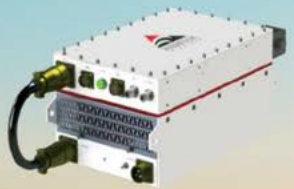
Next Generation Space Defense

MILSATMAGAZINE

October 2022

Cover image is courtesy of ***ULA*** *—*
Photo of the Delta IV Heavy launch of NROL-91



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A United Launch Alliance (ULA) Delta IV Heavy rocket carrying a critical payload for the National Reconnaissance Office (NRO) lifted off with the NROL-91 mission from Space Launch Complex-6 on September 24th at 3:25 p.m. PDT. Photo credit: United Launch Alliance

ULA DELTA IV HEAVY DISPATCHES NROL-91 TO ORBIT FOR SSC + NRO

A United Launch Alliance (ULA) Delta IV Heavy rocket carrying the NROL-91 mission for the National Reconnaissance Office (NRO) lifted off on September 24 at 3:25 p.m., PDT, from Space Launch Complex-6 at Vandenberg Space Force Base.

To date ULA has launched 153 times with 100 percent mission success.

"*The NRO has been, and continues to be, a phenomenal partner through 32 collaborative launch campaigns, stemming from ULA's very first launch in 2006,*" said ***Gary Wentz***, ULA vice president of Government and Commercial Programs.

He continued, "*This mission was ULA's 96th National Security mission and the NRO's 10th mission on board a Delta IV Heavy launch vehicle – a history that we are very proud of.*

"*This was also ULA's 95th Delta mission from Vandenberg Space Force Base and our fifth and final Delta IV Heavy from the West Coast, completing a long, successful tenure of delivering critical national security payloads,*" added Wentz. "We look forward to preparing Space Launch Complex-3 for future Vulcan flights from the West Coast."

The Mobile Service Tower (MST) rolls back from the United Launch Alliance (ULA) Delta IV Heavy rocket carrying NRO's NROL-91 mission in preparation for launch from Space Launch Complex-6 at Vandenberg Space Force Base, California. Photo credit: United Launch Alliance

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ORBCOMM'S AIS SERVICES SELECTED FOR TWO USG AGENCY COMPETITIVE CONTRACTS

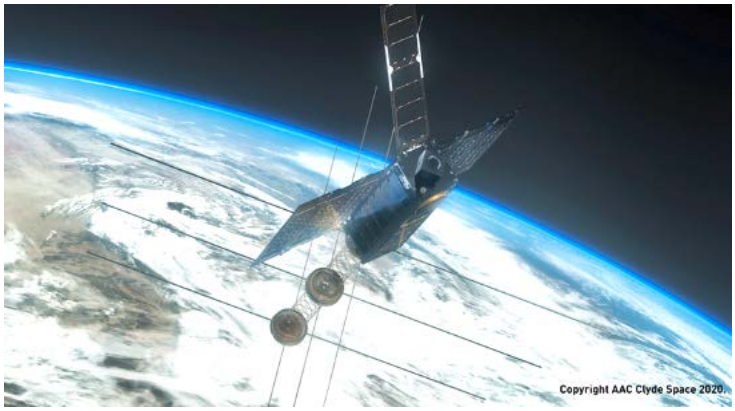
ORBCOMM Inc. has been awarded a multi-year contract by a U.S. Government Agency for a competitive renewal of its global Automatic Identification System (AIS) data services used for ship tracking and other maritime navigational and safety efforts.

In addition, ORBCOMM was awarded a separate competitive contract to deliver AIS services to multiple other U.S. Government users.

ORBCOMM's AIS data service has provided the most comprehensive and reliable global coverage in the market over the last decade. ORBCOMM continues to enhance its global AIS data services with the upcoming launch of two ***Kelpie*** AIS satellites with AAC Clyde Space.

The Kelpie satellites feature advanced ***software defined radio*** **(SDR)** receivers and unique, multi-antenna implementation and are expected to expand coverage of ORBCOMM's constellation, increase visibility to smaller Class B ships and extend its polar footprint.

In addition, ORBCOMM is participating in the ***AOS*** consortium with ***AAC Clyde Space*** and ***Saab*** to launch a ***VHF Data Exchange System*** (**VDES**)



The upcoming launch of two Kelpie AIS satellites with AAC Clyde Space are expected to expand coverage of ORBCOMM's constellation, increase visibility to smaller Class B ships and extend its polar footprint.

ORBCOMM's AIS data will continue to be used in a maritime domain awareness software platform that supports key ***U.S. Department***

GLOBECOMM's nexgen satellites and ground infrastructure process 30 million messages daily from over 240,000 vessels.

of Defense and ***Department of Homeland Security*** agencies, along with U.S. partner nations around the world.

The contract is for a 5-year period, including option years, which began in August 2022.

demonstration satellite, expected to launch in early 2023, that will enable two-way data communications between ships and shore using new VHF channels adjacent to AIS.

"*ORBCOMM has supported the U.S. Government with its pioneering satellite AIS service since 2008, and these significant contract awards once again demonstrate that ORBCOMM continues to provide comprehensive worldwide AIS data to its customers at the best value,*" said ***Greg Flessate***, Senior Vice President of Government and AIS Services.

He continued, "*ORBCOMM remains committed to expanding its industry-leading AIS data services and providing more extensive global coverage with increased bandwidth and versatility.*"

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IDIQ JADC2 CONTRACT GOES TO INNOFLIGHT

Innoflight has been awarded a $950,000,000 ceiling Indefinite Delivery / Indefinite Quantity (IDIQ) contract for the maturation, demonstration and proliferation of capability across platforms and domains, leveraging open systems design, modern software and algorithm development in order to enable Joint All Domain Command and Control (JADC2).

This multiple award contract provides awardees the opportunity to compete for efforts within seven different competitive pools that support the development and operation of systems as a unified force across all domains (*air, land, sea, space, cyber, and electromagnetic spectrum*) in an open architecture family of systems that enables capabilities via multiple integrated platforms. Future work under this multiple-award IDIQ contract will be competed via the Fair Opportunity process.

"*Innoflight is pleased that the Air Force recognizes the relevance and applicability of Innoflight's technology portfolio in the JADC2 strategy*," said ***Jeff Janicik***, Innoflight President and Chief Executive Officer. "*Our long-term proficiency with IP-enabled secure space networking (switches/routers) including NSA-certified end cryptographic units combined with our high performance secure processors, data storage, and software-defined radios (space-to-ground, space-to-space, space-to-airborne, space-to-maritime) solutions, to name a few, are well suited for ABMS.*"

About the company...

Innoflight is a Nontraditional Defense Contractor (NDC) founded in 2004. Innoflight offers state-of-the-art space avionics, including Communications & Networking Solutions, Cyber Security Solutions, Processing, Data Storage & Payload Interface Electronics Solutions, and Bus & Payload Integrated Avionics Solutions. The firm's core competency is secure Command, Control, Communications and Computers (C4) design through innovative implementation of modern Commercial Off-The-Shelf (COTS) technology in tandem with common standards and protocols that produce modular, high performance, yet low Size Weight and Power (SWaP) systems at competitive prices. Our products are qualified through an Innoflight rigorous process that includes parts reliability analysis & testing, system level fault tolerance, and radiation risk mitigation. Our customers include the U.S. government, prime aerospace contractors and commercial space developers.

L3HARRIS' NEXGEN WESCAM MX™ LAND SIGHTS TO ASSIST U.S. ARMY SOLDIERS ID MANNED + UNMANNED THREATS SOONER

L3Harris Technologies (NYSE:LHX) is providing 57 WESCAM MX-GCS sighting systems to help U.S. Army soldiers spot manned and unmanned threats sooner than ever before possible.

This is the second delivery order to ***Moog Inc.*** in support of the U.S. Army's ***Maneuver Short-Range Air Defense (M-SHORAD)*** Increment 1 program. Deliveries began mid 2022.

The WESCAM MX-GCS is a fully digital, above-armor, sighting system. Integrated onto Moog's ***Reconfigurable Integrated-weapons Platform*** turret, the WESCAM MX-GCS delivers situational awareness beyond the range of the vehicle's primary direct fire weapon and provides next-generation sensing and target identification capabilities required to counter manned and unmanned airborne threats.

WESCAM MX-GCS — The Eyes of M-SHORAD (Image Courtesy of DoD)

"*This second M-SHORAD award reinforces our trusted partnership with Moog and the U.S. Army across the land domain*," said ***Sean Stackley***, President, Integrated Mission Systems, L3Harris. "*Providing our soldiers with time-sensitive situational awareness is critical. The WESCAM MX-GCS delivers the capabilities required to assess and engage threats and targets with efficiency and accuracy.*"

L3Harris has delivered more than 1,200 WESCAM MX airborne and land-based systems since 1996 in support of U.S. Army programs.

L3Harris Technologies is an agile global aerospace and defense technology innovator, delivering end-to-end solutions that meet customers' mission-critical needs. The company provides advanced defense and commercial technologies across space, air, land, sea and cyber domains. L3Harris has approximately $18 billion in annual revenue and 47,000 employees, with customers in more than 100 countries.

KLEOS' OBSERVER MISSION SATELLITES PASS TESTING + SIGNIFICANT MILESTONE FOR NRO CONTRACT

The National Reconnaissance Office (NRO) has awarded a Commercial RF Capabilities Contract to Kleos Space Inc. as part of the Strategic Commercial Enhancements Broad Agency Announcement (SCE BAA) Framework.

Kleos Space S.A has revealed that their 4th cluster of four satellites, the ***Observer Mission (KSF3)***, is ready to be shipped to the launch site after successfully completing environmental test phases. The Observer Mission satellites have successfully completed all ***System Assembly and Integration and Test*** (**SAIT**) activities, followed by system level electrical and mechanical functionality verification, including environmental testing of the satellites.

Each system has been subjected to vibration, thermal, and electromagnetic compatibility (EMC) tests, ensuring functionality of the cluster after launch for the duration of the mission.

The Observer Mission satellites will be deployed into SSO from **Cape Canaveral Space Force Station** in Florida on the SpaceX Transporter-6 mission that is currently scheduled for Q4 2022 launch. This smallsat placement will expand Kleos' data collection capacity by as much as an additional 119 million km^2 per day.

The NRO is responsible for maintaining global vigilance in times of peace and war. It develops, acquires, launches, and operates innovative space-based surveillance and reconnaissance systems that collect and deliver intelligence to enhance U.S. national security. After a multiple-phase proposal process, Kleos was awarded the first stage contract under the NRO's SCE BAA Framework, focused on the analysis, modeling, and simulation of Kleos' capabilities to support the U.S. Government's current and future commercial radio frequency (RF) reconnaissance needs.

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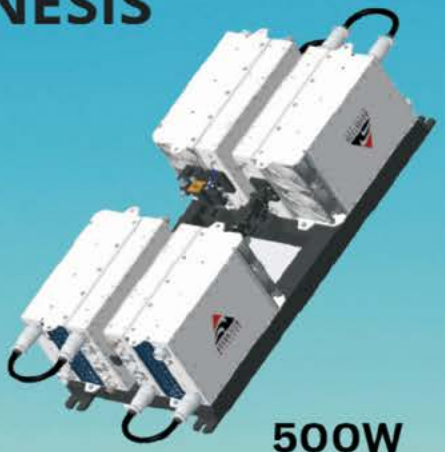
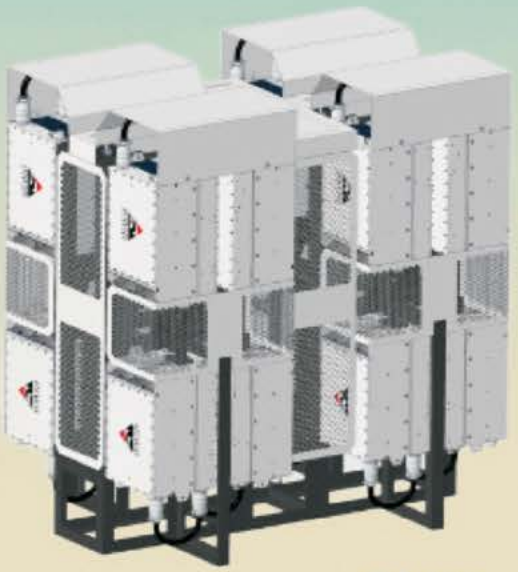


500W Linear Power



2kW Linear Power

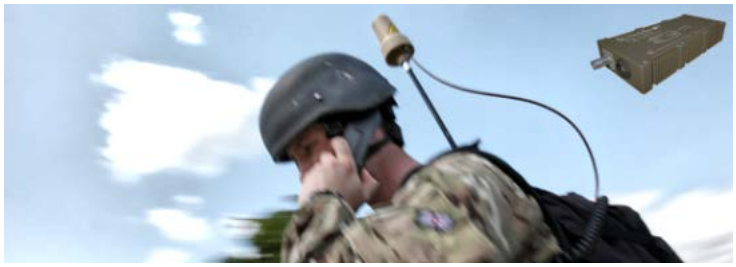
1kW Linear Power

SPECTRA GROUP'S 4,000+ SLINGSHOT SYSTEM SURPASSES A SIGNIFICANT MILESTONE IN THE U.S.

***Spectra Group** has announced at the **Association of the United States Army (AUSA)** exhibition that there are now more than 4,000 of their SlingShot SATCOM systems in operation with U.S. Special Operations Forces.*

This announcement follows on the heels of the company's recent celebration of more than 7,000 SlingShot systems in operation with specialist and regular forces world-wide. The Spectra Group team will be available at AUSA to discuss their product capabilities.

Since the SlingShot launch at the Military Satellite Conference in London in November of 2014, this small and lightweight SlingShot system has proven to be hugely popular with the United States Special Operations Forces and Intelligence Communities.



SlingShot manpack unit, image is courtesy of the company.

The system received safety accreditation from the ***U.S. Army Test and Evaluation Command*** for U.S. Army Expeditionary Warrior Experiments and has been recommended by **Battle Lab**s for its continued deployment.

Spectra Group is now poised to help the U.S. Military leverage all of the key advantages of SlingShot, designed for specialist forces, to transform regular forces tactical communications capabilities throughout the wider U.S. Military on land, sea and air. Slingshot is perfect for missions where troops are deployed with minimal logistical support, in remote locations and have limited transport capacity.

By integrating the SlingShot system with ***Inmarsat's L-TAC*** satellite service, and attached to an in-service VHF or UHF radio, deployed troops instantly gain strategic communications over thousands of miles that would otherwise not be available without a significant communications infrastructure.

