

Next Generation Space Defense

MILSATMAGAZINE

January 2023

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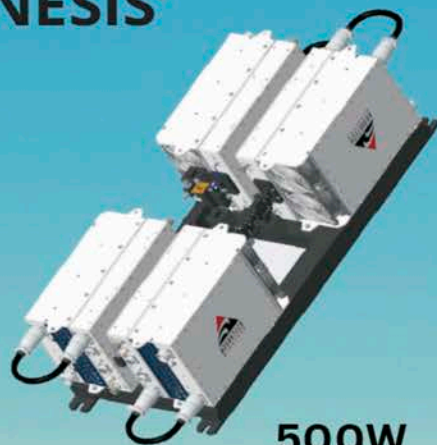
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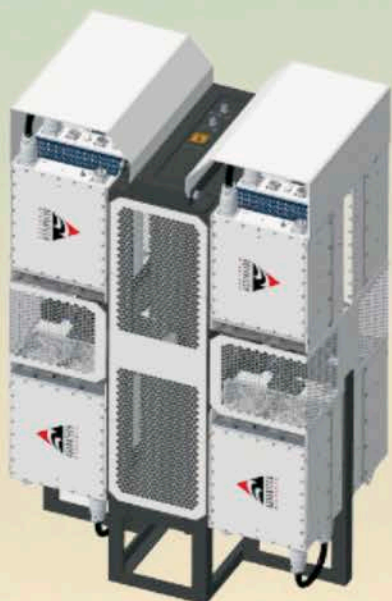


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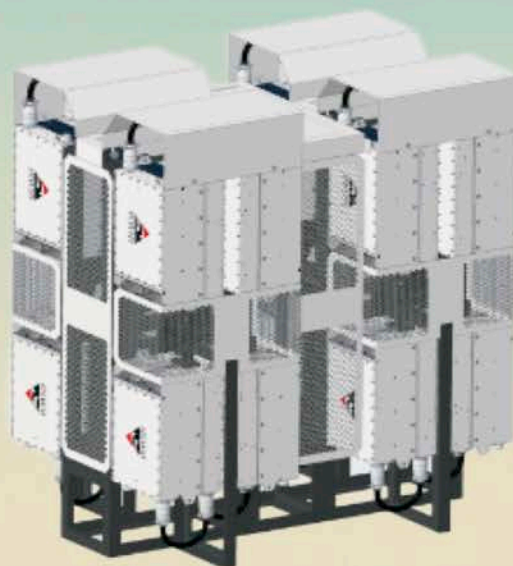
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Power**



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Power**

RAYTHEON INTELLIGENCE & SPACE'S CONTRACT WITH U.S. SPACE FORCE FOR MISSILE TRACK CUSTODY SYSTEM



Raytheon Intelligence & Space has been awarded a prime contract to develop a prototype Missile Track Custody (MTC) system for the U.S. Space Force. MTC is the service's first Medium Earth Orbit (MEO) missile tracking system.

Under this contract, Raytheon Intelligence & Space will serve as the prime contractor, developing and delivering a space vehicle, hosting a state-of-the-art missile tracking mission payload and ground-based command and control and mission-data processing elements.

This system was developed using model-based systems engineering that significantly increased the speed of development, all the while reducing cost.

The company will also deliver the *command and control* (C&C) and real-time mission-data processing elements for MTC.

The ground system will use the *Future Operationally Resilient*

Ground Evolution Mission Data Processing Application Framework (FORGE MDPAF).

Raytheon's FORGE MDPAF is a ground system framework that collects and processes data from satellites, including *Overhead Persistent Infrared (OPIR)* space vehicle data from Space Force's **Space-Based Infrared System (SBIRS)** constellation and the future **Next-Generation OPIR** constellation.

"This is an advanced solution to counter emerging missile threats facing our country," said Roger Cole, executive director, Strategic Systems programs, Raytheon Intelligence & Space. "From its MEO perch, our system will enable Space Force to accurately detect and track adversarial hypersonic weapons with precision accuracy."

Lockheed Martin is providing its mid-sized **LM 400** bus to host a Raytheon IR sensor payload for this U.S. Space Force mission. The rapidly producible LM 400 supports the mission to accelerate a U.S. layered missile defense system.

Raytheon Intelligence & Space's mission payload, which passed critical design review in November of 2022, will be integrated onto the LM400 satellite bus that includes **SmartSat**,™ software-defined satellite capabilities that allow it to adapt to changing mission needs and deploy new capabilities to stay ahead of evolving threats.

"Lockheed Martin is excited to provide our mid-sized, rapidly-producible LM400 bus to Raytheon, supporting our customer's mission to deliver initial warfighting capability with Missile Track Custody Epoch 1," said Mike Corriea, vice president, Lockheed Martin's Overhead

Persistent Infrared mission area. "Lockheed Martin will leverage a full suite of digital engineering tools to produce satellites that are dramatically more responsive and flexible, at a fraction of the cost and delivery time for our customers."

The team plans to complete a system critical design review in 2023, followed by a build, integration, and test campaign to deliver capability to orbit by 2026.

Work for this program will be executed in El Segundo, California, and Aurora, Colorado.



Lockheed Martin is providing its mid-sized LM 400 bus to host a Raytheon IR sensor payload for the U.S. Space Force's first missile tracking capability at MEO.

Fairwinds Technologies has grown significantly since the firm's founding in 2016 and the expectation is that the company's size, sales and offerings will continue to increase into 2023, with projected revenue growth more than 55%.

In 2022, Fairwinds was awarded its first program of record — an integration contract — and we expect additional contracts in 2023.

