

Next Generation Space Defense

# MILSATMAGAZINE

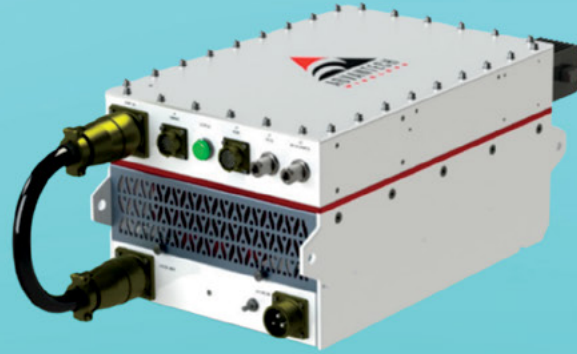
April 2023



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## Introducing **GENESIS** - the new series of Ku-band SSPAs and BUCs from Advantech Wireless Technologies.

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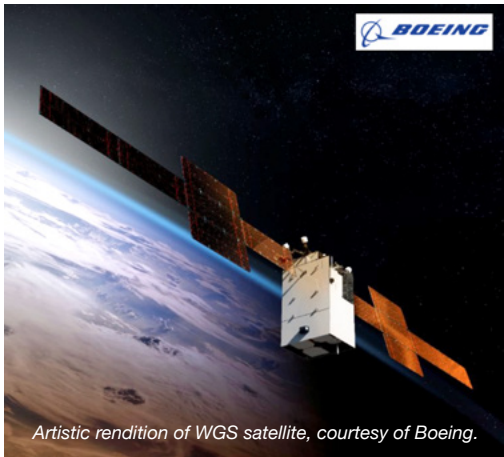
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# DISPATCHES

*New member of Intellian's family of WGS terminals intro'd*



***Intellian Technologies Inc. has unveiled their ARC-M4 Block 1 terminal that provides simultaneous X- and military Ka-bands, plus all commercial Ka-, and this Block 1 marks the next extension of Intellian's [Wideband Global SATCOM \(WGS\)](#) certified products.***



*Artistic rendition of WGS satellite, courtesy of Boeing.*

WGS is a high-capacity **United States Space Force** satellite communication system, developed by the **U.S. Department of Defense (DoD)** and now includes partnerships with Canada, Australia, The Netherlands, New

Zealand, and other member nations. WGS Phase 1 testing has been completed and the terminal is expected to be approved for use on the WGS constellation by Q2 2023.

Intellian's ARC-M4 Block 1 is a tri-band terminal for X-band, MIL Ka-band and ultra-wide 2.5GHz commercial Ka-band networks. Naval customers can use simultaneous X-band and Ka-band transmit and receive when operating on a WGS satellite, giving unprecedented layers of resilient connectivity and throughput for mission critical operations.

ARC-M4 stands for Advanced Resilient Communications, Multi-mission, multi-role, multi-band, and multi-orbit. It's designed for operation on LEO, MEO, GEO and HEO satellite orbits.

Built as a follow on terminal to the [Intellian's v130NX PM Dual Ka Block 0 terminal \(AN/USC-73\)](#), the ARC-M4 Block 1 was developed with a "family of terminals" concept in mind keeping the importance of common CONOPs, common doctrine, ILS, sparring, and preventative maintenance across different antenna types and mission sets. The Block 1 incorporates the *Intelligent Mediator 8* enabling users to electronically switch between waveforms, frequency bands, constellations, and orbits.

The ARC-M4 family of terminals are all designed to support full SATCOM shipboard automation through the implementation of Intellian's ground-breaking Orchestra — the first, Naval policy-based, connectivity management suite.

Orchestra is a 3-tier connectivity policy creation, enforcement, and management system designed for high-intensity mission-critical and highly complex shipboard environments. It alleviates the need for manual intervention to swap frequencies, constellations, waveforms, or orbits in order to maintain connectivity.

The ARC-M4 family of terminals are commercially off the shelf and available now in volume production. Orders are being accepted for CY 2023 delivery for both v130NX PM Dual Ka Block 0 and ARC-M4 Block 1.

*"Intellian collaborated closely with the US Navy to develop the ARC-M4 family of terminals. The Block 1 terminal is the first simultaneous X- and MIL Ka-band terminal to have ever undergone the WGS Certification process. We're delighted to be unveiling this new technology at Satellite 2023 because we understand how valuable this family of WGS terminals can be for our US Naval customers but also the impact these systems will have on all US-allied Global Navies." — Sam McKee, General Manager + VP of Sales for Intellian USA*



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CPI is a global industry leader in designing state-of-the-art ground station antenna and astronomy systems, successfully delivering professional turnkey installations, routine maintenance programs, upgrades, refurbishments and integration services.

CPI Antenna & Power Technologies

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# DISPATCHES

## Curtiss-Wright Defense Solutions delivers defense grade security solution



**Curtiss-Wright's Defense Solutions division has shipped their first, integrated, defense grade security solution to a leading defense system integrator for use on a U.S. defense platform.**

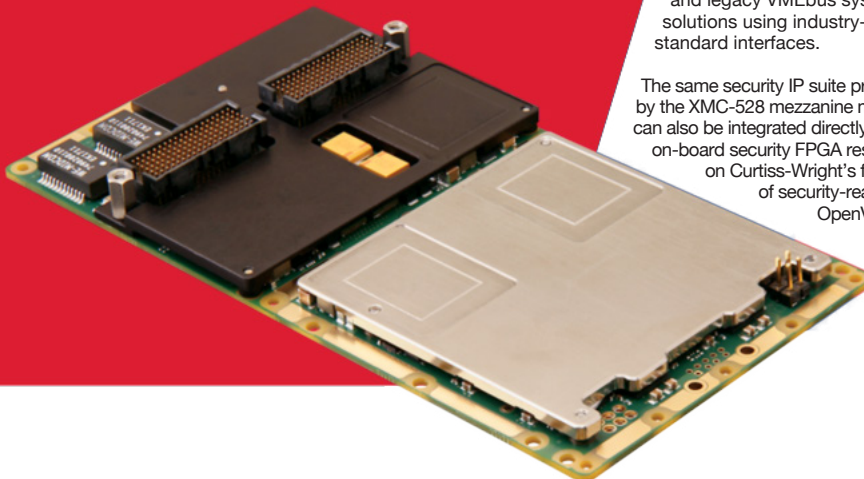
The fully tested, proven solution includes a suite of IP from best-in-class third-party embedded security developers.

This milestone highlights how Curtiss-Wright's enhanced **Trusted COTS (eTCOTS™)** technologies enable customers to more quickly and cost-effectively add state-of-the-art security protection to an existing system within a **Department of Defense (DoD)** end state application.

Curtiss-Wright's eTCOTS also provides an ideal solution for system designers seeking to rapidly address defense grade security requirements for FMS programs.



### XMC-528 Xilinx Zynq Ultrascale+ Quad-core Arm A53 Secure Mezzanine



Curtiss-Wright eTCOTS solutions bring advanced defense grade security to MOSA based systems. For example, the XMC-528 Mezzanine Card, an XMC form factor (VITA 42/61) mezzanine module speeds the integration of advanced security IP into OpenVPX™ and legacy VMEbus system solutions using industry-standard interfaces.

The same security IP suite provided by the XMC-528 mezzanine module can also be integrated directly into the on-board security FPGA resident on Curtiss-Wright's family of security-ready OpenVPX

modules – such as the CHAMP-XD3 3U digital signal processor card and select products in Curtiss-Wright's upcoming high performance **Fabric 100™** range of SOSA Technical Standard aligned modules for 3U and 6U embedded computing systems that feature a **100GbE Data Plane** and **PCIe Gen4 Expansion Plane**.

Traditionally, defense-grade security solutions have required custom hardware to protect the system. Curtiss-Wright's eTCOTS solutions offer an alternative MOSA-based approach that provides customers with secure embedded processing faster and at less cost than the traditional custom approach.

eTCOTS leverages the latest innovations from leading suppliers of defense-grade security to the DoD market and provides the necessary infrastructure on select processor modules to enable the hosting of the IP from these partners and provide users with the exact level of defense-grade security they require. eTCOTS uniquely enables security IP to be added at any phase of the program to support changes in Security Policy.

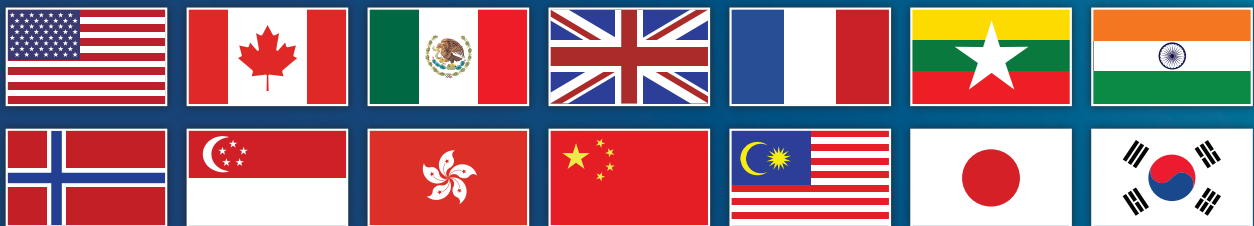
*"We are very proud to announce that we have delivered our first fully integrated defense grade security solution to satisfy critical security requirements for program protection on DoD systems. This important milestone provides a great example of the value of our enhanced Trusted COTS approach, which leverages leading third-party partner IP to bring advanced security capabilities to the warfighter."  
Chris Wiltsey, Senior Vice President and General Manager, Curtiss-Wright Defense Solutions.*



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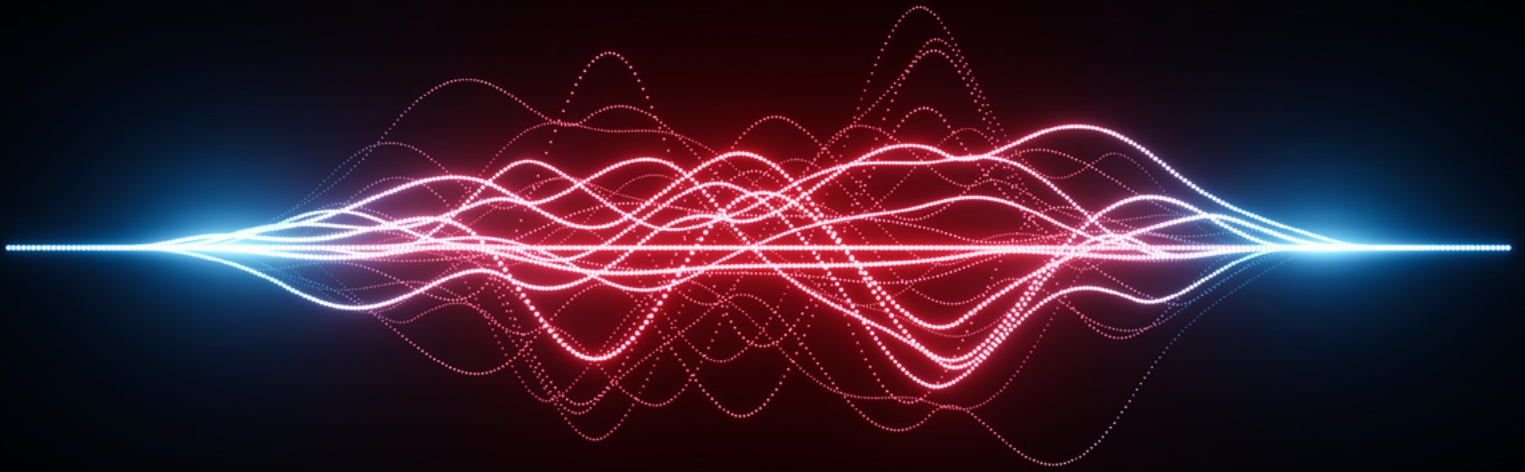


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# SIGNAL EXCISION TECHNOLOGY VITAL TO ENSURING CRITICAL MILSATCOM

Author: Karl Fuchs, iDirectGov Senior Vice President of Technology + MilsatMagazine Senior Contributor

**A growing concern for military and government SATCOM users exists with radio frequency (RF) interference and jamming in satellite communications (SATCOM). With increasing spectral usage and frequency overlap, jamming incidents have become commonplace.**

Add to this picture *Low Earth Orbit* (LEO) satellite constellations and 5G terrestrial players, and there is a growing number of jamming incidents occurring to the SATCOM landscape.

