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# From Custom To Catalog

## Industrializing Propulsion Components For the Commercial Space Era

***The global space industrial supply chain was not built for high-volume satellite and spacecraft production. Modern procurement strategies from government offices like the SDA and NRO include resiliency through proliferation, increasing demand for small and medium-class commercialized satellite buses.***

Industry issues, such as long lead times and fragile component ecosystems, are slowing the pace of these satellite network deployments. These pressures have triggered a broad pivot toward design for manufacturing (DfM), modular architectures, and common component building blocks that enable volume production, deliverable in months instead of years.

Proliferated satellite networks represent a new philosophy of space access: faster, more distributed, less fragile, and far more dynamic. Their missions are incredibly diverse, powering commercial mega-constellations or defense programs such as the Pentagon's Golden Dome and the Space Development Agency's Proliferated Warfighter Space Architecture (PWSA). In step with demand, propulsion designs are now expected to support high-volume production, rapid deployment, and agile maneuverability at a scale the legacy supply chain was never built to handle.

With propulsion component availability among the biggest barriers to constellation growth, system developers are rethinking how hardware is specified and selected. Off-the-shelf availability and established performance now reflect the priorities of constellation-era production. Systems are specified around available components, rather than components designed to function in prescribed systems.

### The Commercial Satellite is on the Rise

Industry pressures and new opportunities are reshaping how space missions are architected, driving the rise of commercial satellite buses. Reusable, commercial launch vehicles have dramatically reduced the cost of access to space. Rideshares and in-space mobility platforms have similarly expanded the frequency and general availability of launch services.

A constellation of commercial satellites doesn't face the same vulnerability as a single high-value asset; individual members can fail without disturbing the overall mission. This resiliency is especially appealing for communications, navigation, Earth observation, and other high-demand services. At the same time, payloads are evolving. Capabilities once requiring buses the size of trucks can now fly on satellites weighing just hundreds of kilograms.

Missions specified to extend 15+ years in geostationary orbit can be aged out prior to end of life with the continued technological advancement of sensing and communication payloads. Faster replenishment and refresh cycles are enabled by lower-unit-cost satellites manufactured in higher volume.

Combined, these factors have led to a proliferated satellite network approach rather than bespoke system builds. This, in turn, requires more propulsion systems, significantly increasing demand for propulsion components with shorter cycle times.

### Supply Chains Built for Yesterday, Stressed by Today

Accordingly, the challenge is not just delivering the right propulsion technology but doing so at production volumes that have never been available to the space industry.

The biggest bottleneck in satellite delivery is component lead time, especially for propulsion valves and regulators. Long lead times and a concentrated vendor base are historic hallmarks of the propulsion development sector. Both challenges stem from decades of low-volume, high-complexity production, and together they form a circular bottleneck that cannot keep pace with the surge in satellite manufacturing.

Historically, space programs placed occasional orders and manufacturers responded with highly customized hardware. Propulsion components (valves, regulators, thrusters, feed systems) were built by hand in small quantities. Commercial satellite builders now want consistent performance across dozens of identical satellites, and need deliveries measured in months, not years. When regulators or valves take a year to build, an entire satellite network can fall behind. Integration schedules slip, launch manifests change, and program costs rise. The gridlock affects the entire industry and is driving a fundamental change in how hardware is designed and built.

### Design for Manufacture, Build for Scale

To address this, propulsion system designers are now shifting their focus from purely optimized performance to availability. Systems are designed around common, available components, mirroring the pivotal shift commercial space launch vehicles underwent a decade ago.

With the issue of satellite bus and payload mass decreasing, system providers are able to expand consideration for components that are not solely power/weight-optimized but are rate-produced and available. This strategy for repeatable, manufacturable design meets performance requirements while avoiding unnecessary complexity. The trade-off is intentional: a propulsion system produced reliably and quickly is more valuable to a constellation operator than a marginal performance gain.

This new strategy is driving the emergence of common propulsion product catalog items. These are designed, qualified, and built to manufacturer specifications and provided to the industry at large.

Common products consolidate satellite component demand at the component OEM level, enabling economies of scale for rate manufacture. Propulsion component OEMs can then impart build-to-stock models, a major turning point in a sector that previously relied almost exclusively on long-lead custom orders.

Modular, catalog-based components let engineers re-use common designs across platforms, while providers begin stocking core parts, machining parts in batches, and pre-building assemblies ahead of customer demand.

The result is significantly reduced manufacturing timelines; in many cases, lead times that once extended past a year are down to 30 weeks or less.

Standardizing design options across platforms also strengthens supply chain resilience and product reliability. Critical parts are common and dual sourcing strategies become straightforward when backed by volume. Product reliability is greatly enhanced through rate manufacturing: building a greater number of common units quickly expands the manufactured sample size and reduces the time to feedback that impacts issue discovery and resolution.

The commercial launch industry has long maintained that the path to the highest reliability is through more frequent manufacture and launch. Satellite system components are presently experiencing the same mindset shift.

## What's Next: A New Industrial Framework for Space Designs

What's next? As commercial procurement strategies manifest, satellites shrink, and missions diversify, networked satellites will continue to demand more components in shorter timeframes. Available, commercial components that can meet the demanding program timelines and quantities will continue to centralize and proliferate.

The commercial satellite approach measures propulsion excellence by production speed and reliability, not just peak performance. And the more standardized the propulsion ecosystem becomes, the easier it will be to scale missions into the hundreds.

The industry is responding with building-block catalog designs, build-to-stock approaches, and commercial, common product offerings that systems are designed around. What's emerging is an industrial backbone for spacecraft systems. One that matches the tempo of proliferated satellite networks and the strategic urgency of resilient, repeatable systems in modern space missions.

*Pursuing modularity and standardization, manufacturers are developing propulsion "building blocks" that can fit multiple missions with minimal redesign. Standardized designs for in-space propulsion systems can be illustrated by Marotta Controls' family of **Delta-V** common product catalog items. This valve family leverages the company's expertise in high-volume production manufacturing of solenoid valves for the commercial launch market. Delta-V components include fill/drain service valves, pressure regulators, high- and low-pressure latching valves, and thruster valves, enabling propulsion companies to plan production around repeatable designs.*

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### Propulsion Design Sets the Pace of Deployment

*Networked satellite systems require propulsion for a variety of maneuvers. Satellites must raise themselves from their drop-off orbit, point payloads, maneuver to avoid collisions, maintain long-term orbits, and eventually de-orbit. When these requirements are multiplied by tens or hundreds of satellites in a single layer, propulsion design and procurement often set (and limit) the pace of deployment for the entire constellation.*

*Propulsion systems are now built for scalability and diverse missions, tapping the full slate of technical options. Electric propulsion (EP) is the preferred choice for long-term orbit maintenance and slow, efficient transfers. Its high Isp (specific impulse) allows small satellites to carry less propellant and more payload, a benefit that scales well in LEO constellations where maneuvering demands are moderate and efficiency matters more than outright thrust capability.*

*Chemical propulsion provides higher thrust and more rapid maneuvering, an advantage for tactically responsive space missions and reconnaissance platforms. Hybrid approaches combine electric and chemical propulsion, enabling the endurance and tactical agility ideal for many longer-term, more complex missions.*