In addition, Fairwinds Technologies anticipates large satellite equipment deals in the new year, solicited via the company's **GTACS II** and **NASA SEWP** prime contracts.

We also predict significant growth for our professional services business with several opportunities now tracking. March will note the launch of our first product, a significant advancement in the area of ground technology, developed in-house. **Global Link** is a multi-modem, antenna management system that allows the warfighter to route any modem to any antenna, as well as quickly add or change modems and antennas.



Further, Global Link enables multiple, simultaneous frequencies and connections over LEO, MEO and GEO satellites. In the year ahead, Fairwinds foresees the award of R&D contracts, enabling us to go to market with even more revolutionary products.

Author **James Sprungle** leads the team at Fairwinds Technologies as Chief Executive Officer. As one of the founding members of the company, Jim previously led all sales and business development efforts and was instrumental in directing company strategy. Prior to Fairwinds, Jim was a Senior Vice President at TeleCommunication Systems (TCS). Jim is a graduate of the United States Naval Academy and has an MBA from Loyola University.



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Governments and their militaries are experimenting more and moving faster to stay ahead of adversaries and rapidly shifting geopolitical changes.

For example, the U.S. defense agencies, such as the **Defense Innovation Unit**, **Air Force Research Laboratory**, and the **United States Space Force**, are accelerating the testing and procurement of advanced technology that gives warfighters an edge.

At **Intelsat**, we believe in collaborations and that satellite connectivity can no longer function on networks operating on bespoke hardware or standards — only integrated systems can keep up with the rapid pace of change. Interoperability can provide seamless transitions between the multiple layers of connectivity, networks, and terminals and is the future of meeting demand needs.

Intelsat and our partners are building a unified network to seamlessly extend global telecoms and cloud infrastructure capabilities that enable easy-to-deploy managed services across satellite and ground technologies, embracing various open standards and architectures.

We are moving to all-domain resilient communications that are multi-layer, multi-orbit, and multi-band, using RF and 5G, for example, to create combined/blended, surge-capable bandwidth

with no single point of failure, better performance, and lower cost per Megabyte.

As the importance of space-based communications for military applications continues to grow, it is vital to implement security measures to counter threats to critical space infrastructure from adversaries, space debris, solar storms, and weather events.

In the coming decades, multi-layer satellite-based satellite communications systems will continuously adapt to enhance military communications for mission success.

We believe we can achieve this through our next-generation unified network, which is a step-change transformation in the delivery of satellite connectivity.

Author Dave Micha is the President of Intelsat General Communications.



DISPATCHES

A \$2.25 BILLION WIN FOR CACI

CACI International Inc. (NYSE: CACI) has been awarded the Defense Counterintelligence and Security Agency (DCSA) Background Investigation Fieldwork Services Contract, a five-year single-award indefinite delivery/ indefinite quantity contract valued at \$2.25 billion, to provide background investigation capabilities to the DCSA.

CACI has a long-standing partnership with the DCSA and has supported national security by performing security clearance background investigations for three previous, consecutive iterations of the contract.

DCSA is currently responsible for conducting more than two million background investigations per year on civilian and military applicants and Federal employees or employees of Government contractors and consultants to Federal programs.



Under this enterprise technology contract, more than 1,000 of CACI's background investigators will conduct these initial investigations and periodic re-investigations nationwide.

John Mengucci, CACI President and Chief Executive Officer, said, "CACI brings more than 17 years of experience in conducting background

investigations to DCSA. Our tenured background investigators are the first line of defense in identifying threats to our national security and preventing infiltration of our government facilities. CACI's support is crucial to securing the trustworthiness and integrity of the U.S. Government's workforce."

Work will be performed in all 50 states, Washington, D.C., and all commonwealths and U.S. Trust Territories.

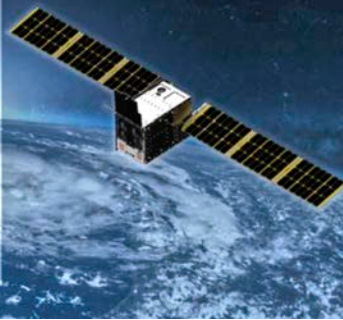
CACI's approximately 22,000 talented employees are vigilant in providing the unique expertise and distinctive technology that address our customers' greatest enterprise and mission challenges. The company's culture of good character, innovation, and excellence drives the firm's success and earns CACI recognition as a Fortune World's Most Admired Company.

www.caci.com

SPACE SYSTEMS COMMAND'S EWS TECH DEMO SMALLSAT LAUNCHED BY SPACEX

EWS CubeSat Technical Demonstration

Launching on the Transporter-6 commercial rideshare mission, this one-year demonstration will prove out emerging space-based EO/IR radiometric imaging technology, using a smaller sensor to provide timely weather imagery data from Low Earth Orbit (LEO). If successful, this next-generation capability will support warfighter mission planning, operations and execution.



Space Systems Command successfully launched the organization's Electro-Optical/Infrared (EO/IR) Weather Systems (EWS) cubesat technical demonstration onboard the SpaceX Transporter-6 mission at 9:56 a.m. (Eastern, 6:56 a.m. Pacific) from Cape Canaveral Space Force Station, Florida on January 3, 2023.

This one-year EWS cubesat tech demo will prove out emerging, space-based, EO/IR radiometric imaging technology, using a smaller sensor to provide timely weather imagery data from LEO.

In February of 2002, the EWS program competitively selected two vendors to develop and launch two separate, sensor prototypes.

Orion Space Solutions, a non-traditional government contractor, delivered the cubesat for this demonstration.