Military communication systems have a double threat — not only do they need to deal with rising congestion, but ever increasingly, more sophisticated direct jamming attempts are happening to outright deny communications. These interfering signals can be intentional, such as adversaries attacking military communications by signal jamming, or through unintentional interference.

There has been a great deal of effort spent in recent years on concepts such as path diversity and resilient waveforms. Although these techniques can be helpful, they have been designed on the singular idea of avoiding interference, such as using an alternate path to avoid interference or hopping to frequencies with the hope of avoiding interference.

Given that *military satellite communications* (MILSATCOM) and government SATCOM are critical communications assets, the stakes can be high to employ technology to

counter jamming incidents. Simply detection — or even locating a geographic origin of an interference — is simply not enough. Mitigation strategies that include interference removal and network resiliency should be an integral part of the system architecture.

This growing incidence of interference or jamming, intentional or not, highlights the need for improved mitigation capabilities, not just avoiding interference. An ideal solution should:

- Mitigate multiple non-cooperative interferer types;
- Require no prior knowledge of the interferer;
- Introduce minimal implementation loss;
- Introduce minimal latency;
- Minimize architectural complexity; and
- Require no additional bandwidth.

One of the key elements of SATCOM networks is the availability and use of the *radio frequency* spectrum. The introduction of noise or interference, whether it be intentional or unintentional, can degrade a SATCOM network, sometimes rendering that network completely unusable.

Due to the finite amount of available bandwidth, some organizations and agencies restrict the spectrum for use with specific applications and services. Despite their efforts, the ever-



growing demand for wireless capability still results in congestion and interference within the RF spectrum. The SATCOM industry has recognized this surge in devices and usage by responding with innovations to address the situation.

Among the effective technological solutions is signal excision, which is any technology, either analog or digital, that can identify and remove an interfering signal without the need for additional bandwidth.

Signal excision contrasts with the traditional method of anti-jam, which relies on spread spectrum necessitating, of course, a large spread factor and thus enormous amounts of bandwidth to overcome even small jamming signals. Quite often, there simply isn't enough available bandwidth in theatre to overcome a threat with spread spectrum technology.

Employing a signal excision anti-jam as a first line of defense against interference for the military can be beneficial. Signal excision systems can remove a wide range of interferer types and that is important for critical communications.

In the real world, there are various types of interferers. These include carrier waves (CWs), modulated carriers, sweeping tones, multiple CWs or combs, hopping carriers, and at times, a combination of multiple threats.

Safeguarding critical communications signals is important and, any satellite remote attempting to operate in a congested environment, especially where adversaries may be intentionally jamming signals, needs to have signal excision, anti-jam technology in place.

**iDirect Government (iDirectGov)** addresses the concern of interference through its **Communications Signal Interference Removal (CSIR — [product video at this direct link...](#))**, which eliminates an interfering signal from the **authorized signal of interest (SOI)**.

With only the SOI's center frequency, bandwidth and symbol rate information, CSIR will monitor and remove an interfering signal in real time.

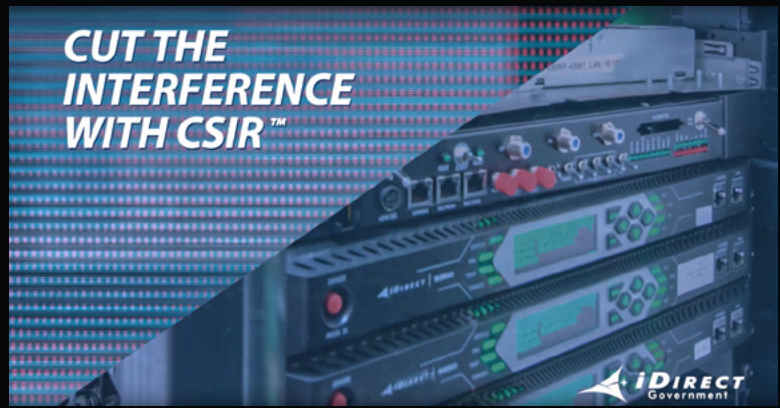
CSIR can remove a variety of unwanted signals, whether they are modulated carriers, unmodulated tones or interference that changes characteristics (such as burst or frequency hopping) for anti-jam use for defense and government.

The power difference between the SOI and the interferer can be quite small when using CSIR. This is important as adversaries are always implementing **signals intelligence (SIGINT)** so they can attack military and government spectrum use by jamming transmissions used for radio communications, radar and various operations.

As a mature digital signal processing solution, CSIR is designed to excise an interfering signal before it reaches the receiver's demodulator and decoder.

Based on the SOI's information noted above, CSIR can monitor and remove an interfering signal with as little as 1dB of power separation from the SOI. Additionally, CSIR has little to no effect on the SOI's signal quality.

Another substantial benefit of CSIR is the relative compactness of the **field-programmable gate array (FPGA)** image, making CSIR technology particularly portable to existing, FPGA-based, radio systems.



CSIR allows defense, homeland security, first responders and other government users to have reliable and secure communications to support their critical missions. Whether attacks are intentional or unintentional, the CSIR interference mitigation is designed to ensure holistic communication integrity and availability.

Interference is prevalent in many operating environments, and data shows it to be on the rise. Any satellite remote attempting to operate in a congested environment, especially where adversaries may be intentionally jamming signals, can benefit from CSIR.

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

**iDirect GOVERNMENT**

*Karl Fuchs is the Senior Vice President of Technology at iDirect Government (iDirectGov), (iDirectGov), a U.S. corporation that is a trusted partner of the U.S. government and has been for more than 18 years. All of the company's employees are U.S. citizens, with a third being U.S. military veterans and more than 60% holding U.S. security clearances.*

*Fuchs leads iDirectGov's team of federal systems engineers and serves as chief architect for new product integration and specialized technology including transmission security (TRANSEC), Communication Signal Interference Removal (CSIR™) anti-jam technology and Open Antenna Modem Interface Protocol (OpenAMIP). All Defense-grade products sold by iDirectGov are designed, developed, assembled, programmed and verified within the United States.*

*Fuchs leads iDirectGov's team of federal systems engineers and serves as chief architect for new product integration. Fuchs has more than 20 years of experience in the areas of technology and the federal government and is a Senior Contributor to MilsatMagazine; [kfuchs@idirectgov.com](mailto:kfuchs@idirectgov.com).*



# INTERFERENCE: CONTINUOUS WAVE OR TONE

**WITHOUT CSIR**

**WITH CSIR**

# DISPATCHES

## Ensign-Bickford Aerospace & Defense demo mission is a success

**Ensign-Bickford Aerospace & Defense (EBAD) recently deployed an experimental payload with the company's Payload Release Ring (PRR) spacecraft separation system.**

deployed the payload from [D-Orbit's ION carrier](#) (artistic rendition, above) on February 8, 2023.

D-Orbit's ION Satellite Carrier successfully delivered EBAD's experiment to LEO. The data gathered from this experiment

([HDRM](#)) and are configured to fasten directly to industry-standard, circular, mounting interfaces, and to satellites up to 800 kg in mass.

Outside of this mission, EBAD has a long history of successful space separation events with its ultra-low shock and high reliability NEA® Hold Down & Release Mechanisms and resettable [TiNi™ Mechanisms](#) (photo, middle column, bottom).

This includes 187 releases on the **James Webb Space Telescope**, 80 deployments of the **OneWeb** satellites, and most recently, the release of the **O3b mPower** satellites in a 4-Point Mount configuration.

This most recent demonstration focused on the PRR 8-inch diameter and EBAD has several other upcoming flight demonstration missions for its 15-inch and 24-inch diameter PRRs, and its integrated 4-Point Mount Separation System, which also use the flight-proven NEA® HDRMs.

*"EBAD's extensive experience in providing reliable, high-quality products to various missions across markets helps them create a product that clients can rely on, no matter the scale of their mission. He said, "EBAD serves both the satellite and launch vehicle markets, giving us a unique understanding of separation and dispensing systems requirements, which reside at the crossroads of both space markets. Our high volume and vertically integrated production capabilities allow us to deliver reliable payload deployment systems with higher value and significantly shorter lead times."*  
**Chad Thompson, president of EBAD**

*Ensign-Bickford Aerospace & Defense has been in business for more than 180 years, supplying world-class initiation and separation system products for space programs for more than 60 years. With facilities in Graham, Kentucky, Moorpark, California, and Simsbury, the company delivers mission-critical solutions for satellites (separation and dispensing), human spacecraft, missiles, and launch vehicles, and has the Space industry's widest array of flight-proven pyrotechnic and non-pyrotechnic separation system solutions.*



The PRR demonstration mission launched on SpaceX's Falcon 9 on January 31, 2023, and the PRR successfully

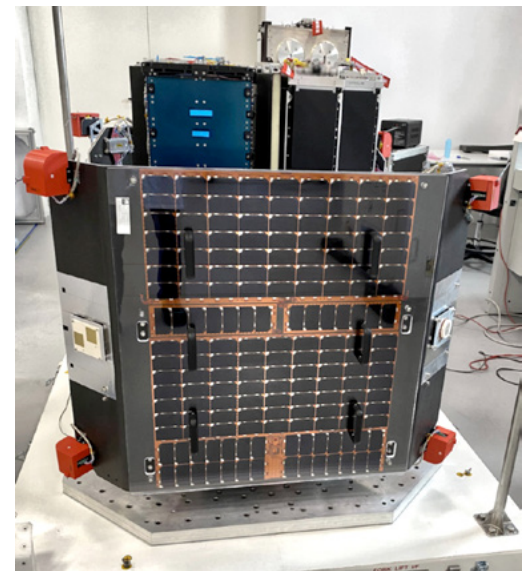
ensures EBAD's new spacecraft dispensing products carry the same reliability that the industry is accustomed to with its heritage [NEA® release mechanism](#) (photo to the left).

separation system solutions.



The experiment provided valuable data on the performance of the PRR, which is designed to separate satellites from the launch vehicle or orbital transfer vehicle (OTV).

Available in 8-inch, 15-inch, and 24-inch diameters, the PRRs use the [NEA® Hold Down & Release Mechanisms](#)



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# DISPATCHES

## Airbus selects Blacktree Technology for UHF MILSATCOM across Australasia



The payload with 18 UHF channels will enable up to 200 simultaneous communications over Europe, the Middle East, Africa, large parts of Asia, as well as the Atlantic Ocean (to eastern Brazil) and the Indian Ocean (to western Australia).

Airbus funded UHF payload will serve allied armed forces that include European and NATO countries

Airbus Chief Representative, Australia, New Zealand and the Pacific, **Stephen Forshaw**, said that the selection reinforced Airbus commitment to integrate Australian technology into the wider Airbus supply chain.

"We've been excited to see how much technology is being developed by local companies to support the development of the Space industry in Australia, and that they are winning selection to provide global solutions in Space," Forshaw said.

**Martin Rowse**, Airbus Defense and Space Australia director said, "We have selected Blacktree as they offer a proven Australian solution which will support this critical satellite communications capability. The ground segment will be essential in ensuring our customers have access to vital UHF connectivity across the region and beyond."

Blacktree Technology's Managing Director, **Joe Nevin**, added, "Blacktree Technology is proud to, once again, be selected to support Airbus with UHF ground segment capability. This builds on our strong heritage providing UHF solutions in Australia and across the globe."

Airbus has been working with Blacktree for more than 15 years under the UK's SKYNET 5 secure milsatcom program and is partnering with them in Team Maier, as part of the bid to address Australia's Joint

Project (JP) 9102 to provide a complete Sovereign Defense Satellite Communications System.

Team Maier members include technology and encryption specialists Blacktree Technology, Clearbox Systems, Canberra's specialists Blacktree Technology, Clearbox Systems, Canberra's Penten, Sydney-based ground-control infrastructure specialist UGL, Surrey Satellite Technology and Indigenous and veteran-owned Willyama.

**Airbus Defence and Space** has selected **Blacktree Technology Pty Ltd** of Perth, Australia, to provide the ground segment for the Airbus funded, UHF military

**communications hosted payload on-board a commercial telecommunications satellite manufactured by Airbus.**



# DISPATCHES

## U.S. Navy receives final GPS-based JPALS unit delivery



**The U.S. Navy accepted delivery of the final GPS-based, Joint Precision Approach and Landing Systems (JPALS) unit, marking another on-time or ahead of schedule delivery for increased capability at sea.**

JPALS is a ship-relative, GPS-based system that provides aircraft carriers and amphibious assault ships with precision approach and landing capability, surveillance, and over-the-air inertial alignment in all weather and mission environments.

