

# MilsatMagazine

February 2022



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# DISPATCHES

## TEAMING AGREEMENT



**Volansi and Sierra Nevada Corporation (SNC) have entered into a teaming agreement and partnership in support of the Army Future Tactical Unmanned Systems Increment 2 (FTUAS) Program.**



Future Tactical Unmanned Aircraft System (FTUAS)



Based on Volansi's design of a commercial unmanned aircraft and SNC's turnkey *Intelligence, Surveillance, Reconnaissance (ISR)* integration, the Volansi/SNC *Vertical Take-off and Landing (VTOL)* platform was recently selected as one of the potential offerings for the U.S. Army **FTUAS** program for its redundancy and durability.

Volansi's VTOL aircraft only require a small operational footprint, eliminating the need for runways, catapults, or infrastructure and can operate in challenging terrain and contested environments.

"We are proud to be a part of this Army effort," said Volansi CEO, **Will Roper**. "Combining the best know-how of highly reputable defense companies, like Sierra Nevada Corporation, with a Silicon Valley-based startup is an innovation formula I encouraged while in government. It unlocks the full potential of the U.S. industrial base for our warfighters."

"We are honored to work with key partner, Volansi to provide the US Army a Multi-Domain Operations ready FTUAS solution, blending the best of commercial innovation with SNC's unprecedented turnkey ISR pedigree," said SNC's Executive Vice President, **Tim Owings**.

## MILLIONS T6 ORDER FOR OVZON

**Ovzon** has secured an order for a total order value of \$9.8 million for 14-months of SATCOM-as-a-Service for the Italian Fire and Rescue Service.



The order includes the entire broadband capacity of one of Ovzon's steerable satellite beams, twenty-one **Ovzon T6 On-The-Pause** terminals and twenty-one Ovzon *On-The-Move* terminals.

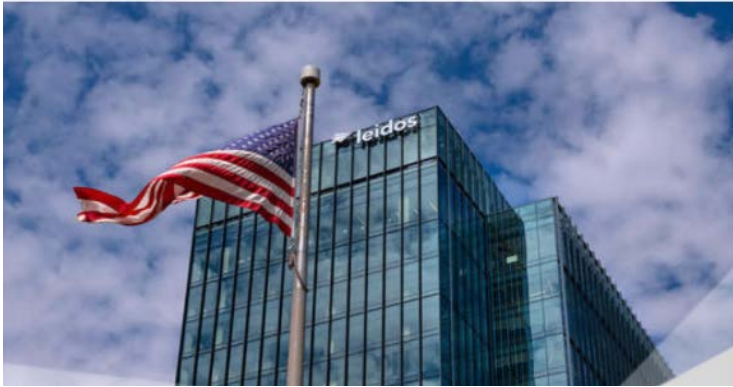
The service will be rolled out gradually and will start late in Q1, 2022. The service will be managed and supported in co-operation with Ovzon's Italian partner, **Gomedia Satcom**, using Gomedia's Teleport and First Line Customer Support in Catania, Italy.

Ovzon's SATCOM-as-a-Service will allow the Italian Fire and Rescue Service (Corpo dei Vigili del Fuoco) to address the increasing need for fast, reliable, and high-performing communications solutions for their important missions. Based on Ovzon's satellite solution, the Italian Fire and Rescue Service will deploy a secure communications network and solution that can support the high throughput requirements for data and voice communications as well as the need for high-definition video streaming.

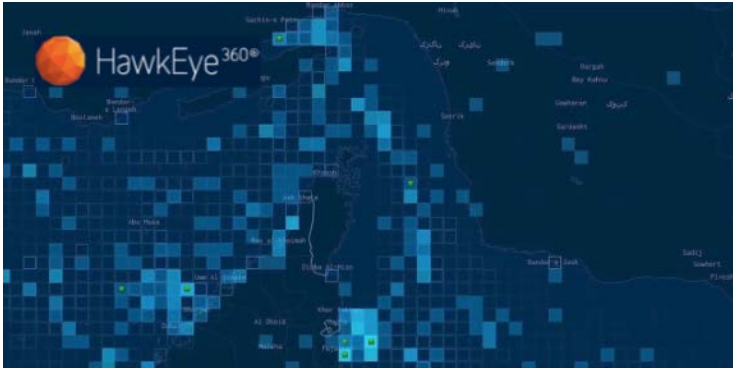
"Fires are an increasing threat in Italy, as climate change factors become visible in areas such as the Mediterranean. The complexity and risk to safety and rescue (SaR) and disaster recovery operations (DRO) requires reliable and fast communication and Ovzon's satellite communication solutions is a perfect solution for this need," said **Gaetano Morena**, the CEO of Gomedia Satcom.

# DISPATCHES

## HAWKEYE 360 RECEIVES STRATEGIC INVESTMENT



**Leidos** (NYSE:LDOS) will make a \$5 million strategic investment in **HawkEye 360**, a leading commercial provider of space-based radio frequency (RF) data and analytics — this brings the total of the firm's Series D round to \$150 million.



The companies will share information and combine efforts to achieve transformational growth in data and analytical services. Leidos' investment in HawkEye 360 will build on the company's multi-decade heritage of serving National Security Space customers and will also support the creation of new, differentiated technological capabilities.

HawkEye 360 delivers a groundbreaking source of global knowledge based on RF geospatial intelligence, further accentuating Leidos' efforts to make the world a safer place. This mutual agreement will accelerate the company's growth while creating new opportunities for customers in the humanitarian, environmental, commercial and national security sectors.

*"We are pleased to invest in HawkEye 360 and their innovative work to enhance geospatial intelligence solutions,"* said Leidos National Security Space Executive Vice President, **Paul Engola**. *"We're confident this investment will strengthen our robust capabilities in the National Security Space arena. This will also create innovative pathways to deliver bold solutions to our customers as they work to safeguard U.S. and allied interests."*

*"HawkEye 360 is pleased to welcome such a distinguished defense and intelligence leader as Leidos to our group of world class investors,"* said HawkEye 360 CEO, **John Serafini**. *"We look forward to harnessing their support to create significant value not only for the defense, intelligence and national security communities, but also for organizations addressing some of the most complex global challenges facing humanity and the environment."*



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# DISPATCHES

## SES GOVERNMENT SOLUTIONS LAUNCHES ON-DEMAND X-BAND SERVICE PLATFORM



**SES Government Solutions, a wholly-owned subsidiary of SES, launched tactiXs, a mission-specific, managed service platform in partnership with Network Innovations and GovSat, a public-private joint venture between the Government of Luxembourg and SES.**

The full end-to-end managed service provides practical, cost-effective solutions to mission parameters by allowing the customer to purchase a volume-based Mbps service, as opposed to MHz bandwidth agreements, while ensuring security and performance of the connectivity service

Leveraging the **GovSat-1** satellite, operated by GovSat, tactiXs delivers secure, non-preemptible, X-band capacity to customers on an on-demand basis across any domain or austere environment in Europe, Africa and the Middle East.

Using high-powered, steerable spot beams that can be quickly repositioned to provide robust coverage, makes this solution well suited for any U.S. military or government-based mission, whether it be **Comms-On-The-Move (COTM)** or **Comms-On-The-Pause (COTP)**.

tactiXs can support a myriad of use cases required by military users, including covert missions and various types of special ops.

The GovSat-1 satellite connectivity is ideally paired with the capabilities of the tactiXs platform and has all the key attributes of MILSATCOM, such as anti-jam, encrypted telemetry and control, as well as secure beam steering & control, and can augment the **Wideband Global SATCOM (WGS)** system with secure X- and Mil Ka- band capabilities.

*"Our new service platform is a non-preemptible alternative to WGS that can handle the most tactical-edge customers' data and mission requirements, and with no lead time required can be set up within hours for the mission at hand,"* said President and CEO of SES Government Solutions, Brigadier General **Pete Hoene**, USAF (retired). *"We are proud to partner with both Network Innovations and GovSat as we understand the demand for reliable, uncontended bandwidth and we are excited to bring this innovative and secure solution to the market."*



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# DISPATCHES

## TRX SYSTEMS DAPS SELECTION BY U.S. ARMY

The TRX DAPS solution will allow warfighters to better target, move, and communicate in operational environments where GPS is degraded or denied.



### TRX DAPS - Dismounted Assured PNT

**TRX Systems**, developer of NEON® GPS-denied location solutions, has been selected by the U.S. Army to provide a next-generation Dismounted Assured Positioning, Navigation and Timing (PNT) System (DAPS).

The TRX DAPS solution employs a lightweight soldier-worn device that enables dismounted warfighters to successfully conduct operations when operating in GPS challenged, degraded, or denied environments.

Military equipment can be the subject of enemy electronic attacks, potentially resulting in a loss of location awareness that can put Army missions at increased risk.

The TRX DAPS solution alerts the user when their position isn't reliable and then leverages multiple sensors and timing sources to provide the best soldier position possible within the GPS degraded operational environment.

The solution is designed to replace the *Defense Advanced GPS Receiver (DAGR)* with support for both a standalone configuration and integration with the *Nett Warrior* ensemble.

The TRX DAPS solution leverages the company's proven experience in delivering GPS-denied location technology to thousands of military, public safety, and security users worldwide.

The solution combines inputs from small, body-worn sensors and other sources to provide assured PNT while meeting the challenging *Size, Weight, and Power (SWaP)* needs of dismounted soldiers already physically burdened with heavy equipment loads.

"Maintaining assured PNT is paramount to the situational awareness of U.S. warfighters in the many conflict zones around the world," said **Carol Politi**, President and CEO of TRX Systems. "When initial units are fielded in mid-2022, the TRX DAPS solution will deliver a balance of the highest possible level of integrated PNT capabilities with the smallest package that can be fielded for dismounted warfighters."

TRX Systems is the developer of NEON GPS-denied location solutions, delivering location, mapping, and proximity solutions where GPS is not available or is unreliable including indoors, underground, in dense urban areas, and where GPS is jammed or erroneous. NEON delivers ubiquitous, low-cost, GPS-denied location through use of advanced sensor fusion, ranging, and patented dynamic mapping algorithms. NEON location technology provides the foundation for several commercial applications, including NEON Personnel Tracker and NEON Signal Mapper.

For more information, visit



# DISPATCHES

## RUGGEDIZED RF MICROELECTRONICS CONTRACT AWARDED TO MERCURY SYSTEMS



***Mercury Systems, Inc.*** (NASDAQ: MRCY) has been awarded a \$17 million contract to provide crucial RF microelectronics supporting missile capabilities of the U.S. and its allies in ensuring 21st-century air dominance.

