, even as flagship launch and satellite companies achieve multi-billion-dollar valuations, the underlying manufacturing base remains constrained and undercapitalized. Together, reduced relative government investment and private capital's bias toward downstream applications produce constrained manufacturing capacity, fragile supplier bases, and structural underinvestment in the physical space supply chain.

[13] PwC analysis conducted using government budget and spending data.

03

Findings and recommendations

This section leverages insights from interviews with space supply chain leaders, analysis of government and industry data, and PwC's industry experience to examine three interrelated drivers of supply chain stress. We focus on space-specific demand and budget dynamics, persistent part-level and component bottlenecks, and the cumulative impact of regulatory and compliance requirements. For each area, the analysis makes targeted recommendations to relieve capacity constraints and enable the space industrial base to scale with mission demand.

01 Space-specific demand and budget dynamics

While the global space industry is valued at more than $613 billion annually as of 2024, this headline figure masks significant uncertainty in underlying demand signals.[14] A substantial portion of space demand is driven by government customers, making public sector procurement dynamics influential to the overall space supply chain. This government demand, however, can be inconsistent and unreliable, shaped by budget processes, policy shifts, and program delays, and often driven by procurement need without a clear assessment of industry's capacity to deliver. Together, these dynamics discourage capital investment, weaken industrial resilience, and create bottlenecks when demand finally materializes.

Government agencies such as USSF, NASA, NOAA, intelligence agencies, and others represent a large anchor customer for US space systems, yet their demand signals are frequently distorted by budget instability and policy-driven shifts. Chief among these are continuing resolutions (CRs), National Defense Authorization Acts (NDAAs), and executive orders, all of which introduce uncertainty into long-term demand planning.

Under CRs, agencies are prohibited from initiating new programs and often delay contract awards, disrupt schedules, and force suppliers into stop-start production cycles.[15] What's more, CRs have emerged in 46 of the last 49 federal fiscal years, embedding uncertainty into space-related procurement.[16]

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[14] Space Foundation, ***The Space Report 2025 Q2: Global space economy highlights***, July 22, 2025. Note: Including Commercial Space Products and Services ($343B), Commercial Infrastructure and Support Industries ($137B), US Government Space Budgets ($77B), and Non-US Government Space Budgets ($55B).

[15] Department of Defense Office of Inspector General, ***Audit of the Impact of Continuing Resolutions on DoD Acquisition Programs*** (Report No. DODIG-2025-132), July 30, 2025.

[16] Congressional Research Service, ***Continuing Resolutions: Overview of Components and Practices*** March 27, 2025.

Beyond budgets, policy instruments such as NDAAs and presidential directives can rapidly alter priorities, architectures, and requirements. NDAAs frequently face delayed authorization and recent NDAAs have repeatedly adjusted force structure and space resilience priorities, while at least ten Executive Orders have affected the space supply chain since 2016.[17] For example, Executive Order 14028: *Improving the Nation's Cybersecurity* rapidly reshaped software and supply chain cybersecurity requirements for space ground systems and mission software, and Executive Order 13873: *Securing the Information and Communications Technology and Services Supply Chain* introduced new authorities and review mechanisms that altered risk assessments and vendor eligibility for space-related communications and ground infrastructure. These directives often take effect faster than agencies can align funding, acquisition strategies, or industrial capacity, forcing suppliers to hedge against shifting requirements.

Large space programs also add to demand uncertainty. NASA's Artemis program, for example, has experienced repeated schedule adjustments with a crewed lunar landing once scheduled for 2025, delayed most recently to 2028.[18, 19]

Space supply chain professionals tell us that when demand materializes, it often does so in large, discrete steps rather than smooth, predictable ramps.

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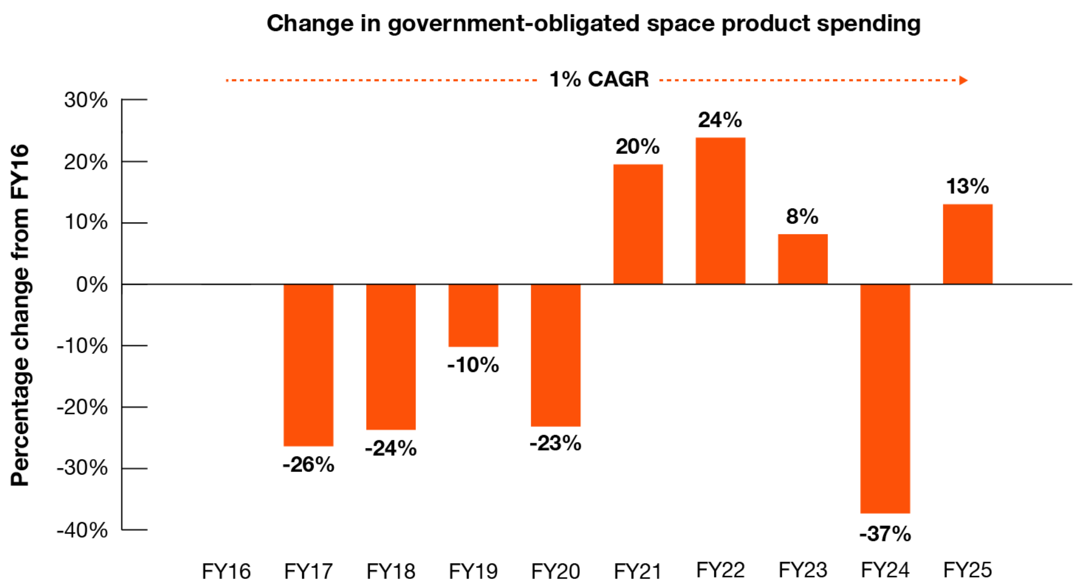
[17] Executive Office of the President, ***Reducing Regulation and Controlling Regulatory Costs*** (EO 13771), January 30, 2017; ***Strengthening the Cybersecurity of Federal Networks and Critical Infrastructure*** (EO 13800), May 11, 2017; ***Assessing and Strengthening the Manufacturing and Defense Industrial Base and Supply Chain Resiliency of the United States*** (EO 13806), July 21, 2017; ***Securing the Information and Communications Technology and Services Supply Chain*** (EO 13873), May 15, 2019; ***Encouraging International Support for the Recovery and Use of Space Resources*** (EO 13914), April 6, 2020; ***Ensuring the Future Is Made in All of America by All of America's Workers*** (EO 14005), January 25, 2021; ***America's Supply Chains*** (EO 14017), February 24, 2021; ***Improving the Nation's Cybersecurity*** (EO 14028), May 12, 2021; ***Ensuring American Space Superiority*** (EO 14369), December 18, 2025; and ***Prioritizing the Warfighter in Defense Contracting*** (EO 14372), January 7, 2026.

[18] National Aeronautics and Space Administration, ***Artemis III mission overview***.

[19] US Government Accountability Office, ***NASA Artemis Programs: Crewed Moon Landing Faces Multiple Challenges***, (GAO-24-106256), November 30, 2023.

Despite sharp year-to-year swings driven by procurement cycles, US government space product spending has remained essentially flat



Source: USASpending.gov, Prime Contract Awards database, FY2016–FY2025[20]

Note: Includes selected space-related PSCs (1555, 1675, 1677, 1725, 1735, 1810, 1820, 1830, 1840, 1850); federal obligation transaction amounts summarized by fiscal year.

For example, government-obligated contract awards (federal agency funding commitments made within each fiscal year) for space products have seen periods with rapid growth (a 56% increase from FY20 to FY21) and periods with equally rapid declines (-49% from FY22 to FY24).[20, 21]

[20] ***USAspending.gov,*** Department of the Treasury, Bureau of the Fiscal Service, Prime Contract Awards, FY2016–FY2025, filtered by selected space-related Product Service Codes (PSCs 1555, 1675, 1677, 1725, 1735, 1810, 1820, 1830, 1840, 1850); federal obligation amounts summarized by fiscal year, data as of February 26, 2026.