In addition to the robust Beyond Line of Sight (BLOS) voice capability, SlingShot also has sufficient bandwidth to carry critical data to support essential applications such as: situational awareness tools; GPS tracking; reporting and other data messaging without the requirement for ground-based line-of-sight re-broadcasting architecture.

Finally, the Slingshot omni-directional antennas provide manpack, land, sea and air platforms with real-time Comms on the Move (COTM) rather than having to be static, as experienced with traditional TACSAT systems.

***Simon Davies**, CEO of Spectra Group, said, "We are very proud of the Slingshot system and how successful it has been in solving the communications challenges faced by both specialist and regular forces when deployed all over the world in austere locations. Seven thousand units globally and 4,000 in the U.S. is a significant milestone. In Europe, SlingShot is now proving to be a battle-winning capability for regular forces and part of its success is the fact it is genuinely "plug and play," converting any in-service tactical radio system into a BLOS and COTM SATCOM system with minimal training. We are now poised to help expand this capability from specialist to regular forces for the U.S. Military."*

INDRA AWARDED NORWEGIAN DEFENCE MATERIAL AGENCY CONTRACT FOR SATELLITE GROUND SEGMENT IMPLEMENTATION

The Norwegian Defence Material Agency has awarded a contract to Indra to implement the satellite communication ground segment that is critical to the management of the Norwegian Armed Forces military operations.

The company will be responsible for implementing the X- and Ka-band nodes that will act as a gateway between user terminals at various locations via the ***Wideband Global SATCOM (WGS)*** satellite constellation, one of the most advanced of its kind and with greater capacity for high-speed data exchanges.

Indra will install certified anchor terminals, which will provide satellite communication services through a constellation used by some of the world's most advanced armies.

This project will enhance Indra's position at the forefront of satellite communications, a technology field of increasing importance as theaters of operations are digitized and agile data exchanges becomes key.

The systems are ready to operate under Nordic environmental and weather conditions and in settings with a heavily congested electromagnetic space, resisting any attempt by the adversary to hinder their transmissions.

"We're very proud of the trust that the Norwegian Defence Materiel Agency has placed in Indra with this important contract. Our goal is to take the communications of the Norwegian Armed Forces to the highest standards of reliability and effectiveness. Our long-standing experience in the deployment of networks, stations and satellite terminals for all kinds of platforms place us at the technological forefront in this field", said ***Igancio Matai**x*, Indra's Chief Executive Officer.

Indra provides proprietary solutions in specific segments in Transport and Defence markets, and a is leading firm in Digital Transformation and Information Technologies in Spain and Latin America through its affiliate, Minsait. Its business model is based on a comprehensive range of proprietary products, with a high value, end-to-end focus and with a high innovation component. In the 2021 financial year, Indra achieved revenue of €3.390 billion, nearly 52,000 employees, a local presence in 46 countries and business operations in more than 140 countries

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SIGMA DEFENSE RECEIVES ABMS IDIQ CONTRACT FOR JADC2 SHARE

***Sigma Defense** has been awarded a $950 million ceiling indefinite-delivery/indefinite-quantity (IDIQ) contract for the maturation, demonstration and proliferation of capability across platforms and domains, leveraging open systems design, modern software and algorithm development in order to enable Joint All Domain Command and Control (JADC2).*

This multiple award contract provides Sigma Defense the opportunity to compete for efforts within seven different competitive pools that support the development and operation of systems as a unified force across all domains (*air, land, sea, space, cyber, and electromagnetic spectrum*) in an open architecture family of systems that enables capabilities via multiple integrated platforms.

Future work under this multiple-award Indefinite Delivery/ Indefinite Quantity contract

will be competed via the Fair Opportunity process.

Sigma Defense will support the ***U.S. Air Force's Advanced Battle Management System for JADC2*** by providing the critical surveillance, tactical edge communications, processing, networking, and battle management command and control capabilities to the joint warfighting force.

"*We are excited and honored to be chosen to support the Air Force ABMS program, taking the next step in making JADC2 a reality*," said **Matt Jones**, Chief Executive Officer at Sigma Defense. "*Our ability to transmit and analyze data from multiple disparate sources is a key enabler of the DoD's sensor to shooter architecture and further delivers on the vision of sense, make sense and act. Sigma Defense is uniquely positioned to deliver open architecture systems across multiple integrated platforms for greater visibility, enabling any shooter whether in space, on land, at sea, in the air, or in cyberspace.*"

Sigma Defense is a leading technology company serving the Department of Defense (DoD) providing systems and services for Intelligence Surveillance and Reconnaissance since 2006. The company's software-focused approach to tactical communications accelerates information collection and sharing for faster decision making and better mission outcomes. Customers turn to Sigma Defense for engineering, program management, and data logistics services for technical solutions that encompass ground, air, and space-based systems and sensors and network and satellite communications. Sigma Defense is headquartered in Perry, GA with satellite offices both CONUS and OCONUS.

LEONARDO DRS AWARDED MILLION$$$ CONTRACT FOR ADVANCED THERMAL WEAPON SIGHTS

***Leonardo DRS, Inc.** ("DRS") received a contract that was originally awarded earlier this year to produce the company's nexgen thermal weapon sights for the U.S. Army — the firm-fixed-price contract from the U.S. Army Contracting Command is valued at $579 million over five years.*

The ***Leonardo DRS Electro-Optical Infrared Systems*** (EOIS) business will produce advanced ***Family of Weapons Sights – Individual (FWS-I)*** systems for its U.S. Army customer.

Using DRS' uncooled thermal imaging technology, FWS-I is a stand-alone, clip-on weapon sight that connects wirelessly to helmet-mounted vision systems including the ***enhanced night vision goggle binoculars*** (**ENVG-B**) and the next-gen ***integrated visual augmentation system*** (**IVAS**) and provides rapid target acquisition capabilities to the soldier.

The FWS-I gives users the ability to acquire targets day or night and in smoke or fog, which provides strategic and tactical advantages to the soldier.

At the core of the technology is decades of Leonardo DRS experience in the uncooled thermal weapon systems field.

The FWS-I employs a proprietary *vanadium oxide micro-electromechanical focal plane array* that requires no visible light to operate. Production of the FWS-I will be in the company's Electro-Optical Infrared Systems facility in Melbourne, Florida.

"*We are proud to continue to provide this cutting-edge technology that ensures our soldiers will have the most advanced weapon sight systems on the battlefield today, and well into the future*," said ***Jerry Hathaway***, senior vice president and general manager of the Leonardo DRS Electro-Optical Infrared Systems business.

Hathaway continued, "*We have a long history of supplying the Army with advanced Electro-Optic and Infrared (EOIR) technologies, and this award will help to keep soldiers safe and better ensure their mission is accomplished.*"

The Leonardo DRS EOIS business is part of the advanced sensing and computing segment, which has an extensive installed base across the U.S. military. Advanced Sensing technology is a key strategic focus for Leonardo DRS as the company integrates its world-leading sensing and computing technologies for the men and women of the U.S. armed forces.

COMTECH AWARDED A FOREIGN MILITARY SALES (FMS) CONTRACT FOR THE UKRAINIAN GOVERNMENT

Comtech's FMS contract with the Ukrainian Government is for Beyond-Line-Of-Sight (BLOS) communications terminals and upgrades to the country's existing systems.

In March, Comtech donated identical systems to those now being purchased to the international effort to support the defense of Ukraine at the request of the Ukrainian government.

These systems were requested by Ukrainian Special Forces to enhance their ability to rapidly deploy secure, resilient communication channels in contested environments.

Comtech has supported multiple communications upgrades and modernization initiatives for the Ukrainian Ministry of Defense since 2017. As a result, Comtech is well placed to provide systems that were previously certified for use by the Ukrainian military and can be fielded with training provided by Comtech and current operators.

Comtech's solutions, coupled with the firm's ability to speed deployment of these critical s support capabilities, made the company the choice for a contract award.

The Company's terminals can easily be linked with other Comtech tactical, mobile and fixed systems to provide a robust, comprehensive BLOS communications solution that can be used to enhance the Ukrainian Military's existing communications capabilities.

Comtech's solutions are ideal for Tactical Military, Disaster Recovery, and Emergency Communications Restoration applications anywhere in the world.

"*Comtech's Troposcatter Family of Systems (FOS) provides U.S. and International customers the benefit of transporting secure, resilient high-capacity IP data communications to the tactical edge*," said ***Doug Houston***, President of Comtech Systems, Inc.

"*Global militaries have relied on our Comtech Systems division to consistently provide robust communications solutions globally for over forty years and our new state-of-the-art radio-modem technology is a game changer in the marketplace*," said Comtech's Chairman, President and CEO, ***Ken Peterman.***

HII WINS U.S. AIR FORCE MILLION$$ TASK ORDER FOR ELECTRONIC WARFARE RESEARCH AND ANALYSIS

***HII** (NYSE: HII) announced that the company's **Mission Technologies** division has been awarded a $76.7 million task order by the U.S. Air Force (USAF) to perform research, analysis, test and evaluation that will support and inform USAF decisions related to electronic warfare (EW) and electromagnetic spectrum (EMS) capabilities development.*

"*We are pleased to extend our partnership with the U.S. Air Force on a strategy to ensure EW and EMS dominance and enable the U.S. to maintain its advantage over a rapidly evolving global threat,*" said ***Grant Hagen***, president of the division's Cyber, Electronic Warfare & Space business group. "*The award reinforces the USAF's confidence in our team, and we look forward to executing the contract.*"

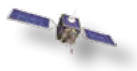
The EMS superiority development task order was awarded under the ***Department of Defense Information Analysis Center***'s (**DOD IAC**) ***multiple-award contract*** (**MAC**) vehicle. The ***USAF 774th Enterprise Sourcing Squadron***, part of the ***USAF Installation Contracting Center***, awards DoD IAC MAC task orders through a competitive process.

HII has been supporting the program since 2017 and is teamed with ***DCS Corporation***, ***Modern Technology Solutions Inc.***, ***On-Line Applications Research Corporation***, ***Southwest Research Institute*** and ***Vanderbilt University*** to perform the work over five years.

The HII team will develop technical recommendations for the ***Advanced Capabilities and Strategic Integration*** team — part of the ***Air Force Life Cycle Management Center*** (**AFLCMC**) ***Electronic Warfare and Avionics Division*** — that provide AFLCMC leaders with decision quality information regarding EW and EMS capability development and modernization. Areas of research may include artificial intelligence and machine learning, cyber and microelectronics among others.

HII's research and analysis will be leveraged by the USAF to reduce technical risk, provide mature technologies, and deliver systems engineering rigor needed to improve warfighter survivability at reduced total lifecycle cost.

HII is a global, all-domain defense partner, building and delivering the world's most powerful, survivable naval ships and technologies that safeguard our seas, sky, land, space and cyber. As America's largest shipbuilder and with a more than 135-year history of advancing U.S. national defense, we are united by our mission in service of the heroes who protect our freedom. HII's diverse workforce includes skilled tradespeople; artificial intelligence, machine learning (AI/ML) experts; engineers; technologists; scientists; logistics experts; and business professionals. Headquartered in Virginia, HII's workforce is 44,000 strong.



INMARSAT GOVERNMENT AWARDED A MILLION$$$ CONTRACT FOR SATCOM SERVICES BY THE U.S. NAVY

***Inmarsat Government** has been awarded a U.S. Navy Commercial Broadband Satellite Program (CBSP) Satellite Services Contract (CSSC II) for complex and worldwide, end-to-end, commercial satellite communications (SATCOM) services by the **Defense Information Systems Agency (DISA)** — the ceiling value of the award is $980 million over a 10-year period.*

Under the contract, Inmarsat Government will deliver worldwide managed telecommunications services, including satellite capabilities, via Inmarsat Global Xpress Ka-band, as well as C-, Ku- and X-band frequencies, for mobile and fixed satellite services on crewed and uncrewed maritime, airborne and ground platforms. The company will also provide commercial teleport services; backhaul connectivity; monitoring and control; operations; information assurance and cybersecurity.

The CSSC II program is the follow-on to the CSSC contract where Inmarsat Government was the prime contractor, delivering proven, reliable connectivity between the Navy's global fleet of shipboard terminals and shore-based telecommunications infrastructure.

Under the newly-awarded CSSC II contract, the company will provide end-to-end SATCOM services capable of supporting approximately 400 simultaneous full period, full duplex, simplex and simplex broadcast connections/modems between a designated point of presence and the end user terminal through the means of space and terrestrial connectivity. Solution benefits include:

- *Global network infrastructure – A complete, efficient, scalable and resilient in-place solution that is compliant with Information Assurance requirements and includes redundant commercial teleports and a global Multiple Protocol Label Switching (MPLS) terrestrial backhaul network for reach back to designated points of presence.*
- *Resilient space segment and interoperability with MILSATCOM – Required user terminal data throughput and quality of service requirements to include global Military Ka augmentation and Arctic services on Inmarsat's forthcoming Highly Elliptical Orbit (HEO) GX10A/B satellites.*
- *Cybersecurity – Inmarsat Government has a proven track record of providing comprehensive cybersecurity services, including the ability to respond to vulnerabilities and incidents in accordance with the Risk Management Framework, by evaluating the holistic nature of the risk factors, incidents, and mitigation techniques.*

Susan Miller, Chief Executive Officer, Inmarsat Government, said, "*Inmarsat Government is proud to be selected as the end-to-end SATCOM provider under the U.S. Navy CSSC II contract. Inmarsat Government has delivered proven, reliable and resilient worldwide capabilities to the U.S. Navy over the past decade, and we look forward to continuing our support to their highly demanding operations at sea, in the air and on the ground, anywhere in the world.*"

VIASAT AWARDED MILLION$$ ORDER FOR MIDS MILITARY TACTICAL RADIOS

***Viasat Inc.** (NASDAQ: VSAT) has been awarded a $99 million order for **Multifunctional Information Distribution System (MIDS)** Joint Tactical Radio System (JTRS) terminals from **U.S. Naval Information Warfare Systems Command (NAVWAR)** on behalf of the MIDS Program Office.*

MIDS are among the most widely used, ***Link 16*** terminals by the US military and global allies, acting as the foundational communications datalink on the modern battlefield and providing a secure communications capability for operations in any environment.

Viasat's MIDS JTRS terminals provide access to the secure Link 16 line-of-sight network enabling tactical communications and data transport to ground, maritime and airborne platforms to provide greater situational awareness on the battlefield.

This order falls under a **U.S. Navy Indefinite Delivery, Indefinite Quantity (IDIQ)** contract awarded to Viasat in 2020 with a maximum value of $998 million for the production, retrofits, development and sustainment of MIDS JTRS terminals.

This order was received during Viasat's Q2 FY23.