JPALS has been supporting F-35B deployments on U.S. Navy LH-class amphibious assault ships since 2016 and F-35C deployments on U.S. Navy aircraft carriers since 2021. Initial operational capability was reached in May 2021 with full operational capability scheduled for fiscal year 2026.



An F-35C Lightning II, from the "Rough Raiders" of Strike Fighter Squadron (VFA) 125, makes an arrested gear landing on the flight deck of the aircraft carrier USS Nimitz. Joint Precision Approach and Landing Systems (JPALS) has been supporting F-35B deployments on U.S. Navy LH-class amphibious assault ships since 2016 and F-35C deployments on U.S. Navy aircraft carriers since 2021.

JPALS is currently being deployed on all U.S. Navy aircraft carriers and amphibious assault ships, and is on the United Kingdom Royal Navy's HMS Queen Elizabeth and the Italian Navy's ITS Cavour. Japan became the third foreign military sale customer in December and is scheduled to be deployed on the Japan Maritime Self-Defense Force's JS Izumo in 2024.

*"This is a significant milestone for the JPALS team, and highlights the incredible efforts of hundreds of our teammates over the past decade who developed and now have fully delivered these critical systems that our Warfighters and International Partners need. This team overcame many barriers over the past several years, successfully achieving the required outcome to deliver all of the capabilities needed, on time and affordably."*

**Captain Kevin Watkins**, Naval Air Traffic Management Systems (PMA-212) program manager in 2024.



# SATCOM ANTENNAS



## BUILDING MORE RESILIENT COMMS FOR THE WARFIGHTER

Author: Matthew Little, Director of Communications Systems, Tactical Systems, Ball Aerospace

**Military satellite communication (MILSATCOM) options are growing as the market continues the integration of Low Earth Orbit (LEO) and Medium Earth Orbit (MEO) constellations, with the capabilities of established Geostationary Orbit (GEO) satellites – however, the deployment of these new satellite networks is also increasing the complexity of communications systems and driving the need for new user terminals.**

The communication industry's efforts on LEO satellites are centered on the promise of truly global broadband coverage, further building on the traditional capacity of GEO satellites and looking toward a future where high-performance connectivity isn't just a luxury, but an expectation – even in the most remote and extreme environments in the world.

As the market's transformation begins to take shape in earnest, some of the most exciting developments will emerge on the back of multi-orbit and multi-band capabilities, which will come to define the next era in resilient tactical communications.

For our nation's warfighters, these technologies will bring the flexibility and confidence of knowing there are always multiple communication pathways overhead, providing new assurances in the ability to move important data about adversary movements and the health and wellness of our troops.

These pathways will even help to improve the everyday lives of warfighters abroad, allowing them to better connect with friends and family back home. Currently, that level of connectivity isn't always available for our armed forces.

### Multi-Orbit Support With Electronically Steered Antenna (ESA)

The warfighter needs a single terminal that can connect to GEO satellites as well as LEO and MEO satellite networks. The impending proliferation of these constellations is already emphasizing the need for apertures with greater functionality to support the beam and tracking speeds of these constellations. The traditional reflector antennas used for satellite communications do not meet these latest requirements.

Introducing moving satellites adds an additional level of complexity for mechanically steered solutions. A traditional antenna using mechanical steering is constantly scanning from one horizon to the next to pick up another satellite. That process inevitably creates disruptions in connectivity.

**Ball Aerospace** is meeting these challenges with **electronically steerable antennas (ESAs)**. Designed and assembled in the United States, Ball's ESAs have the capability and flexibility to support multi-orbit communications with GEO, LEO and MEO satellites from a single, low-profile antenna.

For commercial **satellite communications (SATCOM)** and MILSATCOM users, this technology provides confidence that the ESA enabled terminals can support any existing or future satellite network.

Electronically steerable antennas don't contain any moving parts that can wear out over time. Plus, ESAs can steer beams in microseconds as they are not constrained by momentum restrictions such as mechanically steered antennas.

ESAs are able to provide the required agility to meet tight handoff requirements between satellites in the latest constellations.

Electronically steerable antennas will finally provide military personnel with more options for global connectivity. This means more dependable communications at large as well as providing a new standard in resilience.

A multi-orbit terminal will make it far more difficult for adversaries to jam signals – our warfighters will have the option to select from an array of optional satellite networks. If a network is jammed, the user can move to another, independent network.

This ubiquitous connectivity will make a difference on multiple fronts, from providing safer and more reliable communications for military operations, to ensuring our warfighters are connected back home while they're doing the nation's work.

### Developing The Next Wave of Antenna Technology

Now that ESA technology has been proven to be a viable and affordable solution, what does the next evolution of this technology look like?

Communications resiliency can be improved even more by combining multi-orbit with multi-band capability. A single terminal that could support both Ku- and Ka-band frequencies would allow the user to connect with any satellite network that was visible.

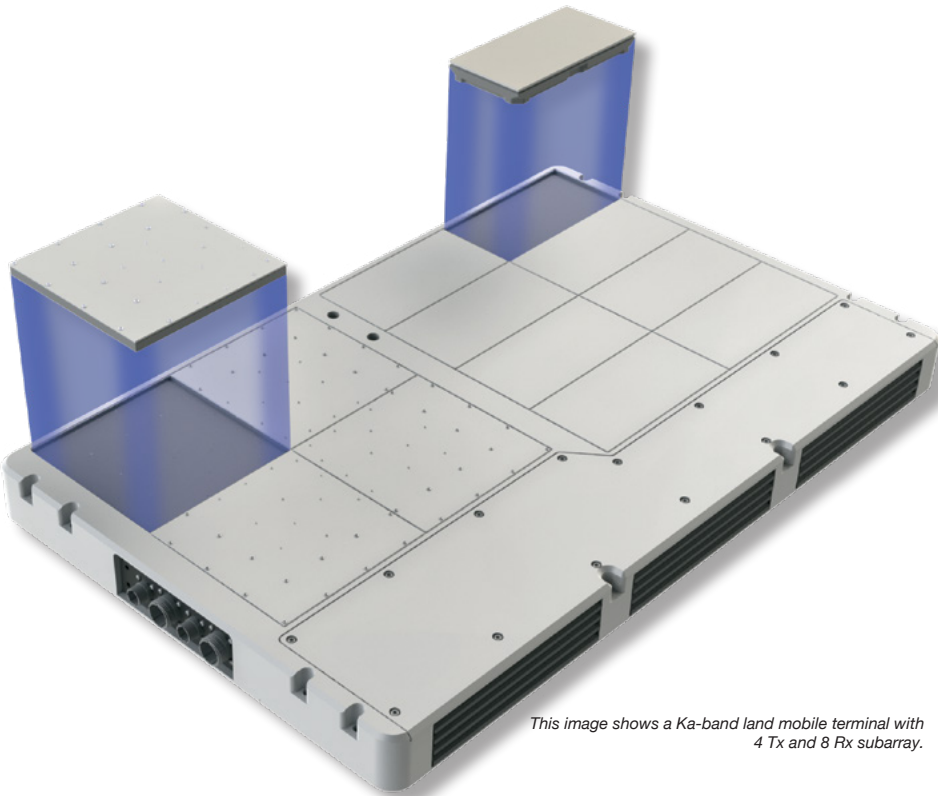
As the technology starts to take shape, finding ways to keep costs down without sacrificing performance is vital and that will be a focus area and engineering challenge for the industry going forward as we work to meet MILSATCOM demands and close warfighter capability gaps.

<https://www.ball.com>

*Matt Little is the director of the Communications Sector within the C3I Mission Area at Ball Aerospace. He has more than 20 years of experience developing electronically scanned antennas for communications, radar and electronic warfare applications.*



Matthew Little



This image shows a Ka-band land mobile terminal with 4 Tx and 8 Rx subarray.

# DISPATCHES

## Raytheon Technologies awarded SDA contract for a missile warning + tracking constellation



Raytheon Technologies has been developing missile warning systems for decades. Since acquiring **Blue Canyon Technologies** and **SEAKR Engineering**, Raytheon Technologies has expanded its space payload and satellite bus capabilities and expertise, becoming a leading provider of space systems to a growing number of programs.

Raytheon will leverage existing designs, available commercial products and common components to reduce technical risk and speed delivery.

The seven-vehicle satellite constellation will feature Raytheon's **Wide Field of View** overhead persistent infrared sensor, Blue Canyon Technologies' **Saturn-class** smallsat bus, and SEAKR Engineering's electronics payload.

**Raytheon Technologies** (NYSE: RTX) has received an award valued at more than \$250 million to design, develop and deliver a seven-vehicle missile tracking satellite constellation, as well as support launch and ground operations by the **Space Development Agency**.

Once deployed, the LEO constellation of networked satellites will become the fifth plane of satellites providing missile warning and tracking for the **Department of Defense** (DoD). The program is a key element of the **Proliferated Warfighter Space Architecture**.

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# HARSH WEATHER?

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# Exploit what we have, buy what we can, and build only what we must.

At Space Systems Command (SSC), that mantra is dramatically reshaping how the command acquires the cutting-edge technology and capabilities necessary to keep the nation's joint warfighters ahead of the threat. Adversaries know how the world increasingly relies on space power, and are seeking to surpass U.S. space dominance and disrupt equitable access to space and U.S. space assets.

Several of SSC's leaders took time this month to explain how this new operating focus is changing how the U.S. Space Force Field Command is executing its mission.



"At SSC we're shaping a more resilient space architecture, by reducing redundancies and costs while increasing the speed of program development cycles. Our flat command structure and expert workforce, allow us to create a new culture focused on countering the threat by guaranteeing the capabilities our joint warfighters and our Nation depend on will be there without fail during times of crisis or conflict. We are proud to partner with industry and are utilizing commercial innovation to outpace the growing threats."

-- Lt. Gen. Michael A. Guetlein,  
Commander, SSC



Dr. Claire Leon

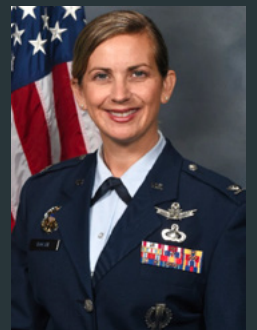
"Our Space Systems Integration Office is chartered with integrate the current disparate systems developed by SSC program executive offices and mission partners into a resilient and integrated warfighting enterprise capable of deterring competitor aggression. How will we achieve this? Through delivery of an integrated investment strategy, enterprise roadmaps, and enterprise enablers – a united effort between Space Force's three field commands, U.S. Space Command, mission partners, industry, and allies." — Dr. **Claire Leon**, Director, Space Systems Integration Office



Col. Dennis Birchenough

"We're excited about our space-based environmental monitoring (SBEM) programs, including the Weather Support Follow-on Microwave satellite and Electro-Optical/Infrared Weather System prototype. The former enables the production of enhanced, warfighting weather-prediction and -analysis capabilities, while the latter trail-blazes the Space Force's pivot to proliferated architecture for delivering cloud characterization and weather imagery. And we're also collaborating with industry, other government agencies, and our Allied partners to provide SBEM data to the warfighter at operationally-relevant speeds to prevail against the threat." — Colonel **Dennis Birchenough**, senior materiel leader, Environmental and Surveillance Delta, Space Sensing Directorate

"The Space Sensing Directorate is exploiting capabilities from non-OPIR (Overhead Persistent Infrared) sources from within the space enterprise and exploring how to buy overhead imaging data from commercial sensor providers to tackle space-based ISR and weather warfighter needs. The directorate is building niche capabilities such as Next Generation GEO and Next Generation Polar for missile warning and pivoting toward the new MEO Missile Track systems aimed at detecting movements of adversaries emerging and highly maneuverable weapon systems." — Colonel **Heather B. Bogstie**, senior materiel leader, Resilient Missile Warning, Tracking, and Defense Acquisition Delta, Space Sensing Directorate



Col. Heather Bogstie

"SSC's Missile Warning Acquisition Delta exposes the constant stream of raw infrared wideband data to government labs, academia, and small business at our Tools, Applications, and Processes Lab, where we downlink terabytes of information daily to meet emerging threats. Capability must exist through all phases of conflict -- up to and including during a nuclear conflict. Those niche capabilities of nuclear-survivable sensors and communications systems for which there's no commercial market, represent an area where we 'build what we must.' Future Missile Warning architectures that allow more simplified sensors, hosted in larger constellations provide resiliency in depth and create a ripe environment for high volume production that drives industry competition - all which maximize our return on investment." — Colonel **Daniel Walter**, senior materiel leader, Strategic Warning Acquisition Delta, Space Sensing Directorate