[21] "Space products" generally include contracts categorized under space vehicles, launch services, satellite systems, spacecraft components, and related ground and support equipment, as defined through federal product and service codes and NAICS classifications associated with space systems.

At the program level, formal demand-planning mechanisms provide visibility but not confidence. The Space Development Agency's transition to proliferated low-earth-orbit architectures offers long-lead forecasts, yet produces large demand surges that depend heavily on confidence in award timing and production readiness.[22] Similarly, the National Security Space Launch (NSSL) program awards missions in tranches to support industrial planning, but task-order timing and volume still vary significantly year to year.[23] Historical adjustments, such as changes to NSSL Phase 2 launch allocations between launch providers, reinforce supplier skepticism and caution.[24, 25]

Despite these formal demand planning mechanisms, mistrust persists throughout the supply chain, particularly below the prime level. In interviews across the sector, companies report consistent difficulty aggregating their own demand signals for suppliers, reflecting uncertainty about which programs will proceed on schedule and at scale. This dynamic creates a collective-action problem. The industrial base would be more resilient if companies invested early in capacity and workforce, but each company is incentivized to wait, fearing that it will be the only one left with stranded capital when schedules slip or requirements change. The result is a cycle in which optimistic top-down demand signals meet cautious bottom-up responses, ultimately producing the very bottlenecks and delays policymakers seek to avoid.

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[22] Space Development Agency, ***Space Development Agency Makes Awards to Build 72 Tracking Layer Satellites for Tranche 3***, December 19, 2025.

[23] US Space Force, ***Space Systems Command awards National Security Space Launch Phase 3 Lane 2 contracts***, April 4, 2025.

[24] US Space Force, ***Space Force Awards National Security Space Launch Phase 2 Launch Service contracts***, August 7, 2020.

[25] Congressional Research Service, ***Defense Primer: National Security Space Launch Program***, January 14, 2026.

Recommendation

A bidirectional, integrated data sharing platform

The solution is not simply more data sharing, but the creation of a mechanism for sharing accurate, validated, and bidirectional data across the space industry. The US Government Accountability Office has found that nearly half of major federal acquisition programs lacked a planned industrial base assessment, limiting the government's ability to judge whether stated demand was executable given existing capacity.[26] Effective demand signaling should flow downward—from government to industry. But realistic capability assessments should also flow upward, reflecting supplier constraints, workforce limitations, and long-lead dependencies. Absent this feedback loop, government organizations will likely pursue desired outcomes without a full understanding of what the supply chain can deliver, eroding trust when programs slip due to predictable capacity shortfalls.

The industry needs a shared platform that provides end-to-end visibility into demand, capacity, and risk across programs and supply chain tiers, and reconciles them into credible demand signals. Such a platform could be operated by the government (for example, jointly by the US Space Force and NASA), by industry, or by an independent third party. One such platform has already been envisioned by the Aerospace Corporation's proposed STAR topology, a conceptual framework designed to aggregate supply chain data across stakeholders to enable dynamic risk assessment and capacity visibility. Given its cross-sector visibility, the Department of Commerce is well positioned to play a role. Unlike defense-focused entities, Commerce has insight into both national security and rapidly expanding commercial space markets, and it should be funded and empowered to identify and propose solutions to constraints across the broader space industrial base.

[26] US Government Accountability Office, ***Defense Industrial Base DOD Should Take Actions to Strengthen Its Risk Mitigation Approach***, (GAO-22-104154), July 2022.

Encouragingly, both government and industry are already taking steps toward greater demand visibility. The Space Enterprise Consortium (a US Space Force OTA) has demonstrated the value of flexible, cross-industry engagement for paid prototyping and early-stage investment, though it functions primarily as a contracting vehicle rather than a strategic coordinating authority. Similarly, the Commerce Department Bureau of Industry and Security's 2023 civil space supply chain assessment was an important step toward understanding industrial capacity, but its impact was limited by unreleased findings.[27]

Stakeholders across the board agree on the need for a shared visibility platform spanning government and industry that would help reduce uncertainty, rebuild trust, and enable earlier, more confident investment across the space supply chain.

[27] National Oceanic and Atmospheric Administration, Office of Space Commerce, ***Commerce, NASA Begin US Civil Space Industrial Base Assessment***, March 6, 2023.

02

Bottlenecks in components, testing, and post-processing

To further complicate demand and supply planning across the space supply chain, industry leaders consistently report longer lead times and higher costs for components than their counterparts in other sectors. Interviews with space supply chain specialists, analysis of publicly available data sets, and industry experiences reveal four primary challenges across core impacted components.

Primary challenge	Impacted components
Lengthy, complex supply chains with limited suppliers at key nodes	Composites such as structural elements, COPVs & propulsion tanks, and rocket motor nozzles; cryogenic and high-pressure valves; actuators; optical inter-satellite links
Dominance of other industries in component sourcing	Switchgears, transformers, and other electrical transmission equipment used in manufacturing facilities, launch sites, and testing centers
Extensive testing and qualification requirements that drive disproportionate cost	Connectors, FPGAs, and other commercially available hardware adapted for space
Limited capacity and inconsistent quality in chemical and post-processing	Chemicals and post-processing production steps (anodize, heat treat, etc.)

Complex component production with limited sourcing options

Several key components in the space supply chain are complex to manufacture, with long, tightly coupled supply chains, significant capital investments required of suppliers, and consistently long lead times. Carbon-carbon rocket motor nozzles are a perfect example of these issues. These nozzles are stacks of multiple materials (carbon-carbon throats, carbon-phenolic liners, silica-phenolic insulation rings, and others) that each have their own long, tightly controlled supply chain. These supply chains are both expensive to maintain and extremely fragile. Based on analysis, there are currently only three major domestic suppliers of carbonized-rayon fabric/reinforcement, a critical element in the production of composite nozzles.[28] NASA has highlighted the need to mature the domestic supply chain for carbon-carbon nozzle extensions and notes that most state-of-the-art options are produced abroad.[29] Laws such as the Buy American Act and the Build America, Buy America Act limit the space sector's ability to import materials, putting even more pressure on the constrained domestic supply chain. While these policies do have exceptions and waivers, this adds yet another hurdle to the already challenging procurement process for these components.

As with many other key components, the space industry plays second fiddle to another sector with much larger demand: defense. For carbon rocket nozzles, the defense industry's missile production dominates the supply chain, as the volumes space companies produce are insufficient for suppliers to make them a priority. An aerospace-grade carbon fiber supplier shared that acquiring the fiber needed to produce aerospace parts has a minimum lead time of six months. Recent US defense priorities such as the Golden Dome initiative, a proposed program that would detect and defeat missile threats, further crowds out the space industry by increasing supply chain cost and making sourcing these nozzles even more difficult.