"*This award further indicates Viasat's commitment and expertise providing Link 16 tactical communications solutions supporting US and Allied armed services*," said ***Craig Miller***, president of ***Viasat Government Systems***.

Mr.Miller continued, "*MIDS JTRS radios are a critically important tool that enables warfighters to maintain communications superiority and secure data transport on the battlefield, as well as securely communicate with allied forces. Viasat is proud to be a trusted supplier of this capability for today's allied warfighting force.*"

L3HARRIS BENEFITS FROM TWO PRODUCTION ORDERS FROM THE U.S. ARMY FOR LEADER + MANPACK RADIOS

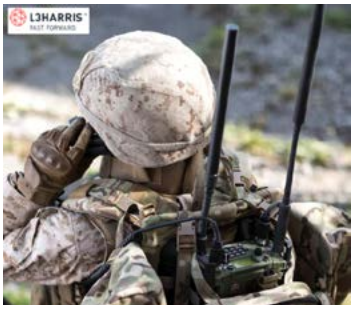
L3Harris Technologies ***(NYSE:LHX) has received two production orders, totaling $235 million, to provide leader and manpack radios for the U.S. Army.***

The ***AN/PRC-163 Leader*** and ***AN/PRC-158 Manpack*** radios are part of the U.S. Army's Handheld, Manpack & Small Form Fit (HMS) program. These second, full-rate production orders deliver multi-mission networking capability for warfighters in the field.

The industry's most flexible cryptography-modernization-compliant radio, the two-channel L3Harris AN/PRC-158 radio leverages a software-defined

L3Harris AN/PRC-163 radio photo, courtesy of the company.

architecture and integrated cross-banding between waveforms to provide advanced capabilities while maintaining backward interoperability with legacy systems.The AN/PRC-158 also includes ***Mobile User Objective System*** (**MUOS**)-ready hardware for satellite communications connectivity while on the move.



L3Harris AN/PRC-158 Manpack radio photo, courtesy of the company.

The AN/PRC-163 radio enables soldiers to share information up and down the chain of command, integrating voice and data across the Army's integrated tactical network and with partner nations.

The Army expects to purchase more than 165,000 HMS radios under the indefinite delivery, indefinite quantity contracts, which include a five-year base and an additional five-year option, with a ceiling of more than $16 billion.

More than 60,000 AN/PRC-163 and AN/PRC-158 radios provide secure, resilient and interoperable communications capabilities for over 20 allied nations around the world.

"*The radios we will deliver under these two orders provide our soldiers with a resilient network, enabling integrated soldier systems and vehicular on-the-move communications*," said ***Dana Mehnert***, President, Communication Systems, L3Harris.

Mehnert continued, "*The true software-defined architecture also facilitates the porting of future waveform requirements enabling spectral dominance against peer adversaries*."

NORTHROP GRUMMAN AUSTRALIA INTEGRATES END-TO-END CONTROL SEGMENT INTO PARALLAX LABS

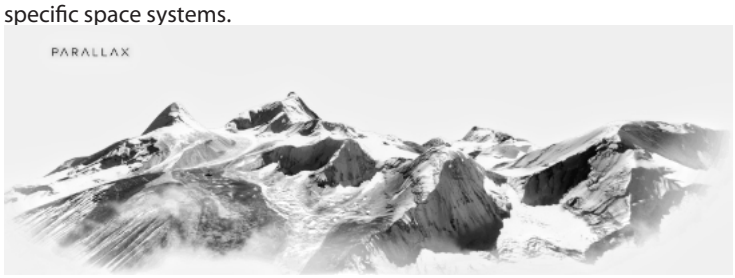
Northrop Grumman Australia ***(NYSE: NOC) recently integrated a Dynamic Satellite Simulator and Spacecraft Command and Control (C2) system into its state-of-the-art systems integration, advanced mission visualization and demonstration facility,*** ***Parallax Labs*****.**

This complex integration demonstrates the high level of technical readiness of Northrop Grumman Australia's end-to-end control system in preparation for the ***Defence Joint Project 9102***,

That project will provide the nexgen, sovereign, satellite communication component of the ***Australian Defence Force's Satellite Communication (SATCOM) System***.

Parallax Labs leverage Northrop Grumman's 60-year space heritage of designing, developing, delivering and operating mission specific space systems.

Incorporating the full control system within Parallax Labs facilitates the integration of MILSATCOM components, especially from local Australian companies.



This system will connect with the **Defence MILSATCOM Service Planning and Network Management System,** to be delivered under **JP2008 Phase 5B2**, enabling simulated control of both ground and space segments.

"*Using our trusted C2 system significantly reduces technical, integration and scheduling risk*," said ***Christine Zeitz***, general manager, Northrop Grumman Asia Pacific. "*Through knowledge sharing, collaboration and partnering with global and Australian leaders in space communications, Northrop Grumman can deliver a cost effective, scalable and timely response to the Defence SATCOM requirement*."

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NEW IRIDIUM CERTUS SERVICE PROVIDERS TO SUPPORT U.S. GOVERNMENT CUSTOMERS

Iridium Communications has announced that Iridium partners, MetOcean Telematics, NAL Research, and Trace Systems, are all now Iridium Certus® service providers for U.S. government customers, joining Satcom Direct, in this capacity.

These long-term deals will allow these companies to provide Iridium's secure, global, satellite broadband and mid-band connectivity for mobile voice and data services to the U.S. government through a dedicated gateway.

By leveraging the inherent advantages of the Iridium® network, including global, on-the-move, L-band connectivity, MetOcean Telematics, NAL Research, and Trace Systems are now able to deliver enhanced capabilities that meet ***Communications Security*** (**COMSEC**) requirements for the **Department of Defense (DoD)** and warfighters.

These capabilities include global and resilient voice, data and 1080 HD live-action, ***Video-over-SATCOM*** (**VoS**) across all domains (land, maritime and air) on the move.

The service also serves as the "*ACE in PACE*" — alternate, contingent or emergency communications link, supports early entry communications packages and command and control for autonomous or uncrewed systems and data backhaul.

Whether in high-risk combat zones or during inclement weather events, the Iridium network provides uncompromising satellite communications that keeps users connected when it's needed most.

Iridium Certus™ terminals enable U.S. government users to securely connect remote assets to respective command and control centers in the U.S. in a cost-effective and secure manner, from anywhere in the world.

The Iridium Certus broadband service provides highly reliable, truly global, weather-resilient connectivity for on-the-move internet and high-quality voice access.

Iridium Certus terminals are low-profile and capable of maintaining broadband connectivity in fast-paced, unpredictable environments on land, at sea, in the air — and can do it without landing in, or passing through, non-U.S. territories.

"*Iridium Certus continues to provide mission-critical broadband and midband capabilities to the modern warfighter and we're excited to add new service providers to expand the distribution of these offerings,*" said ***Scott Scheimreif***, Executive Vice President of Government Programs, Iridium. "*With the addition of Iridium Certus for the government, these partners will play a critical role in supporting DoD personnel as they utilize this value-added service.*"

LEIDOS SECURES $1.5 BILLION SENTINEL AWARD

Leidos (NYSE: LDOS) has been awarded a prime task order to support the Department of Defense.

The task order holds a ceiling value of approximately $1.5 billion if all options are exercised and includes a one-year base period of performance, with four additional one-year option periods. Work will be performed worldwide.

Through this contract, Leidos will use ***Command, Control, Computers, Communications, Cyber, Intelligence, Surveillance and Reconnaissance*** (**C5ISR**) capabilities to enhance technological innovation with a focus on rapid insertion of technologies across the mission spectrum, for multiple services, and integrating new technology with existing and legacy systems for enhanced effectiveness.

Leidos will support the government with rapid technology insertion to enhance C5ISR missions at global scale. This award enables Leidos to expand upon its extensive C5ISR support to the warfighter as well as deliver a critical capability towards improved warfighter support. "*In today's battlefield, the command who has actionable multi and cross domain data fastest is the one with the high ground*," said ***Gerry Fasano***, Leidos Defense Group President.

"*Leidos has finely tuned our portfolio of expertise and developed a dynamic enterprise suite of C5ISR solutions, including Joint All-Domain Command and Control (JADC2) tools to ensure our warfighters exploit state-of-the-art technology to maintain their decisive advantage and enable joint synergy for operational superiority. We are honored to support this critical mission, providing readiness against evolving global threats.*"

BAE SYSTEMS' NETVIPR™ — A PIONEERING NEW MILITARY COMMS NETWORK

BAE Systems has unveiled their latest deployable networking product, NetVIPR™, which provides intelligent and secure military communication networks linking everything from small reconnaissance drones to combat vehicles, fighter jets, aircraft carriers or military commands.

The modern, multi-domain battlefield that comprises land, sea, air, space, cyber and electronic warfare is hugely contested and it is vital that militaries maintain control of their communications in this challenging environment. NetVIPR™ uses the full spectrum of communications infrastructure to avoid being solely reliant on satellites or fixed infrastructure which are often targeted by adversaries, so will be much more able to sustain a communications network through a myriad of offensive challenges.

NetVIPR™ is made up of a series of nodes and each node in the secure network is able to add, access and move data. This means that even if some nodes are damaged in warfare, the rest automatically re-route to maintain optimum network speed and flow of information, making it highly resilient.

Traditional military networks rely on hardware being set up and then maintained by specialists. As NetVIPR™ uses software to perform functions usually carried out by hardware it can be updated from remote locations instead of the frontline, providing uninterrupted network access and data transmission.

This 'plug and play' approach works with communications hardware found in most military platforms.

NASA AWARDS CONTRACTS TO ASSESS NEAR-SPACE COMMS CAPABILITIES

NASA has selected two companies – Kongsberg Satellite Services (KSAT) USA of Denver and SpaceLink Corporation of McLean, Virginia.

These companies will develop capability studies to explore and demonstrate communications and navigation services in support of ***Artemis*** missions to the Moon.

The awards, under the ***Next Space Technologies for Exploration Partnerships-2 (NextSTEP-2) Broad Agency Announcement (BAA) Appendix O***, are firm fixed-price milestone-based contracts in the amounts of $161,638 for KSAT and $189,881 for SpaceLink Corporation. The studies will involve Direct-to-Earth and lunar space relay

communications and navigation services that would enhance telemetry, tracking, and commanding services for orbital and sub-orbital missions at the Moon.This will be accomplished through relay of critical data between spacecraft and ground stations

NASA's Space Communications and Navigation (SCaN) program oversees the agency's two primary networks: the ***Deep Space Network*** and the ***Near Space Network***.
The latter program provides services to missions within 2 million kilometers of Earth through a blend of government and commercial providers. These studies are intended to inform NASA and its stakeholders on industry's capabilities and concepts that would enable a commercial space communications and navigation marketplace where NASA is one of many customers.

The companies will help NASA and its stakeholders understand advancements in RF compatibility testing that will lead to Near Space Network efficiencies, address industry best practices, tools, and capabilities related to mission planning and scheduling, understand the barriers, challenges, and solutions associated with integrating optical communications ground terminals into the Near Space Network, and understand the advancements of ***software-defined radios*** (**SDRs**) and cloud computing assets and their integration into the Near Space Network architecture.

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FIVE WAYS COMMERCIAL TECHNOLOGY BENEFITS MILSATCOM + THE JADC2 VISION

Author: Dr. Rajeev Gopal, Vice President Advanced Programs Hughes

The overarching concept of Joint All-Domain Command and Control (JADC2) is that all military network systems should "talk" to each other in order to achieve a common command and control system across forces.

The JADC2 effort will only be realized through the collaboration of industry and government and by leveraging mature, proven commercial SATCOM technologies.

I explored this topic recently during a presentation at the **Military Space USA** conference, asserting that new commercial technologies and capabilities will help realize the JADC2 vision.

In fact, there has been significant commercial investment — from the launch of ***Low Earth Orbit*** (**LEO**) ***HTS*** satellite constellations to development of ***artificial intelligence*** (**AI**) and ***machine learning*** (**ML**) models — that will be of benefit military SATCOM and advance the JADC2 vision.

Here are five ways the ***Department of Defense*** (**DoD**) can employ commercial innovations for JADC2:

- *Orchestrate diverse resources, including GEO (geostationary), LEO, and even 5G for increased resiliency. Enterprise Management and Control (EM&C) and software-defined wide area network (SD-WAN) concepts can actively manage multi-modem terminals (both commercial and government built, such as PTW), to create networks that rely on diverse transport types, multiple frequencies and multiple orbits.*

- *Consolidate SATCOM to improve readiness. With a simplified and streamlined SATCOM enterprise, made possible by flexible terminals that support multi-path operations and agile and responsive EM&C capabilities, commands can integrate and therefore improve situational awareness and mission management.*
- *Rapidly deploy flexible rule-based and machine learning models. Since commercial AI/ML technologies (EM&C) are already in production, defense networks can quickly apply them for smart equipment diagnostics, automatic SLA (Service Level Assurance) compliance, and network health and interference analytics.*
- *Add purpose-built security layers. Off-the-shelf commercial components can strengthen security at each layer of an Open Systems Interconnection (OSI) model to support interoperability and secure access. Depending upon the defense network's needs and purpose, options include those for classified environments, Zero Trust Architecture (ZTA), continuous monitoring threat management, roles based controls and the ability to address data at rest and in-transit.*
- *Develop next generation 5G tactical networks. The Department of Defense has already begun to create private 5G networks. However, their range can be extended, capacity increased, and resiliency improved through the use of low, mid, and high (mmWave) bands and GEO/LEO satellites as well as orchestration and optimization.*
- *When industry and government work together, the Defense Department's stove-piped systems can be unified into a single sophisticated and intelligent global network. Then the JADC2 vision can be realized, with battlefield data operationalized to enable more confident and rapid decision-making by our nation's warfighters.*

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AN INTERVIEW WITH MAJOR GENERAL SHAWN BRATTON, COMMANDER, STARCOM

STARCOM Tackles Training and Preparing U.S. Space Force Guardians for Readiness

A Kratos Constellations podcast feature

SPACE TRAINING AND READINESS COMMAND (STARCOM)

Constellations

STARCOM, the Space Training and Readiness Command for the US Space Force, is coming upon its first anniversary. Major General Shawn Bratton talks about training and developing world-class Guardians for the new and evolving space domain, and the challenges in creating realistic training, range, and test environments to support the warfighter.

John Gilroy (Constellations podcast host)
Welcome to Constellations, the podcast from Kratos. Our guest is Major General Shawn Bratton, Commander, Space Training and Readiness Command of the United States Space Force. We are going to talk training of the Space Force Guardians to operate in this new frontier and some of the challenges presented by this unique domain. Welcome Major General Bratton. Can you please tell us more about STARCOM and its mission?