These multi-channel digital RF assemblies will help provide real-time signals intelligence data, speeding information to the warfighter. The award was received in the company's fiscal 2022 first quarter and is expected to be shipped over the next several quarters.

"We have developed and continue to develop technology and products that are critical to our Nation's and that of our Allies' air defenses, and this award is the next step in our journey toward being the preferred partner in this important mission area," said **Roger Wells**, EVP and president, Mercury Microelectronics. "As one of only three domestic U.S. suppliers of key defense-grade microelectronics, our customers and the military depend on us to develop advanced high-performance RF and digital signal processing technologies critical to help them maintain electromagnetic spectrum dominance over our adversaries."

Mercury leverages more than 40 years of microelectronic manufacturing investments to support their customers from prototype to full-rate production, including automated manufacture and test, in-line quality assurance, and on-site engineering support.

Its custom, miniaturized RF modules are produced in AS9100 and IPC-1791-certified facilities using *Defense Microelectronics Activity* (DMEA)-accredited design and manufacturing capabilities to enable rapid, cost-effective deployment of innovative microelectronics and secure processing solutions.

Mercury envisions, creates and delivers innovative technology solutions purpose-built to meet its customers' most pressing high-tech needs.

*Mercury Systems is a global commercial technology company serving the aerospace and defense industry. Headquartered in Andover, Mass., the company delivers trusted, secure open architecture processing solutions powering a broad range of mission-critical applications in the most challenging and demanding environments. Inspired by its purpose of delivering Innovation that Matters, By and For People Who Matter, Mercury helps make the world a safer, more secure place for all. To learn more, visit [mrcy.com](http://mrcy.com), or follow us on Twitter.*

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# DISPATCHES

## METIS TECHNOLOGY PARTNERS RECEIVES USSF CONTRACT FOR CRITICAL LAUNCH OPS OVERSIGHT



***Metis Technology Partners, LLC (MTP), a joint venture between Axient LLC and Metis Technology Solutions, Inc., was awarded the United States Space Force (USSF) Pad Safety Support Contract (PSSC) II, an indefinite delivery/ indefinite quantity (IDIQ) single-award contract valued at up to \$53.5 million.***

MTP will partner with [Space Launch Delta 45 \(SLD 45\)](#) to facilitate the safe launch of DoD National Security Space, National Aeronautics Space Administration (NASA), National Oceanic and Atmospheric Administration (NOAA), commercial and Naval missions.

MTP will provide oversight of hazardous and safety critical operations at Cape Canaveral Space Force Station and other sites, such as Kennedy Space Center, Patrick Space Force Base, Los Angeles Air Force Base, Vandenberg Space Force Base, and other locations in Utah, Alabama, Virginia, Georgia, and others as requested by the customer.

With the option of firm-fixed-price, cost-plus-fixed-fee, and cost reimbursable task orders, the PSSC II contract provides a wide range of operational and technical services to SLD 45's comprehensive safety program. The PSSC II MTP team will add value to the ever-increasing launch tempo operations on the Eastern Range, forecast to exceed 60 launches in 2022, while working to ensure public safety in partnership with SLD 45.

Key mission areas of performance include: oversight of Flight Termination System integration and checkout; spacecraft fueling/defueling; spacecraft and launch vehicle lifting and transport operations; launch operations; and incident response. Additionally, the MTP team will develop launch safety

planning documentation, provide technical reviews for new space lift programs to characterize hazards, perform pad safety training, and provide hazard abatement as part of range safety approval. Additionally, the team will administer, facilitate, and implement the Pressure Vessel/System certification/re-certification program at SLD 45.

Metis Technology Partners is a joint venture formed under the Small Business Administration's Mentor Protégé program. Protégé company and joint venture Managing Member, Metis Technology Solutions, is a 100% woman-owned small business and software and systems engineering aerospace company headquartered in Albuquerque, New Mexico. Axient is a systems engineering and technical services company headquartered in Huntsville, Alabama. The company has a 30 year history providing superior technical and systems services to aerospace customers, including multiple USSF contracts.

*"MTP is dedicated to launch safety, and our systems engineering team brings a wealth of aerospace expertise and experience to the SLD 45 missions," said **Joy Colucci**, Managing Partner of the MTP JV and founder and CEO of Metis. "The Metis team is committed to bringing innovative solutions to address today's aerospace challenges, and we look forward to working together with Axient to support launch base operations."*

*"We are proud to continue to deliver exceptional performance to the US Space Force and their launch safety mission. Axient looks forward to continuing our 15+ year heritage with this customer providing market-leading launch and range safety expertise on this contract," said **Patrick Murphy**, President and CEO of Axient.*

# Advantech Wireless Technologies Military & Government Solutions



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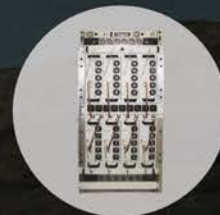
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At Advantech Wireless Technologies, we have over 25 years of experience delivering cutting-edge innovations in communications that solve mission critical communications challenges.

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# SATCOM BORDER MONITORING IN THE NEW AGE

ARMY SURVEILLANCE ACTIVITIES TO ENABLE ECONOMIC GROWTH

Author: Alexandre Silva, Government and Defense Business Development + Defense Product Owner

The Brazilian Army's Integrated Border Monitoring System (SISFRON) was in need of an efficient solution to provide more flexible, efficient and reliable satellite communications (SATCOM) to improve the operational requirements of various Army units along the Brazilian terrestrial borders.

Selecting the correct solution was the key to overall project success, as the system's objective is to enable state and federal defense and security agencies to curb illicit acts such as arms trafficking, drug and contraband smuggling, cargo and vehicle theft, environmental crimes as well as the prevention of border conflicts. The system also aims to help the long-term development of the Amazon region in Brazil.

The issue at hand with the previous system was that the satellite bandwidth allocation was static, with SCPC (Single Channel Per Carrier), this meant that to deploy a terminal, the Army had to apply in advance for this allocation, wait for the approval after a priority analysis, receive the frequency plan and then set up the terminal's parameters. Additionally, in the presence of interference, the terminal's operators needed to relocate the terminal or, as a last resort, request a new frequency plan.

That process could last such a significant amount of time that it could prevent Command and Control (C<sup>2</sup>) from performing properly, situational awareness of the command would be impaired due to the lack of real-time data, and this meant the entire operation would be jeopardized. This is where SpaceBridge's ASAT™ WaveSwitch™ technology supplied the solution.

SpaceBridge ASAT™ VSAT hub and terminals technology was selected due to the products' efficiency in supplying communications with enough flexibility in mission-critical, real-time conditions, to significantly optimize the Space Segment and provide reliability to the communication links in remote areas.

## “WHERE YOU NEED THEM AND WHEN YOU NEED THEM”

With the acquisition of an ASAT™ WaveSwitch™ system (pictured to the left), the Brazilian Army was able to make better use of the available satellite resources and increase flexibility and efficiency with quickly deployable, lightweight, flyaway terminals — delivered by Spacebridge. The implementation of the system would easily connect remote military units or subunits to the headquarters.

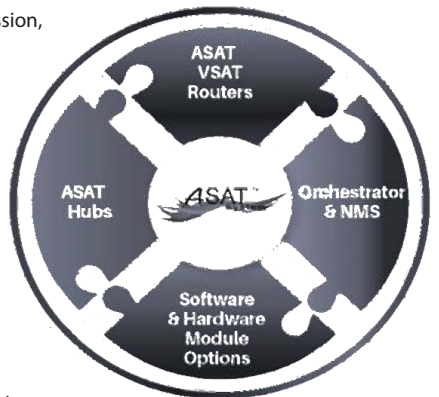
The ASAT™ WaveSwitch™ system is capable of dynamically managing the available bandwidth and switching the waveform according to each application's demands. In a scenario where military HF and VHF radio aggregation and termination are needed, the most favorable, real-time, MF-TDMA waveform will take place and be automatically activated in the system for the secured and immune transmission.



However, when an important event such as illegal trafficking or other civil crime is occurring and real-time video or picturing is needed, the SCPC waveform will go into action, transmitting secured, high data rate and high-quality live video from HD cameras deployed in the Army's maneuvering vehicles.

With the adoption of this new paradigm, a newfound flexibility was clear as it was no longer needed to reserve constant-rate, SCPC circuits bandwidth. Better efficiency was then achieved with the system's ability to provide **Bandwidth on Demand (BoD)** from the unused capacity on the fly for those remote vehicles or deployed command posts and maneuvering special units, according to their needs and applications. This includes:

C<sup>2</sup> systems, sensor data transmission, trunking radio communications backhauling, VoIP calls, video streaming and video conferencing — without the need of previous scheduling. This allows the remote units to communicate with headquarters more fluently and, as a consequence, a better outcome is produced from the defense and law enforcement activities along the Brazilian border.



Worth noting is that the ASAT™ WaveSwitch™ system was provided with the capacity to absorb all the armed forces' X-band terminals of the **Military Satellite Communications Integrated System (SISCOMIS)** currently in use, as well as advanced gateway Geo-redundancy capabilities, to provide continuity and resilience in case of turbulent weather conditions or other disasters. The SpaceBridge disaster-ready architecture is designed to deal with such high-risk scenarios. All of the Brazilian Armed Forces and the **Ministry of Defense (MoD)** can benefit from the flexibility, efficiency, resilience and reliability of the SATCOM infrastructure accessed during joint and interagency operations.

During the second phase, SISFRON expanded the number of deployed terminals by procuring and adding many additional, flyaway, remote terminals to allow for flexibility, resilience and independence when the SATCOM aspects of the deployed commands were required.

As a well-established vendor and operator of advanced managed services, SpaceBridge provided in-country project management. This included the **Factory Acceptance Test** in Canada as well as **Advanced SATCOM** trainings and knowledge transfer to Brazilian Army operators and other partners.

Army officials' satisfaction demonstrated that the ASAT™ WaveSwitch™ system provided the Brazilian Army the capability of better monitoring of the almost 16,000 km of the nation's terrestrial borders. The system also provided the

other Brazilian armed forces the provisioning of C<sup>2</sup> information to key-decision makers in joint and interagency operations for matters of National Defense.

As a result, the Brazilian population living closer to the borders can feel more secure as they are being better supported and defended by the Brazilian Army. This allows for better economic growth in that area, land dominancy and better use of natural resources.

Ultimately, the Ministry of Defense benefits immensely, as they can save up to 30% of the precious satellite important resources of the **Brazilian Defense and Strategic Communications Satellite (SGDC)**, a highly valuable technological inclusion within the **Brazilian Communications and Defense System**.