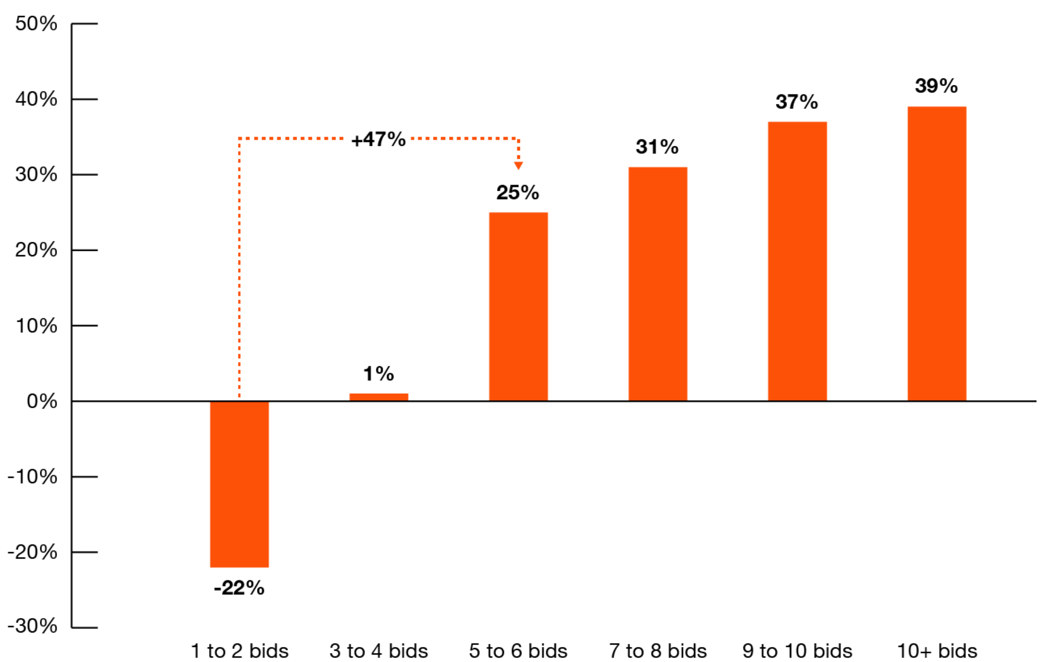
Rocket motor nozzles are not the only components that face this issue. Valves, a key component for many space applications, are difficult to source as well. Valves used for aerospace applications often have more rigorous specifications requiring them to function in a vacuum, hold up to vibrations during launch, and survive the unforgiving environment of space with no possibility of maintenance. They're also

[28] Review of open-source literature identified three major suppliers. Additional smaller volume suppliers may exist for niche applications.

[29] National Aeronautics and Space Administration, ***Carbon-Carbon Nozzle Extension Development in Support of In-Space and Upper-Stage Liquid Rocket Engines***, 2017.

used as part of some propulsion systems, in which they may need to withstand superheated, high-pressure gases or contain cryogenic propellants. As with composite production, there are relatively few suppliers capable of making space-grade components. Additional suppliers are discouraged from entering the market, as space-grade components are engineered to rigorous standards and generally required only in low volumes. Despite the rapid growth of the space industry over the past decade, US Census data shows that the number of valve manufacturers declined by 11% from 2010 to 2022.[30] Supply chain leaders lamented the difficulty in finding suppliers for valves, often relying on three companies or fewer to provide quotes. As shown in the chart below, this causes significantly higher prices. Products that receive five bids or more achieve almost 50% savings on average than products which receive only two or fewer bids.

Average savings by count of competitive bids



Source: PwC analysis[31]

[30] US Census Bureau, ***Manufacturers' Shipments, Inventories, and Orders (M3) Data Series***, December 2025.

[31] Estimates from PwC analysis.

Optical inter-satellite links (OISLs) suffer from this same issue. While these components are critical for satellite communication, enabling much greater bandwidth and reducing sensitivity to interference compared to traditional RF systems, the supply of vendors is limited, and the supply chain for parts is complex and fragile. The Space Development Agency (SDA) has pursued implementation of these laser communications systems in military satellite constellations but has faced significant supply chain delays. The initial demonstration tranche was launched two years behind schedule, and 50% of the prime contractors included in that tranche demonstrated no OISL capabilities.[32] The lack of healthy competition means the space industry is at the mercy of these suppliers, resulting in higher prices, longer lead times, and disruptions to the overall space supply chain.

Recommendation

Identify alternative sources and expand supply base through financial incentives

Companies should start by identifying which components have lengthy, complex supply chains with few suppliers at each production step. Where feasible and not significantly cost prohibitive, they should strive to source these components from multiple suppliers to encourage competition for improved pricing and hedge against single points of failure. If a company can split its demand for risky, long-lead components among two sources, a delay at one supplier will be easier to offset. Even if most material is purchased from a single source, building relationships with secondary suppliers can cut the time required to source from an alternative company if necessary.

[32] US Government Accountability Office, ***Laser Communications: Space Development Agency Should Create Links Between Development Phases***, February 26, 2026.

If there are minimal alternatives within the space industry, look toward commercial standards in other industries to see where parts can be adapted. For example, similar standards may exist in parallel components such as naval equipment or hyperbaric chambers. While many companies may face challenges competing with other industries due to demand challenges, some may be able to leverage commercially available products with no or minor changes. The government is beginning to recognize the need for this approach instead of requiring bespoke, space-only parts. The Defense Innovation Unit recently issued a Commercial Solutions Opening to address constraints and diversify the space supply chain, particularly leveraging nontraditional defense contractors.[33]

An alternative option lies in exploring vertical integration, which can help manage the cascading effects of supply chain challenges. When multiple steps of the supply chain are centralized within one company, delays are spotted sooner and there are aligned incentives to mitigate their effects. It's much easier to address the issues when all stakeholders are aligned to one business goal and requirements do not need to be flowed through to lower levels of the supply chain. A major launch provider has taken this approach, manufacturing most of its launch vehicle and satellite components in-house. This approach has enabled substantially higher launch cadence than competitors and greater control over supply chain risk, allowing the company to scale production and respond more quickly to schedule disruptions. While vertical integration does require significant capex and realistic assessments of technical capabilities, long-term benefits and stability may overcome near-term expenses.

In cases where alternative sourcing or vertical integration are not feasible, it's important to expand the supplier base for at-risk components. Through Congressional investment in constrained supply chain nodes or targeted contracts awarded by NASA and agencies across the Pentagon (e.g., the Office of the Assistant Secretary for Industrial Base Policy, Space System Command, or the Defense Innovation Unit), the federal government can provide financial incentives for companies to operate in the most constricted and fragile segments of the supply chain. Increasing the number of companies producing carbon-rayon

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[33] Defense Innovation Unit, ***Commercial Solutions Openings*** (CSO).

111%

growth in total imports of switchgears and transformers from 2019 to 2024.[35]

fabric by even a few would represent a massive increase in the supply capacity that might spur growth at other levels of the supply chain. These additional suppliers could make the space industry far less reliant on single sources, making a delay at one supplier no longer catastrophic for an entire program.

While making these kinds of major supply chain changes is not easy, company-wide efforts can yield significant results. In PwC's industry experience, focused, well-resourced initiatives to redefine supply chains and reduce lead times in cooperation across supply chain, engineering, and finance teams have shown dramatic results, with companies successfully reducing lead times from over a year to less than 100 days. By increasing the number of options available to space industry companies and encouraging those companies to build more resilient supply chains, the inevitable delays in the production of complex components like composites, valves, and OISLs can be mitigated.

Other industries dominate component supply

Across the supply chain, the space industry is losing out to other rapidly growing industries for the supply of key components. Nowhere is this clearer than when sourcing switchgears, transformers, and other large electrical equipment. Launch pads, manufacturing facilities, test stands, and ground stations all require complex electrical infrastructure consisting of many of these key components. Delays in the electrical supply chain can prevent tests from being conducted on schedule and stop a program in its tracks.

These large components have high and growing demand across the world. According to the Department of Energy, US transmission systems need to expand by roughly 60% by 2030 and may need to triple by 2050 to meet rising demand.[34] This trend is reflected in Census and trade data. From 2019 to 2024, total imports of switchgears and transformers grew by 111% (from $17.4 billion to $36.8 billion annually).[35] Over the same period, domestic production grew 50%,

[34] Department of Energy, ***THE TRANSMISSION MISSION: Building an Infrastructure for our Clean Energy Future***, December 2022.