Col. Daniel Walter

"The MILSATCOM and Position, Navigation, and Timing portfolio is delivering on today's programs to provide increased anti-jam performance across multiple domains. At the same time, we are moving out on prototyping diverse phenomenologies and building acquisition strategies to leverage commercial capacity to enable the next generation of layered resiliency for communications, navigation, and timing." — **Cordell DeLaPena, program executive officer, Military Communications and Positioning, Navigation, and Timing (PNT)**



Cordell DeLaPena

"We are building an integrated and resilient constellation of partnerships driven by innovation and allied by design. The pacing challenge from competitors on the world stage is real and, as the clock ticks, we are capitalizing on alliances to cover capability gaps and add resilience to our architecture. Our mission is driven by the need to partner with like-minded nations who desire the same opportunities and freedoms as the U.S. We're focused on updating policies to allow greater freedom of action to obtain capabilities at the speed of industry in the U.S. and around the globe. By harnessing the tremendous intellectual capital and resources from the global space marketplace, we will outpace our competitors and maintain the advantage needed to deter conflict." — **Deanna Ryals, Director, International Affairs**



Deanna Ryals



Dr. Walter Lauderdale

"The National Security Space Launch (NSSL) program was one of the first modern SSC programs to rely on industry to develop commercial capabilities, rather than to require build to a specification. As a result, we've benefited from the focus and innovation of our industry partners. As we look forward, we are expanding those partnerships to meet the growing demand of our spacecraft customers and their mission areas. New space mission architectures that incorporate resilience and maneuverability must have rapid, responsive launch services to address growing threats in the space regime. NSSL is tapping the energy and creativity of the launch industry to create resiliency to meet national requirements where and when needed." — **Dr. Walt Lauderdale, Chief, Falcon Systems & Operations, Launch Execution Acquisition Delta, Assured Access to Space**

"Front Door identifies non-traditional companies that are getting after critical pieces of a challenge or problem and determine if they're doing it in a way that could fill a current or emerging need. Artificial intelligence and machine learning, software-defined network solutions, and that next level of computing power is what's going to make the U.S. Space Force more effective and efficient. We're discovering and leveraging potentially game-changing commercial capabilities; focusing on where we can buy versus build." — **Brian Gamble, Front Door executive consultant**



Brian Gamble



Lt. Col. Jonathan Shea

"Following Lt. Gen. Guetlein's direction to utilize commercial innovation, the DoD Space Test Program leveraged venture-class launch vehicle providers such as Rocket Lab, Virgin Orbit, and Astra for our Rapid Agile Launch Initiative. Going forward, we want to buy commercial-off-the-shelf (COTS) space vehicles utilizing a new contract. This will provide an innovative way to attach multiple experiments to a variety of vehicles at a rapid pace." **Lieutenant Colonel Jonathan Shea, materiel leader and director, DoD Space Test Program**

"When people come to us at the Front Door, all they see is big 'G' government — they may not realize that each organization has unique lanes and each entity has its own scope. As part of the DoD, SSC has a mandate to acquire systems that will support a 'protect and defend' mission. But there are many other organizations like NASA and NRO that have other missions that need space technology. If someone approaches us with technology that doesn't fit our mission needs, the Front Door will do its best to connect them to organizations that might." — **Minh Jones, Front Door executive consultant**



Minh Jones



Col. Joseph Roth

"SSC is one of many working to get capabilities into warfighter hands - it takes teamwork and collaboration with our sister USSF organizations and other mission partners to rapidly experiment and prototype new space and C2 capabilities to ensure we continue to out-innovate the threat and maximize combat power by 2026 and beyond." — **Col. Joseph Roth, Director, Innovation and Prototyping Directorate and commander, Space Systems Center, Detachment 1, Kirtland Air Force Base, New Mexico**



SSC DEVELOPS, ACQUIRES, EQUIPS, FIELDS AND SUSTAINS LETHAL AND RESILIENT SPACE CAPABILITIES

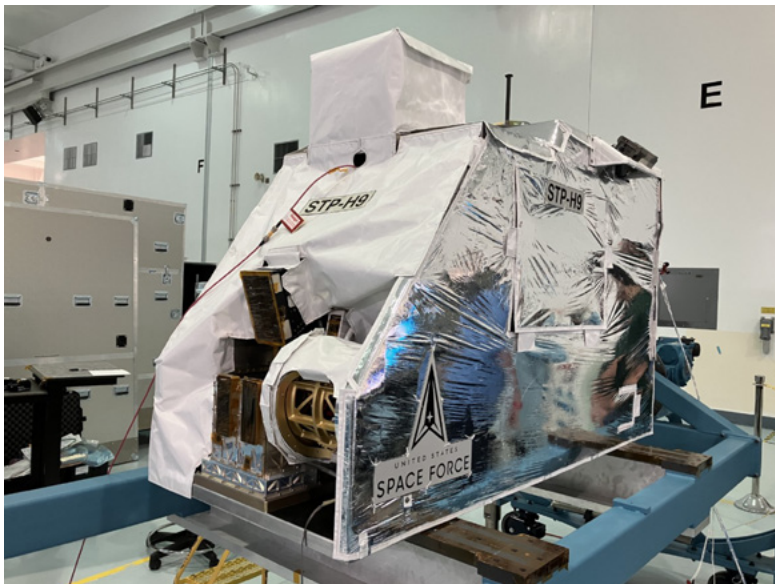
Space Systems Command is the U.S. Space Force Field Command responsible for acquiring and delivering resilient war fighting capabilities to protect our nation's strategic advantage in and from space. The Command manages an \$11 billion space acquisition budget for the Department of Defense and works in partnership with joint forces, industry, government agencies, academic and allied organizations to accelerate innovation and outpace emerging threats. Our actions today are making the world a better space for tomorrow.

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

Visit Space Systems Command, Space Operations Command and Space Training & Readiness Command together at the Space Symposium, Booth #110-114.

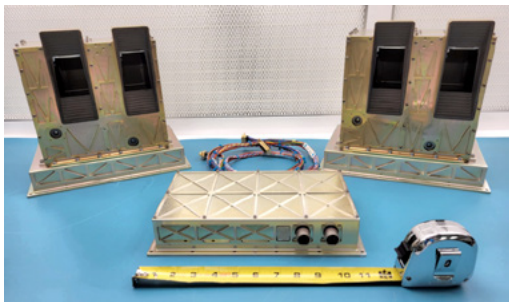


## Space Systems Command (SSC) collaborates with NASA to launch Space Test Program-H9 experiments to the ISS



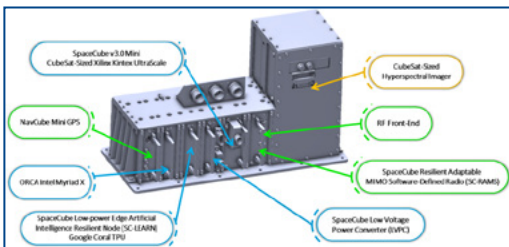
Space Systems Command (SSC) prepares the Space Test Program-Houston 9 (STP-H9) mission containing eight DoD Space Test Program (STP) experimental payloads in the NASA Kennedy Space Center (KSC) Space Station Processing Facility (SSPF) before being turned over to NASA for a March 14 launch aboard the SpaceX's Commercial Resupply Service (CRS)-27 mission from Kennedy Space Center, Florida. (Photo courtesy of DoD Space Test Program)

**Space Systems Command (SSC) is preparing to launch the Space Test Program-Houston 9 (STP-H9) mission to deliver eight DoD Space Test Program (STP) experimental payloads to NASA's International Space Station (ISS).**



The STP-H9-ECLIPSE flight hardware is shown prior to its delivery to NASA's Johnson Space Center in March 2022. (Image courtesy of the Naval Research Laboratory)

NASA's ISS will host the experiments for one year. Once docked to the ISS, the STP-H9 payload will be robotically installed on the [Japanese External Facility](#) where it will get power and data to support the eight experiments.



The Space Test Program - Houston 9 - SpaceCube Edge-Node Intelligent Collaboration (STP-H9-SCENIC) investigation mechanical closure and labeled components. (Image courtesy of NASA)

The STP-H9 mission, in partnership with NASA's ISS Program, the [U.S. Naval Research Laboratory \(NRL\)](#), the [U.S. Air Force Research Laboratory \(AFRL\)](#), the [U.S. Air Force Academy](#), and [Lawrence Livermore National Laboratory \(LLNL\)](#), is scheduled to launch on SpaceX's **Commercial Resupply Service (CRS)-27** mission aboard a [Cargo Dragon](#) spacecraft from **Kennedy Space Center**, Florida on March 14.

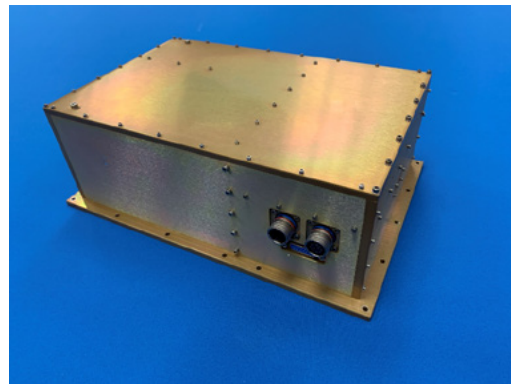
"This mission marks another milestone in the valuable partnership between SSC and DoD's Space Test Program and NASA and continues the STP's 58-year history of providing access to space for emerging DoD technologies. This is STP's 305th mission in its 58-year history," said **Lt. Col. Jonathan Shea**, SSC director of the DoD STP.

STP operates from a prioritized list of critical space technologies that require testing in the space environment in order to ensure their maturity for future space capabilities. STP is the catalyst creating partnerships and developing payloads and support operations.

"We have a great partnership with the ISS Program," said **Rick Caldwell**, SSC mission manager for the STP-H9 payload. "Our STP missions fly alongside NASA and international partner payloads in a continuous research process that has been ongoing for more than 20 years. It is incredibly complicated to build a payload to meet the hundreds of requirements and interfaces to make this all work. Because the ISS is already in orbit, the first chance we get to actually connect the payload to the ISS will be after we launch. We only get one shot, there is no room for error."

STP-H9 is managed by the **DoD Space Test Program** office located at [Kirtland Air Force Base](#) in Albuquerque, New Mexico, and has an Operating Location at [NASA's Johnson Space Center](#), Houston, Texas.

**SSC's Space Domain Awareness & Combat Power**, headquartered at Los Angeles Air Force Base, administers the DoD STP, which delivers experimental demonstrations of new capabilities and expedient space access solutions for R&D experiments.



A preflight view of the Space Test Program-Houston 9-Neutron Radiation Detection Instrument (STP-H9-NeRD). (Image courtesy of U.S. Naval Research Laboratory)

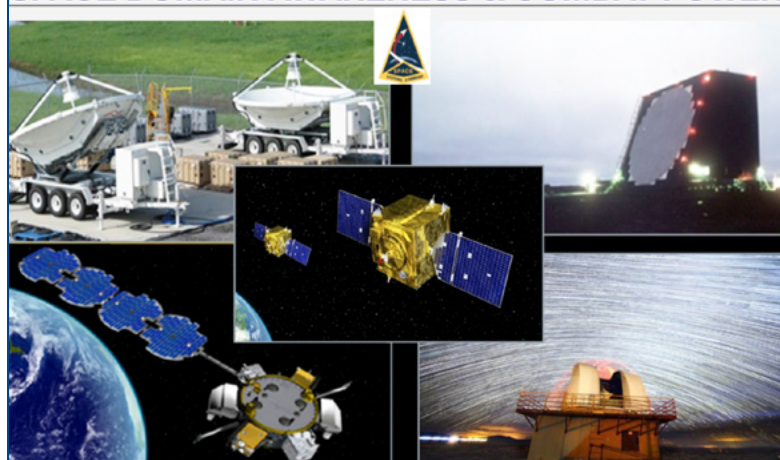
The STP team designed and built the integrated payload that will connect the eight experiments to the ISS and allow science data collection. Avionics developed by STP are used to build and test these platforms on the ISS.

