

THE COMMUNICATION CONSTELLATION: INTEGRATED NETWORK AND THE USSF

The United States Space Force (USSF) is in a transformational period. Between preparing to defend assets from external adversaries like Russia and China, and supporting internal needs for rapid information gathering, processing, and secure dissemination, the USSF is at the forefront of information and defense in space. To achieve this mission, it is critical that the agency also be at the forefront of information and communication technology. However, with legacy architectures inherited from the U.S. Air Force, the agency now looks to reimagine how it gathers and communicates information at mission speed.

The historical siloing of legacy systems created a “stovepipe” architecture that no longer serves the needs of modern warfighting and space capabilities. Systems that do not talk to each other are slower to receive and process information, impacting decision-making and response capabilities. To ensure that the United States remains the leader at the tactical edge, even in space, it is critical that the USSF envisions a network architecture that seamlessly connects ground with space capabilities.

“Defense and survivability, especially in a military context, you have to have [network modernization] as entry level stakes for the game. We know that our data decision is not fast enough. There is a lot of siloed data, and really static data is not going to help us win the fight. We have to have that speed, we have to be able to get data from anywhere to anywhere and at any time to be able to use that data for the fight and to make decisions quickly.”

– Lauren Knausenberger, U.S. Air Force CIO

The Multi-Domain Architecture Future

The historical stovepipe systems inherited from the services that built the USSF are just that — historical. The extraordinary volumes of data, interoperability requirements, and need for analytical processes at mission speed are all tools that empower defense and space leaders to make better and more confident decisions, but they must be enabled by a network that allows for rapid collation and collaboration.

The Joint All Domain Command and Control (JADC2) initiative from the Department of Defense (DoD) is an example of this reimagination of collaboration. Where in the past the separate services operated their own domain-specific networks and technologies that could not speak to each other, JADC2 is intended to break down these siloes to create an integrated network. An effective JADC2 architecture would improve decision-making and the acceleration of operational readiness by collecting and analyzing data from sensors and data platforms across the services and sharing that information down to the tactical level.

“Our ability to sense from the space domain, transport and make sense of data, and then get that data into the hands of our joint warfighting partners on land, in the air and at sea, is what the USSF delivers to JADC2...Space capabilities underpin modern warfare.”

– Gen. John W. “Jay” Raymond, Chief of Space Operations¹



JADC2 and the role of the USSF within it are both still evolving, but the USSF will undoubtedly play a key role in both technological development and command leadership. The data transport layer, for example, a constellation of small, low-cost satellites in Low Earth Orbit, will likely play a crucial role in “linking sensor to shooter,” rapidly transmitting information from anywhere in the world to decision makers.² A recent paper from the Air Force Association’s Mitchell Institute for Aerospace Studies goes further to suggest that JADC2’s integration efforts should be consolidated under the Chief of Space Operations.³



This future, for both the USSF and the Armed Services at large, promises yet-unseen capabilities that will reach the tactical edge even in the atmosphere. Underpinning all these possibilities, however, is the necessity to build an integrated and responsive network architecture.

Challenges Facing Network Integration

The USSF is a unique institution, not only within the DoD but across the government, in that it is an agency primarily composed of personnel and legacy systems from other services. This leads to specific challenges facing network integration goals.

Legacy Architecture

The USSF’s network architecture is largely an inherited one – a piecemeal group of closed, legacy space systems that often cannot talk to one another without human interaction. These legacy systems were largely designed by and for one branch of armed service, intended to be used exclusively within that silo. While this may have worked within that stovepipe, it is much more challenging to use these systems in conjunction with the other systems that they must now work with. This complicates the USSF’s ability to use these tools together to receive, analyze, and disperse information from and to the tactical edge, and challenges efforts to build a resilient integrated network that can respond at mission speed without human intervention.

Cultural Challenges

Just as many of the networks and systems were designed to serve only the needs of the service that built it, the culture within the Armed Forces has also

traditionally been siloed. Different perspectives, operational goals, and specializations have long separated the military branches. However, while different groups and mindsets can bring important insights to the DoD as a whole, it is no longer tenable to operate so distinctly. While recognizing the strengths that each service branch brings to the enterprise, the warfighting edge needs collaboration of technologies and skills to build a resilient and interwoven communication network. The consolidation of groups under the USSF umbrella is a good start, but it is a culture that must be continually nurtured and evolved to create a truly collaborative workforce.

“The field command has adopted a mantra: Exploit what we have, buy what we can, and only build what I must [...] When I look at our metrics going into 2026, it’s first and foremost, how have I integrated and networked the current capabilities that I have in new and imaginative ways. Under ‘Buy what I can,’ it’s how have I partnered with our allies, and how have I partnered with commercial to buy what commercial services and international services are available? And under ‘Exploit what we have,’ how I have integrated that better into the current networks that we have today?”