General Atomics Electromagnetic Systems Group will deliver the second prototype by 2025.



This launch satisfies the **FY20 National Defense Authorization Act (NDAA)** Congressional mandate to launch a weather EO/IR pathfinder prototype by FY23.

The program expects the first transmittal of data early in 2023.

"The EWS cubesat technical demonstration effort represents SSC's continued commitment to working with non-traditional partners to broaden the competitive industrial base. If successful, this will provide an innovative option to deliver Space-Based Environmental Monitoring data to the warfighter at an operationally relevant speed," said Lt. Col. **Joe Maguadog**, EWS Materiel Leader and Program Manager. *"This demonstration will inform our transition toward a more affordable, scalable, and resilient EO/IR weather constellation."*



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NORWEGIAN-DUTCH MILSPACE2 SMALLSATS SUCCESSFULLY LAUNCHED

MilSpace2
Satellites Birkeland and Huygens

Ministry of Defence

Who were Birkeland and Huygens?
Kristian Olaf Bernhard Birkeland (13 December 1867 – 15 June 1917) was a Norwegian scientist. He is best remembered for his theories of atmospheric electric currents that elucidated the nature of the aurora borealis. In order to fund his research on the aurora, he invented the electromagnetic cannon and the Birkeland-Eyde process of fixing nitrogen from the air.
Christiaan Huygens (14 April 1629 – 8 July 1695) was a Dutch mathematician, physicist, engineer, astronomer, and inventor, who is regarded as one of the greatest scientists of all time and a major figure in the scientific revolution. (Source: Wikipedia)

Platform

- 2 6U Cubesats
- (Passive) radar detectors
- Active attitude control
- Ion thrusters
- Sun Synchronous Orbit

In orbit
The two satellites will be placed into a polar Low Earth Orbit (LEO) with an altitude of 535 km. They will be positioned in the same orbital plane and the separation distance will vary throughout the mission.

“Birkeland” and “Huygens” are 2 similar satellites flying in formation. They both receive radar signals from the ground by their on-board antennas. By using the angle of arrival, one satellite alone can determine the geolocation of the transmitter. When including the data of the second satellite, the accuracy of the geolocation can be improved, by using the time difference of arrival measurements of the same signal. To remain in formation the satellites are equipped with small thrusters to maintain their position.

One of the unique aspects is the fact that the satellites are owned and operated by 2 countries: the Netherlands and Norway. Two like-minded NATO nations have joined forces in this research mission. Together they are able to create a capacity that can observe radar systems on land and at sea: the MilSpace2 satellite system.

Launch, Ascent, Stage separation, Flip maneuver, Boostback burn, Grid fins deploy, Entry burn, Aerodynamic guidance, Vertical landing, Fairing separation, Payload separation

SpaceX - Falcon 9

Forsvarsdepartementet
Norwegian Ministry of Defence

FFI Norwegian Defence Research Establishment

TNO innovation for life

nano avionics

nlr Dedicated to Innovation in Aerospace

Two Norwegian-Dutch smallsats were successfully launched on January 3, 2023 — Birkeland and Huygens were placed into orbit by SpaceX via the Transporter-6 mission.

MilSpace2 is a cooperation project between the **Netherlands Ministry of Defence**, the **Norwegian Ministry of Defence**, the **Norwegian Defence Research Establishment (FFI)**, the **Netherlands Aerospace Center (NLR)** and the **Netherlands Organisation for Applied Scientific Research (TNO)**.

Defence Vision 2035 states that space has become a crucial link in the information-driven operations of the armed forces.

The defence organization is very dependent on satellites for navigation and communication systems, among other needs.

This is the second time that the Netherlands Ministry of Defence has launched satellites and is, therefore, implementing **Defence Vision 2035**.

The satellites, each of which is not much larger than six, one-liter cartons of milk, each measuring approximately 30x20x10 cm, are named after Norwegian physicist *Kristian Olaf Birkeland* and the Dutch astronomer, *Christiaan Huygens*.

Strategic mutual assistance in research and technology (SMART), military use of space (MilSpace) and cooperation in science and technology

are elements of the bilateral agreement between the ministries of defence of the Netherlands and Norway.

The project team that is acting on behalf of the two ministries consists of the Norwegian Defence Research Establishment (FFI), the Royal Netherlands Aerospace Centre (NLR) and the Netherlands Organisation for Applied Scientific Research (TNO).



In 2023, we will see more Low Earth Orbit (LEO) satellite implementations as these constellations come online and begin delivering bandwidth for low-latency applications.

We'll get a better sense of how the new LEO constellations can be integrated with existing military networks, such as the Protected Tactical Enterprise Service running on the DoD's WGS constellation. We will also see more announcements of plans to launch 5G-ready constellations that can connect with 5G cellphones on the ground.

Since 2018, Hughes has been working with Boeing on the **U.S. Air Force's Protected Tactical Enterprise Service (PTES)** to demonstrate anti-jam SATCOM capability. This past year, we showed that PTES will enable secure operations over the military's WGS constellation and in the future, the processed PTS satellites.

The next challenge will be that similar results can be achieved if the military were to integrate commercial GEO satellites into its networks and possibly run DoD-specific waveforms similar to this on MEO and LEO satellites. In 2023, we could also take further steps toward having 5G connections in space. This would require a constellation of interconnected satellites built with 5G capability, essentially cellphone towers in the sky.

When 5G is finally available, it could finally help solve the DoD's problem of having so many ground terminals incompatible with one another. A ruggedized 5G cellphone would be a simple solution to solving the problem and could be an adjunct to the current 3G-based MUOS system.