*Space Domain Awareness & Combat Power is the program executive office within Space Systems Command that is responsible for delivering ground- and space-based infrastructure and systems that identify threats to national, allied, and commercial space systems. Its innovations integrate seamlessly across the space enterprise and promote deterrence by providing advances in space-enabled warfighting capabilities to our joint military forces.*

*Space Systems Command (SSC) is the U.S. Space Force Field Command responsible for acquiring and delivering resilient war fighting capabilities to protect our nation's strategic advantage in and from space. SSC manages an \$11 billion space acquisition budget for the Department of Defense and works in partnership with joint forces, industry, government agencies, academic and allied organizations to accelerate innovation and outpace emerging threats. Our actions today are making the world a better space for tomorrow.*



### SPACE DOMAIN AWARENESS & COMBAT POWER





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**Antenna Systems**

# A Conversation With... Ken Flowers

Vice President of Government Solutions, Iridium

With increased geopolitical interest and rising ecological threats in the Indo-Pacific region, the need for reliable connectivity is at an all-time high. Currently, satellite communications (SATCOM) is the ideal solution for delivering reliable Beyond Visual Line of Sight (BVLOS) connectivity to the most remote corners of the Indo-Pacific. As the only network that provides coverage to the entire planet, Iridium remains the pre-eminent leader of enabling weather-resilient SATCOM to the region.



Ken Flowers

In September of 2022, the company conducted a field demonstration of Iridium® and Iridium Connected® technology called Operation Pacific Waves (OPW). Iridium technology partners in coordination with existing customers like the U.S. Department of Defense, coalition partners, and scientific research organizations exhibited Iridium's weather-resilient SATCOM technology on-base, on-the-move and remotely from the field in the Indo-Pacific and other remote locations around the globe.

Iridium's Vice President of Government Solutions, Ken Flowers, explains Iridium's important and unique role in enabling reliable communications in the Indo-Pacific and shares highlights from Operation Pacific Waves.



Mr. Flowers, why is reliable SATCOM connectivity in the Indo-Pacific important?

## KEN FLOWERS

As home to more than half of the world's population, almost two-thirds of the world's economy, and some of the world's largest militaries, the growing Indo-Pacific region continues to play a critical role globally. 40 countries and economies with vast biogeographic landscapes are spread across the tropical waters of the Indian Ocean and the western and central Pacific Ocean to the seas connecting the two near Indonesia.

Even today, parts of the Indo-Pacific are some of the most challenging places to find reliable terrestrial connectivity. Currently, Iridium is the best suited SATCOM provider to deliver reliable connectivity in the Indo-Pacific, due to the company's orbital location in Low Earth Orbit (LEO), L-band spectrum and crosslinked network architecture enabling robust and weather-resilient coverage across the entire planet.

Indonesia is a clear example of this. As the largest archipelago in the world, Indonesia is comprised of five major islands and more than 17,500 smaller islands, of which about 6,000 are inhabited. The size and scope of its territory makes building and maintaining cellular or land-mobile radio (LMR) network infrastructure expensive, challenging and impractical. To overcome those communication challenges, the Indonesian government adopted [Iridium® Push-to-Talk \(PTT\)](#) devices for reliable real-time communications on land, at sea or in the air.

Would you tell us more about the Iridium network's capabilities and why they are unique?

## KEN FLOWERS

For the last 20 years, Iridium has been the leader in global connectivity, providing our narrowband services to people and organizations in the Indo-Pacific and around the world. Due to the unique architecture of the Iridium network, we are able to deliver a reliable and strong SATCOM connection to the most remote territories in the Indo-Pacific, even through inclement tropical weather. Our crosslinked satellites in LEO are always in communication with one another, converging at the poles as they rotate around the Earth, delivering a strong signal to locations that typically lack reliable coverage.



Iridium + Iridium partners during the company's OPW expedition. Photo courtesy of Iridium.

In addition to our unique network architecture and polar orbit, our location in LEO delivers a low-latency connection, making real-time communications possible. Our L-band spectrum allocation delivers a weather-resilient connection that is ideal for those operating in the Indo-Pacific, widely known as the region most exposed to natural disasters.

In addition to delivering our traditional narrowband services, such as messaging and voice calling, we are providing our broadband services with [Iridium Certus®](#). The availability of multiple Iridium Certus speed classes brings additional capabilities, such as the ability to enable compressed video, an important tool for search and rescue organizations that rely on BVLOS technology to conduct both civilian and military rescue missions. Essentially, we can provide the "eyes" that can investigate the most remote areas.

What was the main purpose of OPW and was it a success?

## KEN FLOWERS

Following the success of [Operation Arctic Lynx \(OAL\)](#), the main purpose of OPW was to exercise our capabilities to the Indo-Pacific for all who operate in the region, and in that regard, it was a complete success. Given the company's long history, Iridium is often thought of as just a satellite phone company. OPW was a great opportunity to expose the Indo-Pacific region to various other solutions like PTT, unattended sensors, trackers, Iridium Certus and video compression and more.

Iridium's truly global coverage provides the Combatant Command, its subordinate component commands and its coalition partners a critical on-the-move L-band resiliency for its Joint All-Domain Command and Control ([JADC2](#)) **Primary, Alternate, Contingency** and **Emergency (PACE)** communications plan/architecture. We were able to demonstrate to key military organizations, including the United States Air Force, Coast Guard, Army and National Guard, what our upgraded network is capable of providing.

The [Iridium Certus Connected® Thales MissionLINK™](#) in the Philippines set up so those inside the conference room could watch live Iridium Certus video channels. Image is courtesy of the company.

Can you share any findings or highlights from the expedition?

## KEN FLOWERS

In addition to demonstrating the strength of our SATCOM services and solutions within the Indo-Pacific region, we were able to show participants our full global scope. During OPW, we not only connected with those in the Indo-Pacific, but we were able to facilitate voice, data and video calls with colleagues in Antarctica and Colorado Springs during a variety of weather conditions, truly highlighting the power of our services.

A major highlight was live video sent over Iridium Certus. This included a telemedicine use-case over the Iridium Certus Connected Thales MissionLINK broadband terminal using the [AnsuR Asmira](#) software. Multiple live video channels were sent simultaneously from Japan, Philippines, South Africa (airborne commercial ISR 3,200 feet elevation), Hawaii, Antarctica ([South Pole Station](#)) and northwest USA (airborne platform 34,000 feet elevation). Successful Iridium Certus video shows that Iridium services are an important element of any JADC2 PACE plan ensuring connectivity to the data fabric and providing critical information for leader decision-making.

Did any Iridium technologies perform better over others?

## KEN FLOWERS

All of our services performed very well, but there were a few standout moments with our tracking capabilities. During OPW, Iridium and its partners successfully demonstrated a variety of technologies to open the customer and user's eyes as to how far Iridium has come since the days of the firm's first-generation constellation 2.4 kbps narrowband capabilities. You can learn more about the specific Iridium technologies from Iridium partners [at this direct infolink...](#)

Are there plans for future Indo-Pacific demonstrations similar to OPW?

## KEN FLOWERS

Given the growing importance of the Indo-Pacific region, our team is continuing the efforts of OPW. This year, we are going out in the field again to put [Iridium Connected](#) equipment into the hands of the users. We know it's important to let the user "kick the tires" and use the equipment in line with unit [Concept of Operations \(CONOPS\)](#). We look forward to leading and supporting additional exercises in the future that demonstrate the breadth of our worldwide services.

For additional Iridium network information, [access this direct link...](#)

To learn more about Operation Arctic Lynx (OAL), revisit [MilsatMagazine's](#) conversation with Iridium in the September 2021 issue: [The Importance of Reliable SATCOM in the Polar Regions](#)



MissionLINK demo underway



# DISPATCHES

## ThinKom delivers SATCOM system for SNC's RAPCON-X™ program



**ThinKom Solutions, Inc. (ThinKom) has delivered their ThinAir@Ka2517 phased-array satcom antenna systems to Sierra Nevada Corporation (SNC) for installation on its new RAPCON-X aircraft.**

This rapidly configurable aerial intelligence, surveillance, and reconnaissance (AISR) platform also includes next-generation mission system and signal intelligence products for multi-domain operations.



in GEO and NGSO orbits, ensuring highly efficient, worldwide connectivity in a multi-orbit environment.

This configuration is supported on the RAPCON-X by a U.S. military-compliant modem, enabling real-time, reliable, and resilient broadband transmission to and from the aircraft in flight.

The Ka2517 is based on ThinKom's field-proven, patented **Variable Inclination Continuous Transverse Stub (VICTS)** phased-array technology. VICTS antennas have more than 33 million hours of accrued flight time and a **mean-time-between-failure (MTBF)** exceeding 100,000 hours. Ka2517 antennas have been providing continuous service on a range of U.S. government aircraft since 2018.

Based on the **Bombardier Global 6500**, the RAPCON-X platform delivers superior range and endurance to facilitate immediate worldwide deployments within an operational envelope that enhances survivability.

The low-profile radome for the Ka2517 minimizes in-flight drag, resulting in lower fuel consumption and longer time on station, further enhancing RAPCON-X's capabilities.

The RAPCON-X program aims to reduce the time required to integrate new systems or add functions in the AISR domain. Rather than requiring a complete redesign, a modular approach allows for a unique approach to the market as a contractor-owned, contractor-operated solution.

The Global 6500 base provides the space and excess electrical power to easily accommodate current mission equipment while allowing for substantial future growth in functionality.

*"ThinKom's Ka2517 antenna is a key component of the RAPCON-X airborne system-of-systems that arrives ready to complete the mission, whenever and wherever the need evolves. The open architecture platform provides robust, reliable and resilient command, control and communications capabilities, operating across multiple satellites and constellations and using multiple waveforms, including those enabling specialized cryptographic capabilities."*  
**Bill Milroy, Chairman and CTO of ThinKom**

# STRONG



### Tardigrade

**Resistant to extreme conditions**, with unique characteristics in the animal kingdom such as being able to survive in the vacuum of space or withstand very high pressures of almost 6,000 atm; they can survive temperatures of 73 K and up to 423 K, prolonged dehydration (they can go up to 10 years without obtaining water) or ionizing radiation.

**Ka-Band** Low Noise Amplifier (LNA) Frequency converter  
Block Up Converter (BUC) Solid state Power Amplifier (SSPA)  
Block Down Converter (BDC) **X-Band** Transceivers (TRX) Test  
Loop Translator (TLT) Low Noise Block (LNB) **Q-Band** Redundancy



# DISPATCHES

## Northrop Grumman to produce MESA for U.S. Air Force E-7



A U.S. Air Force E-7 equipped with the Northrop Grumman MESA sensor. (Credit: Boeing)

**Northrop Grumman Corporation (NYSE:NOC) will enter into production of the Multi-role Electronically Scanned Array (MESA) sensor for the U.S. Air Force E-7 aircraft.**

As part of the E-7 weapons system, the combat proven MESA sensor will provide critical long range sensing, detection and identification in challenging environments equipping the U.S. Air Force with simultaneous air and maritime sensing capabilities, critical early warning and air battle management capabilities.

When tracking and identifying electronic signals and targets, false alarms or thermal noise can be mistakenly identified by a surveillance radar.

With MESA's quick updates of the entire landscape, the sensor provides higher quality data — reducing inaccuracies and furthering the edge of the warfighter.

This modern Airborne Active Electronically Scanned Array (AESA) sensor is already in production and deployed for customers worldwide, providing 360-degree situational awareness and flexibility to adapt to missions and environments in all weather conditions.

MESA allows operators to simultaneously focus on priority missions, rapidly revisit targets with increased accuracy and pass relevant information to enable timely **Battle Management Command and Control** decisions.

MESA is on an active production line to address global threats in the modern-day battlespace and evolve to meet future mission requirements. Australia, Turkey and South Korea have fielded the E-7 system, with production underway on the United Kingdom E-7 AEW&C fleet.