[35] Comtrade Database, ***Comtrade – v1 API***, December 2025.

from $134 billion to $201 billion in annual shipments of electrical equipment, appliances, and components.[36] Despite this sharp increase in imports and production, demand continues to far outstrip supply. Total unfilled orders, a proxy for production backlog, have risen from an average of $25.2 billion in 2019 to $51.4 billion in 2024, an increase of 104%.[37] As the AI industry continues to grow, this demand is only expected to accelerate, making switchgears and transformers more expensive and difficult to source, with even longer lead times.

While these supply chain shortages affect all industries that rely on this electrical equipment, the space industry is hit especially hard. Space supply leaders said that when executing a project on a site without an existing power source, lead times for electrical equipment add years to the timeline. Data shared by one construction company showed consistent lead times of well over a year, with certain components at 130 weeks or more.[38] As with other trends we've discussed, this has worsened over the past few years. In December 2023, no component had a lead time longer than a year, with most less than 30 weeks.

Issues sourcing these components are aggravated by regulations such as ITAR and Cybersecurity Maturity Model Certification 2.0 (CMMC 2.0), clean room requirements, strict specifications, and other complexities of the space industry. Since demand for these products is so much higher than supply, it makes little sense for most suppliers to dedicate significant resources to the lower volume purchases of the space industry. Focusing on supplying the massive demand from large tech companies and other major players is far more profitable and avoids the space industry's complex regulations. As a result, the sector is left behind, forced to pay a premium for critical equipment and wait years for it to be installed.

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[36] US Census Bureau, ***Manufacturers' Shipments, Inventories, and Orders (M3) Data Series***, December 2025.

[37] US Census Bureau, ***Manufacturers' Shipments, Inventories, and Orders (M3) Data Series***, December 2025.

[38] Proprietary supply chain data shared with whitepaper research team as part of interviews with space industry supply chain leaders.

Recommendation

Unleash the space industry to compete with larger rivals

While much of the difficulty in acquiring switchgears and transformers is simply a downstream effect of the current AI boom, there are actions that the government could take to help the space industry compete more effectively.

First, greater insight into the future supply chain would be hugely beneficial and enable long lead times to be mitigated by long-term demand planning. Second, Congress and the Pentagon could work to strengthen programs like the Defense Priorities and Allocations System (DPAS) that enable the space industry to cut to the front of the line. These programs can help ease the effects of regulatory requirements and put space companies on more equal footing with other industries. Currently, DPAS only applies to a narrow set of projects that have been designated as essential to national defense or emergency preparedness. This is almost never applicable to commercial projects such as launch sites or industry testing centers. To enable this program to better support the space industry, the military could work to designate national testing centers, launch pads, and other critical infrastructure as critical to national security. With DPAS in effect, NASA would be able to contract more easily for additional sites, since critical equipment could be procured without extreme lead times.

Simultaneously, Congress can work to expand DPAS beyond strict national security project scope, allowing those in the space industry to apply for the designation for long lead time parts. By enabling the commercial space industry to leverage DPAS for constrained parts such as electrical transmission equipment, Congress could ignite the industry, cutting lead times significantly and decreasing the cost of new site construction.

76x

higher price for space-grade connectors, relative to commercial equivalents.[39]

Finally, where feasible, shared infrastructure, either between companies or through public-private partnerships, can be a game changer. If space industry companies leverage joint test sites, or build test sites using existing power distribution infrastructure, this can greatly reduce the effect of high-priced power transmission components. This also serves to decrease the significant up-front costs to build this infrastructure, as that capital investment would be split between several stakeholders.

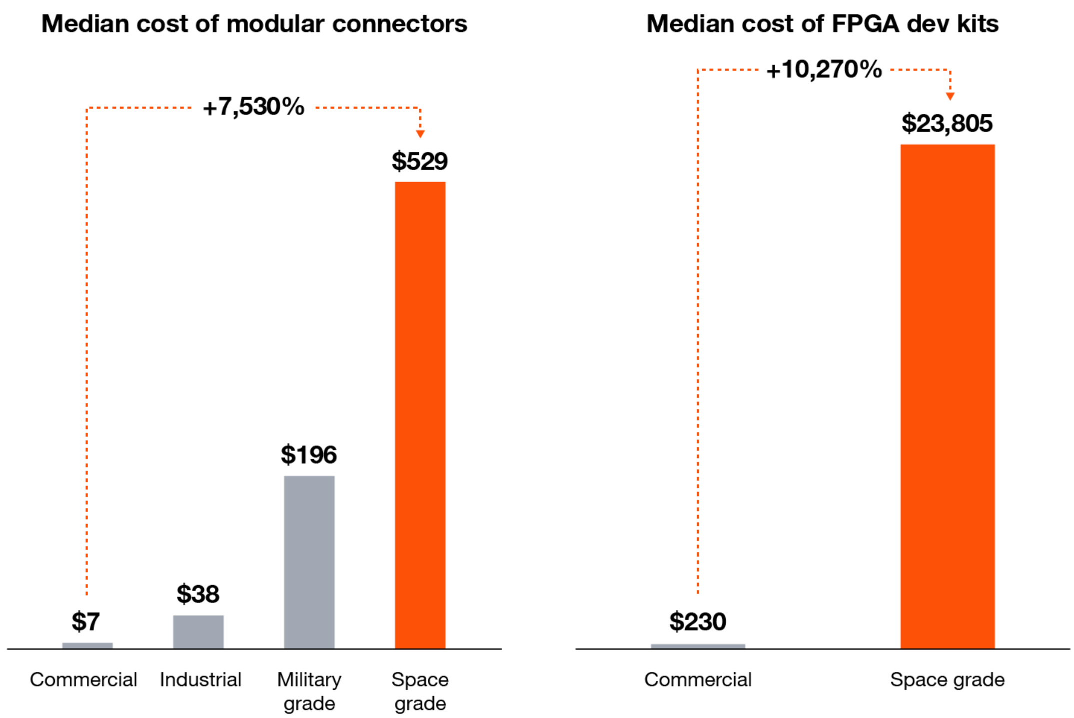
Testing and qualification requirements drive disproportionate cost

Across the space supply chain, the limited number of qualified suppliers creates longer lead times and higher prices for less complex but more commonly used components such as ethernet connectors, field programmable gate arrays (FPGAs), and other hardware. While the lower complexity of these supply chains helps to reduce delays in sourcing, the space industry pays higher prices for these parts than other industries. A comparison of commonly available connectors on commercial off-the-shelf (COTS) sites such as Digikey and Mouser revealed that space-grade connectors were orders of magnitude more expensive than even military-grade components. The median cost of a standard commercial RJ45 modular connector was about $7, for instance, while a Hi-rel Micro-D connector (a frequently-used connector designed and certified for the space industry) was 76 times as much at about $529.[39] Similarly, FPGA dev kit price also shows much higher prices for space components. The median space and rad-tolerant dev kit is about $23,805, 104 times the $230 median price of a standard commercial dev kit.[40]

[39] PwC analysis of market pricing for COTS products.

[40] PwC analysis of market pricing for COTS products.

Comparison of component cost across industries



Source: PwC analysis of open market pricing[39, 40]

These higher prices do have justifiable explanations. First, in many cases, space grade components are made from more expensive materials and cannot be easily reduced without significant technological or manufacturing advances. A major portion of these costs, however, come from the high qualification and testing hurdles faced by space industry suppliers. This testing includes vibration, thermal, radiation, and other processes that require certifications, documentation, and acceptance data packages (ADP) throughout the lifespan of the part. To become qualified to support these tests and related production presents a significant cost, especially for smaller suppliers that may not have as much funding.

Beyond cost, the testing landscape is challenging. Aerospace supply chain leaders tell us that certified testing facilities are limited, and securing capacity at facilities such as commercial thermal vacuum facilities is a significant burden. Vacuum testing is critical for hardware such as thrusters, satellites, and avionics. Components are already facing long lead times, so extended testing lead times stack on more delay. Schedule roadblocks can also arise when companies try to secure capacity at testing facilities that support demand outside of the aerospace industry.