We will also start seeing more stand-alone ground networks using 5G technology—such as the stand-alone, 5G network Hughes has deployed at *Whidbey Island Naval Air Station* in Washington state to support flightline operations, aircraft maintenance and flight traffic management.

Many companies are looking for the satellite industry's Holy Grail: a single antenna that can connect simultaneously with multiple satellites in different orbital planes. While the antenna problem may not be solved in 2023, steps have been taken by the DoD to develop a contracting method that makes it easy for the DoD to use LEO satellite capacity.

The best solution will be a managed service model that defines the amount of data, location of use, duration of use and quality of service necessary for the application. With this approach, the DoD can save the cost and complexity of setting up their own systems (as they do with GEO) while accessing the reach, resiliency, low latency, and security of LEO systems.

For the DoD to fully embrace the capabilities of the LEO constellations, the commercial operators will need enough experience and enough satellites to confidently promise the high quality of service expected by the military. Delivering "best efforts" service is not good enough. LEO satellite technology is evolving quickly and can be combined with ground and other satellite resources into hybrid networks with capabilities never before available.

The challenge will be delivering the capacity and network management techniques in a way that fits smoothly into the DoD existing networks and existing procurement procedures.

Author Rick Lober is the vice president and general manager of the Defense & Intelligence Systems Division at Hughes.



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DEMYSTIFYING COMPLEX COMMS

*The impetus behind
delivering battlefield
intelligence*

*Author: Macy W. Summers,
President and
Chief Executive Officer,
Blu Wireless Technology Inc.*



Effective battlefield intelligence, with the ability to share data between a country's military services is vital for truly effective, tactical communications.

This is not just about a country's own services, but also interoperability with partner or coalition nations in order to enable critical operational data to be shared across **Command and Control (C2)** structures from those in the field as well as those in fixed, C2 facilities.

While this has long been the requirement, we are now seeing military forces starting to bring **5G** capabilities into the tactical environment — indeed, this is seen as so crucial that the **U.S. National Science Foundation** is accelerating 5G solutions to assist the **U.S. Government (USG)** and critical infrastructure operators to communicate securely, anywhere and at anytime.

Partnering this year with the **Department of Defense Office of the Under Secretary of Defense for Research and Engineering** on an investment of \$12 million, the NSF selected 16 multidisciplinary teams for the **Convergence Accelerator** program 2022 cohort for the research topic — **Track: Securely Operating Through 5G Infrastructure.**

This builds on the **Department of Defense (DoD)**'s 5G initiative to assess and mitigate 5G vulnerabilities, inform 5G standards and policies through rigorous research as well as promote technology development to advance communications for the U.S. military and Federal Government.

Old Problems, New Tricks?

Is this a new dawn, or something we've seen before, where different technologies and systems for sharing information have been developed with the specific needs of each service, making them incompatible

and difficult to share data directly between domains such as air and navy?

Too often, technology and networks are used within forces that were initially developed for low level data, meaning that the available technology and bandwidth is no longer right for huge data usage involving video, high-definition sensor data and mega-pixel imagery. Such legacy systems and siloed ways of working pose complex challenges when ensuring overwhelming military advantage with near-peer adversaries.

The DoD, through the agency's **Joint All-Domain Command and Control (JADC2)** initiative is also working to overcome such challenges. JADC2 aims to produce a more resilient communications network that will ensure a quicker response to threats.

JADC2 also looks to ensure a co-ordinated approach that will allow data-sharing across military services, enabling parity of access to information and reliable communications across command-and-control structures.

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Photo of a roof mounted, Blu Wireless node.

Integrated Systems

For commanders looking to communicate through a fully integrated system, it is vital that data can be shared in different formats that are in place, but this can be challenging and difficult.

Communication technologies currently in use in the military domain typically date back 20 or more years and are, therefore, only capable of supporting low data rates — usually for voice and limited data rate transmission.

This is, in part, driven by the need for high levels of security combined with the traditional slow moving procurement process (for example the UK's **BOWMAN tactical communication system** where the highest data rate supported by BOWMAN terminals is low – typically 500 kbps).

What is needed, therefore, is an increase in the adoption of **commercial-off-the-shelf (COTS)** technologies, such as 5G, to meet the specific needs of intelligence and military applications.

To share tactical data across multiple platforms, technology must be capable of managing the needs of forces operating across complex environments, through soldiers navigating different terrains in the Middle East, to pilots looking for up-to-the-minute surveillance data from the ground, or naval platforms.

The use of satellite systems, particularly **Low Earth Orbit (LEO)** satellites with their lower latency compared to GEO satellites, is one potential answer.

However due to **size, weight, and power (SWaP)** constraints, the power and bandwidth of satellites is limited and therefore a precious commodity.

Additionally, the power and bandwidth of a LEO satellite is focused on a relatively small, geographic area, hence the need for hundreds or thousands of LEO satellites to provide global coverage.

In a regional conflict, the bandwidth and power of the small number of LEO satellites overhead could be easily overwhelmed or, at the very least, be limited to high priority communications.

Is there another option? Terrestrial **IEEE 5G mmWave** networks are proving to be a key element in providing resilient networking, particularly at the tactical edge.

Comprised of multiple points called “nodes,” these radio devices, communicating with one another, create an overlapping, multi-Gbps, **Low Probability of Intercept/Low Probability of Detection (LPI/LPD)** mesh networks that do not rely on a central hub, allowing for quick and efficient data routing.

Self-sufficient and self-managed, they find the most reliable paths, even if those are “*daisy-chained*” along the communications route.