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*Author Alexandre Silva retired from the Brazilian Army in mid-2021 as a Colonel and military telecommunications engineer, after more than 29 years of service. He is now part of SpaceBridge's team, leading the Government and Defense Business Development initiatives and defining the next Generation Product Lifecycle as Defense Product Owner. Throughout his career, he commanded and led several ground and satellite communications systems and projects, among them worth mentioning his role as technical engineering commander of the Brazilian MoD's Defense Operational Network (ROD) and the Military Satellite Communications System (SISCOMIS).*



# OPTIMIZING MIL-AERO TELEMETRY LINKS ENVIRONMENTS

## COMM LINKS OPTIMIZATION VIA RF OVER FIBER BACKHAUL

Authors: Richard Jacklin, Global Sales and Business Development Director, and Craig Somach, Director of Sales, ViaLite Communications

**Military and commercial aerospace businesses involved with the testing of multiple and simultaneously present powered flying objects, such as manned aircraft, drones or missiles, need to be able to receive and send telemetry data during the entire course of the test flights. By its remote nature, this can be accomplished wirelessly using radio communications systems to provide high quality communication links with no signal dropouts or data corruptions. This article describes the optimization of these links through a RF over fiber backhaul system ensuring high fidelity and wide dynamic range.**

### FREQUENCY USE IN MIL-AERO APPLICATIONS

In the case of Military Aerospace applications, the Air Force, Navy and Army facility radio systems often work simultaneously across frequencies in all of the P, L, S and C-bands, so in effect, have multiple wideband frequency coverage up to at least 6 GHz.

The telemetry antennas utilized can be of various types including parabolic dishes and directional horn feed antennas. This type of telemetry setup is also known as boresight communications and testing.

When the physical nature of the deployment prohibits the use of coaxial cables to transport the RF signals due to high cable losses and RF immunity concerns, the signals received need to be sent to the mission control room through an RF over fiber (RFoF) backhaul network, to be analyzed and recorded. The mission control room can also be used to transmit RF signals back out, making the system bi-directional and a more challenging design, since receive signals are very low power and transmit signals need to be much higher power. The ability to add additional low noise amplification for the transmit signal is not always available.

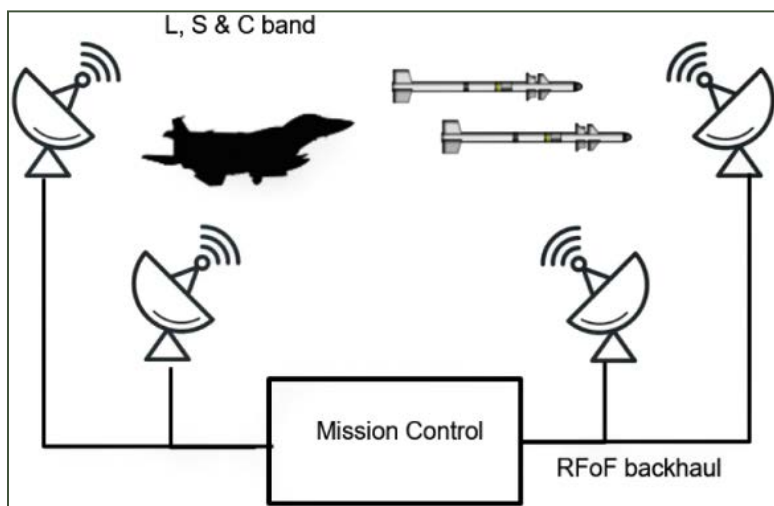


Figure 1. A typical Mil-Aero telemetry system using RFoF across backhaul

#### Why is RF over fiber used in the backhaul?

Fundamentally, it's due to distances and the frequencies used. Linking the telemetry antennas to the mission control can involve distances up to a number of kilometers. Using frequencies up to 6 GHz across long distance

makes traditional RF coaxial cable far too lossy and not appropriate to the task. RF over fiber has the advantage of super low loss at 0.2 dB/km and can easily cope with the wide frequency bandwidth of multiple and simultaneous telemetry signals. RFoF also benefits from a very small conversion delay with very low signal dispersion.

This is very important for the Mil-Aero application where fast moving objects can affect the radio signal through frequency Doppler shift, multipath propagation and shadowing; critically ensuring that the backhaul connection does not add to these negative effects. The fiber optic cable is also a very inexpensive and lightweight medium, it is extremely stable across different environmental conditions and offers RF immunity, as an added benefit. Crucially the RFoF solution is an analog technique; none of the received signal information is encoded digitally, and neither is it encoded into IP protocol which can be seen as a cyber-vulnerability. The technique of using RFoF in this Mil-Aero telemetry backhaul application is not new. The key questions are:

- » What makes a good performing link and under what conditions?
- » How do you design and optimize the RFoF system for an uplink, downlink or different types of aerospace vehicle telemetry and tracking?

### MIL-AERO 6 GHz RF OVER FIBER LINK PAIR

[ViaLite Communications](#) introduced a product line specifically aimed at the Mil-Aero telemetry market to address these needs. ViaLite's **Mil-Aero 6 GHz Link Pair** (photos below — Form factors: Rack Chassis Card, Blue OEM and Black OEM).



This product actually covers the full frequency range from 10 MHz through to 6 GHz without sacrificing **Noise Figure (NF)** or reduction in **Spurious Free Dynamic Range (SFDR)**. Traditional coaxial cable systems have a challenge under similar conditions.

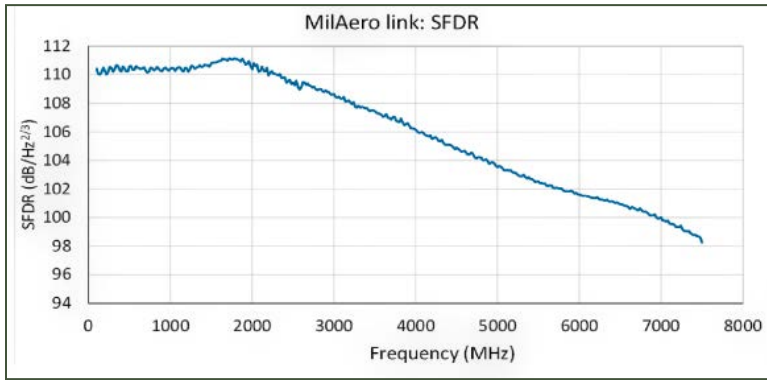


Figure 2. Typical SFDR measurement from ViaLite 6 GHz Mil-Aero link pair

The link comes in various form factors\*; OEM module, rack card for use in a chassis, and a uniquely integrated module with an **IP55 (Ingress Protection)** rating for outdoor use without the need for an additional outdoor enclosure.

### USE CASE #1 – TELEMETRY DOWNLINK TRAFFIC

For the typical telemetry downlink path it's important that the **RF-to-Optical (E/O)** transmitter is able to handle objects that pass "close-in", such as an aeroplane taxiing near a boresight antenna, which may present signals up to 0 dBm after the first LNA stage.

The Mil-Aero 6 GHz Link Pair, for this circumstance, has the default transmitter gain set to -10 dB and the **Optical-to-RF (O/E)** receiver set to +15 dB. With a lossless optical connection, this provides a link gain of +5 dB. With real-life connection losses, this would be closer to a 0 dB unity link gain.

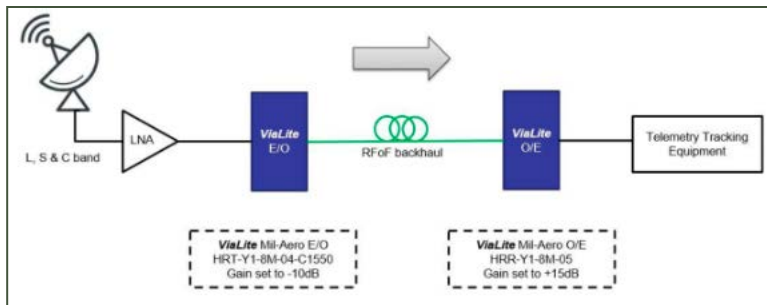


Figure 3. ViaLite Mil-Aero 6 GHz standard gain link pair

### USE CASE #2 – TELEMETRY UPLINK TRAFFIC

For the telemetry uplink path, higher power RF signals are typically output from the Telemetry Tracking equipment which, in turn, needs to be connected to the input of an uplink **Power Amplifier (PA)** positioned near the antenna. Higher RF power levels need to be treated with care, particularly as they get closer to **P1dB** compression level and harmonic components increase. Typically the system performance would need these harmonic components to be **35dB** less than the wanted carrier signal.

In the example shown in **Figure 4**, the ViaLite transmitter (E/O) is set to **-12 dB** gain (**attenuation**) with the ViaLite receiver (O/E) set to **+24 dB**. These precisely optimized gain settings (*from factory default gain settings*) can be adjusted in a live field setting using a readily available USB-C cable and simple PC software when using ViaLite Blue or Black OEM modules, or they can be adjusted through software commands if using a ViaLite 19 inch rack **SNMP** enabled solution.

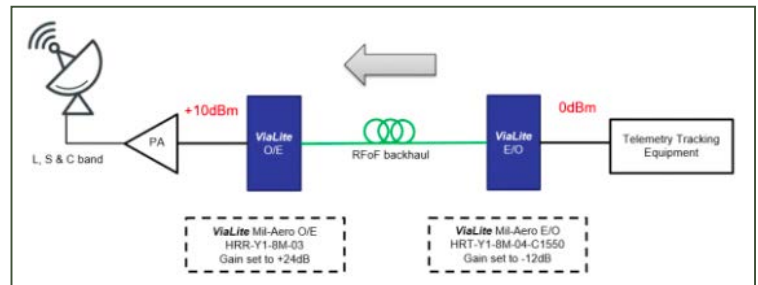


Figure 4. ViaLite 6 GHz Mil-Aero high output link pair

### USE CASE #3 – TELEMETRY, MULTIPLE TARGETS OPERATING IN C-BAND

In this use case example, the application scenario requires tracking multiple simultaneous flying objects and at a long distance away from the antenna, operating in C-Band. This situational solution requires a high sensitivity, high gain front end, with a low Noise Figure.

This enables the Telemetry Tracking equipment to pick up the smallest level RF signals, all present at the same time and possibly very near to each other. C-band frequency communication presents superior performance in terms of signal dispersion, but can suffer more with signal shadowing, so minimizing the signal black out is essential.