MAJOR GENERAL BRATTON
Thank you John, I'm excited to talk to you about ***STARCOM***, the ***U.S. Space Force***, and space in general. This is certainly an exciting time.


Major General Bratton

STARCOM is, as you spelled out, the **Space Training and Readiness Command** for the Space Force. We do all the training and education activities, as well as the test activities. Combined together, it really comes down to preparing the force, in this case, the Space Force for competition and conflict in the space domain. As part of the broader joint force, we are taking them from street to basic training and turning them into guardians.

As a new command within the U.S. Space Force, and a new position for you personally, what is your priority?

MAJOR GENERAL BRATTON
You're correct. This is a new command we just stood up a year ago on August 23rd, so this is our one-year birthday. I am honored to be the first commander of STARCOM.

When I came over from U.S. Space Command, some of the priorities laid out by ***General Raymond*** for Year One was to establish an independent professional military education for the Space Force. General Raymond felt strongly that, "*Hey, we need to grow independent guardians. Take the best lessons, not just from the Air Force, but from the other services, and then define our own education.*"

That independent PME, or Professional Military Education, is one part, but two other priorities were building out the National Space Test and Training Complex. That's our big technical challenge, creating the playground or gym to work out the force and try out new capabilities and new tactics and techniques, and defining Space Force training.

We get so much from our partners in the Air Force, so there are things we want to keep and stay partnered with and some areas where it makes sense for us to maybe start to go our own way.

Organizationally, what is the relationship of Space Force to the Air Force? Is it similar to the Navy and Marines?

MAJOR GENERAL BRATTON
In some ways, absolutely. We are all in the department of the U.S. Air Force and ***Secretary Kendall***, the service Secretary for both the Air Force and the Space Force, relentlessly states, "*one team, one fight*" within the Department of the Air Force.

Secretary Kendall is our civilian leadership in the Pentagon, and beneath him is Chief of Staff for the Air Force, ***General Brown***, and the Chief of Space Operations, ***General Raymond***, my boss. The next echelon down are the field commands. There are three in the Space Force. STARCOM is one. We do training, education, and tests. Operations command and acquisition command are the other two.

Other than what's been done in the past with the other services, how are you determining the best way to build out new training and testing programs for a service area that is so vast and unmapped?

MAJOR GENERAL BRATTON
It's exciting to be on the ground floor. I started my professional career as a high school teacher, so I've been in the classroom and that's my background, and so, it makes sense to be here. But there is a lot of new ground to break.

We're really thinking through what does it mean to be a guardian, everything from the kind of culture to the very technical aspects associated with space operations, and how to impart that. And how can we benefit not just from the Department of Defense, but also from what NASA is doing, what commercial companies are doing, and how do we bring some of those best practices into the Space Force, and exchange information as we grow as part of the broader space industry.

You're operating in a dynamic environment, where things change almost constantly, from new launches to new technology. You're in a position where you have to cover all the basics yet have to have some flexibility for the new stuff that's going to happen in six months. How can you train and prepare for what in part is the unknown?

MAJOR GENERAL BRATTON
One of the benefits I think that will prove out over time is that being such a small force lets us be really agile. There'll be about 18,000 folks in the Space Force, about half in uniform, where in military, that's just a fraction of the size compared to the other services. And so, the idea that all of the training and education falls within a single organization, STARCOM in this case, as something new happens, we can introduce it correctly into the curriculum.

Last year we published new guidelines on planning for space operations within the Department of Defense, one of our first doctrine publications for the Space Force. As soon it came off the presses, we could take it and hand it to the trainers and educators to incorporate immediately into the classrooms across the Space Force. And so in responding to rapid innovation, whether within the department or industry, our small size will benefit our agility.

With satellites operating in space how do you do live testing and training? What are some of the technical challenges you're working through?

MAJOR GENERAL BRATTON
Great question. You'll hear the Pentagon staff talk about operational test and training infrastructure, and we put a label on it called the **National Space Test and Training Complex**, but generally we just call it the range.

So, how are we going to operate and test and train on a space range? As you know, it's so different than land, sea, and even the air domain, where you can carve out some real estate and declare a piece of geography set aside for test and training purposes, such as **Nellis Test and Training Range** in Nevada for Air Force, or the **National Training Center** in California for the Army.

Certainly, we can't do that in ***Low Earth Orbit*** (**LEO**) or in ***Geosynchronous Orbit*** (**GEO**). So we have to think about it differently, in how we meet our test and training objectives. For things that we have to do live, how do we communicate that, and how do we think about safety and making sure our intentions are clear so no one misunderstands the activity? But also, how do we benefit from the advances in digital space? What can I do in the simulators, in a digital environment that I don't have to do live? And do the digital models have the fidelity to deliver results that are accurate against live modeling?

Lots of folks do this well, certainly NASA being one. We're trying to learn from and understand how they do test and training in the digital space and on simulators before they go live in a range-like environment.

When training for a space mission, it seems your guardians would require the realism of a contested environment. Can you train for this within a virtual reality environment?

MAJOR GENERAL BRATTON
One of the challenges is how do I weigh the value of live training versus training in a simulator? And how do I know that one way is better than or less than the other. I had a chance to talk to a couple astronauts about the incredible training capabilities that NASA has and employs to prepare them for going on orbit and conducting human space flight missions.

The amount they do in the simulator, such as practicing docking, for example, as relayed to me from the astronaut community was, "*Hey, that first live dock was almost just like that last dock in the simulator*," meaning that the fidelity of the simulators and the level at which they're operating really prepare them for live space operations.

That requires incredible investment in simulating and training capability. So we're trying to balance that and understand how to measure what can we do virtually, make sure there is cost savings with it, or some other benefit that we realize.

And then, how do we think about live training and what things absolutely have to be done live in the training environment. We don't have all the answers, but we are learning from and relying on some of the experts and then working hard to really come down to an end state for the Space Force.

What are the major considerations for creating a space training and testing environment that's both digital and realistic? Are you getting help from industry and can you give us an example?

MAJOR GENERAL BRATTON
One of the greatest technical challenges ahead of STARCOM is the build out of the test and training complex, this weighing of value between digital and live in the digital space. We're getting a lot of help from other parts of the Space Force. The ***Space Warfighting Analysis Center***, which does a lot of our architectural analysis for future systems, is starting this process where they build a digital model of a system that we might acquire in future years.

As we work that through the acquisition cycle, what we hope is that once the department decides, "*Hey, we are going to acquire this system*", that digital model gains fidelity and interaction with industry has already started. And so we're all contributing to the fidelity of the model, the accuracy of the model

Eventually, I get my hands on it and I can use that same high-fidelity model and use that for test and training. And that works great. It works great for friendly systems. And then we have to rely on the intelligence community really to try and help us best understand what the potential adversaries are operating in their models, and then how do we bring those together in a training environment?

Can you tell us more about the Space Test Enterprise Vision?

MAJOR GENERAL BRATTON

Yes, that's one of the early documents from the Space Force, before STARCOM, to do with roles and responsibilities within the Space Force on who does what and how can we do things. Where is innovation that we can employ? How can we speed up the process to get equipment into the hands of operators faster? One thing the Vision talks about that we hit on is what we call integrated testing.

Historically the Department of Defense does developmental testing, which has to do with, "*Did the contractor deliver the thing that we asked for? Does it meet the specifications as designed*?"

When a new aircraft or a new land vehicle comes online, they'll run it through operational testing, and put it in the hands of the operators and see what they can do with it. And how to integrate it into a broader architecture or set of capabilities. We're trying to combine those things into integrated tests.

The Vision really speaks to how we think we'll gain advantage in the cost and delivery portions of the acquisition process delivery schedule. For integrated tests, we're putting operators and professional testers who work for STARCOM, operators who work for space operations command, and then the acquirers and engineers all together in the same room to field new capabilities.

Space Flag is not that, there's no live activity. It really is a limited use of simulation, using the capabilities that we have today. It's more of a planning exercise where if the adversary does this, now what will you do? In some cases, we're back on whiteboards, thinking through the tough problems, and explaining it to the leadership for the event, and then presenting the trainees with another challenging scenario.

We are definitely trying to up our game, but I don't think we'll go as far as Red Flag and the incredible capability that the Air Force has to do so much live. But I think we will start to introduce maybe some more live elements in what the Space Force is going to.

What is next on horizon?

MAJOR GENERAL BRATTON

We'll continue to run Space Flag, but we're going to begin a new series of exercises that we call the **Sky Series**. So black skies, red skies, blue skies, and each of those is four different communities. Black skies, for example, will be for the electronic warfare community. Blue skies will be for the cyber operators in the Space Force, and so on. A focus for us is to solve the training complex, the range problem first so we have a place to go take the force to work out and own our skills. Then you'll see us start to use those in both Space Flag and the Sky series as that comes online over the next few years.

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

This interview was edited for brevity. You can find the full interview here.

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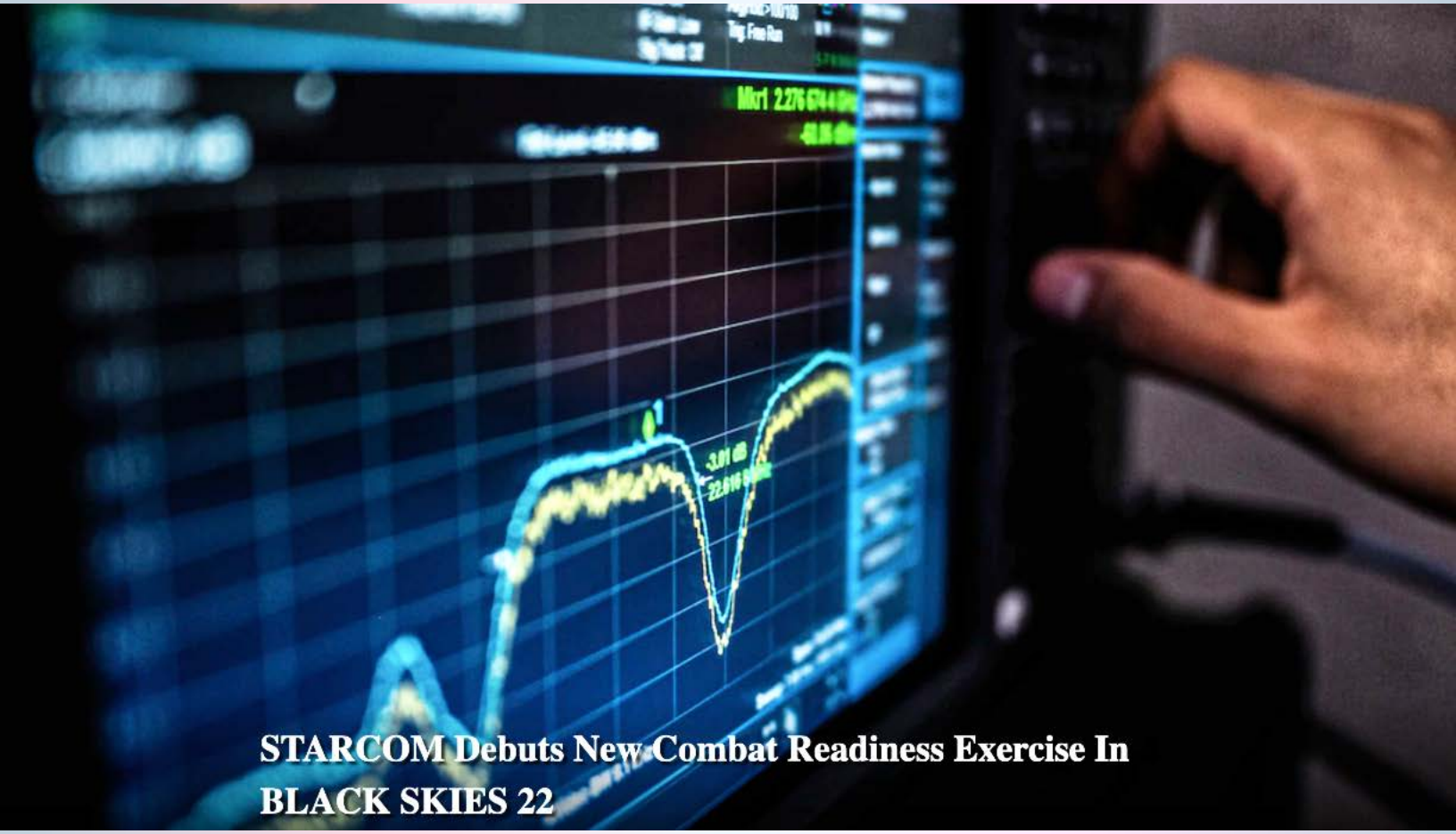

STARCOM Debuts New Combat Readiness Exercise In BLACK SKIES 22

ORBIT'S GX30 TERMINAL'S FULL TYPE APPROVAL NOW OPERATES ON INMARSAT GLOBAL XPRESS' COMMERCIAL AND MILITARY KA-BAND NETWORKS

Inmarsat and Orbit Communications Systems Ltd.'s Orbit GX30 airborne Ka-band multi-purpose terminal (MPT) received full type approval for use over Inmarsat's Global Xpress (GX) network for commercial and military Ka-band (Mil Ka).

The GX30 terminal fulfills the 'everywhere, all-the-time' coverage requirements of both military and commercial airborne users and allows government users to roam between commercial Ka-band and Mil Ka services.

This low ***size, weight and power*** (**SWaP**) user terminal delivers up to 126 Mbps forward link and up to 29 Mbps return link, maintaining uninterrupted connectivity during all flight phases.

Comprised of three Line Replaceable Units, the GX30 terminal consists of a Radio Frequency antenna assembly, a Ka-band Power Supply Unit and a Modem Unit that includes Inmarsat's ***G-MODMAN II*** solution.

GX30 can be installed on a range of business jets, military aircraft and ***uncrewed aerial vehicles*** (**UAVs**) and complies with industry standards including **MIL-STD-188-164C**, **RTCA DO-160G**, **Federal Communications Commission (FCC) 47 CFR 25.218** and **European Telecommunications Standards Institute (ETSI) EN 303 978.**

The terminal is compatible with military satellite systems, helpful for government airborne ***Intelligence, Reconnaissance and Surveillance*** (**ISR**) applications.

Tuomo Rutanen, VP Sales and Business Development – Americas, Orbit Communications Systems, said "*We are proud of this cooperation with Inmarsat. This GX30 design, coupled with Inmarsat's Global Xpress network, make it an ideal solution for U.S. government missions that transmit large volumes of data, including military aircraft and UAVs.*"

Inmarsat's GX serves as an example of the company's first, seamles,s mobile commercial wideband service available.