Built to connect multiple systems, and to work in tandem with existing technologies, mesh networking creates a holistic system, delivering a reliable transmission of huge amounts of data.

Today, IEEE 5G solutions can provide gigabit bandwidths up to 3 Gbps per link, growing to 30+ Gbps plus in the next generation.

When connected to a LEO WLAN, IEEE 5G mmWave mesh networks can connect a tactical edge network to higher echelon, C2, fiber optic networks.

Budget constraints, however, are important, with even the military having to evidence value for money to the public when upgrading communication system.

Upgrading legacy technology and ensuring interoperability provides clear benefits for the safety of military personnel, maintaining a tactical advantage against near-peer adversaries.

COTS Vs. Bespoke

We are now seeing a growing adoption of COTS technologies in the defense community, which is solving some budget constraints, as COTS technology doesn't need to be developed from scratch.

Typical examples would be taking commercial smartphones and adding software to improve security or using IP (**Internet Protocol**) networking products with software that adapts to meet military needs.

The question now is what technology the military should be using going forward and how quickly such can be deployed to ensure the sharing of data and battlefield intelligence between our country's military as well as those of our coalition partners.

5G Private Networks solutions are available today in several industrial and public applications — but how applicable are they to military use?

First of all, private wireless gigabit networks differ greatly from 5G wireless consumer services. Many functions (e.g., *billing, etc.*) in the carrier-grade consumer networks are simply not needed. Private networks often bring their own spectrum or wish to use unlicensed airwaves to reduce **CAPEX (capital expenses)**.

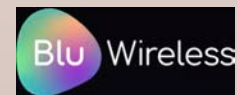
A key consideration to answering the military's communication challenges could well be found in the IEEE 5G mmWave-based systems. The IEEE protocols can be configured to a distributed mesh network rather than a centralized core, meaning there is no single point of failure.

In recent military trials the 5G mmWave technology was deployed on tactical land vehicles in simulated complex scenarios. The objective was to provide coverage to effectively deliver gigabit communication links between the vehicles. The trials saw the capability tested over a wide range of conditions, including traveling at high speed, over rough terrain, at the halt and in RF congested environments. The beamformed mmWave systems were effectively able to deliver the connectivity required to maintain a reliable gigabit network across all scenarios.

Military forces need robust, secure capabilities when communicating and sharing vital data, otherwise the impact on forces and operations could be dire.

While questions remain as to how to deliver these capabilities to the field, IEEE 5G mmWave mesh networks, coupled to LEO satellite systems, offer a proven, reliable, cost-effective solution that holds the key for connecting essential, two-way communications capabilities at the tactical edge to strategic forces and military commands.

www.bluwireless.com



Author *Macy W. Summers* is the *President and Chief Executive Officer of Blu Wireless Technology, Inc.*





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GOVERNMENT SATELLITE REPORT (GSR)

General Dickinson examines the path to U.S. space superiority

Author: David Pesgraves, Government Satellite Report (GSR)



Last November, General James H. Dickinson, Commander of the U.S. Space Command (SPACECOM),



joined the Mitchell Institute for a special Schriever Spacepower forum dedicated to examining the current status of U.S. superiority and domain awareness in space.

During the event, Gen. Dickinson discussed what is required in order for the U.S. to gain and maintain space superiority, the distinction between space situational awareness and space domain awareness, and how the future transition of space traffic management to the U.S. Department of Commerce (DoC) will enhance the **Department of Defense's (DoD)** deterrence and defense capabilities in the arena.

What Is Space Power?

Gen. Dickinson started the forum by outlining the definition of space power. He explained, "Military space power exists to preserve freedom of, access to, and freedom of action in space." According to Gen. Dickinson, these are the priorities of all joint and combined space forces in the U.S. military. And this freedom in the domain is only gained and maintained through space superiority, which is the primary objective of space warfare.

When space superiority is achieved, it means that freedom of action exists in the domain, while simultaneously denying dynamic freedom of action to the adversary. It is designed to give us a strategic, operational, and tactical advantage. Space superiority requires coordinated offensive and defensive operations... importantly, offensive and defensive operations are conducted across all three segments of the space architecture: ground, link, and space."

Gen. Dickinson then touched on the fact that achieving and maintaining space superiority requires the presence and support from SPACECOM's joint allies and partners in the domain.

"Our coalition approach affords us redundant capability and creates dilemmas for our adversaries," he said. "In this way, space superiority is a critical component of integrated deterrence. Threats to U.S. and allied interests in space are substantial and — I think we can all agree — growing."

He explained that U.S. adversaries are prepared and ready to contest the space domain.



TO THE LAST TACTICAL MILE

Space is a vital interest that is integral to the American way of life and national security.

Space superiority enables the Joint Force to rapidly transition from competition to conflict and prevail in a global, all-domain fight.

Space warfighters generate the combat power to win in space.

Space provides the warfighter a combat advantage from the ultimate high ground to the last tactical mile.

Gen. Dickinson pointed to China and Russia as prime examples of near-peer competitors that are rapidly developing and demonstrating space and counterspace capabilities that can deny the U.S. and its allies the advantages derived from space.

"In response to the rapidly changing strategic environment, U.S. Space Command is leveraging today's space power in new ways to achieve greater effects," said Gen. Dickinson. *"Because of the speed of competition with China and Russia, I cannot wait for new capabilities over the next five years. I'm looking for what is good enough today, that I can use right now."*

Situational Awareness Vs. Domain Awareness

Gen. Dickinson then pivoted to the recent memorandum of agreement (MoA) between the U.S. Departments of Commerce and Defense on space traffic management. This MoA is the first step in transitioning space situational awareness and traffic management missions from the DoD to the DoC.