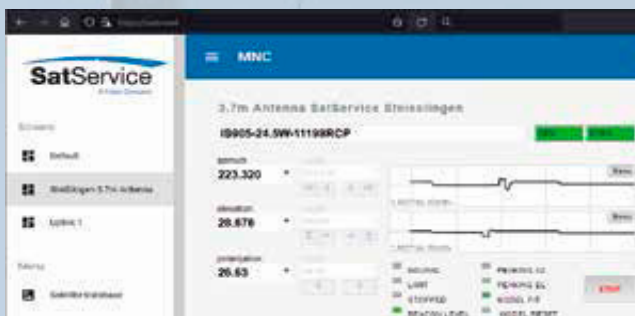
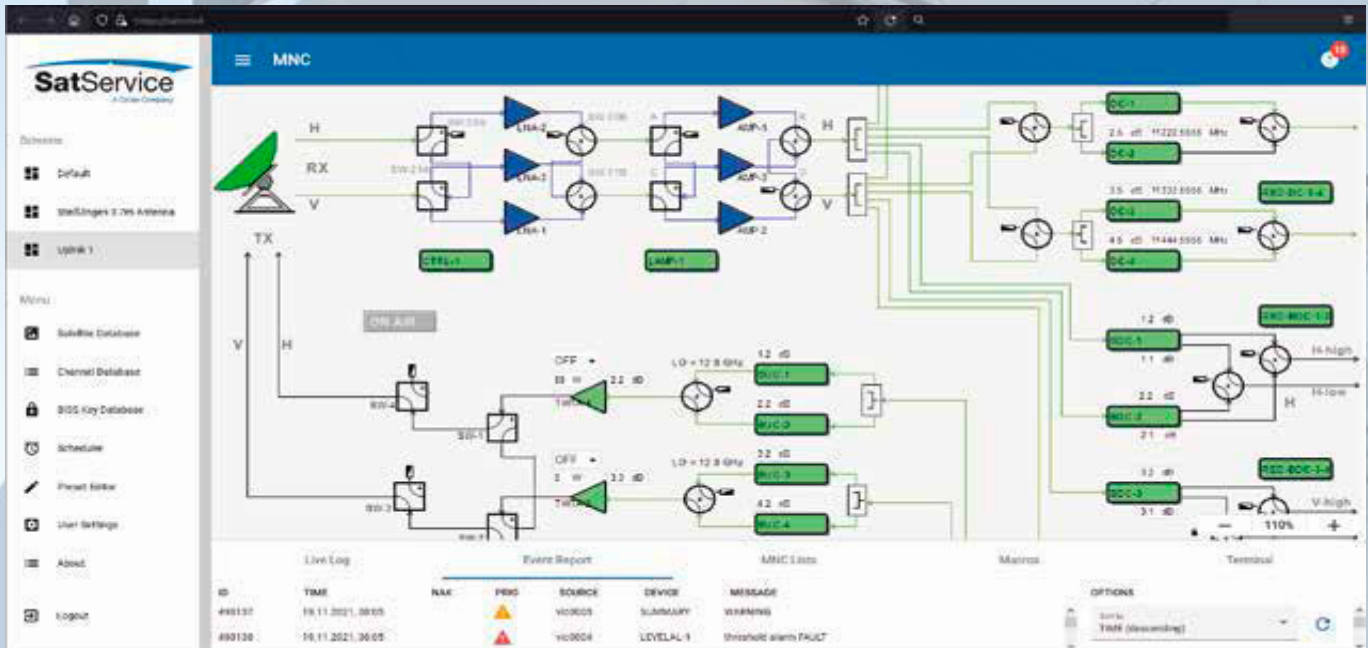
*"The multifunction MESA sensor will provide the U.S. Air Force with critical multi-domain awareness to enable decision superiority for the range of mission requirements today and into the future. As we fulfill our promise to the Air Force to rapidly bring unmatched, decisive air battle management sensing capabilities including long range first detect and first engagement in the battlespace, we look forward to enabling global allied interoperability in partnership with Boeing." Ed Griebel, vice president of airborne surveillance programs, Northrop Grumman*



When tracking and identifying electronic signals and targets, false alarms or thermal noise can be mistakenly identified by a surveillance radar. With MESA's quick updates of the entire landscape, the sensor provides higher quality data — reducing inaccuracies and furthering the edge of the warfighter.

Schedule your demo  
for the new web based M&C System

# sat-nms Monitoring & Control System

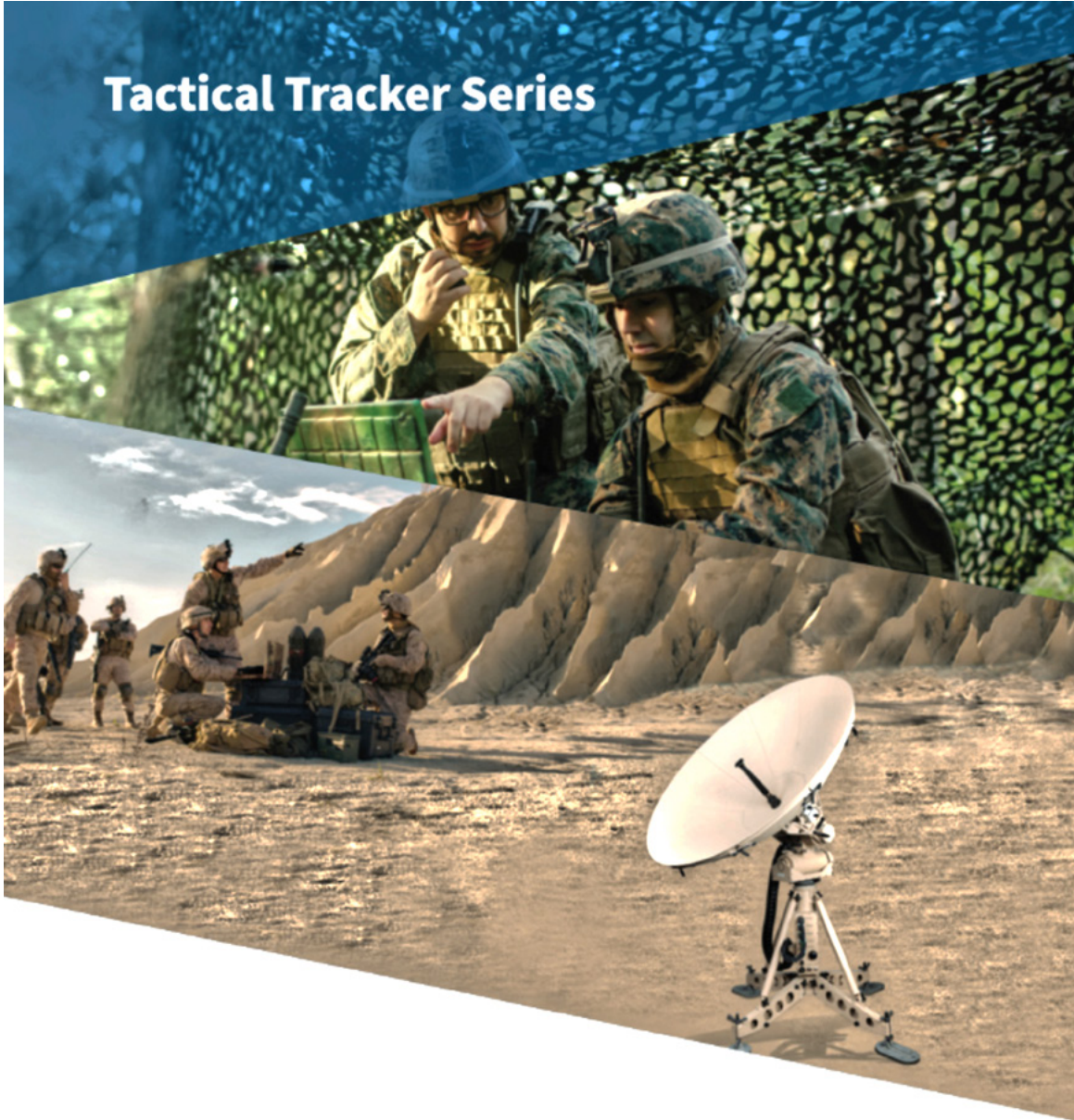


- web browser client
- easy re-configuration
- operator friendly GUIs
- smart work flows
- vendor independent

The new **sat-nms** Monitoring & Control System is part of SES mPOWER  
Check it out on [www.satservicegmbh.de](http://www.satservicegmbh.de)

## Cobham Satcom rolls out O3b mPOWER transportable terminals to SES

### Tactical Tracker Series



Cobham Satcom's TACTICAL TRACKER terminals are easily converted between Ku- and Ka-band and offer multi-band, multi-orbit, COTP capabilities.

The antennas are transported in rugged man cases and can be set up and operational within 30 minutes.

Additionally, the terminals can be operated in a dual antenna make-before-break configuration, with a rapid retrace capability enabling a single antenna operation while preserving link security.

The O3b mPOWER system represents a tremendous step forward in communication satellite capabilities, providing unprecedented flexibility and throughput.

The new terminals expand Cobham Satcom's O3b mPOWER terminal portfolio, joining the recently certified Sea Tel 2400 Tri-band terminal for the energy market.

The EXPLORER 8120 is a rugged, field-proven, 1.2 m tracking antenna, available in Ku and Ka-band versions, and easily adapts to a range of vehicles and platforms.

The antenna can be used in single or multi-antenna configurations, with rapid deployment and acquisition within minutes.

*"We are pleased to provide new capabilities to SES for the growing COTP segment and to offer proven defense and enterprise solutions. The TACTICAL TRACKERs are the first, man-portable, multi-orbit terminals that actively track across GEO, LEO, and MEO systems, providing mission-critical connectivity to government customers. In addition, the adaptation of the well-proven EXPLORER 8120 also meets the needs of some of the largest telco carriers."*

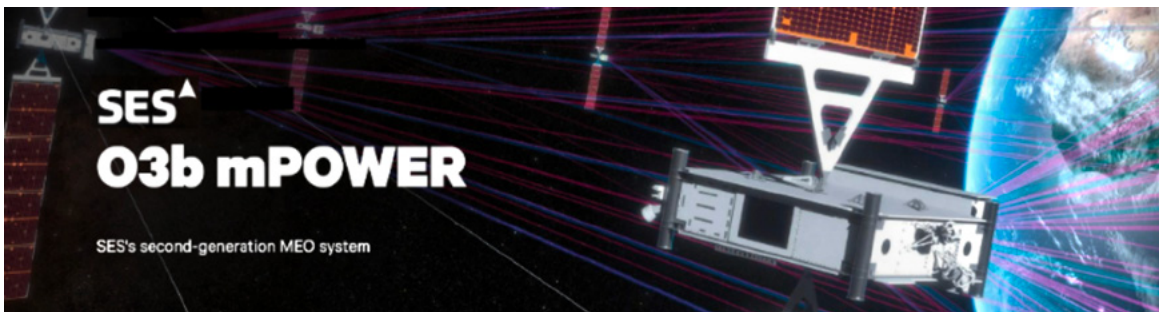
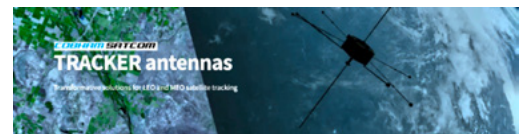
*Kirby Nell, VP of Business Development at Cobham Satcom.*

**Cobham Satcom and SES have engaged in a contract for a range of O3b mPOWER-enabled, Communications-on-the Pause (COTP) terminals.**

The contract consists of Cobham Satcom's rugged, man-portable, LEO/MEO/GEO capable, **TACTICAL TRACKER** terminal series that range in size from 1.35 to 2.64 meters as well as the successful **EXPLORER 8120** vehicle mount tracking antenna.

The TACTICAL TRACKER Terminal serves the Government and Defense segment, while Government agencies, carriers, and enterprise customers use the EXPLORER terminals for service augmentation and restoration.

The active tracking TACTICAL TRACKER terminals will enable seamless connectivity across SES's multi-orbit network of Geostationary (GEO) and MEO satellites, with forward compatibility on SES's new MEO system O3b mPOWER, as well as SES's second-generation, high-throughput, low-latency constellation.





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# SPACE-BASED MILITARY INTELLIGENCE ACHIEVED USING A PROVEN ELECTRONICS INFRASTRUCTURE

Author: Pratish Shah, General Manager, Aitech USA

Upon its inception in 2019, the [Department of Defense's \(DoD\) Space Development Agency \(SDA\)](#) quickly defined the agency's mission to contribute to the defense of our nation. According to then-Secretary of Defense, Patrick Shanahan, the SDA was formed to serve as "a national security space architecture that provides the persistent, resilient, global, low-latency surveillance needed to deter or, if deterrence fails, defeat adversary action as a prerequisite to maintaining our long-term competitive advantage."

By leveraging speed, delivery and agility, the SDA aims to provide the needed space-based capabilities to the joint warfighter as well as support terrestrial missions through development, fielding and operation of the [Proliferated Warfighter Space Architecture \(PWSA\)](#).

This PWSA is the organization's threat-driven constellation of smallsats that deliver critical services to our warfighters from space, formerly known as the [National Defense Space Architecture](#).