In the example shown in **Figure 5**, the ViaLite transmitter (E/O) is set to **+5 dB** (*which helps to provide a lower NF and added sensitivity*) and the ViaLite receiver (O/E) is set to **+15 dB**, thereby giving a link gain of **+20 dB** (*minus any fiber connectivity losses*).

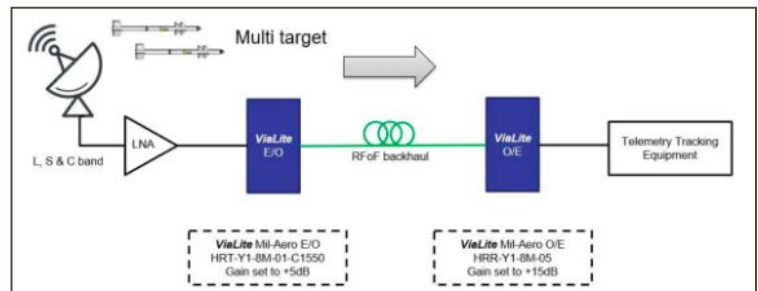


Figure 5. ViaLite 6 GHz Mil-Aero high gain link pair

### CONCLUSION

This article has described the radio telemetry application known as **boresight communications and testing**, as applied to flying objects at aeronautical test ranges. ViaLite produces a range of specialist RF over fiber links aimed specifically at backhauling the boresight telemetry signals from the antenna through to the mission control room. These links need to have superior bandwidth, dynamic range and low Noise Figure in order to maintain telemetry link quality and minimize signal black-out. The RF over fiber links also need to accommodate the specific requirements for the uplink and downlink signal dynamics in power level and harmonic content.

Authors: Richard Jacklin is the Global Sales & Business Development Director and Craig Somach is the Director of Sales, both with ViaLite Communications.

[www.vialite.com](http://www.vialite.com)



# GOVERNMENT SATELLITE REPORT (GSR) #1

SUPPLEMENTING MILITARY X-BAND WITH A FLEXIBLE, MANAGED SERVICE — TACTIXS

Author: Ryan Schradin, Editor, GovSat

In September of 2021, [SES](#) and [Hughes](#) announced that they had successfully used the Hughes Resource Management System to seamlessly switch signals across SES satellites in Geostationary (GEO) and Medium-Earth Orbits (MEO).

According to Jim Hooper, Chief Commercial Officer and Corporate Vice President at SES Government Solutions (SES GS), the test was instrumental in, "...illustrating the power of next-generation satellite services and technologies to provide mission-critical, assured communications to the government and military, at a time when connectivity is increasingly essential."

In multiple recent articles on the [Government Satellite Report \(GSR\)](#), the increasing importance of network-enabled devices, solutions, platforms and services within the U.S. military have been discussed, as well as how the [U.S. Department of Defense](#) increasingly relies on connectivity in theater, the need for resilient, assured communications only increases. Ultimately, if connectivity is going to be essential for military operations, communications are going to have to be guaranteed if warfighters are to accomplish their missions.

To learn more about what this demonstration means for the resiliency, security, and capability of the satellite systems and services available to the military, GSR talked with Rick Lober, the Vice President and General Manager at Hughes Defense.

## Government Satellite Report (GSR)

Hughes and SES recently conducted a test for General Atomics Aeronautical Systems to demonstrate multi-orbit satellite communications for remotely piloted aircraft. Can you tell our readers a bit about this demonstration and what it entailed?

## RICK LOBER

This was a static demonstration for [General Atomics](#) that paired the *Hughes HM series* software-defined modems and our resource management system with SES's satellites operating in GEO and MEO. The demonstration replicated a typical, unmanned, *intelligence, surveillance, and reconnaissance (ISR)* mission, transmitting *high-definition (HD)* video and sensor data to and from the unmanned aircraft.

Based on the mission's pre-set policies, our management system automatically switched between the satellite signals to stay connected – even when a signal experienced interference and jamming scenarios. The quasi-instant and seamless beam switch took just seconds to complete, much faster than you normally see today when it's done manually.

The rapid beam switching is important for the U.S. military's *Automated Primary, Alternate, Contingency, and Emergency (APACE)* communications planning. In addition, the Hughes modems and management system delivered three times the throughput of the currently deployed SATCOM service using a terminal less than half the size that still meets *size, weight, and power (SWaP)* requirements.



Rick Lober

*What was so different and revolutionary about this particular test? What were SES and Hughes looking to accomplish that was new and exciting?*

## RICK LOBER

There were several things about the demonstration that broke new ground. I mentioned that the autonomous switching between satellite signals saved critical time during the RPA mission and that the switching supports APACE communications planning for RPAs, a feature that does not exist today. This communications capability was provided as a managed service which is new for RPAs. Using end-to-end managed service enables the RPA operator to switch signals on demand as the bandwidth is needed, without having to acquire it in advance.

On the technical side, the switching showed the agility of using the [HM 400 modem](#) and the Hughes resource management system, which both use software-defined technology to make the SATCOM operation smarter. We were able to get the higher throughput because the Hughes HM modem leverages a proprietary *Scramble Code Multiple Access (SCMA)* waveform that also enables greater security for the link so adversaries cannot detect the transmission.

*Why is the ability to seamlessly switch from one satellite to another so important or desirable for the military? What could this enable them to do on the battlefield and in theater that they can't already? How does it enable them to respond to modern threats in the space domain?*

## RICK LOBER

I think the U.S. military's experience flying RPAs in multiple theaters over the past decade has demonstrated the vital importance of maintaining a constant connection between an unmanned aircraft and its operator on the ground.

Jamming, signal interference, and other factors can cause a break in the satellite signal and perhaps the loss of critical ISR data needed by commanders making decisions during an operation. If the communications link is disrupted, the ISR data about the threat cannot be sent to the ground as quickly as needed.

Only by being able to switch seamlessly from satellite to satellite can the user be assured of uninterrupted communications.

*Why is it important that the demonstration allowed the user to switch between MEO and GEO satellites? Why would the military ever want or need to do this in theater?*

## RICK LOBER

Being able to switch between satellites in different orbit planes provides greater network resiliency and gives commanders more options to enhance their APACE communications. Having a diversity of satellites allows for optimizing the best solution set while making the network more robust.

A key advantage of the satellites closer to earth is that they have lower signal latency. GEO satellites are further from Earth than satellites at MEO and LEO, meaning the signal will take significantly longer to transmit each way.

For the DoD, adding more satellite resources at LEO and MEO means less latency, more redundancy in the communications network, and less chance for an adversary to disrupt the satellite that is carrying the communications.



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As satellite services like O3b mPOWER come online, what new capabilities will be enabled for the government and military? How does the impending launch of services like O3b mPOWER make this demonstration even more important and timely?

**RICK LOBER**

The new [mPOWER satellites](#) that SES is building for its **O3b MEO** constellation will be another step in providing the DoD user with more resilient communications. These are much more powerful than the existing O3b spacecraft and will have as many as 5,000 spot beams per satellite. They will support automatic switching to satellites in other orbits and much higher data throughput than MEO offers currently.

For the DoD, they could become a vital part of APACE communications planning to support new missions in today’s multi-domain battlespace as well as the Joint All-Domain Command and Control (JADC2) concept to connect sensors from all the U.S. military services into a single network.

How could you envision the Hughes HM series and O3b mPOWER working together to enable the military in theater moving forward? What advanced capabilities and services could they enable? Why is it important that technologies like these are available to the military of today and tomorrow?

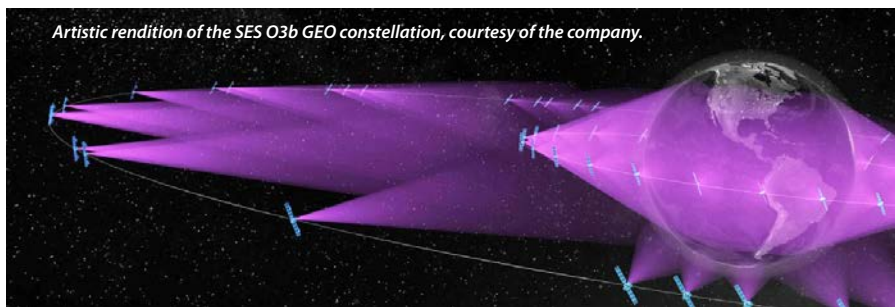
**RICK LOBER**

One of the key features of our HM modem technology is that it uses a commercially based, open-standards architecture, adaptable to almost any network. Another is that it is frequency-band agnostic and can work with just about any satellite, enabling affordable, resilient solutions to meet a wide variety of mobility and portability requirements for government users

By using software-definable modem (SDM) technology and the Hughes enhanced SCMA waveform, the HM System allows government users to adapt the solution to their specific needs. As the first gateway was installed in September OF 20015, the HM System has grown to where it can now provide global **Satellite-On-The-Move (SOTM)** for airborne, maritime, and land-mobile platforms and on-the-pause capabilities for users in the field.

Combining the open-systems, HM-series airborne modems with the MEO, mPOWER, and GEO satellites, government users can maintain communications in more complex environments and conduct missions in contested and congested environments with uninterrupted connectivity — all of which we like to call, ‘*secure connectivity, anytime, anywhere, any comms.*’

To learn more about the recent tests conducted by SES and Hughes, [select this direct link...](#)



Artistic rendition of the SES O3b GEO constellation, courtesy of the company.

## GOVERNMENT SATELLITE REPORT (GSR) #2

### SUPPLEMENTING MILITARY X-BAND WITH A FLEXIBLE, MANAGED SERVICE — TACTiXS

Author: Ryan Schradin, Editor, GovSat

[SES GS](#), [Network Innovations](#) and [GovSat](#) partnered to recently introduce [tactiXs](#), a new X-band and military Ka-band volume-based managed service that will make mission-specific, military-band satellite capabilities available to the U.S. Government and its Alliance partners.

The partners will leverage Network Innovations’ long history of providing global managed satellite services to introduce this new solution that will make commercially-provided X-band and military Ka-band capacity available to the military on-demand — when and where it’s needed within the reach of GovSat-1.

In advance of the official launch of [tactiXs](#), GSR sat down with Patti Aston, a Senior Director at SES Government Solutions, to talk about the new service and why it’s an important new tool for the military. Here is what she said:



Patti Aston

Government Satellite Report (GSR)  
How is military X-band different from commercial Ka and Ku band?

Are there benefits to X-band for military satellite communications?