As a result, SPACECOM will be able to focus its resources on enhanced space domain awareness for space superiority. What exactly is the difference between space situational awareness (SSA) and space domain awareness (SDA)?

According to Gen. Dickinson, situational awareness in space is the high-level proliferation tracking of on-orbit satellites and other space assets. Domain awareness in space involves a more granular, strategic scrutiny of assets that are of interest to SPACECOM and the DoD.

"If I had to use an analogy, space situational awareness is a little bit like doing air traffic

control," said Gen. Dickinson. *"Compare that to space domain awareness, that's a couple of steps beyond that, in terms of being able to identify characteristics more closely, more accurately...and understanding the characterization of what's happening on-orbit."*

Gen. Dickinson explained that in 2019, the DoD tracked nearly 25,000 pieces of debris objects on-orbit. These included old and defunct satellites, rocket bodies, etc. Today, there are about 48,000 pieces of debris.

"You can deduce very easily how complicated [space traffic] has become, how congested it has become. So we are open arms, welcoming, working hand-in-hand with Department of Commerce...on space traffic management."

Commercial Partnerships Within SPACECOM

As Commander of SPACECOM, Gen. Dickinson is responsible for meeting capacity and capability challenges in order to deter and defeat any adversaries that pose the U.S. and its allies harm.

"And we don't have the luxury to wait for capabilities...I think we all agree our strategic competitors are not waiting for that," said Gen. Dickinson.

He then explained how critical commercial mission partners are to the DoD's mission of deterring and defending space assets in the domain, hence why the DoD has two commercial integration cells: one at **Vandenberg Space Force Base** and one at **Schriever Space Force Base**. At Vandenberg SFB, commercial entities have operations consoles that are side-by-side with military operators, exchanging information in near real-time. At Schriever

SFB, there is a commercial operations cell that supports the Joint Task Force-Space Defense (JTF-SD), enabling it with real-time synergy and information exchange between owner-operators and tactical users.

"This information exchange ensures that our industry partners and our operators can rapidly and accurately respond to anomalies on-orbit, share valuable lessons, and improve our overall readiness," said Gen. Dickinson.

To watch the Mitchell Institute's entire discussion with Gen. Dickinson, [select this direct link...](#)



This article first appeared in **Government Satellite Report** and is republished with permission of GSR and **SES Space & Defense**.



Author David Presgraves is a Staff Writer for GovSat Report, in addition to several other online publications dedicated to defense, military, and federal government agency technologies.

INNOFLIGHT'S MULTI-MILLION GOVERNMENT CONTRACTS TO RADIATION-HARDEN AND CYBER-HARDEN SENSOR PAYLOADS



Innoflight was awarded more than \$5 million in government contracts to radiation-harden and cyber-harden advanced terrestrial sensor payloads for space.

Within **Department of Defense (DoD)** space programs, there is a significant interest in leveraging affordable, advanced, and low *size, weight and power (SWaP)* avionics systems for use in *proliferated Low Earth Orbit (pLEO)* space sensors and seekers on aerospace vehicles.

This approach allows the DoD to rapidly adopt advanced software-defined and reconfigurable sensor payloads to respond to emerging threats.

Innoflight's contracts cover the entire scope of these payloads, including the sensor, read-out electronics, edge processing and power electronics and will leverage Innoflight's expertise to space qualify *Commercial Off-The-Shelf (COTS)* technologies for mechanical, thermal, electromagnetic and radiation requirements.

A key element of Innoflight's space qualification is a systems-engineering focused, multi-layer mitigation of natural and man-made threats to the payload's electronics and embedded systems.

The largest of the government contracts emphasizes the requirement to harden against cyber threats.



Innoflight CFC-500P GPU-based Processor in the 3U SpaceVPX Form Factor

CyberDog actively protects all communications between the spacecraft and external entities, including *Internet Protocol (IP)* traffic.

For IP traffic, CyberDog selectively calls upon Intrusion Detection System (IDS) routines to quarantine dangerous data or suspicious outbound traffic for further analysis.

The CyberDog algorithm can be tuned to provide high-assurance encryption services to protect sensitive mission data. Finally, CyberDog monitors the internal behavior of the system in real-time.

The proprietary algorithm will monitor for sudden changes in the behavior of the system and rapidly discriminate the change

event as an attack or anomaly. CyberDog will meet the attack based on threat condition, programmed rulesets, or updates from an external command and control node.

These contracts will produce prototype hardware that has completed qualification testing and ready for on-orbit demo.

"Innoflight has built upon its breadth and depth in radiation mitigation of advanced secure communications, networking and processing solutions for responsive space; furthermore, we have taken our expertise and experience in information assurance through multiple U.S. Government Information Assurance cryptographic solution certification programs to build a comprehensive cyber capability called CyberDog," said **Jeff Janicik**, Innoflight President and CEO.

REPORT REVEALS RISING GOVERNMENT SPACE DEFENSE SPENDINGS ANTICIPATED BY INVESTMENTS IN SPACE SECURITY AND EARLY WARNING



Government Space Programs

Benchmarks, Profiles & Forecasts for the next decade.

An extensive view of the activities and economics of government space programs.

euroconsult-ec.com

The new edition of Euroconsult's "Government Space Programs" report provides detailed insight into rising government space budgets in civilian and defense applications for the decade ahead, highlighting spending patterns and specific areas of investment from nations around the globe.

Euroconsult's report reveals a continued increase in global governments' space budgets.

