CREATING AN AGILE DOD SPACE ENTERPRISE

Unfettered access and freedom to operate in space is a vital interest to the United States. With the emergence of new entrants, new business models, and new technology, the DOD space enterprise is poised for transformation. Foreign development and proliferation of advanced space systems across the commercial, civil, and military sectors has left space operations congested and contested. Further, U.S. adversaries are quickly developing ever more lethal anti-satellite capabilities that threaten our interests. These circumstances present both threats and opportunities.

We must transform our national security space enterprise into an architecture that enables us to outpace the adversary threat. It can take 10 to 20 years to develop, build, and launch highly complex space systems, which means that the technology is obsolete when launched. These space systems became the information backbone supporting U.S. military operations as well as U.S. economic interests. Relying on undefended "exquisite" systems worked for a long time when space was a sanctuary, but our adversaries have come to recognize our dependence on these assets and are actively seeking to deny our access, making space a potential warfighting domain.

A new paradigm is needed. In some mission areas, that means dramatically new concepts. In others, it means changes to existing systems and processes. The DOD must develop a space enterprise that is resilient, responsive, scalable, and affordable. We must remove roadblocks, modernize antiquated processes, and think differently about how we develop new capabilities.

As the DOD works to adapt and develop a new enterprise, The Aerospace Corporation is working aggressively to address all aspects of this critical challenge. As a trusted advisor and liaison between DOD, intelligence, civil, and commercial space, we bring a unique perspective. Our decades of experience working with government and industry give us the insight needed to develop and apply new approaches. Aerospace has both the technical depth and domain breadth to help the government make this crucial transformation.

We have identified four key lines of effort that would enable the DOD to implement a space portfolio plan that will outpace the threat:

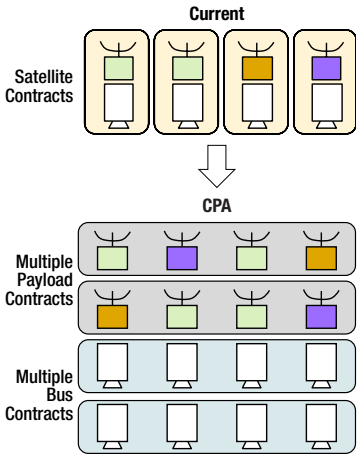
1) Continuous Production Agility: A New Model for an Accelerated Pace

Problem:

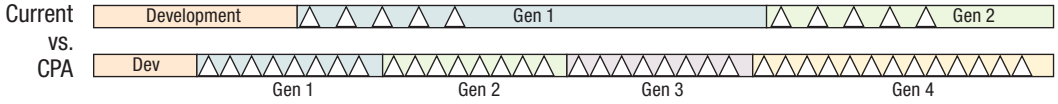
The current slow pace of constellation refresh driven by extended on-orbit satellite life limits opportunities for technology insertion and disincentivizes investment in long-term production efficiencies. With significant manufacturing breaks, non-recurring engineering must be repurchased when production lines are restarted, creating exorbitant unit-cost increases.

Solution:

- Accelerate production by producing bus, payload, and peripheral capabilities in a **modular fashion** utilizing standard interfaces.
- Award multiple, **long-term contracts** to incentivize investment in production efficiencies and to enhance competitive alternatives to reward strong performers and eliminate weak performers.
- **Inject maturing technologies,** when available, into the modular designs, making technology insertion affordable and ensuring that on-orbit capability is no longer decades old.
- Launch satellites at **regular, frequent intervals** to diminish dependence on individual satellite reliability and create constellations that are more robust against threats.
- Use **simpler designs** with less redundancy and lower life expectancy, lessening the requirement for extended and costly testing and reducing per-unit costs.



Multiple contracts enable greater flexibility and increased productivity.



CPA provides faster, high-volume production.

2) Enterprise Alignment and Governance: Eliminating Stovepipes

Problem:

The DOD enterprise operates as stove-piped programs (space, ground, the transmit/receive layer, user equipment, launch, and cyber), rather than as an integrated whole.

Solution:

- Create a sound, cogent **digital engineering strategy** to be exploited in maintaining enterprise alignment.
- Use DevOps commercial software approaches for the ground segment, fielding **incremental solutions**.
- **Enhance the transmit/receive** layer by using broad array of flexible commercial and allied gateways.
- Aggressively move to update terminal equipment for communications and GPS to **enable in-situ upgrades** via software upload and line-replaceable modular elements.
- Design **cyber security** into the entire enterprise and employ nearly continuous penetration testing.

3) Rapid Prototyping and Strategic Partnerships: Staying Ahead of the Threat

Problem:

The threat is driving the need for continual upgrades, and current timelines are not fast enough to enable rapid technology insertion.

Solution:

- **Expand the use of prototyping** to allow for experimentation and demonstration of alternate technologies and CONOPs prior to installation across constellations, which allows for improved user acceptance and technology advances as they are ready.
- **Partner with commercial and international allies** for sharing and collaboration in broad array of high-interest services such as hosting, joint mission, data sharing and other service-level agreements.

4) Streamlined Decisionmaking: More Responsive Execution

Problem:

Current DOD decision making processes are not nimble enough for the current pace of technology and may be a hindrance to effectively supporting our warfighters.

Solution:

- Delegate detailed implementation of requirements, resources, and acquisition decisions to an **accountable authority** who is tightly connected to operational risks.
- Streamline the requirements validation process by using **service-level agreements** to capture the warfighter-essential requirements.
- Simplify the financial rules by **creating a new appropriation** for all space procurement activities – S&T to sustainment – with fewer program elements aligned to CPA activities to allow for greater flexibility in the year of execution and still provide for sufficient oversight.

Resiliency does not come from picking one optimal future architecture now; instead, it comes from the ability to adapt the architecture and scale to future needs in an affordable way.

The Aerospace Corporation

The Aerospace Corporation is a national nonprofit corporation that operates a federally funded research and development center (FFRDC) and has approximately 4,000 employees. The Aerospace FFRDC is aligned to support the most critical programs of the Department of Defense and the nation and to serve as its customers' innovation partner across the space enterprise. Consistent with the competencies outlined in our sponsoring agreement, Aerospace provides strategic value through independent, intellectually rigorous, relevant, and timely products and services. With three major locations in El Segundo, CA, Colorado Springs, CO, and Washington, DC, Aerospace addresses complex problems across the space enterprise including the DOD, Intelligence Community, civil, commercial, and other areas of national significance.

The Aerospace Corporation | 2310 East El Segundo Boulevard, El Segundo, California 90245-4609 USA | www.aerospace.org