**PATTI ASTON**

X-band frequencies are more robust than Ka and Ku-band frequencies – which are what most commercial operators provide. The major benefit of X-band is its resistance to interference. The satellites are set further apart, so the adjacent satellite interference is mitigated. Also, the frequency band is better for mitigating rain fade. Ka and Ku are not as resistant to rain fade, which can create mission assurance concerns for the military. Rain fade is caused when the terminal on the ground can’t “see” the satellite on orbit because of clouds, rain, snow, sleet, or other environmental factors. This creates a situation where the signal fades and the terminal can’t transmit to the satellite.

Consumers of satellite television are probably very familiar with this — as they’ve most likely lost service or experienced pixelation in bad storms. Finally, X-band users are typically more highly trained and less likely to accidentally create interference.

With X-band available to only government and military users, terminal operators know how to access that capacity responsibly. That can’t always be said about other satellite frequencies. These things all contribute to X-band being considered more reliable – or more mission-assured for critical operations. And when the lives of tactical operators and warfighters are on the line, the military doesn’t want to take the chance that there could be interference or signal loss.

*If X-band is considered more reliable for military use, why aren't all military communications sent over the X-band WGS satellite constellation? What limitations exist within the WGS constellation?*

## **PATTI ASTON**

There are a couple of reasons why the military may look outside the X- WGS constellation for satellite communications and connectivity. But the biggest reason is available non-preemptible capacity. It can be difficult for a mission to get X-band capacity on the WGS constellation because of the demand.

There is also a hierarchy within the military that is often reflected in which mission gets access to WGS capacity. Some missions have priority. For example, enabling communications for a special forces' operation would take priority and capacity away from a testing or training mission.

Another factor is the time required to obtain access to the WGS satellites. From request to access can take weeks or even months. Often missions need immediate access to capacity and will turn to commercial operators for that access.

For mission-critical communication, WGS is terrific — but only if the warfighter and mission take priority and get access to it when they need it. Typically, if another, higher-priority, mission comes along, that warfighter or mission may get preempted and they won't have connectivity at all.

*SES and the Government of Luxembourg launched GovSat-1 to provide a commercial X-band alternative – effectively a commercial military satellite. Why is this needed? How can this help the military?*

## **PATTI ASTON**

By making a military band satellite available through a commercial operator, we can eliminate the potential of preemption. When a mission is contracted on a commercial satellite, that mission will always have the connectivity and capacity it needs, no matter what else is happening.

This is especially important if that satellite offers coverage in a region with a large military presence or where there are multiple military operations or missions being conducted.

GovSat-1 covers Europe, Middle East, and Africa (EMEA). That region is particularly important to the U.S. Government and its Alliance partners. In the EMEA region, our Government — and other Allied governments, including NATO members — need access to communications with the same amount of security and mission assurance as the WGS satellite constellation. But they also need that access to be reliable and not get preempted by other users or missions.

GovSat-1 ensures that secure, X-band satellite communications and capacity are there for them in one of the most active areas of operation on the planet.

*Recently SES announced the launch of a new service called tactiXs. How is this service new and different from other commercial satellite managed services on the marketplace?*

## **PATTI ASTON**

tactiXs is the only commercial satellite managed service available to the military that offers X-band satellite capacity on an as-needed volume-based basis. Essentially, by making capacity on GovSat-1 available as a short-term managed service, tactiXs enables the military to access X-band capacity specifically tailored to the mission in which communications are needed.

*How does tactiXs change the way the military can access the GovSat-1 satellite and benefit from its capabilities and capacity?*

## **PATTI ASTON**

With tactiXs, if a military contracting officer needs to deliver a specific amount of X-band connectivity and capacity to the EMEA region for a specific amount of time, they will be able to purchase and deliver just what is needed to the warfighter within hours. This gives the military user tremendous flexibility and agility. They now have on-demand access of X-band capacity on an as-needed basis. And they don't have to buy the capacity on a long-term basis. Since this is a managed service, they also don't have to provide the ground infrastructure. The ground stations and teleports — everything necessary to enable access — is provided for them.

*What military use cases can you anticipate for tactiXs? What kinds of missions could tactiXs help to support?*

## **PATTI ASTON**

Candidly, all of them. Special operations, covert missions, missions in which warfighters have to drop into an area discreetly and receive or send data securely. Any mission that requires military X-band capacity that won't be preempted. Any mission that needs the security of X-band satellite communications from a trusted industry partner — and they need it right away. Any time assured communications are essential and mission-critical for the warfighter, tactiXs is a valuable resource.

There is also the ability to serve missions like training, testing, and airborne training missions. These are missions that require small amounts of connectivity for short periods of time. They're also the missions that are most often preempted on the WGS satellite constellation. tactiXs is an incredible solution to meet the connectivity requirements of these missions without waiting or for the military having to over-buy bandwidth.

*What will the military need to do to access tactiXs? Is there a long lead time or notice needed to use the service? Is new hardware needed?*

## **PATTI ASTON**

There is virtually no lead time needed as long as you have the terminal. However, it would be beneficial to have an agreement set up ahead of time. That way, if the military knows there is the potential to use the service, that mission-critical capacity is simply a phone call or email away. There is no special or proprietary hardware necessary to access the service. Military users simply need an X-band terminal similar to others already available and widely adopted across the military. We use the *Dialog* platform infrastructure, so there is a good chance that similar hardware has already been deployed into the field.

*To learn more about GovSat-1 and the military benefits of X-band satellite capacity delivered via commercial satellites, [select this link](#).*



**Ryan Schradin**

*Author Ryan Schradin is the Executive Editor of GovSat Report. A communications expert and journalist with more than a decade of experience, Ryan has edited and contributed to multiple, popular, online trade publications that are focused on government technology, satellite, unified communications and network infrastructure. His work includes editing and writing for the GovSat Report, The Modern Network, Public Sector View, and Cloud Sprawl. His work for the GovSat Report includes editing content, establishing editorial direction, contributing articles about satellite news and trends, and conducting both written and podcast interviews. Ryan also contributes to the publication's industry event and conference coverage, providing in-depth reporting from leading satellite shows.*

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# A CONSTELLATIONS CONVERSATION WITH...

LT. COL. GARY THOMPSON, SPACE SYSTEMS ARCHITECT, U.S. SPACE FORCE, AND BEN HILBURN, MICROSOFT AZURE, AND STUART DAUGHTRIDGE, CHAIR, DIGITAL INTERMEDIATE FREQUENCY INTEROPERABILITY CONSORTIUM (DIFI)



## DIGITAL TRANSFORMATION: INTEROPERABILITY, OPEN STANDARDS AND NEXT LEVEL FLEXIBILITY



From left to right: Stuart Daughtridge, Lt. Col. Gary Thompson and Ben Hilburn.

*John Gilroy: The first question is for Lt. Col. Thompson, the space systems architect with the U.S. Space Force (USSF) where he is working to advance U.S. government, commercial and coalition partner MILSATCOM capabilities as an integrated enterprise. There seems to be a growing desire for the U.S. military and commercial satellite ground systems to be able to operate together in a coordinated way. What's driving this?*

### LT. COL. G. THOMPSON

The need is being driven for many factors, including our operational needs for mission assurance and budgetary efficiencies for more effective use of available ground assets. Ground is a critical component to the end-to-end communications that U.S. forces and our allies rely on to perform their missions each day.

Many of the SATCOM services include connection to ground sites that act as gateways to move data across terrestrial links to destinations worldwide. Unfortunately, how we plan this end-to-end connect is often closed and inflexible.

Breaking this paradigm is important to ensure the next level of flexibility, which is the ability to transition between military and commercial space and ground systems independently and at the speed of need. This is a hard problem due to the way that many of these connections are currently developed, procured, planned and operated.

*John Gilroy: Standards often form the basis for ensuring that new technologies and innovations work together and that products from different companies will be mutually compatible. So, what role do you see open standards playing to make commercial and military ground systems more interoperable?*

*The views expressed in this article do not officially represent the views of the U.S. Military or the United States government. The appearance of U.S. Department of Defense, DoD visual information, does not imply, or constitute, DoD endorsement.*

John Gilroy — Host, Constellation

Welcome to Constellations the podcast from Kratos. We'll be discussing the challenges associated with interoperability and how industry can support the digital transformation of space and satellite with our three guests.

## LT. COL. G. THOMPSON

Standards are a key tenet of *MOSA*, or *Modular Open Systems Architecture*, which is a priority here to enact as guardrails to guide our programs to be more interoperable. This also helps to prevent vendor lock when applied to the right level of our architecture.

We need to develop standardized interfaces at our portfolio level, architecture that maps to lower level program or implementation architectures to meet our desired mission capability. These standards need to be open, and consensus-based, to truly reach *MOSA* ideals.

Our space systems architect engineering office has been participating in several consortia and groups to mature our approach for enterprise portfolio management. We are working with industry to incorporate best practices while minimizing the amount of changes needed in existing product lines, and facilitating the evolution of new product lines towards greater compliance with our interface standards.

*John Gilroy: Going a bit further, would simply complying with framework standards such as VITA 49 (VITA-49 is a generic packet-based protocol to convey digitized signal data and metadata pertaining to different reference points within a radio receiver) guarantee interoperability between a military and commercial satellite ground system?*

## LT. COL. G. THOMPSON

*VITA 49* plays an essential part in standardizing the underlying plumbing for interoperability at the IP transport layer. But interoperability at the data and application layers must also be built in. For this reason, at [Space Systems Command](#), we're working on flexible networking, cross mission, and interoperability standards to build on *VITA 49* in *DIFI*, in order to enable interoperability between military and commercial ground networks.

We envision user networks that can be easily moved between different ground antenna sites operated by different service providers. Our *MILSATCOM* capabilities include a significant number of heritage systems, so applying middleware overlays can help us move towards data fusion

sooner rather than waiting for a complete recapitalization of our terminals, space systems and ground segments. This approach allows us to harvest interoperability sooner and higher levels of mission assurance now. However, these are predicated on having defined in standards and interfaces. This also requires a retooling on how we plan and monitor these systems in providing their end-to-end connectivity.

Over the past couple years, we've done several demonstrations and have advanced standards for flexible terminals and *SATCOM* networking. In each demonstration, we were able to show a significant increase in our ability to detect where and why the end-to-end link broke and quickly restore to an alternate path. This knowledge, and having each appliance in the end-to-end connection become a sensor to provide critical data on the status of the mission traffic, is an important step to providing the user at the edge with the information they need to keep their link active.

This can't work if we treat each end-to-end connection as a single connection to move our data. Having standards, which enable us to quickly reroute our data over the full inventory of government and commercial, space and ground service providers, is a revolutionary advancement in our delivery of *MILSATCOM* services.