## Space As The Next Battlefield

Of the [nine space acquisition tenets](#) outlined in a memo issued by the [Department of the Air Force](#) in October of 2022, "Build Smaller Satellites, Smaller Ground Systems, and Minimize Non-Recurring Engineering" tops the list.

This presents a growing challenge to meet aggressive development-to-deployment schedules within a tight budget that is shared among satellite and payload builders, from privately funded organizations to government entities alike.

As the space industry pushes for designs with increased computing performance and tighter system integration, system engineers are then asked to achieve these goals within the extraordinarily *small size, weight and power (SWaP)* profiles.

Even with the reduction of costs and the growing opportunities in space electronics, reducing risk will always be a factor, as will the ability to meet challenging budget, power, weight and environmental targets.

Flexibility in system design, modular solutions built for any orbit level and reconfigurable, space rated components are all things to assess when developing space-rated electronics.

## Establishing A Cost-Effective Electronics Pathway

A common thread across all parts of today's space technologies is the digitization of electronics using [Commercial-Off-The-Shelf \(COTS\)](#) systems that rely on open standards and highly adaptive scalability to facilitate cost-effective innovations.

With the ability to capitalize on proven computing technologies in the highly rugged space environment, innovations from launch vehicles, satellites, propulsion and even future habitat environments, are being conceptualized or brought to market more rapidly than ever.

In theory, commercial components can be used in space applications, but important to note is that radiation tolerance in space components plays a significant role in determining the success or failure for the duration of a mission.

As a result, characterizing the radiation hardness is critical. But "COTS in Space" is not a new concept. In fact, [Aitech](#) has been providing reliable COTS-based systems to the space industry for nearly four decades.

What is new — the ability to better integrate COTS electronics into higher density, more compact, network-based satellite clusters being developed throughout the space industry at significantly lower cost and shorter development cycles.

This is, in part, thanks to the [Space Digital Backbone \(DBB\)](#) that enhances communication among space electronics and is helping forge a path for higher levels of military intelligence and situation awareness through networked, low-orbit, satellite constellations.

## Space Digital Backbone: A Common, Networked Infrastructure

Modeling an "information highway" approach, the Space DBB architecture provides a unified, flexible and scalable communication infrastructure for the increasing number of IoT technologies being implemented into space architectures, such as the PWSA of the SDA.

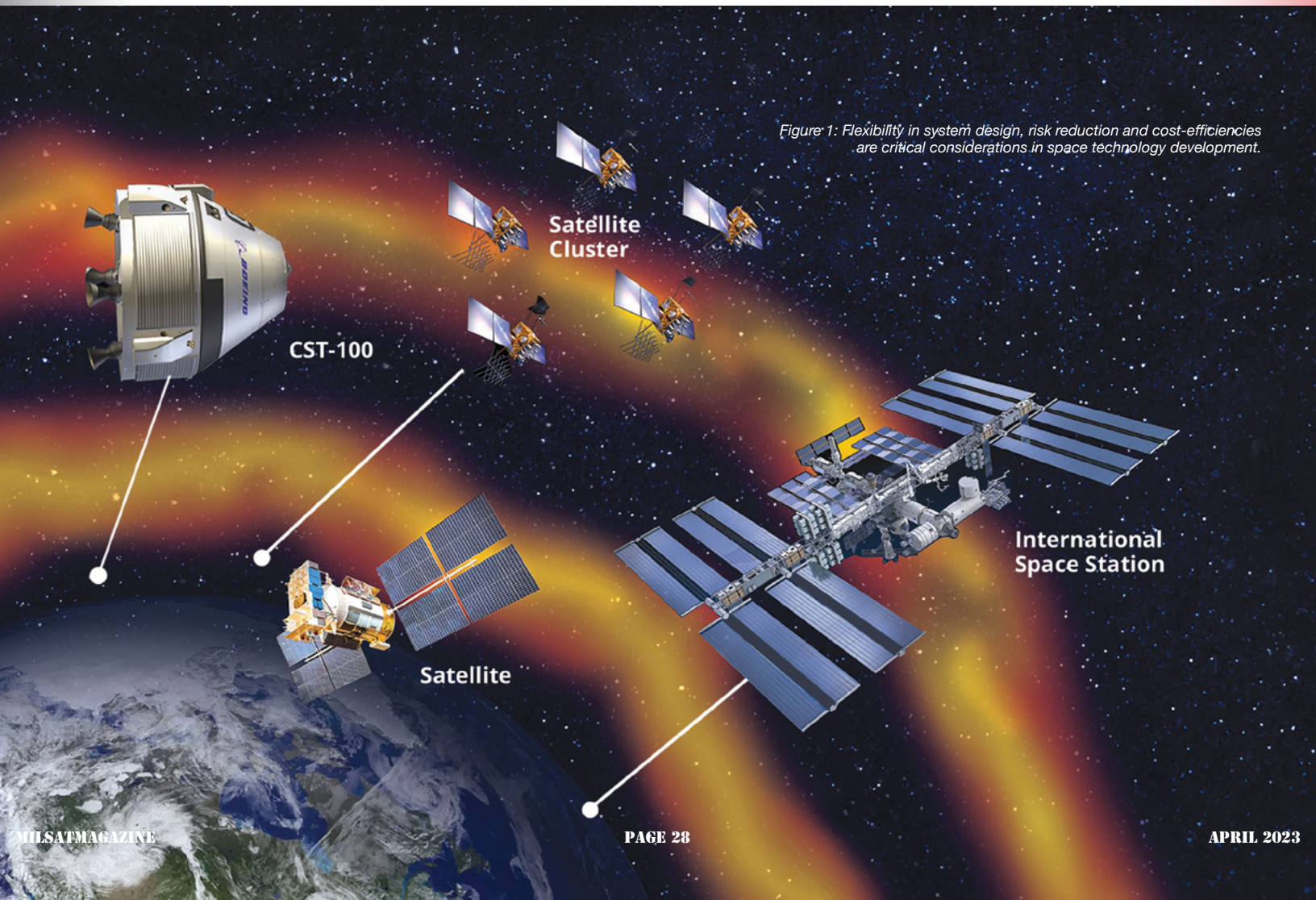


Figure 1: Flexibility in system design, risk reduction and cost-efficiencies are critical considerations in space technology development.



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# The Universe is Calling



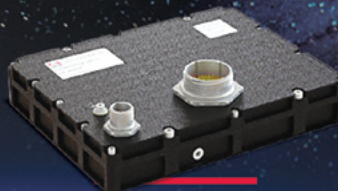
## GET THERE WITH A SPACE DIGITAL BACKBONE



SPO-S SBC



S-A1760



S-A6640



A445

Heavily using COTS systems for scale and cost-efficiencies, the Space DBB provides space electronics that operate across all orbits by removing connectivity and computing limitations as well as the associated performance bottlenecks that have forced space-grade, radiation-tolerant electronics to lag several generations behind similar systems on Earth in terms of technology advancement, adoption of modernized scalable architectures and open standards.

The Space DBB architecture includes three main elements:

- *Open Standard Networking*
- *Edge Computing with AI/ML*
- *Network Attach Storage (NAS)*

Examples of successful Space DBB networking include an Ethernet-based network switch ([S-A6640](#)) from Aitech as well as the first-in space, AI supercomputer — ([S-A1760 Venus™](#)) — based on the **NVIDIA GPGPU** architecture, enabling multiple edge computing and *artificial intelligence and machine learning* (AI/ML) applications to be deployed directly in space.



Aitech S-A1760 Venus Space AI GPGPU (General-Purpose Graphics Processing Unit)

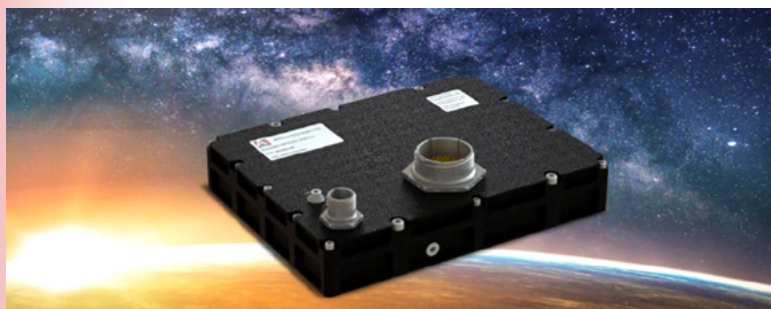


Figure 2: Ethernet switch technology, such as Aitech's S-A6640, enables the build out of the Digital Backbone architecture for increased space-based communication.

The onboard computing capabilities save the need to send significant data streams back to Earth.

### *Improved Space Communications*

Two instantiations of the Space DBB examples can be realized and implemented — one for LEO/NEO satellites and ISS, and another for GEO satellites/missions and Lunar exploration.

Both use the main three elements to enable easy up/down scalability, based on the size of a constellation, a spacecraft size and mission requirements.

Each of the implementations provides specifically designed and radiation-tested products for its target space environment in a compressed development timeline.

The Space DBB streamlines high performance onboard computing and expedites valuable data assets for transmissions within a spacecraft or inter-constellation as well as back to Earth, eliminating significant technical challenges, such as extremely slow, cumbersome communications.

### *Future Of Space Being Led By COTS*

Much like the insatiable need for high computing performance in harsh environments in the defense sector, there is a growing need for reliable, space-rated systems that meet the ever-evolving technology requirements around communication, imaging, and processing capabilities.

Proven and reliable COTS electronics enable aggressive development-to-deployment schedules and provide embedded designs with enhanced capabilities and performance.

A paradigm shift in the approach to building space electronics has paved the way for an entirely new economy of commercial spaceflight and has also enabled military and defense entities to reimagine the use of this expansive landscape.

The use of cost-effective COTS-based electronics is reducing latency risk and cost, while increasing connectivity, ultimately helping to build a far more efficient intelligence infrastructure for the warfighter in space environments.

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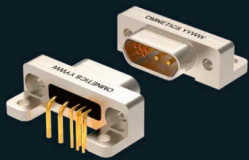
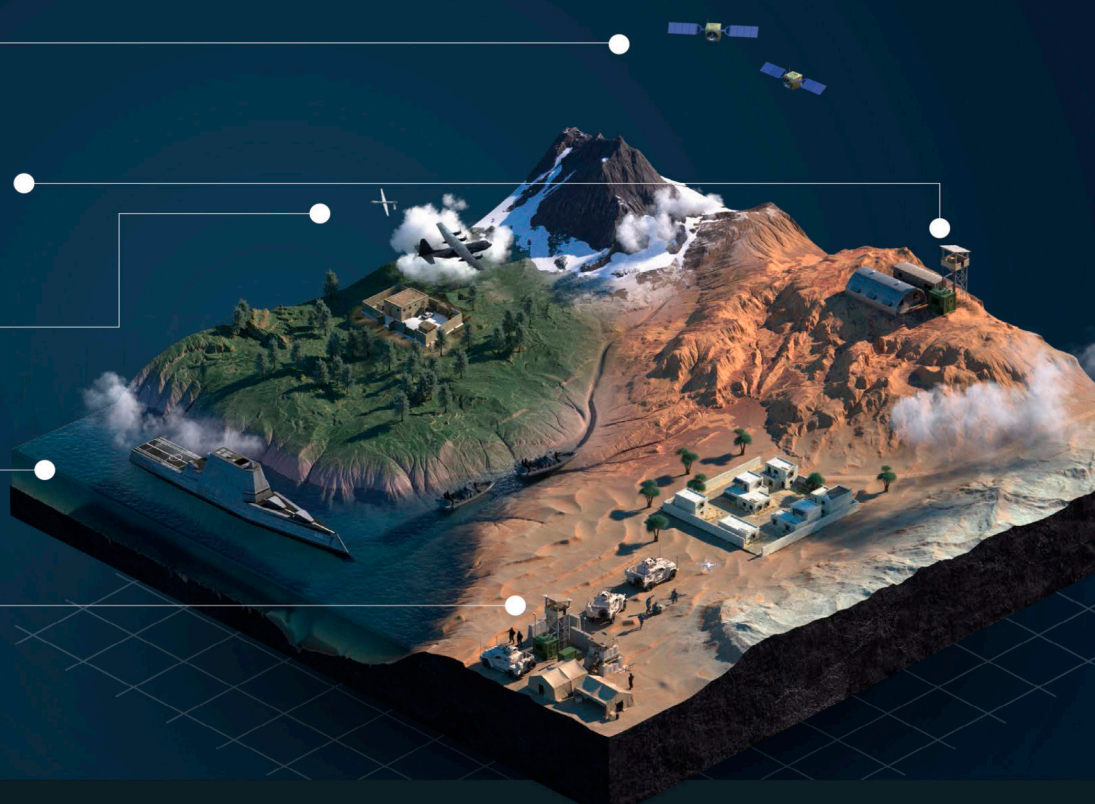
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Radar Guided Missiles  
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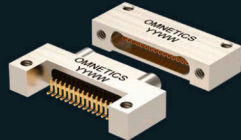


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# THE CYBER VULNERABILITIES OF SATELLITES MUST BE ADDRESSED

Author: Egon Rinderer, Chief Technology Officer, SHIFT5

In January of 2023, U.S. Defense Secretary Lloyd Austin and Secretary of State Antony Blinken hosted Japanese Foreign Minister Hayashi Yoshimasa and Defense Minister Hamada Yasukazu for the 2023 U.S.-Japan Security Consultative Committee.

