

Paving a Pathway to Resilient Satellite Operations

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There has been much discussion in Washington and across the Department of Defense about the need for heightened resiliency in space. Specifically, the conversations — which have inspired notable legislation — are framed around the increasing challenges placed upon DoD mission-supporting satellite systems from electromagnetic interference, either intentional or accidental, as well as other increased risks of operating through a contested space environment. These disruptions threaten the performance and safety of DoD military units as they conduct the full spectrum of military and humanitarian operations. Depending on the type and the severity of the interference, their satellites may be jeopardized as well. Therefore, it is very encouraging to see the U.S. government's leadership engage on the following developments:

- The National Defense Authorization Act for Fiscal Year 2015 included a section that supported “fully-developed, multi-faceted” approaches in deterring and defeating adversary-launched acts of aggression in space. The act directed the Secretary of Defense to submit a report to the congressional defense committees in which the Secretary would assess the ability of the DoD to deter and defeat the attacks. The act also stipulated that the Secretary produce a detailed study to propose alternative defense and deterrent strategies in response to these threats.

- A House Armed Services Committee report prepared as part of the National Defense Authorization Act for Fiscal Year 2016 recognized the importance of secured satellite communications. The committee backed efforts to leverage existing military and commercial satellites to ensure the safeguarding of military units. Such efforts included the establishment of protected tactical waveforms for commercial satellites and Wideband Global Satellite Communications (WGS), as well as a cost-benefit analysis of options to counter electromagnetic interference. “The committee believes in the importance of a robust ability for the warfighter

to monitor, detect, characterize, geolocate and report sources of radio frequency interference on U.S. military and commercial satellites that are in direct support of combatant commanders,” according to the report. “The committee is concerned that the Department has not developed a clear strategy to meet the related warfighter requirements.”

- A September 2015 white paper from the Office of the Assistant Secretary of Defense for Homeland Defense and Global Security titled “Space Domain Mission Assurance: A Resilience Taxonomy” revealed that a lack of robustness within space architectures must be overcome through “a single term, resilience.” The paper cites a DoD definition of resilience as the “ability of an architecture to support the functions necessary for mission success with higher probability, shorter periods of reduced capability, and across a wider range of scenarios, conditions, and threats, in spite of hostile action or adverse conditions.” Resilience, the paper notes, must exist at the forefront of any space planning or architecture analysis. “Unfortunately, the National Security Space community lacks both an agreed-upon taxonomy for discussing resilience, and a quantitative method for measuring it,” according to the paper.

Three Essentials of Resiliency

To overcome the lack of cohesion and progress, the paper recommends what can be called the essential characteristics of resilience. It is critical for U.S. government leadership, agencies and industry to consistently work together to strengthen each characteristic, especially the following three:

1. Diversification. The value of architectural diversity within the satellite communications (SATCOM) environment cannot be understated. Commercial SATCOM systems, designed with the goal of seamlessly augmenting and complementing military satellite communications (MILSATCOM) capabilities, diversify the range of communication paths while also complicating the

targeting solution of would-be adversaries. With this, U.S. commanders maintain the option of strictly using MILSATCOM or relevant commercial systems — or a combination of the two — for diverse capabilities and operational flexibility. If an adversary impacts MILSATCOM space installations, commercial global constellations are nearby, interoperable and readily available on the orbital belt. This permits DoD users to continue with their missions uninterrupted, even when their owned assets may be targeted or compromised.

In addition, commitment to SATCOM diversity extends a protected state for all. Because commercial satellites serve both public and private sector interests, they “muddle the picture” with respect to being an obvious target for adversaries. Thus, you could argue that adversaries are less likely to devote their resources to an attempted compromise of commercial systems.

2. Distribution. Users should take full advantage of the vast range of space assets made available to them (including those belonging to industry), so they have seamless access to robust commercial SATCOM capability where and when they must execute their missions. A distribution of assets across the orbital belt, ground segment and even across frequency bands increases the robustness of the operational options. That is why it is advantageous to distribute traffic across all commercial and military assets, to allow operations to proceed to the greatest extent possible, regardless of which satellites may be subject to a degradation or threat.

3. Protection. Innovative and strong commercial SATCOM service providers invest in a wide range of technologies to enhance their satellites, offering improved protection necessary to create a wideband environment



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with increased resistance to jamming and other forms of interference. Satellite design, command encryption and a vigilant mission assurance posture are core to their operational profiles. As a result, government users are better positioned to operate through many congested and contended scenarios. Commercial operators have also successfully demonstrated the use of Protected Tactical Waveform (PTW) commercial satellites. For example, in 2015 Inmarsat and its partners demonstrated PTW across the largest bandwidth to date, bolstering the government's ability to communicate using Inmarsat Global Xpress satellites as a viable complement to their own WGS constellation even in the event of a heavily contested environment.

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ments, even when contested. With the best of breed from industry available to minimize disruptions, the government benefits from enhanced robustness in space combined with ground assets to complement and extend military capabilities. Government operations may proceed with confidence, knowing that interference contested environment — whether intentional or otherwise — will not prevent mission success.

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