*John Gilroy: I heard the phrase "application layer," so, I'm tossing this over to Ben from Microsoft Azure where he is working on software radio and wireless in the cloud, including 5G and virtualized satellite communications. Ben, should open standards be applied to all elements of a satellite ground system, or are there certain areas where mandating standards could actually hinder competitive innovation?*

## BEN HILBURN

Yes, an interesting question. There are many benefits to open standards and interoperability standards. But in the context of this question, it's useful to think of two major ones. One is making technical development easier, and what's transparent to the larger system or a customer.



A second major benefit is in driving interoperability at the systems level. We start to think of things such as where is it useful to disaggregate a system. In a satellite radio system, for example, where you have some higher-level application level processing, or radio processing, is there value in that entire chain being from a single vendor, monolithic, and completely one thing that's inseparable? Or is there more value in disaggregating it such that you're able to pick the pieces from the vendors that are providing the best products along the way. There's all kinds of additional benefits that come with those questions.

In a disaggregated system, if you were able to upgrade the radio without changing the rest of the chain, for example, that allows you to do things such as accelerate your acquisition cycle and to accelerate your development cycle and build new capabilities. You don't have to think about the entirety of the system.

The question comes to where can we use standards such as this to drive innovation — where is the line where it hinders competition? That question is different system to system. But I really think it comes down to what is transparent to a system integrator or an operator, and where does it drive value for them to benefit from these interoperable disaggregated systems. That's kind of the dividing line that defines where you're hindering competition if you go further, because you do want to allow vendors to be able to build their differentiated IP within a block and monetize that.

*John Gilroy: In an ideal world, what are the use cases for interoperability standards?*

## **BEN HILBURN**

A great example is Ethernet, perhaps one of the most widely used, interoperable standards. Ethernet doesn't care what's on either end of a link. It doesn't even care if it's wired or wireless. Ethernet has created tremendous opportunity for innovation and technology advancement. It focused on creating a standard way for moving and understanding data, so that people building products or components that sit on either end of an Ethernet link could differentiate on what you do with that data and not to worry about understanding the data when they get it.

Ethernet's been around for a while, so a more recent example is the 5G community, **ORAN**, which is short for *open radio access networks*. In previous generations of cellular, the cellular operators were buying monolithic systems from the equipment providers... going back to the example in the previous question, about having to buy the radio and the modem and the processing all from a single vendor, that was really limiting what the operators could do. It was limiting acquiring new systems and upgrading systems. It added complexity to the maintenance of systems.

When 5G was being built, the industry said, *"This doesn't make sense anymore. We need an interoperable standard so that we can just buy a unit from the company that builds the best radio for my specific purpose and buy the processing from a different company that builds the best processing for my specific purpose."*

That industry has NOW rallied around ORAN and is fundamentally shaping the direction of 5G. ORAN IS used both commercially and in government, so it's another great example of A successful application of interoperable standards.



*John Gilroy: What exactly is VITA 49 and the relationship to DIFI?*

## **BEN HILBURN**

VITA 49 is often thought of as a standard interface. That's not really accurate. VITA 49 is more like a framework for building interfaces. It got a bad rep because lots of different vendors would produce equipment that they claimed was compliant with VITA 49 and none of them would work together, which kind of breaks the promises of interoperable standards.

VITA 49 isn't a specific interface, but a way of creating interfaces. You'd have vendors creating VITA 49-based interfaces, but they all looked different, so you'd end up with a customer that would buy some piece of processing that ingested VITA 49 and some piece of hardware that produced VITA 49 and they couldn't work together. That's exactly where DIFI lands. DIFI is based on VITA 49, but you could think of it as a VITA 49 schema, a specific implementation of a VITA 49 interface designed to support virtualized satellite communications in the ground segment. VITA 49's been around for a while and so it allows us to benefit and leverage a really broad ecosystem of VITA 49-based technology and IP and vendors that already exist to solve interoperability for virtualized communications in a way that is going to be really impactful.

*John Gilroy: If VITA 49 has been around since the early 2000s, and DIFI is relatively new, then I have some questions for Stuart, the chairman of DIFI. Stuart, what is the status of the DIFI organization?*

## **STUART DAUGHTRIDGE**

The DIFI organization published its 1.0 version of the specification at the close of August last year and, since then, the response from the industry has been fantastic.

We've had steady growth with new members joining every week as well as excellent support from the U.S. DoD. What really counts for a standard is going from a document to adoption. We've had steady downloads of the specification from our website by more than 60 different organizations.

The 1.0 specification has already been made a requirement in a recent U.S. Army RFI, which is exciting. And now our working groups are starting the management of the standard itself and to consider new standards that would help the industry go through a digital transformation. In the near future, we hope to be able to provide a free certification capability to the industry for self-certification, along with a third-party certification program.

*John Gilroy: What are the long-term goals for the DIFI organization?*

## **STUART DAUGHTRIDGE**

We formed the organization to help enable the digital transformation of the satellite industry. The first step in that digital transformation is digitizing the IF infrastructure. We realized that wasn't going to happen without a digital IF standard.

Analog frequencies, IF frequencies, provided a natural interoperability that's lost once you go digital because there's lots of different ways to stuff bits into a packet. When we looked to create the standard, we realized it wouldn't be adopted unless it was simple and easy to adopt and pretty much non-threatening to the vendor community.

That's what we focused on with our initial DIFI digital IF standard for that first step. We also think there's lots of other areas around the digital architected system where standards could be of value — we'll be focusing on those areas as we progress forward.

*John Gilroy: With everything going to the cloud and digital transformation, how will this impact the satellite industry?*

## **STUART DAUGHTRIDGE**

Great question. Digital transformation is going to have huge impacts across the entire industry. I'll answer that with a couple of examples. The first has already happened, and that's basically enabled '*ground system as a service*' for the *Earth Observation (EO)* market.

As little as five to ten years ago, if you put up an EO satellite, you had to consider building out your own ground infrastructure and that would require significant capital expenditure, as well as recurring operations costs. However, now, with the availability of software modems and cloud compute capabilities, it's enabled an entire '*ground system as a service*' industry that can provide better coverage, excellent performance and even help get your data turned into products faster than custom-built ground systems, all for a very nominal pay-as-you-go pricing model.

They can do that because they're able to amortize the costs of the system across multiple satellite operators. This is a significant change to the cost structure required to start an earth observation satellite business. This has had a huge impact on that part of the industry.

Another example is with respect to ground system architectures. If you looked at a block diagram of how satellite ground systems were built from the mid-1970s and how they are constructed today, they would look basically the same — it hasn't changed much. With a digital infrastructure, once you digitize as close to the antenna as you can, it enables a multitude of new architectures. You're now able to use general compute and IP routing to replace your L-band plumbing and your signal processing so you can disaggregate your architecture and optimize it for the service you're providing.

A third example is the impact on remote terminals. Currently, remote terminals are somewhat built around the modems that they integrate with — that's because modems come from different suppliers and they don't come in a standard size, shape or with standard interface points.

But in the future, terminals will not come with modems. What they'll come with is generic compute packages and the modem will be a software application that can be loaded into the generic compute along with other applications.

Think about what that means. If you're the terminal supplier, it greatly simplifies your offerings as you won't need a different model antenna for each modem.

If you're the terminal buyer, it greatly expands your supply chain because now any terminal can be compatible with any modem. Maybe most important of all is to think about the terminal user. They can now load up any modem they need and connect the terminal to any satellite or any network that's available with that same terminal.

Consider the flexibility that creates, and then consider what if the terminal could be a flat panel antenna that could support multiple beams. That just adds a whole other dimension of flexibility.

Or think about a MILSATCOM application where you could use the same terminal one day to support a COMSATCOM application, and then the next day use it for a highly secure MILSATCOM application just by loading different application software into it to go from a commercial mode to a highly secure MILSATCOM mode. Digital transformation's going to have impacts across the entire spectrum of the industry and open up new applications and opportunities that we've not even begun to consider.

*John Gilroy: It certainly sounds as though disaggregation unlocks flexibility. These are going to be exciting times in the next few years.*

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# PROLIFERATED ARCHITECTURE NECESSARY FOR FUTURE SATCOM

Author: Greg Hadley, Congressional Editor, Air Force Magazine

**When it comes to the U.S. Defense Department's plans for satellite communications, the Pentagon will need all different kinds of space architectures, two top Pentagon officials said during a Mitchell Institute for Aerospace Studies webcast on January 7th.**

David Voss, director of the Spectrum Warfare Center of Excellence at the Space Warfighting Analysis Center, and Stephen Forbes, Blackjack program manager at DARPA, addressed the need for proliferated architectures while discussing a recent Mitchell Institute policy paper, "The Backbone of JADC2: Satellite Communications for Information Age Warfare."

The paper, authored by retired U.S. Air Force General Kevin P. Chilton and senior analyst Lukas Autenreid, recommended that the U.S. Space Force (USSF) "distribute, disaggregate, diversify, and expand its SATCOM options," particularly by building out a constellation of Low Earth Orbit (LEO) satellites and linking them with laser communications to create a mesh network.

Such moves, Chilton and Autenreid argued, would complement DOD's current satellite systems, most of which are in Geosynchronous Orbit (GEO) and use radio frequencies (RF).

GEO satellites, Chilton said, are "incredibly capable, but they're incredibly vulnerable," quoting former Vice Chair of the Joint Chiefs of Staff Gen. John E. Hyten in calling them "big, fat juicy targets."

But that's not to say that GEO satellites don't have some value, Chilton and Voss agreed. Indeed, while Voss spent much of his early career working on small satellite (smallsat) LEO architectures for the Air Force Research Laboratory (AFRL), he said his perspective on the larger, more distant satellites has changed.

"I have come to really grow to appreciate and understand a lot of the value that GEO brings to the community," Voss said. "When you look at an information architecture as a whole, each of the orbits bring a value function that is nice to have at an enterprise level. And so, the ability to see the entire globe from GEO, as your paper highlighted, really was why we went there from the first point. It gives you an efficiency both within the networking architecture, and it gives you the ability to see a very large geographic area."

Similarly, analysts and observers have been warming to the idea of free-space laser communication, or lasercom, as key to future satellite communications due to it being faster and more secure than radio waves. In their paper, Chilton and Autenreid recommended that DOD use lasercom to link its LEO satellites, increasing coverage and resilience.

Yet, even as he touted the benefits of lasercom, Forbes said RF can't be abandoned.

"As soon as you start moving out of single-digit spacecraft, the ability to stitch them all together in a resilient communication mesh is going to be a critical enabler to overcome the threats and the challenges that we face and build a much less brittle architecture. And optical is a great way of doing that," Forbes said. "[But] it's not well suited for serving mass users. It is not well served for folks that have weather ... And that's why I also believe that, especially when you get out of the ... backbone class of the portion of the network, that RF will always have its place to serve the users."