The allied foreign and defense ministers announced that military retaliation in response to attacks on Japanese satellites will be considered under the **Japan-US Security Treaty**.

The inclusion of space in this decades-old treaty signals a shift in focus, codifying the defense of space assets at the diplomatic level. To defend space assets successfully, our definition of "attack" must expand beyond the kinetic.

During the Russia-Ukraine conflict, satellites became a central target for adversarial cyber operations, according to defenders.

U.S. Space Force Chief of Space Operations, **General Chance Saltzman**, labeled space and cyber as "inextricably linked." He described their attractiveness as a target for adversaries on the battlefield: "right out of the gate, we saw both sides attacking satellite operations to degrade command and control." In his words, satellites are "important to how a force fights in the modern environment."

As global tensions rise amid the China-Taiwan conflict, the Department of Defense (DoD) must rigorously vet and defend cyber risks to satellites.

Vice Chief of Space Operations at U.S. Space Force, **General David Thompson**, said China is developing and fielding a wide range of technology such as jammers and lasers that could harm America's satellites. Such attacks would have catastrophic impacts on civilian and defense infrastructure, economy, and safety.

## A New Era For Defense

In December of 2022, the DoD Chief Information Office (CIO) released the **Enterprise Satellite Communications (SATCOM) Management and Control (ESC-MC) Implementation Plan** to support of the Department's **Digital Modernization Strategy** and the **United States Space Force Vision for Satellite Communications** (see the sidebar for the complete USSF paper).

This cross-Department effort, involving **U.S. Space Command, U.S. Space Force, DoD CIO**, and the **Defense Information Systems Agency (DISA)** enables offices to manage SATCOM as a holistic capability and enable joint interoperability.

A key element of the Plan involves establishing governance and standards among SATCOM networks. Space poses an acute cybersecurity challenge as satellites are inherently interconnected and can hold sensitive data or even key intelligence. Should an adversary compromise a satellite, their ability to gain and exfiltrate such data is high. As such, the standards in development must include defining reasonable security measures. This would include stipulations to share threat information and develop a common cybersecurity architecture — not just for us, but also our allies and partners who share the space domain. Such standards should be considered basic cybersecurity hygiene measures that mitigate most common and effective cyberattacks.

The DoD can set the industry standard for addressing satellite cybersecurity as another dimension of critical infrastructure. As the current fiscal year moves forward, DoD will be well served to factor in these principles:

Consider the entire satellite asset. Traditional satellite systems were not designed with security in mind. Weak encryption and legacy systems cannot be easily patched or updated. Cognizant of the threats, providers of newer generation satellites are

undoubtedly working to fortify cybersecurity in new spacecraft. Even so, the traditional information technology (IT)-centric approach to security does not include protecting the operational technology (OT) layers that satellites rely on. That makes satellites more vulnerable to hacking, since their OT components share data over the same networks as IT components use. DoD should factor both IT and OT requirements into any forthcoming security standards.

Learn from IT security evolution. Leaning on decades of hard lessons learned in securing terrestrial IT networks will help achieve space asset security. That includes basics like defining best practices to assess what assets are in place, and enabling observability into their operational performance to help detect anomalies that can indicate attacks. Satellite vendors can harden the code running on space systems and use the principle of least privilege for accessing them. These same lessons have been successfully applied to transportation OT systems.

Require a whole-of-industry approach. Aligning with the **2022 National Defense Strategy**, the **Space Systems Command (SSC) Commercial Services Office (CSO)** is seeking industry input that will be used to inform requirements for a pilot program for new satellite cybersecurity guidance.

The program is known as the **Infrastructure Assurance Pre-Approval (IA-Pre)** initiative.

A key goal for IA-Pre is streamlining risk assessments for COMSATCOM vendors while applying a cybersecurity-first approach. The initiative requires building strong industry relationships; however, in the same spirit as the pending **Cybersecurity Maturity Model Certification (CMMC)** requirement for members of the defense supply chain, the plan should assure that those vendors adhere to common standards that will assure cyber resilience for all.

The transition of space to a battle frontier is happening quickly and mandates disruptive change to fortify the technology on the frontlines of cyberattack. New and thorough standards must be developed with expediency, working in realistic industry partnership while setting a non-negotiable bar.

As the number of satellites in orbit and dependence on them for civilian and military uses increase, securing them must be a top national priority.

With 30 years of federal and private sector industry experience, Egon Rinderer serves as Shift5's Chief Technology Officer with a focus on growing a world class field engineering team to drive rapid growth across federal and commercial sectors. A U.S. Navy veteran to the tech startup world, Egon was formerly with Tanium as Global VP of Technology and President of Tanium Federal, having joined Tanium when it numbered fewer than 20 employees. Prior to Tanium, Egon served with the U.S. military and throughout the intelligence community in the United States and abroad in an operational capacity.



Egon Rinderer

Shift5 is the onboard data company that provides dual use technology to defend military weapons systems against operational technology (OT) cybersecurity risks and ensure mission readiness and cyber survivability. Shift5's innovative technology enables military systems to deter adversaries, protect warfighters, and maintain their competitive edge.

# SHIFT5



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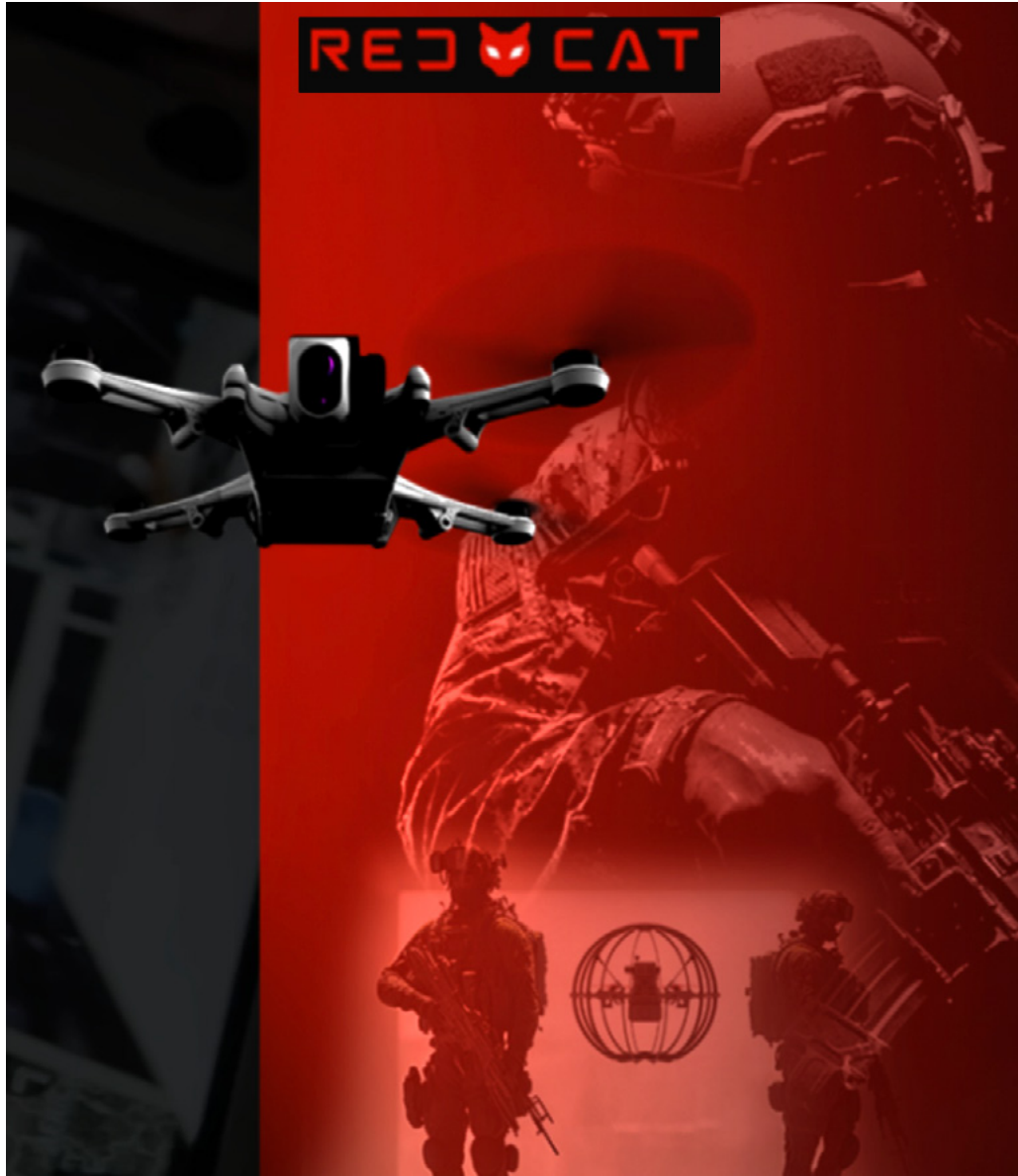
**Interference  
Geolocation**



**Interference  
Mitigation & Removal**

# DISPATCHES

## Red Cat Holdings invests in Firestorm



Firestorm's founding team has deep industry expertise in additive manufacturing, aerospace, and defense and understands how to build and quickly scale dual-use technology companies.

*"Firestorm is changing how UAV's can be designed, manufactured, and delivered quickly, and the Firestorm system solves a lot of problems for many criti situations. Their long-range and long-duration loitering capabilities are a cost-effective approach to winning in the air. We believe that our Teal 2 drone and the Firestorm UAV could be a great combination for the warfighter. We want to help Firestorm succeed, and this investment may be just the beginning. For example, our large manufacturing facility in Salt Lake City could accelerate the production of Firestorm's products to meet increased demand."*  
Red Cat CEO Jeff Thompson

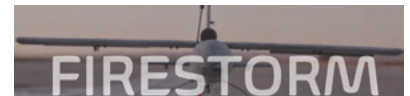
*"We are honored to have Red Cat join us on our journey. Red Cat's Blue UAS products, their American manufacturing facilities, and their industry knowledge have made them a great partner as we work to scale our business."*  
Firestorm CEO Daniel Magy

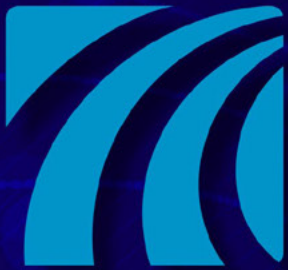
Red Cat (Nasdaq: RCAT) is a military technology company that integrates robotic hardware and software to provide critical situational awareness and actionable intelligence to on-the-ground warfighters and battlefield commanders. Its mission is to enhance the effectiveness and safety of military operations domestically and globally – and to "Dominate the Night." Red Cat's suite of solutions includes Teal Drones, developer of the Golden Eagle, a small unmanned system with the highest resolution imaging for nighttime operations, and Skypersonic, a leading provider of unmanned aircraft for interior spaces and other dangerous environments.

Firestorm is building the future of modular, open-architecture unmanned aerial systems, supporting global requirements to create radically affordable hardware. Firestorm is dedicated to redefining commercial and military expectations for modularity with in-field reconfiguration that supports the widest array of mission needs.

**Red Cat Holdings, Inc. (Nasdaq: RCAT) has made a significant financial investment in Firestorm, a company developing the first, completely Modular Unmanned Aerial System (MUAS) that is 3D printed and payload agnostic.**

Firestorm is building a new category of fixed-wing UAS with 30-day product iterations, a commitment to open-system architectures plus an additive manufacturing approach that allows them to scale production in an elastic manner.





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