This year has seen a cumulative spend of \$103 billion in 2022, a 9% increase since last year and a record high for the sector.

Despite the recent pandemic crisis, governments have increased their investments in the sector to further support the development of their industry and sustain their ambitions.

This growth is notably significant in the defense area, reaching 16% in 2022 and topping a new record at \$48 billion.

Current geopolitical tensions have confirmed space as a strategic operational theater for hybrid warfare tactics, pushing governments to sustain their investments in 'traditional' space applications, such as *Telecommunications*, *Navigation* and *Earth Observation* (EO), but also more prominently in *Space Security* and *Early Warning* systems to further protect their space assets.

On the civil side, government expenditures are increasingly driven by *Human Spaceflight* missions, which now attracts more and more new entrants that have been encouraged by the socio-economic benefits and prestige brought by these programs.

While civil expenditures have historically always been higher than defense spendings, the gap between the two continues to decrease and is expected to reach 50/50 parity by 2031, according to Euroconsult's projections.

In terms of national rankings, the U.S. remains, by far, the largest investor worldwide.

However, its share of global spending has been reduced, from 76% in 2000 to 60% in 2022 as more and more countries join the sector.

In 2022, Euroconsult counted more than 86 countries invested in space activities.

Some regions have shown a particular dynamism over the past few years, notably in the Middle East, with countries such as Saudi Arabia, the UAE, Qatar and Oman accelerating their development in the sector.

Charlotte Croison, Senior Consultant at Euroconsult, said, "The new edition of the *Government Space Programs* report confirms the growing interest of countries in the space sector, notably in the defense area where space militarization has never been stronger."

Euroconsult's 22nd edition of "Government Space Programs" provides a comprehensive assessment of countries and organizations investing in space.

The report is available on Euroconsult's *Digital Platform*, enabling customers to easily sort, compare, customize and visualize datasets of their choice.

Premium users can access thousands of data points included in the database to create customized datasets for their specific needs.

For detailed profiles on all government players and an accurate map to help navigate the international space investments and priorities, access the company's online platform.

Strategic Outlook providing analysis on global government space trends

Global space budgets return to growth

Global spend in 2022: \$44.5

Euroconsult - Government Space Programs

SPACE TEST PROGRAM (STP) ENABLES SPACE TECHNICAL ENHANCEMENT

Author: Lt. Col. Jonathan Shea, Director of the DoD Space Test Program



Every great technological advancement starts with prototypes and experimental designs that are tested, refined and further developed.

For space technology, the **U.S. Department of Defense (DoD) Space Test Program (STP)** is one of the oldest and largest facilitators of the kinds of experiments that lead to tomorrow's innovative space technology.

STP provides mission design, spacecraft acquisition, integration, launch and operations support to facilitate experimental payload access to the space domain.

These experimental payloads demonstrate technologies that accelerate the development of war-winning space capabilities for the joint warfighter.

As the primary agent for **science and technology (S&T)** payloads on multi-manifest missions flown on **U.S. Space Force (USSF)** and commercially procured launch vehicles, STP significantly expands U.S. space access and demonstrates cutting-edge technology to rapidly integrate DoD space power into national, joint and international operations.

At the same time, STP answered General **John "Jay" Raymond's** (former Chief of Space Operations for the USSF) call for more cooperation by using its unique set of services to forge partnerships with commercial entities and international allies.

A Critical Component of National Security

Overall, STP is a critical component of national security as it is one of the only ways that the DoD can mature advanced technologies in the space domain; if unsuccessful, the US will fall steadily behind our adversaries in the technological competition.

One of the main challenges facing the USSF is how the new service can maintain its technological advantage in the space warfighting domain. The DoD STP is a key component of that answer.

Headquartered at New Mexico's **Kirtland Air Force Base**, and managed by the **Innovation and Prototyping Acquisition Delta** within the **USSF Space Systems Command (SSC)**, STP provides a series of unique services to facilitate access to space for experimental space payloads that exhibit potential military utility.

Created in 1965, the STP is one of the longest continuously running programs in the DoD. In its 57-year history, this organization has executed more than 300 missions. Its recent past demonstrates the strength of experience — in 2021, STP successfully integrated payloads on six separate rocket launches.

STP's services enable the advancement of scientific knowledge and capability, which is foundational to ensuring continuous U.S. advantage in the space domain.

Competitive Access to Space

The cornerstone for this success is STP's facilitation of the **DoD Space Experiment Review Board (SERB)**, which evaluates and ranks space-borne experiments from across the DoD that are requesting STP launch support services.

Due to STP's unique ability to facilitate access to space for multiple experiments, the SERB evaluations are an extremely competitive process.

In many ways, it mirrors a "**Shark Tank**" format, wherein experimenters brief the evaluators on their payload's military relevance, mission requirements, technology transition plans and experiment quality.

Once the SERB approves an experiment, STP will then apportion resources to secure space flight opportunities.

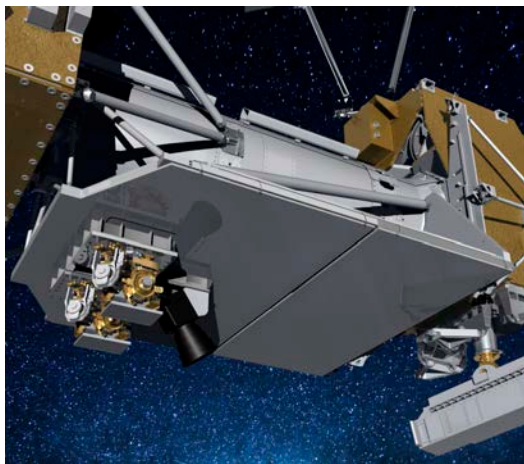
This process is critical as it ensures significant cost savings for many of the laboratories and research and development centers that do not have the funding required to procure their own launch capability.