The Space Development Agency (SDA) is currently in the midst of developing the National Defense Space Architecture, a constellation of satellites that will be used for tracking targets as well as missile warning, communications, data coverage and sharing, and other capabilities. As part of that, the agency has looked to procure dozens of satellites.

At the same time, the USSF has indicated an interest in using commercial SATCOM, as well. In developing its broader architecture, the Pentagon will need both, Voss said.

"This foundational layer — it's critical that it embraces the multi-orbit aspects that are highlighted [in the paper], that it takes advantage of the global perspective that GEO brings as well as the proliferative nature that LEO brings," Voss said. "This foundational layer [has] the natural inclusion of commercial capabilities within a diversified architecture. It gives us that path-agnostic capability that was identified, not only within a contested environment, just to the nature of the complexity of delivering these communications systems for either 5G or even future 6G applications."

The emphasis on using every available technology, orbit and asset available is necessary for resiliency, Chilton said. Based on their recent actions and developments, China and Russia will seek to disrupt the U.S.'s space-based communications in a potential future conflict, he predicted.

"I find it hard to believe, given that they've demonstrated the capabilities to reach those orbital altitudes with anti-satellite weapons, that our adversaries would not be planning on doing such to put themselves in an advantage in the area of operations where we're going to be fighting," Chilton said.

Beyond resiliency, though, a proliferated satellite architecture is also helpful for offensive capabilities, Autenreid said. As the Pentagon continues to develop its joint all-domain command and control concept to connect sensors and shooters more efficiently than ever, having different capabilities to meet different situations is critical, Voss added.

"I think that the challenge we're at right now as we're doing some of these big data analytics is, what is the recipe and how much of each do you need against that JADC2 problem, as you look up provisioning the various types of users across the different services?" Voss said.

Greg Hadley is the Congressional editor of Air Force Magazine. A graduate of the University of Notre Dame, he has more than five years of experience in national and local media, working for The State (Columbia, S.C.) and the McClatchy D.C. Bureau.



Greg Hadley

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# SPACE SYSTEMS COMMAND: SECURING SECURE COMMS

NEW IA-PRE PROGRAM SET TO IMPROVE VETTING PROCESS FOR COMSATCOM

Author: United States Space Force (USSF) Space Systems Command (SSC)

To keep up with the growing demand for commercial satellite services and also ensure these services are secure from adversaries, the U.S. Space Force (USSF) is introducing a new program, IA-Pre, that will strengthen its cybersecurity posture and also make it easier for commercial industry to do business with the military.

USSF's **Commercial Satellite Communications Office (CSCO)** has been in business for more than 25 years, said CSCO Chief, **Clare Grason**. Previously, the office was under the **Defense Information Systems Agency (DISA)** and is now in the process of transferring to the USSF. The office has about 100 people, including civilian, military and contractors and is charged with acquiring all commercial SATCOM services for the **U.S. Department of Defense (DoD)**.



Clare Grason

CSCO is organized into two business units: the **Enhanced Mobile Satellite Services** program, which includes services provided by **Iridium Satellite LLC**, and the commercial SATCOM solutions program office, **Grason** said.

"We're in essence a broker for both programs; regarding the EMSS program, we have the world's largest family voice and data plan," **Grason** likened. "It's unlimited voice and data on the Iridium system for an unlimited number of users or devices. We're operating as a mini telecommunications company, but sealed with DoD security

procedures — we aggregate all the costs of doing business and we recover those costs by levying a rate upon our customers."

"CSCO has the sole authority for the procurement of commercial satellite communications for the DoD, but also supports other federal agencies, some allied foreign military clients and NATO. The contracts vary in length and complexity," **Grason** said. "Currently, there are more than 200 active contracts amounting to an estimated \$5.2 billion lifecycle portfolio, or approximately \$800 million of commercial SATCOM services per year."

CSCO is a reflection of how the military has transitioned from purpose-built systems — designed specifically for, and built by, the military — to incorporating more commercial industry partnerships. Such partnerships help provide the military with the latest and most innovative technology and resiliency; at the same time, government contracts can give emerging companies a solid foundation as they continue to grow, strengthening the industrial base for critical technologies and helping to support competition in markets that might otherwise stagnate due to high cost-of-entry barriers.

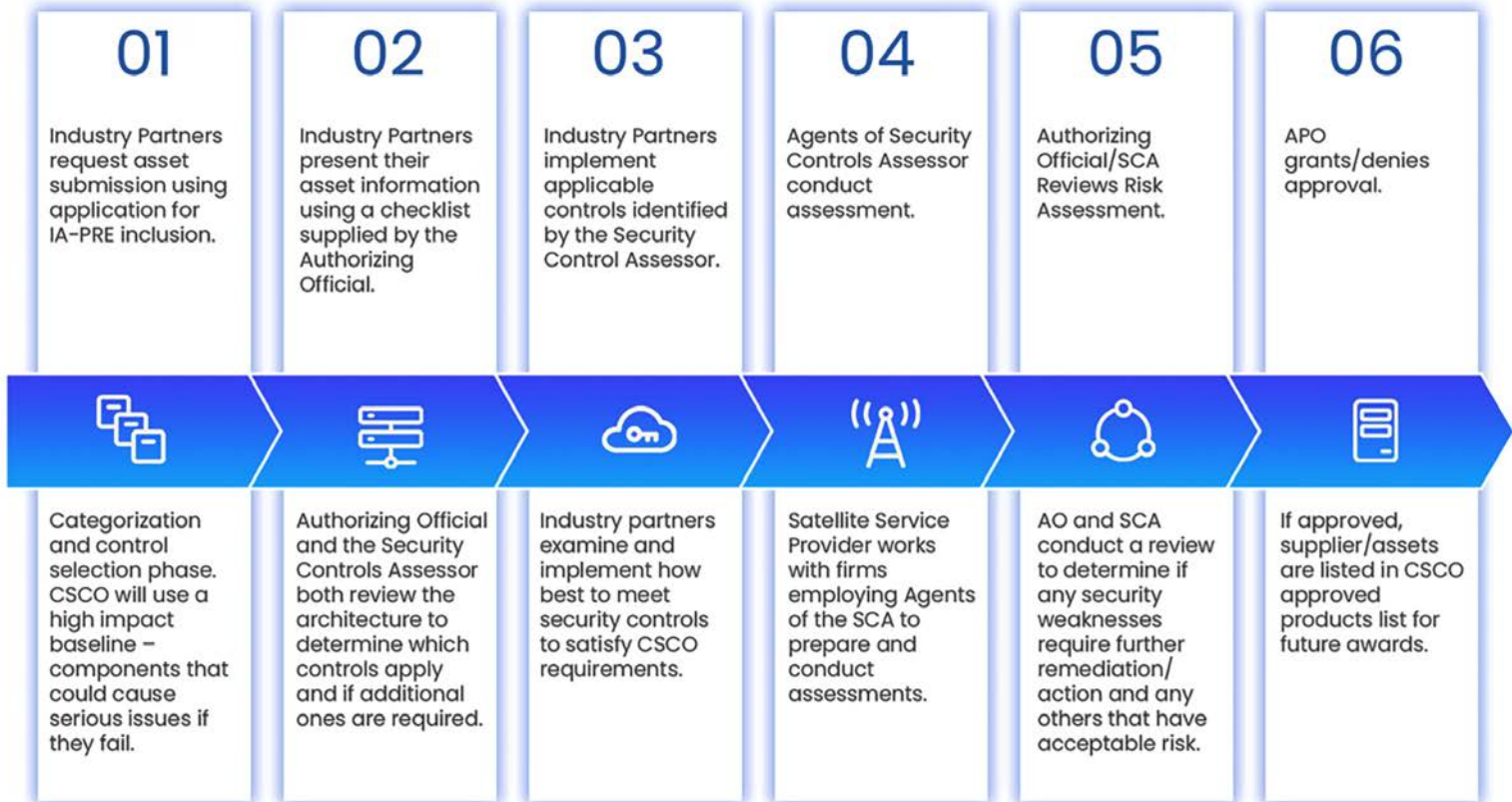
"The more systems and capabilities we can leverage, the more resilient our architecture becomes, and it becomes more difficult for our pacing challengers to disrupt or dismantle our ability to complete missions," **Grason** said. "We've also seen a steady increase in demand for commercial SATCOM through the rapid innovation that the industry is laying out," **Grason** said. "They can be less ham-strung by



SPACE SYSTEMS COMMAND



## Infrastructure Asset Pre-Approval Process



**The Commercial Satellite Communications Office is rolling out a new program: Infrastructure Asset Pre-Approval, or IA-Pre. This new program will develop an “approved product list” of COMSATCOM assets with cybersecurity posture scores based on standard U.S. government requirements, reducing administrative burdens to both U.S. government and industry partners.**

bureaucracy that some MILSATCOM or purpose-built programs are tied to, and they're able to get capabilities rolled out faster, and the technologies are acceptable to our user community for a wide range of use cases.”

“Private industry is investing in enhanced security mechanisms in a way they haven't been in the past,” **Grason** added. “In many cases, there needs to be only modest investments from the government in order to obtain the security conditions we need. They're able to get it to market quickly, and adapt solutions in an efficient manner.”

In a similar fashion, USSF is working to make it easier for these companies to work with the military. The **Infrastructure Asset Pre-Approval Program** is a new program within CSCO being rolled out this year, with the goal of developing an “approved product list” of COMSATCOM assets with cybersecurity posture scores based on standard U.S. government requirements and to enhance commercial asset security posture, reducing administrative burdens to both U.S. government and industry partners.

“SATCOM is its own entity — it's critical infrastructure,” said **Jared B. Reece**, manager of the IA-Pre program within CSCO. “People don't think about how much of their data or what they do on a regular basis relies on satellite services – every component of the defense industrial base relies on SATCOM as a capability to the reliance of tractors and large agricultural companies on GPS and satellites.”



Jared B. Reece

IA-Pre will replace a self-assessment process in which contractors submitted their requested system information to CSCO through a questionnaire for evaluation during the acquisition process. One drawback to this system was that contractors often found themselves submitting the same information, over and over again, every time they bid on a contract.

Under IA-Pre, industry partners will work with a third-party assessor to complete an assessment of their submitted assets against the established cybersecurity baseline for that asset, **Reece** said.

“Industry partners will have to prove that they do, in fact, meet the intent of baseline controls for this program, and that evaluation is sent to us to review, in submission with their asset,” **Reece** said.