Matt Wissler, Chief Technology Officer, Inmarsat Government, said, "*With its best-in-class performance plus its low size, weight and power requirements, GX30 is a game changer for demanding aero applications. It ensures access to an easy-to-use, reliable wideband mobility solution for increased agility, interoperability, and worldwide coverage.*"

He continued, "*Inmarsat Government is pleased to continue our partnership with Orbit to deliver innovative, forward-looking satellite communications solutions that support today's complex missions. Inmarsat is sustaining its market leadership through a substantial investment and a powerful network of technology and manufacturing partners. This ongoing innovation provides a fast, cost-effective solution to the U.S. government's critical need for resilience, speed, and agility to ensure mission success today and in the future.*"

DEFENSE-FOCUSED SURVEY REVEALS MILITARY PERSONNEL CONCERNED ABOUT COMMUNICATIONS BEING SURPASSED BY ADVERSARIES AND LACK OF CURRENT ACTION

Despite signs of improving U.S. defense communications reliability, the survey points to growing concern among Department of Defense (DoD) personnel about U.S. military communications' capabilities being surpassed by adversaries and a lack of current action being taken to address this challenge

Viasat Inc. announced theresults from its ***Annual State of Military Communications study conducted by the Government Business Council (GBC)***, the research division of ***Government Executive Media Group***.

Despite signs of improving U.S. defense communications reliability, the survey points to growing concern among ***Department of Defense*** (**DoD**) personnel about U.S. military communications' capabilities being surpassed by adversaries and a lack of current action being taken to address this challenge.

A copy of the complete survey may be obtained via this direct link...

According to the third annual survey, more than two-thirds (68%) of respondents said they believe near-peer adversaries will match or surpass U.S. military communications capabilities within five years, including 36% believing this will happen in the next two years.

In addition, nearly three-quarters (73%) of DoD respondents believe that U.S. defense communication technologies are on par with or falling behind those used by adversaries, which represents a 13-percentage point increase from 2020.

These findings come despite DoD personnel also reporting greater reliability in their own experience with defense communications.

More than half (52%) of respondents said they rarely or never experience a complete loss in connectivity, a significant increase from 34% in 2020 and 24% in 2019, indicating steady year-over-year improvement in reliability.

However, 85% of respondents still reported experiencing at least one such disruption in the last year.

Other key findings from the survey include:

Actions aren't aligned with beliefs yet on communications improvements and value in commercial capability

- *83% of respondents said they believe improvements to defense communications should be a top or high priority for their agency compared with other priorities. Also, a majority (55%) of respondents agreed commercial capabilities can deliver the same or better levels of performance compared to DoD purpose-built communications.*
- *Additionally, more than half of respondents (59%) agreed increasing the use of commercial solutions is critical to accelerating strategic initiatives such as **Joint All-Domain Command and Control** (**JADC2**) or other joint warfighting programs.*
- *However, when asked if their agency would adopt commercial defense communications technology and services in the next year to keep pace with adversaries, just 33% said commercial communications adoption was very (26%) or extremely (7%) likely to happen.*
- *Similarly, just 35% of respondents said their agency was taking advantage of new acquisition processes and mechanisms like OTAs and as-a-service models to help update defense communications technologies.*

Space-based networks and commercial solutions needed for future warfighting

- *More than three-quarters (77%) of respondents agree the future fight will require advanced space-based networking capability to meet operational and mission needs. But, despite acknowledging the importance of space networks, just 19% said their agency was actively investing in advanced satellite communications to support modern warfighter needs.*

Cyber-attacks on defense communications technology/ infrastructure remain a challenge

- *40% of respondents feel their agency is adequately prepared for a cyber-attack on defense communications technology/infrastructure. While this may signal an improvement from 2020, when only 24% of respondents were very or extremely confident in their agency's preparedness for a cyber-attack on defense communications, it is still concerning that nearly three in 10 respondents (28%) don't think their agency is adequately prepared for such a cyber-attack.*

Next-gen technologies needed to advance defense communications, but investment is lagging

- *Artificial Intelligence (AI), cloud computing and 5G technology were the top technologies selected by respondents to advance defense communications capabilities. However, active investment in these technologies appears to be lagging with just 27% of respondents saying their agency is actively investing in AI and 26% in 5G. Cloud was the biggest priority next-gen technology, with 37% saying their agency is actively investing in cloud to support defense communications.*

"In its third year, the State of Military Communications survey highlights both encouraging and concerning trends surrounding the future of U.S. military communications. Government is recognizing the need to modernize defense communications and the value of commercial capabilities," said ***Craig Miller***, president of Viasat Government Systems. *"However, cultural change is often more difficult than technological change. DoD personnel see adversaries closing the capabilities gap and know new approaches are needed if the U.S. is going to maintain an advantage. Multi-domain communications and data transport is not only vital to missions, but it will likely be a deciding factor in future conflicts."*

SPACE SYSTEMS COMMAND ISSUES MILLION$$$ CONTRACT TO SCITEC

Space Systems Command's (SSC) Future Operationally Resilient Ground Evolution (FORGE) program has awarded a Cost-Plus Incentive Fee contract for $272 million to SciTec Inc. for Mission Data Processing Application Provider (MDPAP).

MDPAP will deliver critical applications for the nation's missile warning mission in direct support of the ***Space Based Infrared System (SBIRS)*** and the ***Next-Generation Overhead Persistent Infrared (Next-Gen OPIR)*** program.

MDPAP creates applications critical to the ***OPIR*** mission, consisting of ***Missile Warning*** (**MW**), ***Missile Defense*** (**MD**), ***Battlespace Awareness*** (**BA**), ***Technical Intelligence*** (**TI**), and **Civil/Environmental** (C/E).

MDPAP applications are integrated with the modular, scalable and extensible ***Mission Data Processing Applications Framework*** (**MDPAF**) which provides a modern and cyber-secure platform to develop, manage, and host MDP applications.

The MDPAF is being developed by ***Raytheon Intelligence & Space***, Aurora, Colorado.

FORGE employed an acquisition approach that ensures flexibility, modularity, and scalability in its contracts, enabling greater commercial participation to spur innovation and promote enterprise solutions.

The initial prototyping contract was accomplished through the ***Space Enterprise Consortium Other Transaction Authority (SpEC OTA)*** which provides access to traditional and non-traditional contractors through OTAs.

The OTA's innovative contracting process allowed SpEC to solicit bids from non-traditional companies. This process deducted at least six months from the pre-award schedule.

After performing competitive prototyping among three nontraditional companies for one year, the down-select and award went to SciTec.

Artistic rendition of SBIRS, courtesy of SSC

This unique approach reflects FORGE's focus on cultivating innovation to deliver capabilities more quickly to the operations community.

SciTec was able to provide early demonstrations of success using resources provided by the ***Tools Applications and Processors*** (TAP) Lab located at Boulder, Colorado.

The TAP Lab provides developers access to data from multiple sensors to create and test new software applications and algorithms.

The unique access, infrastructure, and environment provided by the TAP Lab enabled SciTec to focus on their core competencies

This approach resulted in capabilities like "ARROW," an application that performs dim target tracking, and "***FLAIMM***," which performs data fusion — both provided core elements for the MDPAP architecture.

SciTec's development and tuning of advanced algorithms, signal processing and data communications components deliver operational software that can automatically detect, classify and track a target in real time.

SciTec's code is deployed in satellite ground stations, command and control centers, government laboratories, community clouds, and on-board small satellite systems.

FORGE is the ground system that supports SSC's Next-Gen OPIR program and continued operations of legacy Space Based Infrared System (SBIRS) capabilities.

FORGE enables maximum use of the OPIR constellation by creating a modular and scalable Mission Data Processing architecture that allows for new OPIR sensors to be rapidly incorporated as new threats evolve.

Further, the government owns the technical baseline, which allows for competition of third-party application developers.

"*The prototyping effort under SpEC has allowed us to try before we buy. We had the opportunity to bring USSF Delta 4 operators in to use the applications and shape the look, feel, and function of these applications*," said Col. ***Dan Walter***, Strategic Missile Warning Senior Materiel Leader at Space Systems Command. "*The competition drove industry to bring the best of breed products together for best value for the warfighter. This is a no-fail mission, and we're excited for the game-changing applications being delivered.*"

SPACE SYSTEMS COMMAND: SPACE DOMAIN AWARENESS

As the space domain becomes increasingly congested, contested and complex, the USSF's mission continues to evolve

Author: The Space Systems Command team

Before the U.S. Space Force (USSF) became a separate military service, space situational awareness (SSA) was part of U.S. Space Command's focus: maintaining and updating the catalog of space objects and tracking satellites and space debris on-orbit.

As space becomes increasingly congested and contested, and with USSF approaching its fourth year of operation, the focused has shifted to ***Space Domain Awareness*** (**SDA**), which is much more complex:

F. Schnell

"*We are moving towards the characterization of the space domain – not only the things we know about, but can we find things we don't know about*?" said ***F. R. Schnell***, director, ***Space Domain Awareness Acquisition Delta***, ***Space Systems Command (SSC)***. "*As the environment becomes more contested, our adversaries are going to try harder to evade our observations and do things they don't want the general public to know about, that they don't want their own public to know about. We need to be able to find those things that don't want to be found.*"

It's not enough, Schnell said, to be able to identify a satellite as a satellite: now, the USSF wants to be able to identify the satellites' capability and its intent — what specific threat does it pose to U.S. space assets and to those of our allies?

"*That's an entirely different perspective*," he said. "*It's one thing to say, 'Yes, that's a satellite and it's right where I said it was going to be, and that's a piece of debris and it's right where I said it was going to be.' But to know what the intent of the item is, or what its exact capabilities are, and what its pattern of life is, is different. Does it always 'go left on Tuesdays?' That's the level of understanding we want to have. If it always goes left on Tuesdays at noon and then it suddenly goes right, then we're going to be a lot more interested.*"

The USSF monitors the space domain from 100 kilometers above the Earth out toward ***geosynchronous orbit*** (**GEO**) and beyond through a network of satellites, telescopes, optical systems and ground-based radars all around the globe, said Col. ***Marc A. Brock***, ***SpOC Space Delta 2*** commander.

Colonel Marc A. Brock

All of that data is fused together by the ***18th Space Defense Squadron*** to provide a picture of what's happening in the space domain for operational units and leaders.

That network is complex by design, Schnell said: some sensors are better at detecting things at different orbits than others, and with most of the planet covered in water, obtaining global coverage takes careful planning. In addition to its own equipment, the USSF has been incorporating commercial capability into its SDA architecture, providing more coverage and resiliency.

As of August 31, 2022, the USSF was tracking approximately 47,300 total objects with more than 6,500 of those active satellites — and more are being added every year, Brock added. "*Just since the beginning of this year, we've seen an 18 percent growth in the number of objects in the congested domain, and an over 40 percent increase since the end of 2020,*" he said, largely due to the growth of mega-constellations such as Starlink. "*It's really a space revolution, unlike anything we've seen in decades*."

"*It's not a secret at all that both China and Russia have decided to militarize the space domain: satellites that are highly maneuverable, satellites that have aggressive capabilities like robotic arms or kinetic kill vehicles and they're proliferating these systems at a rate we have not seen at any point in history,*" Brock said.

"*One complication we have, from a space domain awareness perspective, is how do you maintain a 'noise floor' and understand what are the objects in the domain that are threats versus non-threats, and then once you've identified those threats, how do you maintain custody of (track) them and characterize their capabilities and their intent to affect our blue (friendly) assets? And further, how do you provide the warning that our blue assets need so they can respond in time*?

"*The Russians launched Sputnik in 1957, and shortly after that, the United States began to build out a network of ground-based systems that could track those objects in space,*" Brock said. "*Over time, the threats that we've had in the domain have evolved. We are the single service dedicated to supporting warfighting in the space domain – it's not something that the American people and the American military chose to do – we are responding to the actions of our adversaries.*"

Some of that space debris has been deliberately caused, such as when the Russians blew up one of their own satellites, **Cosmos 1408**, in November of 2021, creating a debris cloud of more than 1,500 pieces, of which 615 pieces of debris still remain on orbit today, Brock said. Although Russia has repeatedly said the satellite's destruction was not a threat to manned-flight safety, the initial detonation sent seven astronauts aboard the **International Space Station** — two of them Russian — scrambling for safety.

Since January 1, 2022, **NASA** has had 39 high-concern conjunctions with that debris and one debris-avoidance maneuver. The irony, Brock said, is that the Russians control the thrusters on the ISS, so any debris avoidance maneuvers have to be performed by them.

The United States, Russia and China are all planning return missions to the moon, and that will require the USSF to expand its SDA efforts to the cislunar region. Unlike Keplerian physics, which focus on the satellites' orbits around the Earth — a "*two-body*" problem — the cislunar domain also has the moon's influence, turning it into a much more challenging "*three-body*" problem, Brock said. Cislunar orbits tend to be complex and unstable, making SDA that much more challenging. New weapons, such as hypersonic missiles that travel five times faster than the speed of sound, can maneuver and have a different energy signature than ballistic missiles, and they also pose a new challenge for the USSF, Schnell said.

To keep up with the increasing SDA challenge, SSC is working to increase its partnerships with industry and looking to find the best emerging technology available, using innovative ways of connecting to commercial providers. ***SSC Industry*** and ***Reverse Industry Days*** and the field command's new ***Front Door portal*** are a few examples.

Jennifer Ross

In July, SSC hosted an Industry Day event in Colorado Springs that was focused on SDA, in particular, threats in the cislunar domain, said ***Jennifer Ross***, SSC executive consultant with the Front Door initiative.

More than 400 professionals attended the event, including more than 300 from the space industry, representing more than 180 different companies. The space industry officials represented companies with technology in optical, radar and ***radio frequency*** (**RF**) sensing capabilities, with the ability to augment SDA across all orbital regimes, including cislunar, as well as those looking to provide data analytics.

The event was at the unclassified level, so more space industry partners could understand exactly what the United States and its allies are up against, said Col. ***Brian Gamble***, (Ret.) SSC executive consultant to Front Door.

Colonel Brian Gamble [Ret.]

He added, "*Ideally, when we look at capabilities like SDA, we're looking at being prognostic to the threat. We need to be ahead of it – we don't want to be playing catch-up to China and Russia; they should be playing catch up to us.*

"*One of the things we're trying to do is to ensure is that SSC's Front Door is providing an opportunity for industry, but also for SSC and the U.S. Space Force to make connections across industry to solve and close technical gaps in our architecture,*" Gamble said.