The SERB list currently boasts more than 80 ranked candidate missions and STP is working diligently to get them all into outer space using its core integration services: large launch vehicle integration, small launch vehicle integration, **International Space Station (ISS)** integration and payload-to-bus integration.

First, STP boasts the ability to acquire a dedicated *Atlas*, *Vulcan*, *Falcon 9* or *Falcon Heavy* launch on a four-year cadence.

A recent example is the **STP-3** launch on an *Atlas 551* and its flagship vehicle, **STP Satellite-6 (STP Sat-6)**.

The STPSat-6 spacecraft hosted nine payloads, including a NASA laser communications mission called the **Laser Communications Relay Demonstration (LCRD)** and a **National Nuclear Security Agency (NNSA)** nuclear detection payload, as well as seven DoD **SERB-ranked** experiments.



The LCRD payload is attached to the LCRD support assembly flight (LSAF), depicted in this illustration.

The LSAF serves as the backbone for LCRD's components. Attached to the LSAF are a star tracker and two optical modules (left), which generate the infrared lasers that transmit data to and from Earth. Other LCRD components, including the modems that encode data into laser signals, are attached to the back of the LSAF.

Credits: NASA's Goddard Space Flight Center

The STP-3 mission was one of the most complicated missions ever executed by the USSF.

STP Sat-6 was the primary payload on a co-manifested mission, along with the **Long Duration Propulsive ESPA 1 (LDPE-1)** mission, which is a modular, ring-shaped vehicle that manifested multiple payloads of its own.



The Long Duration Propulsive ESPA (LDPE)-2 spacecraft on this mission consisted of an ESPASat satellite. Image is courtesy of Lockheed Martin.

Altogether, the STP-3 mission featured two space vehicles and 12 distinct payloads, all with different sponsoring organizations.

In spite of the technical, political and bureaucratic difficulties this presented, the STP team flawlessly ensured that the mission got all assets integrated so that the Atlas launch vehicle could take them into their intended orbits.

Another way that STP manifests payloads is by using their capability to obtain a dedicated series of small launch vehicles every two years, as showcased in the successful STP-S28A mission.

For this mission, the USSF and SSC teamed up with **Virgin Orbit National Systems**, a US-incorporated, wholly owned subsidiary to *Virgin Orbit*, to launch multiple DoD satellites from the **Mojave Air and Space Port** in California.



This mission launched seven, SERB satellites from multiple DoD agencies using the Virgin Orbit National Systems Space "**LauncherOne**" system.

In addition to getting SERB payloads into space, the STP-S28A mission also demonstrated commercially available solutions for placing USSF satellite capabilities on-orbit from non-traditional locations.

International Cooperation with Allies

STP is rising to the challenge by realizing the Chief of Space Operations' International Cooperation initiative through participation in the **Responsive Space Capabilities MOU (RSC MOU)**, an international agreement between 13 countries that supports RDT&E cooperative efforts related to responsive space capabilities.

Specifically, STP is integral to the success of the **Responsive Launch and Range Project Arrangement** in providing access to space for experiments from participating members. STP chairs the **International Space Access Review Board (ISARB)**, a venue for international partners to gain access to U.S. launches. The ISARB has successfully approved a total of nine experiments for launch since its inception in 2019.

STP is currently sponsoring three experiments from Australia, Germany and the United Kingdom slated to launch in late 2023. This mission will solidify the USSF's ability to partner with international allies in the research and development arena.

The next element of STP's ability to enable **research & development (R&D)** experimentation is the ironclad partnership

with NASA's ISS team at **Johnson Space Center (JSC)** in Houston, Texas.

STP has a team permanently located on-site at JSC and is designated, per DoD mandate, as the "*single manager for all DoD payloads on the ISS, future manned and unmanned NASA launch vehicles...*"

The Houston team developed a modular platform that integrates seamlessly into the ISS, enabling multiple experiments that use the orbiting station as their host platform.

Experiments onboard the ISS benefit from substantial subsidies provided by NASA; accordingly, manifesting on the ISS becomes an extremely cost-effective option for many SERB payloads.

Expanding Access to Space in the Future

STP is investing in an organic contract to build standard space vehicles (aka "buses") for mounting experimental payloads prior to placing them on the rocket.

This initiative, known as the **Space Test Experimentation Platform 2.0 (STEP 2.0)**, will give STP customers increased flexibility to integrate their payloads onto buses that are specifically tailored to match the STP launch rhythm.

Once on contract, the STEP 2.0 contract will enable STP to reach out to other organizations seeking buses and initiate collaborative partnerships, which will in turn increase the synergy between the DoD's myriad space agencies.

As the primary agent for S&T payloads across the entire DoD, STP is pivotal to expanding space access and demonstrating next-generation technology.

Further, STP is leading the charge for more cooperation in the space domain by using its multi-faceted suite of services to forge DoD, commercial and international partnerships.

STP is a critical component of national security as it is one of the only ways that the DoD can mature advanced technologies in the space domain, which in turn ensures a future of continued space dominance for the United States and its allies.

Lt. Col. Jonathan Shea is the current Director of the DoD Space Test Program and is the first director to come from the USSF. His background includes satellite acquisition, experimental operations, and nuclear maintenance. He deployed in support of OPERATION RESOLUTE SUPPORT and is a graduate of the Air Force's School of Advanced Air and Space Studies.



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