Wind tunnel facilities are also important infrastructure for certifying aerospace hardware, but facilities capable of supporting large hardware are limited. The National Full-Scale Aerodynamics Complex wind tunnel facility has two large scale sections capable of testing large hardware, but this facility supports testing demand from commercial airlines, helicopters, wind turbines, and other commercial customers.[41] Other NASA offerings include the Unitary Plan Wind Tunnel which provides two testing sections of 11-foot by 11-foot and 9-foot by 7-foot.[42] These dimensions do not support testing requirements for hardware such as structural bodies and larger propulsion systems.

Aerospace hardware that can be tested in mid-size or smaller facilities still competes with testing demand from other aviation channels such as defense. The introduction of next-generation defense aircraft has led to increased dependency on advanced electronic systems and the need for extensive testing. Aerospace companies are not only battling their direct competitors for capacity, but other industries that are consistently pushing innovations. The limited availability stems from high upfront capital investment required for a new facility and a focus on revitalizing existing facilities rather than building new infrastructure.[43] Committing dollars to renovations instead of new facilities does not directly improve market availability. If capacity and availability of certified testing sites fail to scale with the growing demand in the market, lead times will continue to grow.

[41] United States Air Force. ***Craftsmen keep largest wind tunnels in the world running at peak conditions***, November 4, 2019.

[42] National Aeronautics and Space Administration. ***About Ames Unitary Plan Wind Tunnel***, August 23, 2023.

[43] Embry-Riddle Aeronautical University. ***Introduction to Aerospace Flight Vehicles, Chapter 60***, published January 1, 2023, updated January 1, 2026.

Recommendation

Explore alternative sources and facilitate quicker qualification, testing, and onboarding

In many cases, the space industry could greatly increase the number of qualified suppliers by placing renewed emphasis on designing for manufacturability across industries. Where companies can use existing commercial parts, or design and contract new parts that have alternative commercial uses, suppliers no longer face the same constraints. Enabling other commercial uses greatly increases the volumes that suppliers can sell, allowing economies of scale to reduce price and shorten lead times. In turn, this might encourage additional suppliers to enter the market, reducing prices even further. However, this does not come without drawbacks, as commercial products receive frequent updates and can fall out of specification faster, triggering redesign and recertification of parts. That said, with faster and more flexible design, qualification, and certification processes, these impacts are manageable and do not outweigh the benefits of increased supplier participation, lower costs, and shorter lead times.

By investigating commercial alternatives, the space supply chain could also benefit from removing the high barriers that currently exist for new suppliers. In addition to scaring away new suppliers, the high qualification burden also limits the ability of legacy suppliers to innovate on existing products. NASA and Pentagon leadership could publish guidance to new companies entering the space industry, and Congress could issue grants to help defray the cost of new part testing and qualification. And while many qualification requirements are necessary due to the harsh environment of space, an industry-led review to streamline and remove unnecessary and obsolete requirements would also lower the barrier to entry. Finally, building a bigger testing network for difficult applications like vacuum testing enables suppliers to reduce lead times and provides benefits to the entire industry.

While there are some joint or public testing facilities that companies can use to complete these expensive and time-consuming tests, increasing the number would greatly decrease lead times and confirm that a failed test results in an improved product. Suppliers should also be investigating which testing capabilities may be potential candidates for vertical integration to take control of lead times. When contemplating vertical integration, upfront investment and hidden costs such as additional labor, maintenance, and specialized engineering hours should be weighed against the cost of third-party testing and the benefit of reduced lead times. Where vertical integration may be cost prohibitive for certain companies, joint ventures that enable partnership in testing capacity could reduce upfront investment while still providing dedicated access for each of the partners alongside additional volume to the rest of the market. By lowering these barriers, the space industry can become a more attractive proposition to suppliers, inviting healthy competition that will lower prices, diminish lead time, and generate higher quality products.

Space companies could also defray the cost of building testing facilities by increasing utilization of the research and development tax credit. This tax credit is based on the cost of US-based labor and subcontractors, as well as the cost of materials used for US-based projects. The construction of test facilities is already a qualifying activity for this credit, but many companies don't take advantage of this. More detailed and specific IRS guidance would serve to make the R&D tax credit far more accessible, allowing start-ups and other small companies to benefit. Additionally, space industry companies should focus on investigating which activities may qualify for this credit, and whether those savings would be sufficient to justify the risk of having to defend against an audit.

Limited capacity and inconsistent quality in chemical and post-processing

Post-processing steps such as chemical treatments, anodizing, and plating are essential to meet aerospace requirements. Post-processing steps play key roles in manufacturing by improving corrosion resistance and durability. Demand for post-processing services is continuously battling limited facility availability and inconsistent quality.

Aerospace industry leaders tell us of widespread searches for a post-processing partner that yielded only two or three shops capable of producing certain required finishes. This scarcity creates backlogs at these shops, stretching lead times up to four times the standard length according to interviewees. Industry specialists say that even when capacity is secured, shops that can provide services like coating, anodizing, and nickel plating can be highly unreliable in terms of lead times and quality. The process of anodizing aluminum, for example, can be affected by density, temperature, casting process, and surface condition. Shops should be advanced enough to replicate or adjust all of these factors to confirm repetitive quality. When quality issues arise, customers may fall to the back of the line to get new parts treated. This can mean additional weeks or even months of delays.

Environmental regulations add even more layers of complexity, hindering the entrance of new shops and maintaining the shortage of capable shops. Chrome plating is a key process for actuator production. The chrome plating process faces significant regulatory hurdles for its potential environmental impact. The California Air Resources Board, for example, proposed modified legislation to further reduce emissions related to chrome plating and continues to address environmental concerns of the process.[44] Across the country, shops are required to comply with EPA 40 CFR Part 63 Subpart GG which outlines strict emission

[44] California Air Resources Board, ***California Air Resources Board Staff to Develop Amendments to the Hexavalent Chromium Airborne Toxic Control Measure for Chrome Plating and Chromic Acid Anodizing Operations***, July 8, 2018.

$300bn

estimated spend in the coming years to meet chemical manufacturing and handling guidelines from agencies such as the EPA, OSHA, and REACH.[46]

standards around cleaning, containment, storage, and other operations for shops supporting aerospace manufacturing.[45] New players may be hesitant to enter the industry due to the extensive regulatory guidelines and the cost to adhere to them. Estimates show there will be around $300 billion spent in the coming years to meet chemical manufacturing and handling guidelines from agencies such as the EPA, OSHA, and REACH.[46]

Industry regulations can also act as a competitive advantage for legacy shops, creating a barrier to entry for new shops. The 1976 Toxic Substances Control Act (TSCA) introduced a list of grandfathered chemicals that don't require additional environmental and safety testing.[47] Even when the TSCA was amended in 2016, there were still exemptions provided that could allow certain grandfathered substances to continue to be used.[48] This allows legacy shops to continue to manufacture with many existing chemicals while new chemicals are subject to rigorous review. New shops face a choice of trying to compete with the existing infrastructure and legacy knowledge or introducing innovative chemicals and processes that are subject to the timelines of various reviews and regulations.

In instances where regulatory changes do not provide exceptions, legacy shops should weigh the cost to innovate or modify processes to comply with changing regulations. With a rapidly aging workforce, including owners and founders, some shops on the back end of a life cycle may not see the value in investing to meet new requirements. This creates an environment where new shops find it hard to get into the game, and old shops may be resistant to changing regulations.

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[45] National Archives and Records Administration, ***Electronic Code of Federal Regulations (eCFR)***, Title 40, Chapter 1, Subchapter C, Part 63, Subpart GG, originally effective September 1, 1996, amended February 13, 2026.