SSC Front Door's web portal is just the start of what we intend to offer, Ross said. In order to be prepared for 2026, "*it's going to take scouting, it's going to take assessments, it's going to take engagement and follow-through, all the way from identifying a great technology and marrying it to the right technological gaps, to working with the program and acquisition strategy teams. (The public) is only seeing the very early stages of what's going to be a much more comprehensive office so that these technologies and capabilities get fielded. Because at the end of the day, that's the metric that matters: did this technology get into the hands of the warfighter*?

"*It's game-changing for industry. A lot of these companies do not have (security) clearances so, for them, the threat has been behind a locked door, and now they're starting to understand why we feel this urgency.*" SSC wants to make certain it isn't missing out on innovative technology from small, start-up companies due to "*vendor-lock*" — where mostly large, well-established "*prime*" defense contractors receive the high-level read-ins as they have secured facilities and have done business with the government before, Gamble said.

"*We're have to be able to evaluate early tech companies based on the operational needs of the Space Force and say, 'You're generating a lot of interest and attention from venture capital, you don't have "nefarious capital" and you're making progress towards solving a problem that nobody else has solved – or you're going to solve it better and cheaper.' Our intent is to help foster those capabilities and companies into our government ecosystem.*

"*We want to help facilitate getting them to the right place, because it would be a shame to miss out on that*," Gamble said. "*It would also be a shame to be years behind where industry is because we didn't tap in with companies already out there solving some of our hardest problems. We need to discover those things before we go spend millions on a Program of Record to solve 50 percent of something that's already been solved in commercial industry.*"

Space Systems Command (SSC) is the U.S. Space Force field command responsible for rapidly developing, acquiring, equipping, fielding and sustaining lethal and resilient space capabilities. SSC mission capability areas include launch acquisition and operations, communications and positioning, navigation and timing (PNT), space sensing, battle management command, control and communications (BMC3), and space domain awareness & combat power. SSC is headquartered at Los Angeles Air Force Base in El Segundo, Calif.

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CYBERSECURITY IS A CRITICAL COMPONENT OF SSC'S MISSION

October is National Cybersecurity Awareness Month, but at Space Systems Command, cybersecurity is top of mind every day, officials said.

That's because protecting the nation's space assets — and the capability they bring to bear — is critical.

"*Computers are a part of our daily life*," said Colonel ***Louis P. Melancon***, director of intelligence at SSC. "*I can't think of many people who don't touch the cyber domain in some form as they go about their day. Every day, we all touch the cyber domain; every day we all touch space. These are two domains that are intertwined and they are absolutely critical to the U.S. way of life*."

Satellites provide everything from GPS to communications to the ***position, navigation and timing*** (**PNT**) used to make financial transactions possible, and the United States' adversaries are well aware of the financial, defensive and economic advantages unfettered access to space has given the nation.

"*Both Russia and the People's Republic of China pose very real cyber threats to the United States*," Melancon said.

Colonel Jennifer M. Krolikowski

"I think civilians have seen glimpses of cyber-attacks and their consequences — think of ransomware on the oil pipelines, identity theft, internet payment fraud, etc. — but maybe don't fully appreciate the catastrophic scale and impact in their lives if an attacker were successful in taking down our space and terrestrial systems," said Col. ***Jennifer Krolikowski,*** SSC chief information officer. "*What if GPS went down? Sure I'd have to get a physical map to figure out getting from point A to point B again, but it's also tied to the global banking industry and how that affects access to our money*."

The Colonel added, "*What if the power grid was taken down because of exploitations realized in the cyber domain? Sure I'd have to light a candle to see at night, but how would that affect folks in a hospital? I don't want to give off the impression that it's all doom and gloom, but this is why we focus on making systems secure, and having that mindset continuously from development, into, and through operations — so we don't have to experience the results of that catastrophic attack.*"

"*At SSC, we aren't developing space capability for the sake of space capability*," Melancon said. "*We need to deliver something that the Joint Force can use, and because of that, the threat is coming after us. (Our adversaries) see that the U.S. uses the space domain and the capabilities that SSC delivers to execute all of its warfare across the other domains: the U.S. Army, Navy, Marines, Air Force – can't do everything that they do without what we generate from space*."

Within SSC, the **Chief Information Office** has a ***Cyber*** division with several functions, such as regulatory compliance (**ATO/RMF**), supply chain management, program protection, and vulnerability assessment including a future ***cyber-sector operations complex***, ***crypto***, ***intelligence-fusion***, and ***cyber workforce development***, Krolikowski said.

"*A cardinal principle of cyber is 'defense-in-depth*,'" Krolikowski explained. "*In that sense, the CIO strives to empower SSC and mission partners to facilitate their cyber missions. For instance, one of our Program Executive Offices has a Space Domain Awareness/Combat Power division which focuses on Defensive Cyber for Space. They build agile software capable of logging and monitoring the entire ground-space-user-launch-crosslink ecosystem. Those operators will work beside our Space Operations Command warfighters, enabling cyber protection at the tactical edge.*

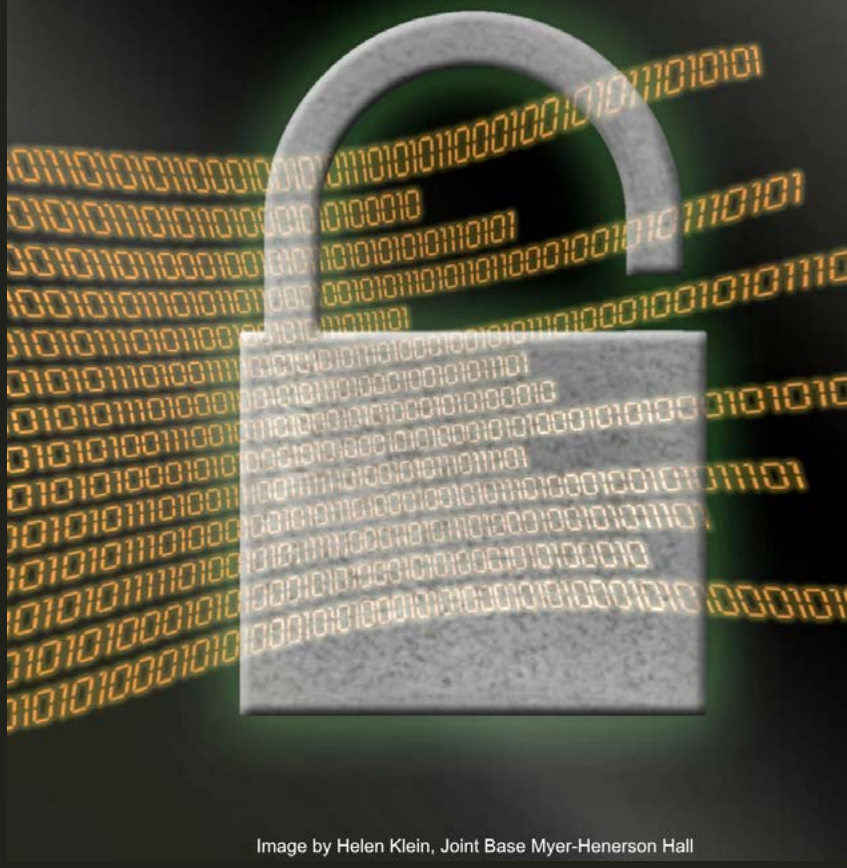


Image by Helen Klein, Joint Base Myer-Henerson Hall

"*All of these efforts come together to try and protect our systems right from the start as part of the design and build instead of trying to bolt on later*," Krolikowski said. "*It's about our being proactive with security instead of reactive. We're in a prolific era of cyberattacks and people trying to exploit vulnerabilities that we may have*," Krolikowski said. "*I can see an increase in those trying to take advantage of the ultimate high ground space offers. As a result, there's a heightened focus when it comes to our security posturing and how we are working to counter those types of threats.*

"*Of course, SSC implements military satellite (MILSAT) missions*," Krolikowski noted. "*It spreads across positioning, navigation/timing, missile detection, ELINT/SIGINT, reconnaissance/mapping/cartography (land, wavetops, ocean floor), weather, radar/lidar/optical/infrared and other spectra*."

She added, "*A more recent addition is space surveillance; instead of looking around-and-down, we look around-and-up, including cislunar and beyond*," Krolikowski said. "*Each of these has its own classified mission purpose, spectra/frequencies/bands, and warfighter orientation as related to other segments of MILSAT data. In addition, Artificial Intelligence and Machine Learning is engineered into the mix such that in a few years we will have orchestrated not only C2 but C5ISR in ways that frustrate, and demoralize, near-peer adversaries. SSC's role is to listen to our Fieldcom requirements generation, and help them procure and pay for smart, survivable technology demonstrations, increasingly devised by commercial SATCOM thought leaders and space industrial base writ large.*

"*Taking all of this into account, we are very interested in exploring the commercial satellite industry*," Krolikowski said. "*I believe in 'buy before build' for as many cases as we possibly can. If commercial space is readily available, secure enough, and can meet our use cases and outcomes, then it doesn't make a lot of sense as to why we wouldn't use these products and technologies.*

"Commercial can help us accelerate getting to those outcomes versus our taking years to build the same thing," Krolikowski said. *"In a lot of cases, commercial already has the capabilities in place, the infrastructure in place, and the maintenance and services there for us to digest and use. I do think there is still a place for government systems, but we can leverage commercial now and learn what to build on the government side to fill any gaps there may be."*

It's important to think in terms of a spectrum of potential cyber threats, Melancon said. On one hand are the basic measures most people take to practice good cyber hygiene: don't click suspicious links on emails, avoid going to questionable websites, being aware of and alert to phishing attacks, and be careful about what you post on social media.

There also are reversible and irreversible threats, Krolikowski said. *"A threat that is reversible is one where, when realized, can be fixed, hopefully rather easily, and brought back to the originating state. So this could be something like someone denying access to a website because they found a way to exploit admin rights. As soon as that vulnerability is fixed, or patched, they website is made available again.*

"A threat that is irreversible usually involves something being affected in a way it can't get back to its original state," Krolikowski said. *"For example, say there is a system that has to operate at certain temperature. An attacker could infiltrate that system and trick it into thinking it's cooler than it is. As a result, it doesn't shut down when it starts to overheat and explodes. That system can't go back to its original state and has suffered from an irreversible cyber-attack."*
It isn't just cyberattacks on satellites or the ground systems that control and process the data from space — it also includes things such as the engineers working on new hardware and software prototypes and hardening protections when data moves from a secured U.S. Department of Defense network to one owned by a private industry partner, Melancon said.

"Each time you do that, you're creating a new attack surface that a threat can go in to attempt to gain access, to gain information about the capabilities being developed or they may be doing it to do something more nefarious, like a denial-of-service attack," Melancon said. *"Broadly, anything with ones and zeros could be an attack surface. The point though, is to make it hard, or undesirable, for a hacker to exploit a vulnerability. This goes back into how you design and build a system in the first place. Are you writing secure code, are you putting controls in place to make accessing a system nearly impossible, are you patching on a continuous basis to plug holes, etc.? This is also why we are working hard at incorporating Zero Trust principles into our architectures - so we can reduce the ability to exploit."*

Recently, Major General ***Douglas Schiess*** said that U.S. Space Operations Command is assigning cybersecurity and intelligence specialists to work side-by-side with satellite operators so they're better prepared to protect U.S. systems from electronic and physical threats.

"You can't disentangle the two – we must use the cyber domain to communicate with our satellites and to operate those satellites," Melancon said. *"The cyber domain must rely on the capabilities that space provides in order to exist. If we suddenly lost all the satellites — yes, there are some terrestrial linkages — but the amount of data that flows through would not be what everyone expects."*
Intelligence analysts are needed to help interpret the data, Melancon said, quoting Ian Fleming, *"**Once is happenstance. Twice is coincidence. Three times is enemy action**.*

"Especially as you're dealing with things that are highly dispersed – such as a space operator at a ground station, and they're interacting with something hundreds to thousands of kilometers away, or zeros and ones zipping through the Ethernet – something unusual may happen, and you may attribute that to a flaw in the system or a bug. An intelligence analyst is looking at it through a slightly different lens."


Captain Elijha J. Williams

Captain ***Elijha J. Williams*** is SSC's program manager for the ***Space Security Challenge***, a portfolio of nontraditional projects that include ***Bug Bounties***, in which testers search for vulnerabilities in software — the ***Hack-A-Sat*** challenge and other cyber and space exercises.

Hack-A-Sat is a competition sponsored by SSC and the ***Air Force Research Laboratory*** (**AFRL**), designed to inspire the world's top cybersecurity talent to develop the skills necessary to help reduce vulnerabilities and build more secure space systems. Participants from more than 75 different countries have participated in the competitions to date, Williams said.

Now in its third year, the event has attracted 2,500 participants on 803 teams from around the world to compete in a series of challenges that will lead up to the final event that will occur from October 22nd. to the 23rd., featuring a digital twin of a satellite, running actual satellite software.

Teams will operate and defend their own space system while attacking opposing teams' systems. The final event will award $50,000 to the winning team as well as a $30,000 second-place prize and a $20,000 third-place prize.

Space used to be solely the domain of government-funded space programs, and seen as largely secure, Williams noted. However, the commercial sector has become a key player and an important partner and as access to space has become easier and less expensive, cybersecurity is much more critical.

"Space is becoming more democratized and we want to make sure the assets we send up there are secure," Williams said. *"We do need to be careful to design our future systems to be as resilient and as cyber secure as possible. One way to do that is to build that alliance between our industry, academia and public partners and share the challenges we face today and some creative ways to solve those problems."*

The Hack-A-Sat competition generally begins with a qualifying event open to everyone, Williams said. Teams compete through a series of challenges, with the top 8 teams advancing to the final challenge.

At the annual ***DEFCON*** hacking conference, Hack-A-Sat has its own booth in the ***Aerospace Village*** to further educate the public about the real-world cyber challenges with regard to space.

Williams said the teams have had as few people as 10 on a team and as many as 60, with some competitors as young as 15 years of age. While many people are adept at and interested in the cyber side of the challenges, what makes the competition challenging is that it requires a diverse set of skills — including knowledge of satellite operations, radio frequency communications, astrophysics, reverse engineering, exploit development and vulnerability research, and not everyone has the space operations knowledge.

"*You need the cyber SMEs (subject matter experts) who are fond of the binaries, crypto, forensic analysis, TCP IP protocols,*" Williams said, "*but part of your team is going to need to be very keen on the space operations side – how to maneuver the satellite, what kinds of commands do you have to send to maybe get your vehicle back into safe mode, the two-body problems and telemetry in general.*"

Next year's competition will take it even further, featuring a ***capture-the-flag exercise*** of an actual satellite in space, Williams said. ***Moonlighter*** is a small cubesat — about 6 to 8 pounds in weight and about the size of a computer monitor — that will be launched into ***Low Earth Orbit*** (**LEO**) in March of 2023 to serve as a "*cyber sandbox in space.*"

"*Moonlighter is going to be the platform for the final event, allowing the finalist teams to access that on-orbit satellite,*" Williams said. "*Not a flat satellite, not a digital twin — actually orbiting the Earth.*

WANT TO KNOW MORE ABOUT CISLUNAR SPACE AND "THREE-BODY" PROBLEMS IN PHYSICS?

