

Time for a New Approach with Satellite Control Network

Executive Summary

The Satellite Control Network (SCN) has provided critical operations and support to our Nation's military and intelligence satellites, along with our civil satellites and spacecraft, for over six decades. With a significant change in the threat to these systems and increasing numbers and volume requirements, the U.S. Space Force should undertake a comprehensive view of the SCN acquisition and sustainment strategy to make a revolutionary change to optimize this essential infrastructure. This paper outlines the elements of this change and desired outcomes.

Satellite Control Network: The Backbone of U.S. Space Operations

The Satellite Control Network (SCN) has had tremendous impact on our National Security infrastructure. Today's era of great power competition demands not only that this weapon system be modernized, but also that it be viewed in the context of the U.S. Space Force Chief of Space Operations' (CSO) Line of Effort (LOE) to field resilient, ready, and combat-credible space forces. In LOE #1, the CSO specifically highlights the need to comprehensively field forces that include equipment, trained personnel, expertise, and sustainment to conduct prompt and enduring operations against an adversary. As the U.S. Space Force considers next steps for the SCN, it must do so with this comprehensive view and avoid locking in a fragile status quo by simply extending current operations and maintenance activities.

The SCN system provides critical operations functions for DoD, NASA, and NRO satellites worth billions of dollars during launch, early operations, routine tracking and control, and emergency support for tumbling or failing satellites. As such, it operates as U.S. national critical infrastructure enabling mission success across both National Security Space and Civil Space. From the Warfighter's perspective, the network assures the ability to employ sufficient space assets at the right place, at the right time and in a manner to achieve the desired, decisive effects. As the major backbone that controls most of our space assets, our adversaries will seek to target the SCN with a variety of reversible and non-reversible means to deceive, disrupt, deny, degrade, or destroy it. Without question, the effects would be devastating to our ability to wage war across all domains.

The shifting, and more threatening space operations environment, coupled with chronic underfunding of this critical asset reveals the fragility of continuing down this path. It is time to consider a new future for this complex and aged system. To set the context for a new approach, it is necessary to outline the current conditions and desired outcomes.

First, and most substantial, this extensive, global, ground-based network is now subjected to the new reality of contested space warfare. The SCN was built in the late 1950s to support low-volume operations in an uncontested space operations era for the Discoverer program.

Undoubtedly, the environment today is no longer the peaceful, uncontested, low-volume domain that existed then. According to every U.S. space leader and the stated doctrine of Chinese and Russian leadership, our adversaries remain focused on the strategic advantage that could be gained by disabling U.S. space capabilities. Our rivals clearly recognize the asymmetric advantages enabled by space systems across every aspect of modern warfare. U.S. space leaders have consistently sounded the alarm as our competitors moved quickly from developing advanced concepts to delivering full scale capabilities to rapidly disable space and ground architectures.

Beyond the new threat posed, within the next three years, the SCN must be ready to support twice the currently supported 200 satellites. Further complicating the situation, a number of these new satellites require twice the contacts to execute command actions with some users also needing 24x7 availability. The system today is already taxed at well over the 70% industry-standard antenna bandwidth utilization rate with over 450 contacts per day, leaving precious little opportunity to maintain or upgrade the system or to respond to urgent needs from the constellations it supports. As more dynamic, highly responsive space operations are envisioned, the SCN must become more resilient, decentralized, and redundant.

In addition to major shifts in the operations environment and SCN resource requirements, any new SCN system must be built on the foundation of a legacy system spanning 7 global sites connected to 2 control centers with old hardware and antiquated software systems that are extremely difficult to maintain. Any plan that requires upgrades would have to be accomplished in sequences to guarantee the ability to control any space asset. A full replacement system must be able to control existing satellite systems for decades to come. Further complicating any change is that the network has undergone multiple block hardware and software changes throughout its five decades lifespan, resulting in a wide variety of subsystems and configurations along with a massive number of system interface control documents. The newest block upgrade, Satellite Communication Augmentation Resource (SCAR), will add yet another level of system complexity by integrating innovative, but software-intensive and dynamic antenna technology.

If the foundational architecture were not complex enough, a system of this size requires ten or more major contractors to provide program and technical management for new and incremental integrated planning, development, testing, execution, operation, sustainment development, deployment maintenance and sustainment. Over the years, the complexity was exacerbated by lack of unified management along acquisition and operations lines, creating divergent priorities for system changes and often driving uncoordinated, suboptimized inefficiencies. After unifying the acquisition and operations support contracts under a single, empowered contractor led by SMC/RN (Space and Missile Systems Range and Network Directorate) over seven years ago, these support functions are again being separated contractually and organizationally along acquisition and operations lines. This is occurring even as the U.S. Space Force is considering implementing Integrated Mission Deltas (IMDs) that organize "...service activities around mission areas instead of functional specialties to strengthen unity of command for readiness and energizing unity of effort for capability development." These IMDs intend to put operators and acquisition leaders together working seamlessly to deliver capability. In addition to embracing the proposed IMD construct, any new approach must quickly address the newly segregated contractor workforce with contracts that are not linked together and without

a unifying contractor fully accountable to design, develop, deliver, maintain, operate, and sustain the best possible SCN capability for the Warfighter.