[46] Value Driven Solutions, Inc., ***Navigating the Top Challenges in Chemical Manufacturing Today***, August 6, 2025.

[47] US Environmental Protection Agency, ***TSCA Chemical Substance Inventory***, data accessed February 18, 2026.

[48] US Environmental Protection Agency, ***TSCA Chemical Substance Inventory***, data accessed February 18, 2026.

Recommendation

Fostering new supplier development, especially in highly regulated landscapes, could enable new certified facilities to take on the growing demand of the industry. Regulatory bodies such as the EPA could help new entrants navigate regulatory standards with playbooks on industry requirements. Regulatory bodies could consider working with industry specialists to review existing guidance to find opportunities to reduce the burden of large upfront investments and operational costs while still preserving regulations critical for safety and environmental impacts.

Vertical integration is another option for post-processing, instead of waiting for regulatory revisions or new industry entrants. Industry specialists told us they brought some processes in-house after lead times became prohibitive. They said vertically integrated processes included clean line, heat treat, and the post-processing of heavy alloys. The insourcing of these processes may allow the integrator to take control of lead times and quality, pending appropriate technical readiness to perform this post-processing at an acceptable level of quality.

While controlling these processes through vertical integration can help reduce lead times, customers should carefully evaluate the business case to bring post-processing capabilities in-house. It is critical to evaluate the “hidden costs” beyond the expense of acquiring the necessary assets. Technician labor, specialized engineers or subject matter specialists, maintenance support, and indirect materials needed to operate the asset are all costs that don’t appear in the purchase price. Additionally, if in-house requirements won’t consume all available capacity of the asset to make the business case sustainable, an outside sales capability analysis should be done. A highly specialized or unique solution may appeal only to a small subset of customers, and other aerospace customers may not provide outside demand, so creating excess internal capacity would have no market value.

Consolidated recommendations

Bottleneck	Key problem	Recommendations
Complex component production with limited sourcing options	Long, fragile supply chains with few qualified suppliers at critical nodes	• Companies should pursue dual sourcing where feasible, explore cross-industry alternatives, and evaluate selective vertical integration. • Government can support new entrants through targeted incentives and contracts focused on constrained nodes.
Dominance of other industries in component supply	Space demand is crowded out by higher-volume industries	• Policymakers can strengthen and expand tools such as DPAS to improve prioritization. Greater visibility into long-term demand and shared infrastructure models can also help space companies compete more effectively.
Testing and qualification-driven cost inflation	High barriers to qualification and limited testing infrastructure drive cost and delay	• Industry should reassess requirements, enable greater use of commercial components where appropriate, and consider vertical integration or joint ventures for testing capacity. • Government funding and streamlined qualification guidance can lower entry barriers.
Limited post-processing capacity and quality variability	Scarcity of certified providers and regulatory burdens create supply chain constraints	• Regulators can provide clearer playbooks and review opportunities to streamline compliance. • Companies should evaluate the business case for vertical integration or partnerships to secure critical processing capacity.

03 Policy dynamics and supply chain impact

Companies face many regulatory, certification, security and engineering requirements to operate in the space supply chain. Interviews suggest that while these frameworks are necessary for safety, reliability, and national security, their cumulative effect concentrates in three areas: barriers to small and new entrants, conservative risk and oversight practices, and operational frictions tied to security and workforce dynamics.

Small business impacts and new entrant barriers

In our interviews, the specialists emphasized that no single regulation is driving issues across the industry. Rather, suppliers face many layers of compliance, and some express frustration, feeling their reputations are being unfairly tarnished as they navigate these requirements. Cybersecurity requirements under CMMC 2.0, for instance, show how requirements translate into real and often unfamiliar costs for small suppliers. Under CMMC, technical data associated with a part, such as CAD drawings, specifications, or process instructions provided by a government customer or prime contractor, should be safeguarded in accordance with NIST SP 800-171.[49] For many space suppliers supporting national security programs, this results in a requirement to achieve at least CMMC Level 2 compliance. According to the Pentagon's analysis, assessment-related costs for small entities seeking CMMC Level 2 compliance are estimated at approximately $48,000 for triennial self-assessment and approximately $118,000 for triennial third-party certification, inclusive of preparation, assessment execution, reporting, and annual affirmations over a three-year cycle.[50] However, this only includes estimated assessment costs, not other implementation costs such as segmented networks and secure cloud environments, creating meaningful barriers to entry for small and emerging suppliers. Over time, these dynamics risk narrowing the defense industrial base by disproportionately burdening smaller companies that lack the scale to absorb new compliance-driven overhead.

[49] US Department of Defense, ***Cybersecurity Maturity Model Certification (CMMC) Program***, Federal Register, Vol. 88, No. 246, Dec. 26, 2023.

[50] US Department of Defense, ***Cybersecurity Maturity Model Certification (CMMC) Program***, Federal Register, Vol. 88, No. 246, Dec. 26, 2023, Table 7 and corresponding Small Entity cost tables, Regulatory Impact Analysis, Federal Register pp. 89125–89131 (PDF pp. 27–43).

As part of a broader effort to modernize defense acquisition and reduce barriers to entry, Congress has taken steps to recalibrate cost and compliance requirements within the defense procurement framework. Procurement reforms included within the most recent NDAA would further reduce friction by raising the truthful cost or pricing data threshold (10 U.S.C. 3702)[51] and aligning cost accounting standards (CAS) applicability thresholds to focus detailed cost reporting on larger, higher-risk awards. Additionally, the NDAA also created additional exemptions for Nontraditional Defense Contractors, including exemptions from FAR Part 31 Cost Principles, DFARS business systems, and limitation on flow downs to commercial organizations. Program offices and prime contractors should anticipate and leverage these higher thresholds by relying on market-based pricing under FAR Part 12 for truly commercial space components and services, reducing requests for certified cost or pricing data when thresholds or exemptions apply. This shift helps prevent the 'worst-case' costing and compliance requirements being passed down to the supply chain while maintaining price reasonableness through market research and value analysis. But while these procurement reforms meaningfully reduce compliance friction and administrative burden, they're not sufficient on their own to drive sustained industry participation. The more fundamental constraint remains weak demand signals and structurally low production volumes. Even with higher cost or pricing data thresholds and expanded exemptions, companies may still contend with uncertain program funding, fragmented procurement cycles, and contracts that lack the scale necessary to justify capital investment. In the absence of predictable demand and meaningful volume, many enterprises, particularly commercial and nontraditional entrants, remain hesitant to commit resources to the space market despite a more favorable regulatory environment.

[51] S.2296, ***National Defense Authorization Act for Fiscal Year 2026***, 119th Cong. (2025).

Recommendation

It’s important to note that several existing federal and quasi-federal financing mechanisms already provide indirect support to portions of the aerospace and defense small business base. Broad small business loan programs administered through the Small Business Administration such as the SBA 7(a) and 504 programs are available to aerospace and defense suppliers and can, in some cases, be used to finance equipment, facilities, or technology investments associated with regulatory compliance. These financing mechanisms, however, are generic small business tools and don’t directly target the non-revenue-generating compliance investments required for participation in aerospace and defense supply chains. In addition, recent defense-focused initiatives including the joint Pentagon-SBA Small Business Investment Company Critical Technologies (SBICCT) initiative and emerging credit programs under the Pentagon’s Office of Strategic Capital reflect a growing recognition of the need to mobilize capital in support of national security-relevant industrial capabilities.[52] These mechanisms, however, are generally sector-agnostic in design, operate through intermediaries, or are targeted toward technology development and scale rather than the compliance readiness needs of small suppliers. As a result, while such programs can benefit certain companies under specific circumstances, they do not consistently address the indirect, non-revenue-generating capital investments required for regulatory, cybersecurity, export control, and quality system compliance that function as prerequisites for participation in space and defense supply chains. To more directly address this gap, the SBA should consider establishing dedicated financing pathways, or explicitly expanding existing loan authorities, to support compliance-driven investments for aerospace and defense suppliers. Favorable loan terms or targeted guarantees for expenditures related to cybersecurity implementation, quality system certification, export control compliance, and facility security upgrades would help smaller companies manage near-term cash demands associated with regulatory participation. By treating compliance readiness as a strategic industrial base

[52] Office of the Under Secretary of Defense for Research and Engineering, ***SBIC Critical Technologies (SBICCT) Initiative***.

requirement rather than an incidental cost, such programs could reduce supplier attrition, ease working capital constraints, and support broader participation by small and emerging companies in space and defense markets.