"A Primer on Cislunar Space"

CYBERSECURITY IS FOR EVERYONE

October is National Cybersecurity Awareness Month, led by the National Cybersecurity Alliance (NCSA), the nation's leading nonprofit, public-partnership focused on helping all digital citizens stay safer and more secure online, and the U.S. Department of Homeland Security.
Lisa Plaggemier, Executive Director of The National Cybersecurity Alliance, had the following cyber safety tips:

USE MULTI-FACTOR AUTHENTICATION

One important way to add an extra layer of security is to utilize MFA. Even though this requires inputting additional features like passwords, a physical key (via a USB device), biometrics (e.g., fingerprint, voice) or a GPS location on your device, the benefit of safeguarding your information is worth it for consumers who want to stay cyber safe. Cyber criminals are taking notice and are increasingly sending "push" notifications or MFA pop-ups via phone or email in hopes that we will tire of entering their credentials and simply "accept" a fake MFA request. Thus, people should be aware and avoid clicking on unusual MFA requests, particularly ones that you didn't initiate.

CREATE STRONG PASSWORDS

Using a unique and strong password makes it more difficult for cyber criminals to gain access and exploit your personal information and data. Often, hackers will use techniques and software to "guess" passwords, so incorporating unique letters, numbers and characters into your passwords improves the odds that it won't be infiltrated. If you are concerned about your password being too unique to remember, manually write down the password and store it somewhere safe rather than settling for a weak one.

UPDATE SOFTWARE ROUTINELY

Everyday consumers can't identify, let alone defend, against bugs that are comprising major softwares. Thus, these major technology companies routinely check for vulnerabilities and offer updates on their software routinely. Consumers should make sure their "update automatically" feature is on for devices like phones and computers to avoid the possibility of missing an important update that may leave you less secure.

ETL SYSTEMS' NEXGEN STINGRAY DEBUTS

***ETL Systems** has launched the next evolution of **StingRay**, the company's RF over fiber range, with additional functionality and flexibility for satellite operations.*

RF over Fiber is a dependable and reliable way of moving satellite signals over longer distances than standard coaxial cable.

With fiber modules allowing antennas and IRD (***integrated receiver/decoder***) modems to be linked from 100 m. to more than 500 km., this is a more efficient and effective medium to transport IF, L- and C-band transmit and receive satellite signals over longer distances.

The new range will be incorporated into ETL's nexgen ***Genus*** platform, designed to offer increased modularity and flexibility for ground stations, including to meet MEO and LEO requirements.

Within the Genus platform, ETL's new StingRay RF over Fiber products cover a comprehensive range of frequency bands including new C-Band links operating over 500MHz to 6725MHz.

The new StingRay system offers ***manual gain control*** (**MGC**) as well as fixed gain and ***automatic gain control*** (**AGC**) modes, providing operators with greater flexibility while setting links up for optimized system performance.

In addition, the platform can house StingRay modules alongside ETL's ***Falcon*** frequency converters, ***ALTO*** amplifiers, switches, splitters and even small RF matrices/routers within the same indoor or outdoor chassis.

Combining these functions within the same chassis offers a reduction in cost and rack space requirements and improves resilience.

Along with improved security aspects (*SNMPv3 and HTTPS*) included with the Genus chassis, the updated StingRay modules offer improved RF performance, while maintaining the same industry-leading capacity of up to 32 optical transmit and/or receiver modules within a single 2U indoor chassis.

As an example of how the new StingRay range can be combined with other ETL products in the Genus platform: at a remote antenna site, 4 x StingRay L-Band Tx modules could be housed with 4 x Falcon downconverters (*e.g., Ku- to L-Band*) to transmit the downlink signals across site to the receiver location, where the StingRay L-Band Rx modules can be combined with RF processing products such as matrices, switches, splitters etc, dependent on requirements.

Any of these ETL components can be housed within Genus 19" indoor chassis or the new Genus IP65-rated outdoor unit.

Esen Bayar, ETL Systems chief executive officer, said, "*StingRay in Genus is a major step forward in ETL's product development and we are very proud of what we've achieved. With flexibility of growing importance to businesses working across the SATCOM industry, as well as the pillars of resilience and redundancy, the ETL engineers have meticulously worked to create a truly unique product addressing the needs of the industry.*"

URSA MAJOR'S U.S. AIR FORCE CONTRACT TO DEVELOP FLIGHT-READY ROCKET ENGINE FOR LAUNCH IN 2022

***Ursa Major** is America's only privately funded company that focuses solely on rocket propulsion has announced a contract under the U.S. Air Force Tactical Funding Increase (TACFI) program.*

Under the agreement, Ursa Major will provide a flight-qualified 5,000-pound thrust, oxygen-rich staged combustion "Hadley" rocket engine, suited for both the booster and upper-stage phases of launch for satellites into LEO orbit.

While more challenging to engineer than other systems, oxygen-rich staged combustion (ORSC) is more efficient for better engine performance and is the architecture preferred by the world's advanced space programs. This effort continues to build upon past investments into ORSC technology by the Air Force Research Laboratory (AFRL) to provide ORSC systems to the nation.

Hadley was developed by Ursa Major's team of world-class propulsion experts, who have more than 1,000 combined years of collective engine development experience on numerous successful launches and engine programs. Like all Ursa Major engines, Hadley delivers high performance, flexibility, and reliability at a significantly lower cost by using advanced manufacturing (3D printing) and a technology-first, market-driven design approach.

Hadley features active throttle, active thrust vector control, and a configurable fuel mixture ratio. It is qualified for operation in flight at various power levels and capable of continuously throttling from minimum to nominal flight power levels. Ursa Major has already delivered numerous Hadley engines to customers from its uniquely integrated 90-acre Colorado facility, which houses its engineering, manufacturing, and testing functions on a single property.

"*We are proud of the Air Force's continued support and recognition of Ursa Major's leadership in developing reliable, high-performing, American-made rocket propulsion*," said Ursa Major founder and CEO, ***Joe Lauriente***. "*Choosing Ursa Major and the Hadley engine means more U.S. satellites in space, which is more important than ever for our national security and global technical leadership*."

As part of the AFRL contract deliverables, Ursa Major will also be providing the ***Air Force Research Lab (AFRL)*** with statistically significant data sets from extensive testing of multiple Hadley engines, including measurements of specific impulse, or ISP, combustion stability, vibration and shock profiles, and range of inlet pressures and temperatures.

Hadley will be qualified using similar metrics according to an internal test plan based on industry guidelines and best practices, focusing on engine life, operating space, functional requirements, and performance. The qualification test campaign under this effort will include runtime at and beyond the extremes of the power level and mixture ratio targets, demonstrating that Hadley operates safely and reliably within the power level and mixture ratio required for missions of DoD interest.

The company's customers get to launch faster and without the development cost of building engines in-house. Ursa Major has built and tested more than 50 staged-combustion rocket engines and plans to deliver 30 to customers by year-end. Ursa Major engines have accumulated more than 50,000 seconds of runtime.

WHEN SECONDS MATTER...

The need for fast access to remote sensing data

Author: Wendy Newman, Vice President, Marketing and Communications, SpaceLink

Artistic rendition of SpaceLink satellites connecting to spacecraft in LEO, MEO and GEO, as well as aerial assets.

Getting remote sensing data to the tactical edge at the speed of relevance is essential to support both military operations and disaster relief. Today, however, access time to retrieve satellite data is often measured in hours or even days.

A high bandwidth relay system with real-time continuous tasking uplink and data downlink can solve this problem and provide access to critical data in minutes to seconds, rather than hours.

Remote sensing satellites in LEO today can only download data or upload tasking commands when positioned over a ground station. Typically, this is limited to six percent or less of each orbit.

Ground station locations are limited by oceans, mountains and unfriendly territories, and combined with limited data throughput and gaps between passes, the real-time intelligence needed to make tactical decisions is often unavailable.

An on-orbit relay system eliminates these obstacles by providing a network that is always in sight of its ground stations and assets in LEO, MEO, or GEO, as well as airborne platforms. It can provide immediate connectivity as needed as well as continuous and persistent links.

WHY NOW

There is an unprecedented proliferation of commercial remote sensing satellites in LEO, collecting EO, SAR, RF and hyperspectral data. New systems are needed to maximize the value of the massive amounts of data these constellations collect.

Advances in transport, analysis and integration are transforming the amount of useful information available and government agencies are looking to benefit from the data that industry can provide.

This proliferation is driving demand for new data relay services and technology advances are making it possible to eliminate the lag in communications with space-based platforms.

Developing a standard for ***optical intersatellite links*** (**OISLs**) and technologies, such as onboard processing with the intelligence to control and direct data traffic to optimize the capacity and availability of the network, are contributing to new solutions that meet the need for speed challenge. Secure commercial relay networks are poised to provide alternative space communications pathways that ensure resiliency and reduce sensor-to-shooter latency.

NASA's plans to phase out its ***Tracking and Data Relay Satellite*** (**TDRS**) system, which now provides communications links for both NASA and national security spacecraft in orbit, is also changing the landscape for commercial solutions.

> ***According to NASA***:
> *Private sector innovation in near-Earth space is accelerating quickly and dramatically. Tapping those advances will ensure NASA missions have the reliable, secure and continual space communications on which their long-term operations depend. That is needed as the legacy NASA owned and operated Tracking and Data Relay Satellite system is decommissioned in coming years.*

SATELLITE RELAY SOLUTIONS

Today's tactical military operators need high-capacity communications links to benefit from the growing pool of remote sensing data that is now available. They need a system that easily connects to gateways in the continental U.S., or directly to deployed ground terminals, when and where there is demand, without delays.

This kind of access has the potential to significantly reduce risk to adversary threats to foreign ground stations and data processing nodes in combat and can make the concept of a hybrid architecture combining government satellites and commercial satellites a reality.

The SpaceLink relay system will augment the coming hybrid space architecture.

SpaceLink is building a MEO constellation of high bandwidth optical and RF relay satellites designed to provide secure, real-time data transport between on-orbit assets and the ground. This continuous link availability transforms the benefit of remote sensing data collected.

With optical inter-satellite links and high bandwidth ***V/Q-band communications*** to the ground, gigabit per second throughput of real-time data is possible. SpaceLink has designed an innovative system architecture, implementing services that provide high security and 100 percent access time so that data is available in seconds when it matters the most.

The SpaceLink relay constellation consists of four satellites equally spaced in an equatorial orbit. Scheduled to launch in late 2024 or early 2025, the constellation's features include:

- ***100 percent line-of-sight access to LEO satellites, eliminating delays between the collection of remote sensing data and the delivery of the data to the end user***
- ***Customer-driven real-time tasking and direct downlink of mission critical data***
- ***An option for on-board processing to support real-time, same orbit, tip-and-cue between multiple and diverse remote sensing satellites*** *(e.g., RF to SAR to EO visible)*
- ***An ability to augment proliferated LEO communications satellites providing a resilient 'fail over' capability for government communications paths during periods of pre-planned or adversary-caused loss of communications.***

SpaceLink's initial four satellite constellation provides ***26 Gigabits per second*** (**Gbps**) of raw data transfer capacity with latencies as little as 150 milliseconds from reception to delivery. Using SDA compatible optical terminals, the constellation is designed to aggregate data from multiple sources and deliver that data using secure cloud-based networks.

The constellation will handle scheduled, ad-hoc, and urgent requests with service level agreements defining priorities. The cost is a fraction of the cost of deploying or renting a traditional ground station network and connectivity and security are dramatically improved.

SpaceLink relay satellites link to its U.S. based gateways using the Q- and V-bands. From there, the SpaceLink network operation center interconnects with top tier cloud providers, including ***Amazon Web Services*** (**AWS**) and ***Microsoft Azure*** for secure and reliable data delivery to end users.

Because of this four-satellite architecture, data can be instantly and securely passed over optical links to the node closest to its U.S. access zones. Initially, the SpaceLink ground network has one access zone with two gateway sites each hosting a 10-meter multi-band antenna system.

Ninety-nine percent availability is achieved by separating these gateway antennas by 100 km. or more to mitigate weather-related interference.

OPTICAL COMMUNICATIONS

Advances in optical communications, also known as laser communications, bring significant benefit to in-space relay systems. Using optical intersatellite links provides an order of magnitude increase in data capacity and transport speed compared to RF networks. This is essential when working with datasets such as large quantities of high-resolution imagery.

The ***Space Development Agency (SDA***) has developed interoperability standards so that companies such as ***Mynaric*** and ***Blue Marble Communications*** can ramp up production and developments for commercial use.