– Lt. Gen. Michael A. Guetlein, Commander, Space Systems Command⁴

Acquisition Growing Pains

Bringing systems together from across multiple branches of service can be very challenging, and the USSF has faced criticism for its cumbersome acquisition pace. Forty-six percent of space professionals reported in a December 2021 poll that the agency had only been slightly or not at all effective at improving space acquisition,⁵ and some congressional figures noted frustration with the slow pace.

However, the USSF has since taken significant steps to streamline its acquisition process. Frank Calvelli, as Space Acquisition head, has emphasized speed, resiliency, and integrating architecture with other warfighting domains as the top three priorities for space acquisition. The more agile acquisition model used by the Space Development Agency, newly integrated under the USSF's umbrella, has provided the agency with a roadmap for faster acquisitions, pivoting to working in increments to buy capabilities. These tighter timelines and more specific stages of work will lead to shorter development cycles and faster standing up of new tools and technologies.⁶

“The best way to buy most of what we need to buy is as a service. We are on an as-a-service journey [...] For instance, device as a service, or virtual desktop as a service. Everything that we need to do in the acquisition space needs to be things that ultimately maximize our consumption of commercial services, and allow us to rapidly deploy technology. Whether it's the proven technology, or in some cases emerging technology, we really have to do this in a way that achieves scale and lowers our costs.”

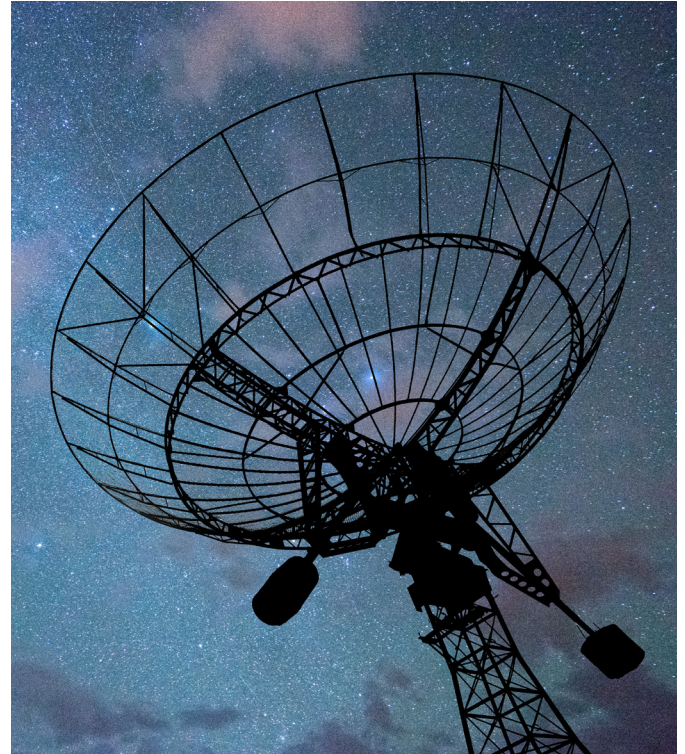
– Lauren Knausenberger, U.S. Air Force CIO

The Constellation's First Steps

Despite its challenges, the USSF has already taken steps to build tools and technologies that rely on an integrated network.

meshOne-Terrestrial

Advanced Battle Management Systems's meshONE Terrestrial System awarded a \$47.5 million contract in



2021 to construct the “USSF Data Transport Highway.” This data-as-a-transport service is intended to enable high-bandwidth and tactical edge networking capabilities that integrate assets from USSF, the Air Force, and others within the DoD and intelligence community at large.⁷

Unified Data Library⁸

After a thirty-day trial period in 2022, Space Systems Command established a permanent capability to directly connect and transfer observational data from the Space Fence radar system into the USSF Unified Data Library (UDL). The UDL allows an unprecedented level of data consolidation, integration, and analysis for Space Domain Awareness, empowering decision-makers to respond at mission speed.

Space Development Agency Transport Layer

The Space Development Agency's Transport Layer, transferred in October 2022 to the purview of the USSF, is designed to be a constellation of between 300 and 500 satellites operating in Low Earth Orbit. Ninety-five percent of the locations on Earth will have at least two satellites in view at any time; 99% will have at least one satellite in view. This data transport layer will provide “assured, resilient, low-latency military data and connectivity worldwide to the full range of warfighter platforms.”⁹

Space Enterprise Consortium

Developed in 2017 as a contracting tool, the Space Enterprise Consortium offers Other Transaction Authority contracts to enable rapid industry connection and prototype development. Over 600 companies are part of the consortium, which has a current ceiling of \$12 billion and supports not only Space Systems Command but the Air Force Research Laboratory, the Missile Defense Agency, and the Defense Intelligence Agency. This multi-domain and collaborative group has already developed new ground systems, a Link 16-enabled space vehicle, and other integrated tools that support the overall vision of an interconnected network of technologies that can support communication and defense at mission speed.