Regarding new entrants, the Pentagon should complement procurement reform with deliberate demand-shaping policies tailored to the space industrial base that provide industry with longer-term stability and credible volume commitments. Although national space strategies and architecture roadmaps often extend 10 to 20 years, funded demand is typically visible only within the five-year Future Years Defense Program[53] or comparable civil agency budget windows, and even that outlook remains subject to annual appropriations and programmatic shifts. For space suppliers facing high upfront capital expenditures, long qualification cycles, and specialized manufacturing requirements, this limited and uncertain demand horizon weakens investment incentives. To strengthen the space supply chain, agencies should expand multiyear procurement authorities for launch services and satellite production, aggregate buys across programs where feasible, provide clearer long-term constellation and replenishment quantity targets, and commit to minimum order quantities that support production scale. Stable, predictable launch cadence and constellation replenishment demand, not compliance relief alone, is what can ultimately unlock private capital and deepen participation across the space supply chain.

Finally, companies should take a more deliberate approach to how they assess and manage risk at the part and process level. Today, regulatory posture is often used as a proxy for technical and supply chain risk, which discourages change and reinforces reliance on legacy components and suppliers. Companies could benefit from more clearly separating compliance risk from risks related to part obsolescence, manufacturability, and supplier concentration. They should be able to document and defend decisions that balance these factors. Without this shift, sourcing and design decisions will likely continue to favor familiarity over resilience, even as long-term supply chain risk grows.

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[53] Congressional Research Service, ***Defense Primer: Future Years Defense Program (FYDP)***, IF10831, updated June 12, 2024.

Risk management and regulatory interpretation as supply chain constraints

Beyond formal compliance requirements, the specialists we interviewed consistently highlighted over-classification and conservative interpretation of regulations as a compounding constraint on the space supply chain. This conservatism is often seen in government and approval agencies, which are structurally misaligned with commercial incentives. Commercial space companies should push to optimize their business to stay competitive in the industry, such as redesigning a component to reduce costs, introducing a new manufacturing process to improve manufacturability, or qualifying an alternate supplier to diversify sourcing. On the other hand, government stakeholders and other independent approval bodies face limited downside for rejecting change and few incentives to enable innovation that could benefit contractor economics, schedule resilience, or long-term supply chain health. As a result, they often default to risk avoidance and status quo preservation with heritage designs and previously approved configurations over incremental improvement. As more space contracts shift away from cost plus to firm fixed-price structures, this sustained stasis erodes competitiveness and viability for commercial space companies that should optimize to achieve profits. Without the ability to evolve designs and processes within reasonable risk tolerance, regulatory stability can paradoxically become a driver of long-term supply chain fragility.

At the same time, the space industry itself often compounds these constraints by interpreting regulatory requirements more restrictively than explicitly required. Companies frequently assume worst-case interpretations, frequently applying ITAR and EAR export controls, NISPOM facility security standards, CMMC and NIST SP 800-171 cybersecurity obligations, and FAR and DFARS procurement rules at the most restrictive level, even when not explicitly required. This approach triggers elevated controls on technical data, facilities, labor onboarding, and supplier processes, introducing delays and limiting sourcing flexibility. Companies internalize avoidance of regulatory risk instead of managing it, resulting in defaults to legacy, flight-proven components and manufacturing approaches to avoid requalification cycles, even as parts and processes become obsolete.

At the same time, many space companies, especially small and mid-tier suppliers without the resources or policy knowledge sophistication of a prime, don’t fully leverage available government incentives that could offset the risks they’re trying to manage. The R&D tax credit, which provides a dollar-for-dollar reduction in tax liability for qualifying research activities, is often underutilized. Space companies regularly perform high-uncertainty, technical activities such as prototyping, testing, systems integration, and qualification, all of which fall within the scope of the credit. And smaller players in particular are often unaware of how broadly the credit applies or lack the technical expertise and time required to document and defend claims under IRS scrutiny. For those that do take the credit, concerns over audit risk and technical substantiation frequently lead them to take a conservative position and underclaim relative to their actual activity. As a result, incentives intended to de-risk innovation and investment fail to meaningfully influence behavior. This reinforces a broader pattern in which perceived regulatory and compliance risk discourages experimentation, delays modernization, and constrains supply chain resilience. Collectively, these dynamics reinforce a risk-averse operating environment in which regulatory posture, rather than technical readiness, increasingly determines sourcing decisions and constrains the pace of supply chain innovation.

Recommendation

Align oversight, incentives, and risk for innovation

First, government and independent approval authorities should recognize and align with the commercial needs of primes and suppliers to enable faster speed to innovation. As more space contracting shifts away from cost-plus and toward firm fixed-price, companies are increasingly required to move faster, optimize designs, and adjust sourcing in real time to remain viable. Approval processes that continue to operate on legacy timelines and risk assumptions slow execution and push companies toward conservative design and sourcing choices. To compete with pacing threats and near-peer advances within space innovation, government and other approval bodies should be willing to accept lower risk changes where technically justified and focus scrutiny on areas of true mission risk. Approval bodies should orient more toward an OODA loop mindset by emphasizing rapid observation, informed orientation, timely decision-making, and iterative action rather than sequential, open-ended review cycles. Clear communication of expected review timelines, decision criteria, and acceptable risk thresholds would allow companies to plan development and sourcing strategies with greater confidence, reducing unnecessary delays while preserving mission assurance.

Second, clearer guidance from the government would be beneficial on how existing compliance and security requirements should be applied in common, low-risk scenarios. Ambiguity around export controls, cybersecurity scope, and facility security often leads programs and suppliers to default to the most restrictive interpretation, even when the underlying part, process, or data doesn't warrant it. More consistent and practical guidance would reduce unnecessary over-classification, lower cost burdens across the supply base, and help align compliance expectations earlier in the program life cycle. At the same time, the Pentagon's recent request for industry input as part of its Revolutionary FAR and DFARS overhaul creates a timely opportunity for reform.[54] Prime contractors

[54] Office of the Under Secretary of Defense for Acquisition and Sustainment, ***Letter to Defense Industrial Base and Acquisition Stakeholders Seeking Revolutionary FAR Overhaul Phase 2 Input***. February 10, 2026.

should use this moment to work constructively with the Pentagon to identify where regulatory language, clause implementation, and approval practices are driving unintended risk aversion across the supply chain. Given their position between government stakeholders and the broader supplier base, primes are uniquely equipped to translate operational friction into actionable reform proposals.

At the same time, structured industry coordination plays an important role in helping companies handle evolving requirements. Established sector bodies provide forums, tools, and shared resources such as the Aerospace Industries Association's CMMC Marketplace that supports more consistent interpretation and implementation of cybersecurity and compliance obligations across the supply base. Strengthening engagement through these mechanisms can reduce duplication, improve alignment, and create constructive feedback channels that inform future regulatory refinement while formal guidance continues to evolve.