Under the current acquisition and support strategy, there is no single contractor responsible for the capability delivered. Without a unifying contractor, the government team will have to serve as the technical and management integrator, a role that is traditionally challenging due to the routine changeover cycles of assigned government staff and leaders. In the past decades, programs have been hampered by significant downsizing of the government acquisition workforce, along with a commensurate loss of acquisition and program management experience. Additionally, the Government generally lacks sufficient long-term system engineering expertise for large complex, hands-on programs. Multiple programs have been hindered by inconsistent focus, system knowledge, and inefficient operations when the U.S. Government inserts itself as a program integrator across systems that have been traditionally operated and maintained by contractors. Through IMDs, the U.S. Space Force should strive to develop the bench strength and talent required to execute this critical function. Until this capability can be established internally, however, retained contractor support will be required. Certainly, some of the specific technical expertise can be mitigated using Federally Funded Research and Development Center staff, but due to statutory limits, may not be at the scale required for the coming demands. Lastly, new capabilities such as SCAR must be inserted with support contractors who are not part of the overall system solution and may have different contractual limitations. Any program of this size and scope requires a singularly focused team with long-term knowledge and full accountability to a set of requirements who can adjudicate the implications and define the effects of proposed system changes.

As the nature of warfare changes across the space domain, it is time to evaluate the necessary infrastructure and management strategies to ensure the best methods to deliver military capability. History is replete with examples of infrastructure changes necessitated by new doctrinal thinking. For example, our vast interstate system was built and upgraded based on the needs of both our economic development and National Defense. In the 1950s, President Eisenhower supported the National System of Interstate and Defense Highways Act, after having observed firsthand in Europe how the advantages of the German Autobahn greatly aided the Allies in moving forces and supplies efficiently. This Act, eventually managed by a unified organization, the Federal Highway Administration (FHWA) recast our entire highway infrastructure.

Similarly, we must look to develop or augment SCN capability under a new overarching approach to fielding space command and control forces, while effectively operating and maintaining the existing legacy capability. The Space Force should consider prioritizing a Space C2 IMD of operations and acquisition personnel to comprehensively look toward the SCN future to achieve the best operational and sustainment capability. This capability should consider a broader architecture to increase capacity and enhance resilience as proposed by the Data Transport and Receive Network (DTRN) concept. The prime directives for any changes are clear and unambiguous for this command-and-control system to move forward in a contested space domain. Any change must preserve existing and near term planned capability improvements and leave an effective standalone system able to be modularly upgradable with required backward-

and forward-looking functionality to meet existing and planned mission requirements. This includes planning for emerging kinetic and non-kinetic threats that could disrupt or deny the SCN. The new capability should also consider how best to take advantage of commercial and civil networks with the intent to drive improved capability and resiliency through the integration of many more modern communication systems. At a management level, change should result in a unified command structure that ensures full stakeholder engagement with an optimized total life cycle cost, schedule, and performance capability when measured against the current and near-term improved system. Lastly, any new plan must minimize the management complexity to plan, develop, deploy, operate, maintain, and sustain the SCN with a simplified contract construct.

Based on the dynamic threats and increasing warfighter needs, a new SCN approach must have a distributed mixed architecture, connected yet dispersed, across communications systems (to include back-up mission data paths) with various ground and space network (multi-path) nodes and AI-based dynamic scheduling. Furthermore, some of the augmented architecture should incorporate access points through commercial satellites and ground nodes for dynamic resilience. A holistic, new SCN future must also ensure a review of the technical and support scope requirements. The alternative analysis to achieve a distributed architecture must consider the full range from an aggressive revolutionary approach (with new capability enabled with a markedly different command and control methodology using innovative technologies) to an incremental evolutionary one (add new capabilities on the existing architecture and eventually replacing most elements over long periods of time).

The time is now to ensure the SCN has the right foundational support in this period of transformational change in space operations, to continue as our Nation's most critical space asset control system. Given the collective impact of continued aging, insupportable SCN National Security and NASA infrastructure, oversubscribed capacity, and the Chief of Space Operations' intent to organize acquisition and operations together around specific mission areas, the U.S. Space Force should immediately examine current acquisition strategies and CONOPS to ensure they take into full account the rapidly changing conditions. A Space C2 IMD, with stakeholder support from NASA and NRO should conduct this effort with a comprehensive operations and acquisition focus to ensure unified mission readiness and accelerate the development, fielding, and presentation of Space C2 forces, along with NASA and National Security User needs. The SCN must change to become an element of a broader system of systems for our country that can support dynamic space operations.

The SCN is one of the oldest systems still operating in the Department of Defense today. Cohort systems, such as the B-52 and Nuclear Command and Control systems are planning or already executing replacement programs. It is time the SCN system received the same scrutiny. It can no longer continue to operate as an evolved platform that's fundamentally limited by its core architecture, and modernization and sustainment should be executed by an integrated contractor team until inherent U.S. Government capabilities can be established. The next SCN fielded capability should be transformational and revolutionary serving our National Security and Civil Space users while providing an asymmetric advantage to U.S. Combatant Commanders, enabling dynamic space operations and delivery of overwhelming mass at speed and scale while

preserving freedom of maneuver and U.S. space superiority. The threats posed today by U.S. adversaries demands new thinking and bold action now for the SCN. Without a course correction to the current acquisition strategy, the SCN will continue to be the Achilles heel of the U.S. space architecture, and therefore a fundamental risk to National Security.