“This will greatly enhance the cybersecurity of these systems,” **Reece** said. “We established a new baseline for commercial SATCOM because the need and use cases for COMSATCOM have changed dramatically over the last decade. Establishing a new baseline was critical in getting a greater understanding of the mission.”

“It really gives industry an idea of what we want from a cybersecurity perspective, what to shoot for within their company if they want to compete for government contracts,” **Reece** said. “So often, DoD tries to marry DoD policy to commercial systems, but what this [IA-Pre] does is basically create a policy designed for commercial systems in use by the DoD.”

Previously, cybersecurity was rated on a pass/fail basis. With IA-Pre, if an asset is not in compliance, the contractor can submit a *Plan of Actions & Milestones (POAMs)* that will allow them to use other methods to become compliant or provide mitigations to achieve an acceptable level of residual risk.

The program emphasizes on-site assessments for verification of cybersecurity compliance using third-party assessors certified and licensed by the U.S. Space Force Security Controls Assessor, Reece said.

The *U.S. Space Force Authorizing Official (AO)* will review the company's cybersecurity assessment results for approval, Reece said. CSCO then will place the industry partner and the assessed assets into an approved platform list. That way, the company will no longer require a cybersecurity evaluation prior to the award of a contract for covered assets.

IA-Pre also contains provisions that may make it easier for small businesses to compete for these contracts, Reece said. Under the old system, a larger, "prime" contractor would have to consolidate security information that would then be submitted as part of their proposal. This could potentially expose small businesses to proprietary methods used by other companies to secure their assets and they would require non-disclosure agreements to be signed between the parties to protect that information.

Under IA-Pre, that proprietary information is released solely to the government under IA-Pre and not to a potential competitor.

Asset owners allowing resale of their product who have approval under IA-Pre will only be required to submit their asset ratings through the prime, instead of proprietary information.

Due to the varying lengths of contracts and their expiration dates, IA-Pre should be fully installed by 2025, Reece said.

**Grason** said she doesn't think commercial SATCOM will ever totally supplant MILSATCOM. "The government should always have assured access and command and control but I do think we're being savvy in how we incorporate commercial SATCOM through our partnerships with companies and what we're looking at."

"One of the things the office is looking at is setting up strategic contracts that don't just enable customers to buy a service, but also influence and take control over a capability," **Grason** said. "For example, a commercial company could send up a satellite constellation, managing those satellites as a network within a network. A government agency could then have access to a subset of those satellites and operate those independent of others."

"It would give us unprecedented access and control over a system in a way we haven't had before," **Grason** said. "It's not an uncommon way of doing business on the terrestrial side – think of fiber-optic cables via long-term leases with the carriers. It wouldn't replace our primary way of doing business, but would offer another really creative model to buy greater access and autonomy than we have today."

"If commercial industry can build it, bundle it into a capability that can be acquired as a service, it takes away an administrative burden for the government," **Grason** said. "We're trying to structure our contracts to help with that."

"Under the leadership of Col. **Albert Olagbemiro**, the new Commercial Services Offices (to include CSCO) will be looking into acquiring commercial services for a variety of other services, from tactical ISR (intelligence, surveillance and reconnaissance) to commercial weather services and situational awareness data," **Grason** said. "This is a great thing for the U.S. Space Force because you have an office that is singularly focused on commercial technologies."

Companies interested in learning more about IA-Pre can contact

**Reece** at [disa.meade.ns.mbx.comSATCOM-iapre@mail.mil](mailto:disa.meade.ns.mbx.comSATCOM-iapre@mail.mil)

*Space Systems Command is the U.S. Space Force field command responsible for rapidly identifying, prototyping and fielding resilient space capabilities for joint warfighters. SSC delivers sustainable joint space warfighting capabilities to defend the nation and its allies while disrupting adversaries in the contested space domain. SSC mission areas include launch acquisition and operations; space domain awareness; positioning, navigation and timing; missile warning; satellite communication; and cross-mission ground, command and control and data.*

Contact Space Systems Command at [SSC@spaceforce.mil](mailto:SSC@spaceforce.mil) follow on [LinkedIn](#).

### **U.S. Leads in Satellites, But Other Nations Working to Catch Up**

*The United States has the largest number of satellites on orbit of any other country in the world, but other nations – including China and Russia – are working to catch up.*

"For a time, only the most resource-centric countries – the U.S. and the then-Soviet Union – had the wherewithal to build these types of assets," said **Stephen Pluntze**, executive director of Space System Command's (SSC) International Affairs Office.

"Driven by Cold War realities, we had to develop rockets, develop satellites and figure out how to run the ground systems," **Pluntze** said. "Then create master command-and-control and analyze the data – none of which had been done before, by anyone. Space is such a broad force multiplier: it enhances all the capabilities you have on the ground, on sea and in the air and makes them stronger."

But now other countries are working to catch up to the United States in terms of space capabilities and numbers of satellites, said **Kevin Mattern**, technical director for the Intelligence Directorate at SSC.

"There are three main reasons why: there are economic opportunities in space; there is the national pride of being a space-faring nation and in having the technology to become an independent space-faring nation; and also strategic reasons – space enables many other military operations," **Mattern** explained.

"The first thing to remember is, it's OK and it's understandable for the other nations of the world to catch up to the United States," **Pluntze** said. "As they make progress and we can make them our partners, we then become a much more powerful unit."

"The countries that we partner with in space are not going into it blindly – they understand the idea of a space coalition: a group of like-minded nations that creates capabilities that work together," **Pluntze** said. "And when we partner we want to work together from the beginning," – we call that 'Allied by Design' in the International Office."

According to the Union of Concerned Scientists, as of September 2021, there were a total of 4,550 operating satellites in space. More than 3,000 defunct satellites also continue to orbit the planet. Of the active ones, the United States had the most active satellites – nearly 2,800 – followed by China with more than 430, Russia with close to 175 and the rest of the world with more than 1,100.

Most of these satellites — 3,790 — operate in Low Earth Orbit (LEO). There are an estimated 139 satellites in Medium Earth Orbit (MEO), 56 in elliptical orbits and 565 in Geosynchronous Orbit (GEO).



**Stephen C. Pluntze**

"Since 2018, the mega constellations driven by commercial interests have added large numbers of spacecraft," said **Roberta Ewart**, SSC Chief Scientist. "If mega constellations actually populate to their envisioned numbers, this could be upwards of 60,000 low Earth orbit entities."

"These increasing numbers will naturally lead to a discussion about the ability to track, conduct collision avoidance and, on a larger scale, coordinate numerous systems devised by different entities," Ewart said. "I believe we have the technology to do these tasks, but lag in the policy to create norms of behavior."

Most of the operational U.S. satellites are commercial satellites. A 2018 report from the National Air and Space Intelligence Center (NASIC) broke down the composition of space assets down even further, finding that most of the active satellites were communications satellites from 45 different countries, with the United States accounting for nearly half of these, followed by China, Russia and the rest of the world.

Thirty-eight countries fielded the next-largest category, satellites dedicated to intelligence, surveillance and remote sensing. The United States had more than half of these, followed by China, Russia and the rest of the world.

Only six countries fielded navigation satellites and while the United States had the most, Russia and China were not far behind

Pluntze said it's not hard to see why certain types of satellites dominate in numbers. It all comes down to which missions are a priority to a nation. Communications satellites, which allow people to speak to anyone, anywhere on the planet, almost instantaneously, are tremendously important, particularly from an economic standpoint.

Intelligence-gathering outweighs navigation if GPS is readily available for free. However, Mattern noted, "The world has been relying on GPS, but China, Russia and the European Union have developed their own to be less reliant on the U.S. system."

Nearly a third of the scientific, technology development or other satellites belong to the United States, followed by China and Russia, according to the NASIC. A total of 38 countries fielded satellites in this category.

Pluntze said there's a distinction between being a space-faring nation and a space-capable one. While the European Space Agency has 22 member nations, only the United States, China and Russia have sent humans into space.

"Smaller nations that are space-faring but not space-capable are going to be relying on partnerships," Mattern said. "But there are more launch opportunities, both at a governmental and commercial level now than there's ever been, and competition in the commercial sector drives innovation and drives down costs."

"Advances in technology have reduced the cost of space capabilities to the point that more nations can be space-faring vs space-capable: they can pay someone to build a satellite and launch it," Pluntze said. "There are probably no universally recognized definitions of either term, and in reality it's a sliding scale."

"Having the expertise in your own country to manufacture satellites and launch vehicles and the national desire to do so, that would be the space-capable end of the scale," Pluntze said. "Many countries are on their way from one end to the other. But more countries are joining both of those clubs. You're also seeing a democratization of space with the proliferation of launch opportunities, both rideshare and dedicated, as well as the emergence of on-orbit servicing and smallsats providing military utility."



**Roberta Ewart**

"You've heard USSF leaders say 'Space is hard' and it is – it's a very unforgiving environment and if you do launch a satellite and it breaks, you can't get it back," Pluntze said. "You have to be very deliberate about the planning, creation and operation of your space resources. But any successful technological development is a source of pride and with technology increasing and the expense coming down, more countries are going to be willing to take a chance on it."

"I think what we're seeing is a wide breadth of space capabilities being developed and operationalized, in all sectors from commercial to military needs," Mattern added. "The space environment is proliferating at a great pace as more space-faring nations are becoming more and more capable in terms of launch and space services."

"The definitions matter," Ewart said, because they can affect policy. What once was 'independent' often implied having capabilities in four segments of a space system of systems: ground segment, user segment, launch segment and space segment. It is possible the definition is evolving to now be interpreted as capability in a few or possibly one of those four segments."

"This evolution of the definition will have effects on our policy efforts, including interactions at the United Nations," Ewart continued. "Any stakeholder wants to influence the environment in which they operate, but for space, this environment is changing more quickly than we as a world are used to devising norms."

Work is currently underway by the United States and its allies on establishing international standards of behavior in space, but in all likelihood a final version won't be completed for at least several years, Ewart said.

"How 'sloppy' can someone be in space and still be allowed to operate?" Ewart said. "Who gets to make that decision?"

"Our capabilities are pretty good, we continue to improve them all the time, and we bring partners into the mix, so our capabilities – especially as a partnership community – are still very formidable and as long as we keep practicing together and improving together, our space capabilities will stay cutting-edge," Pluntze said.

**Want to learn more about space assets on orbit?**

**Check out these resources...**

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[The Union of Concerned Scientists' Satellite Database](#)

[National Air and Space Intelligence Center— Competing in Space](#)