In parallel, the government should improve clarity and outreach around how existing incentive mechanisms such as R&D tax credits apply to common space development activities to support increased innovation. Rather than relying on primes or suppliers to interpret tax policy independently, agencies could provide nonbinding guidance, examples, or educational resources that illustrate how incentives can be applied to de-risk innovation. Increased clarity and transparency would encourage technical development within reasonable levels of risk, particularly for small and mid-tier suppliers with limited internal tax expertise.

Labor, logistics, and security-driven operational friction

These regulatory requirements impact aerospace and defense companies in ways that extend beyond direct compliance costs and capital investment. Security, export control, and facility access regimes, including NISPOM and related requirements, slow the process via extended onboarding timelines, site access approvals, and movement controls. Companies are required to tightly manage not only personnel access but also the entry of vehicles, tooling, parts, and technical data into controlled facilities, often involving multiple layers of review and authorization. Interviewees consistently noted that these processes can create delays at the margins, particularly during program startup, supplier onboarding, or logistics handoffs. While individual delays may appear minor in isolation, their cumulative effect can be significant, especially in production environments that rely on tightly sequenced workflows and just-in-time delivery. Several interviewees reported that contractors, freight providers, and specialized service vendors increasingly prioritize work in non-aerospace and defense industries because of faster security approvals, lighter administrative requirements, and more predictable schedules. Over time, these incremental delays compound into material execution risk, reducing schedule reliability, increasing coordination overhead, and limiting supplier responsiveness.

In addition to these access and compliance-related frictions, demand volatility within the aerospace and defense sector further amplifies workforce instability. Prime contractors often hire in direct response to specific program awards, expanding rapidly when a contract is secured and reducing labor needs once key milestones are completed or funding profiles shift, resulting in a start-stop pattern tied to individual programs rather than a steady pipeline of work. This episodic model creates uneven demand signals for contract labor, specialized trades, and technical service providers, who may experience periods of intense utilization during ramp-ups followed by abrupt slowdowns or gaps between awards. This feast or famine dynamic, where one week may involve supporting a major build effort and the next offers little forward visibility, can make the sector less attractive relative to industries that offer more stable demand, longer project horizons, and fewer administrative barriers. Over time, this volatility contributes to talent migration away from the defense industrial base, constrains the availability of experienced surge capacity, and increases ramp-up and schedule risk when new programs begin.

Recommendation

Start a trusted supplier program

One way to reduce recurring delays and administrative burden without relaxing security standards would be to create a standardized, portable access certification for trusted aerospace and defense industry suppliers and logistics providers. This certification would show that a company has met baseline requirements related to physical security, export controls, and chain-of-custody practices, allowing that status to be recognized across multiple programs and facilities. Rather than re-collecting the same information for each new site or program, companies and facility security teams could quickly verify that baseline requirements have been met and focus instead on site- or mission-specific considerations. This would allow access and onboarding decisions to be made more efficiently for routine, low-risk interactions while still preserving local control over final approval. Government authorities responsible for industrial security, export controls, and transportation security can collaborate on this without creating a new regulatory framework. This type of certification could ramp up gradually, building on existing clearance and compliance processes, to ultimately reduce onboarding delays, improve schedule predictability, and lower coordination costs for both primes and suppliers.

Build a more stable, cross-program workforce model

To mitigate these dynamics, aerospace and defense companies should shift from program-by-program labor scaling to a more portfolio-based workforce strategy that smooths demand across contracts and planning cycles. This can include maintaining a core cross-trained workforce that can be redeployed across programs, using longer-term framework agreements with key contract labor providers to provide greater utilization visibility, and aligning hiring decisions to multi-year demand forecasts rather than near-term award events. Primes can also collaborate with suppliers to share forward demand signals earlier and more transparently, enabling labor planning that reduces abrupt ramp-ups and drawdowns. By improving predictability and continuity of work, companies can strengthen workforce retention, preserve surge capacity, and reduce the execution risk associated with feast-or-famine labor cycles.

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Conclusion

Conclusions and white paper recommendations

The US space sector is entering a period of sustained demand growth driven by national security, civil, and commercial priorities. Yet, as outlined in this white paper, the space supply chain remains structurally fragile—strained by inconsistent demand signals, constrained part-level capacity, high qualification burdens, and regulatory friction. Our recommendations, drawn from industry interviews, data analysis, and stakeholder input, provide a targeted and actionable path to address these issues and build a more resilient, scalable space industrial base.

Improve demand visibility and planning

- The US Space Force and NASA, in coordination with prime contractors and suppliers, should establish a shared visibility platform that links government and industry demand signals with validated industrial base capacity, enabling bidirectional insight across programs, primes, and suppliers while improving confidence in long-term planning and investment decisions.
- The Department of Commerce (Bureau of Industry and Security), in coordination with the Pentagon and NASA, should fund and publicly release a recurring, space-specific industrial base capacity assessment to provide realistic, authoritative insight into constrained components, workforce limitations, and long-lead risks.
- Both government space customers (including the US Space Force, NASA, NOAA, and the intelligence community) as well as large government primes should provide clearer, longer-term demand signals wherever possible to support supplier investment in facilities, tooling, and workforce, and reduce reliance on short-term, reactive capacity expansion.

Address part-level and component bottlenecks

- The Pentagon, in coordination with Congress, could strengthen and expedite DPAS and related priority-rating policies to enable space programs, both national security and commercial, to compete on more even footing with higher-volume industries.
- Prime contractors and space system OEMs should actively pursue dual sourcing and alternative-industry sourcing strategies for complex, long-lead, or capacity-constrained components.

- The Pentagon and NASA could provide targeted subsidies, incentives, or focused contract awards to encourage new supplier entry at the most constrained nodes of the space supply chain.

- The Pentagon and NASA could reevaluate space-specific requirements to confirm they enable innovation and allow consideration of qualified commercial alternatives where mission risk permits.

Expand testing, qualification, and post-processing capacity

- Suppliers and OEMs should evaluate bringing testing and qualification capabilities in-house where feasible to reduce lead times, increase availability, and improve schedule control.

- Industry participants, supported by the Pentagon and NASA, could pursue joint ventures and shared testing facilities when individual investment is cost prohibitive to expand certified capacity across the ecosystem.

- The Pentagon, NASA, and Congress could fund the establishment and sustainment of critical testing and post-processing centers, including environmental testing and chemical processing, to relieve persistent capacity bottlenecks.

Reduce regulatory and compliance burden

- Congress, the Small Business Administration, the Pentagon’s Office of Strategic Capital, and other federal agencies could implement low-burden, low-cost financing mechanisms to help suppliers absorb non-revenue-generating regulatory and compliance investments.
- Government customers and prime contractors should separate regulatory and compliance costs from product pricing to improve cost transparency and supplier sustainability.
- The US government could establish a space-specific government–industry forum, with participation from the Pentagon, NASA, Commerce, and industry, to identify regulatory pain points, reduce over-classification, and inform risk-based modernization of compliance requirements.

Taken together, these recommendations directly address the structural challenges facing the space supply chain today, including misaligned demand signals, underinvestment in capacity, fragile supplier networks, and regulatory friction. By clarifying ownership, aligning incentives, and improving visibility across the space enterprise, stakeholders can break the cycle of reactive bottlenecks and enable durable, scalable capacity growth in line with demand and industry needs. Implemented cohesively, these actions can help strengthen the nation's space industrial base and confirm it can reliably support military and civilian missions in an increasingly competitive space environment.

Prepared with the

Aerospace Industries Association

The Aerospace Industries Association (AIA) has represented the aerospace and defense industry since 1919. AIA serves as an advocate and leader to help shape policy, shed light on the industry's impact, and fortify its future. CEO-level officers from across AIA's more than 300 member companies guide these efforts, helping to strengthen the industry's ability to enable America's national security and economy. AIA works with its membership's representatives through councils and committees to advise the government on critical issues and cultivate a unified perspective on the many challenges and opportunities facing the industry.

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