The Foundation of the Future

The future is integrated. Building robust, highly secured, fast and low latency network layers is the foundation for the next generation of network capabilities and tactical warfare. The initial transition from legacy architecture to integrated systems can seem daunting. But the moment demands it – not only to meet the current needs of the USSF, but to lay the groundwork for the next generation of possibilities.

A fully converged architecture will offer the USSF and agencies like it several key advantages:

- **Resiliency:** Ensuring resilient technologies and architectures is key to maintaining the communication and data network that underpin the next generation of intelligence and warfare. As new systems and enterprises continue to evolve, robust ground segments will need access to resilient communication networks. Degraded communications or collapsed infrastructure can make the difference between mission success and mission failure.
- **High fidelity:** Architectures built from the ground up will provide durable, survivable, and sustainable data collection even as systems start degrading in hostile environments.
- **Velocity:** With faster acquisition processes and opportunities like the Space Enterprise Consortium, new technologies and tools that keep the USSF at the tactical edge are becoming available more quickly than ever. A fully integrated USSF will have the velocity to take on new services and technologies at mission speed, rapidly integrating them for immediate use.

The Integration Constellation

A fully networked battlespace, from the ground to the sky, provides warfighters and decision-makers with a previously unheard of level of information – near-real time satellite imagery, theater-wide tracking, artificial intelligence and machine learning capabilities, broadband internet access even in the most remote locations, edge processing capabilities, and high-fidelity mapping of the space radiation environment. The possibilities enabled by an integrated network extend not only beyond the planetary edge, but into the future.

With adversaries like China and Russia looking to assert their own dominance in space, it is imperative that the USSF guardians be given every tool at their disposal to maintain the tactical edge. For an agency that, among other responsibilities, is now in control of all military satellites, a fully integrated network is a crucial next step.¹⁰ If the USSF can act now to harness all their disparate networks and resources, it will lay a robust and resilient foundation for the next generation of networks.





Ciena's Perspective

The telecom industry—and the equipment vendor ecosystem that supports it—has spent the last couple of decades progressively improving the capacity, resilience, security, and multi-service capability of critical network infrastructure. Today, it is possible to build multi-terabit networks that support independent services over a converged infrastructure supporting any mix of legacy TDM or packet traffic. Networks that support vast capacity with multi-level, adaptable segmentation and encryption using rich automation tools are available today to implement the vision of JADC2 and the USSF. Ciena and Lumen have a complete set of offerings for customers—whether they want to build a network directly, use it as a service, or have a hybrid offering. We also offer a complete set of consulting services to help you design, deploy, test, and operate the network that best fits your mission.



Lumen's Perspective

Lumen remains a strong partner with the DoD on delivering the highest level of reliability and assurance to the nation's most critical networks. For the past 60 years, Lumen has been trusted with managing DoD satellite ground networks, delivering Service Level Agreements that exceed 99.99% availability, and provided secure internet access gateways and cleared personnel. As the USSF evolves towards an interconnected, innovative and digitally dominant force, Lumen stands ready as a trusted partner with the infrastructure, talent and insight needed to envision a truly integrated warfighting network. The Lumen Platform enables the USSF to truly capitalize on mission essential data, more quickly embrace emerging technologies that will reduce decision time, and efficiently deliver the innovation that will redefine the network of the future.

Endnotes

¹ <https://www.spaceforce.mil/News/Article/3078187/air-force-hosts-service-chiefs-to-discuss-jadc2/>

² <https://breakingdefense.com/2022/01/space-forces-data-transport-layer-is-linchpin-of-jadc2-raymond/>

³ <https://www.airandspaceforces.com/new-mitchell-institute-paper-argues-space-force-must-take-lead-role-in-jadc2>

⁴ <https://www.airforcemag.com/space-force-no-plans-to-divest-legacy-assets-ssc-boss/>

⁵ <https://breakingdefense.com/2022/01/is-the-space-force-doing-what-its-supposed-to-infographics/>

⁶ <https://breakingdefense.com/2022/11/exclusive-with-new-scorecard-space-forces-acquisition-chief-talks-changing-culture/>

⁷ <https://www.govconwire.com/2021/09/sev1tech-wins-space-force-contract-for-meshone-t-data-transport-prototype/>

⁸ <https://www.ssc.spaceforce.mil/Newsroom/Article-Display/Article/3011293/ssc-unified-data-library-and-space-fence-establish-direct-sensor-connection>

⁹ <https://www.sda.mil/transport/>

¹⁰ <https://federalnewsnetwork.com/space-operations/2022/08/space-force-controls-all-military-satellites/>

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About Lumen

The LUMEN logo, featuring the word "LUMEN" in a bold, uppercase, black sans-serif font with a registered trademark symbol (®) to the right.

Lumen is guided by our belief that humanity is at its best when technology advances the way we live and work. With approximately 400,000 route fiber miles and serving customers in more than 60 countries, we deliver the fastest, most secure platform for applications and data to help businesses, government and communities deliver amazing experiences. Learn more at Lumen.com/federal.