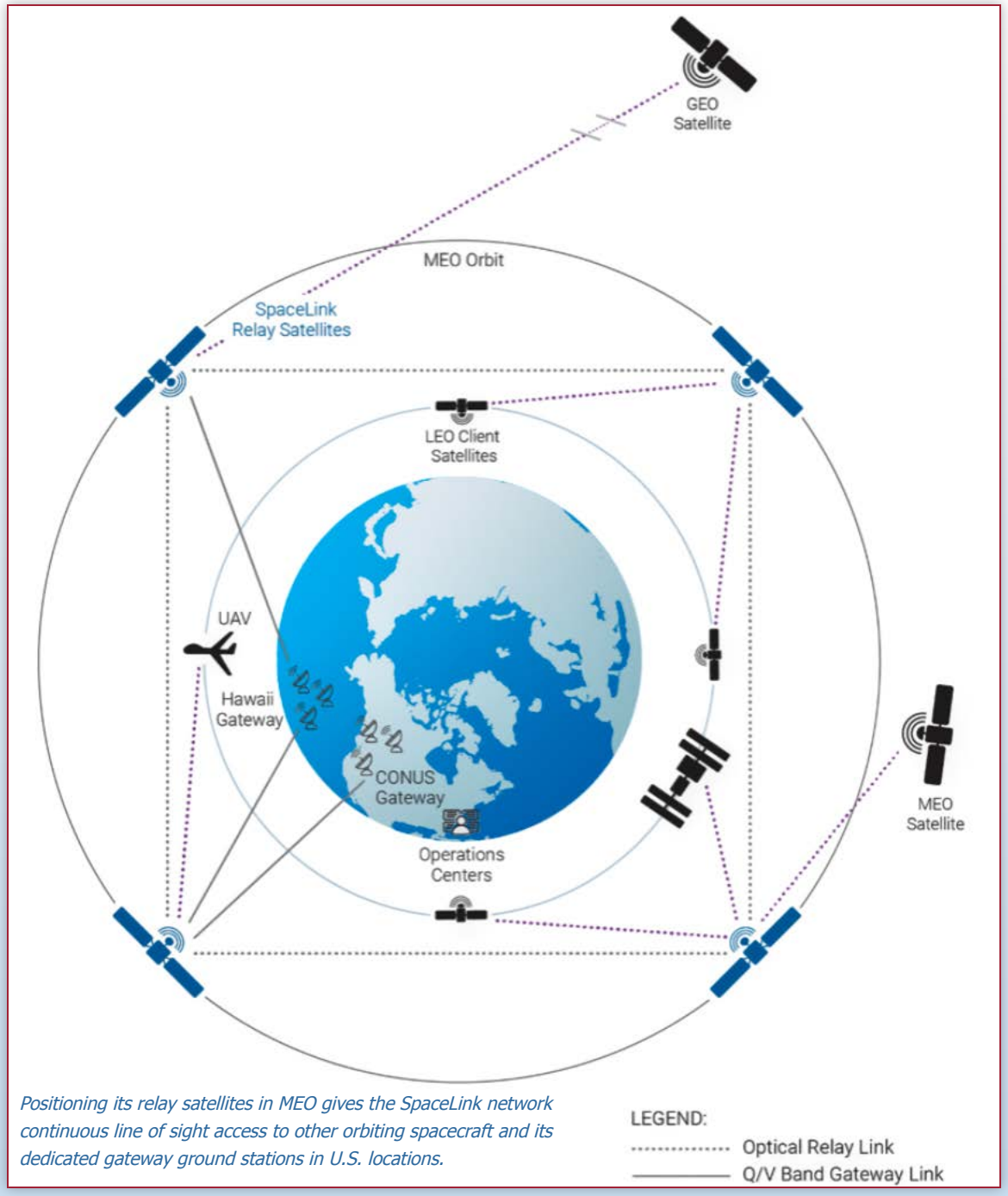
The result is that what was once a cost-prohibitive technology is now becoming affordable for the commercial industry.

Previously, satellites were limited to using RF for communications, which is constrained by spectrum availability, capacity and a broadly dispersed signal which is vulnerable to interference.

RF equipment is also larger, heavier and uses more power than optical terminals and requires large antennas that need to be stowed for launch.

Optical terminals are compact with lower mass and smaller footprints, which is important to satellite operators who need to maximize the cost effectiveness of their spacecraft.

Optical intersatellite links offer the added benefit of an inherent level of security compared to RF signals. As laser beams are small and concentrated, they are much more difficult to intercept and are much less susceptible to jamming or interference than are RF signals.



Positioning its relay satellites in MEO gives the SpaceLink network continuous line of sight access to other orbiting spacecraft and its dedicated gateway ground stations in U.S. locations.

TECHNOLOGY ROADMAP

When SpaceLink launches its first constellation of relay satellites, with 16 optical terminals in all, it will be capable of transporting a data volume of 26 Gpbs per second. The SpaceLink technology roadmap builds toward a 10 Terabit per second, orbiting, optical cloud that will serve users in every orbit — including around the moon.

REAPING THE BENEFITS

Timely access to data is essential to reap the benefits of the proliferation of remote sensing satellites in LEO. Now is the time to implement better and faster methods of downloading and integrating the wealth of EO, SAR, RF and hyperspectral data becoming available. Increased cadence and proliferated ground infrastructure are, at best, only a partial solution. An optical relay network in MEO eliminates bottlenecks, reducing sensor to shooter timelines to seconds. The SpaceLink network is designed to support real-time tasking and downlink of data needed for military operators to make tactical decisions... ***when seconds matter the most***.

www.eosspacelink.com

SPACELINK

Wendy Newman (formerly Wendy Lewis) is Vice President of Marketing and Communications at SpaceLink. She was previously Senior Director of Communications at Space Systems Loral and Maxar Technologies and she is the founder of Strategic Voice, a PR agency focused on the space and satellite industry. Wendy is also the Chairman of the SSPI-WISE Mentorship Committee.

Wendy Newman

GENERAL RAYMOND'S REFLECTIONS

Article by Charles Pope, Secretary of the Air Force Public Affairs

In a speech that was as much an unofficial farewell as a proud update of the U.S. Space Force's (USSF) youthful evolution, Chief of Space Operations, General John "Jay" Raymond told an influential audience on September 20th that the service is on a strong footing and that the USSF has deftly avoided two, major traps.

The first, Raymond told Guardians and Airmen during his keynote address at the ***Air Force Association's Air, Space & Cyber Conference,*** is "*that we wouldn't think bold enough. The second challenge was that when we did think bold the bureaucracy might stifle our bold thinking. We were dead set against either one of these happening. And if we did this right, we wanted all of the other services looking over our shoulder jealous about what we built because we had an opportunity to start with a clean sheet of paper.*"

Raymond's conclusion is that those pitfalls were avoided and, while much more work is ahead, the achievements and advances since the Space Force was born on December 20, 2019, are impressive.

"*The United States Space Force has just begun, and it has a great history ahead. I couldn't be more excited for the future of the Space Force,*" Raymond said.

In a powerful nod to the Space Force's arrival — and permanence — Raymond closed his 40-minute address by unveiling the official Space Force anthem, "***Sempra Supra***." At the same time, Raymond will soon close out a 38-year career split across the Air Force and, in the last nearly three years, as the Space Force's highest-ranking officer.

Lt. Gen. ***B. Chance Saltzman*** has been nominated to replace General Raymond.

With that context and what Raymond called his "*terminal count or, in Air Force terms, the 'short final' of my career,*" he studded his speech with thank you's, calling out by name Air Force Secretary ***Frank Kendall,*** Chief of Staff, Gen. ***CQ Brown***, as well as former Chief of Staff, retired Gen. ***David Goldfein***.

He referenced his stint in ROTC at Clemson University, Space Force Vice CSO Gen. ***DT Thompson*** and his wife ***Mary*** and, most of all, Raymond's wife ***Molly***, whom he called "*my wingman. Not only is she my wingman, she's our family's wingman.*"

All of them, he suggested, had a hand in bringing the Space Force from a "*nearly clean sheet of paper*" to where it is today.

While difficult, focusing on space is also critically important, he said, "*On 20 December 2019 the United States took an opportunity to elevate space to a level commensurate with its importance for our nation; an opportunity to enhance global security by amplifying deterrence, increasing the lethality of our joint and coalition forces that are critical to integrated deterrence. It was an opportunity to firmly establish the United States' leadership in space and to shape the norms of behavior in the space domain.*"

In three years, the Space Force has grown to 16,000 personnel and demand for spots among the highly specialized force is strong, Raymond said. A large reason, he said, is that the Space Force developed six core focus areas and has worked tirelessly to build the nation's first new military service since 1947 around each one. They are:

Recruit, Assess, Develop, Care for and Retain its People; **Write its own Doctrine**… similar to what the Air Force did leading up to its independence; **Build its own budget**; **Design its Force**, both from an organizational and force structure point of view **Ready the Force**; **Present the Force to Combatant Commands**.

As he has frequently in the past, Raymond highlighted the Space Force's novel approach to recruiting and training and finding the highly specialized personnel the service needs to accomplish its missions.

"*Because of our small size and because we were starting from scratch, we wanted to fundamentally change our ability to develop our most important resource, our people,*" he said, noting that the approach required "*applying a little more art than science.*"

That same philosophy applies to operational aspects of the service. It also applies to how the service modernizes, determines the "space architecture" it needs and how it breaks from military norms and institutes a more nimble, flattened organizational structure On all of it, Raymond suggested that the Space Force is moving in the correct direction.

"As the missile threat continues to evolve, and as threats to our space assets continue to emerge, we must transform our space architectures to be more capable and resilient," he said. "*Organizationally, we flattened our structure to eliminate two layers of command and establish mission-focused Deltas.* "

Space Force formed the Space ***Warfighting Analysis Center (SWAC***) "*comprised of our smartest Ph.D.s and our best and brightest operators"* that became the operational heartbeat of the service, Raymond said. *"They first tackled the (missile warning and missile tracking) force design to deliver more effective capabilities in response to the changing missile threat and to diversify the architecture in face of a growing threat to our space capabilities. This is the most consequential work the Space Force has delivered and I am extremely proud of the SWAC team.*"

It was rooted in an acquisition strategy that also veers from the norm. Raymond summarized it as, "*exploit what we have, buy what we can, build what we must.*" Raymond noted that even traditional questions such as "*readiness*" required a different way of thinking for the Space Force.

"*We are leading a fundamental re-think of what readiness means to a force that is primarily employed in place, rather than waiting to deploy overseas,*" he said. "*We are addressing each aspect of readiness – Do we have the right quantity and mix of people? Do we have the right systems, including ground and space, hardware and software? And have we met the right basic, advanced, and continuous training requirements? This means a different way of approaching training and sustainment, as well as new ways of reporting this data up to higher headquarters and to the Pentagon.*"

GOVERNMENT SATELLITE REPORT (GSR)

NRO Director on the benefits of leveraging commercial space assets

Author: David Pesgraves, Government Satellite Report (GSR)

As U.S. near-peer competitors continue to establish a strong presence in space, the domain itself is quickly evolving from a benign to contested arena.

Today's more advanced adversaries continue to find ways to interrupt, deny, or simply destroy U.S. assets and capabilities in space. And that's a problem, since the communications capabilities delivered by satellites are more important than ever for our increasingly technology and network dependent military.

From being able to transmit decision-making ***intelligence, surveillance, and reconnaissance*** (**ISR***)* data, to providing connectivity to warfighters in off-grid environments, the U.S. has countless, highly critical capabilities and solutions that solely depend on a well-defended and uninterrupted space architecture.

This sentiment was recently shared by Dr. ***Christopher Scolese***, the Director of the ***National Reconnaissance Office*** (**NRO**), at a ***Schriever Spacepower Forum***.

"*The world is changing*," said Dr. Scolese. "*We need information faster, and we need to deliver it quicker.*" He explained that space is no longer the uncontested domain that it once was. From cyber threats to adversarial anti-satellite mission tests (ASMT), space is quickly becoming the next, modern battlefield.

Dr. Christopher Scolese

"*We have even more denied areas*," said Dr. Scolese. "*We previously have been operating in a more permissive environment. And that has now gone away.*" Nevertheless, Dr. Scolese made it clear that his agency is committed to supplying rapid and timely ISR when it is needed, especially to the U.S. Space Force and the U.S. Space Command. "*We're going to find ways so that we can be efficient. We can make that happen very effectively.*"

"BUY WHAT WE CAN"

One resource that Dr. Scolese views as a possible solution to NRO needs is the commercial space industry.

"*Buy what we can, build what we must,*" he said. Dr. Scolese explained that the NRO is seeking to expand on its use of capabilities provided by industry. "*We are looking for more commercial services,*" *he said. "What it comes down to is that the commercial market has really grown, and we're seeing a lot of capability out there that commercial companies are providing.*"

According to Dr. Scolese, one major benefit from his, "*Buy what we can*," motto is the affordability factor. He explained that emerging commercial solutions are providing agencies like the NRO with an opportunity to acquire critical data "*at a lower cost*."

He went on to say that the data the commercial industry provides gives the NRO the ability and advantage to share more information faster.

"*The warfighter may not need the exquisite imagery*," explained Dr. Scolese. "*But they need to know what's there. And commercial gives us that opportunity.*"

Dr. Scolese isn't the only high-ranking government official who sees the value in leveraging commercial space assets, solutions, and capabilities.

Top leadership within ***U.S. Department of Defense*** (**DoD**) have recently been echoing a similar sentiment. Last June, former NRO Deputy Director and current Assistant Secretary of the Air Force for Space Acquisition and Integration, ***Frank Calvelli***, also explained how the, "*Buy what we can*," mentality can benefit the U.S. military.

"*I also think that if commercial has a capability…you're not going to get any faster than taking advantage of what you could just buy off the shelf as opposed to develop*," he said.

At another Spacepower Forum this past January, the U.S. Space Force's Lt. Gen. ***B. Chance Saltzman*** also agreed that deploying off-the-shelf commercial capabilities would benefit the DoD.

"*With the technology that's being employed, I think we're going to be able to leverage commercial capabilities to accomplish a subset of our missions*," said the General. "*And, as we distribute those up, not only does it free up resources for us, but it creates a more resilient architecture because of the number of different places and pathways where we can get the information we need.*"

The commercial satellite industry can do more than offer ISR data and imaging at a discount. Commercial satellite providers can also deliver communications and connectivity that can protect military networks from near-peer adversaries.

CREATING RESILIENCY

Having a resilient space architecture was another topic that Dr. Scolese touched upon at the forum. He explained the critical role a resilient space architecture would play for the defense of U.S. assets and capabilities in the domain.

"*A resilient proliferated, architecture gives us faster revisit times and a more responsive system*," he explained. "*So, it gives us greater capability. It gives us more options to deliver what is needed to whoever is needed… We'll have more capability to deliver more flexibility among our systems to get the information that's needed.*"

The development and deployment of a resilient space architecture is another theme top military leadership have been discussing throughout the past year. Last February, Space Force's Chief of Space Operations, Gen John W. "Jay" Raymond explained, "We have got to shift the space architecture from a handful of exquisite capabilities that are very hard to defend to a more robust, more resilient architecture by design."

Much like the resources industry provides for ISR and warfighting capabilities, the commercial sector can also provide the required assets and solutions that would build out a hardened and resilient space architecture.

In a recent interview with the ***Government Satellite Report***, ***SES Government*** Solutions' ***Jon Bennett***, Vice President, Government Affairs, Marketing and Corporate Communications, discussed the important role commercial capabilities play in military space architectures.

"*A benefit of leveraging commercial…is the security, resiliency, and redundancy it provides*," said Mr. Bennett. "*When you're able to complicate an enemy's targeting calculus, that ensures that the built-in security features of your assets can mitigate threats at the highest level.*"

He went on to explain that if the U.S. doesn't take advantage and leverage commercial solutions and capabilities, "*we are certainly putting ourselves at an extreme disadvantage to our adversaries.*"

Select this link to watch Dr. Scolese's interview in full..

This articles appeared first on ***GovSat*** *and is reprinted with permission of the publication and* ***SES-GS***.

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.

David Pesgraves

HYPERSONICS: DEVELOPING + DEFENDING AGAINST MISSILES THAT ARE FAR FASTER THAN SOUND

Author: The Raytheon Technologies Team

The challenges of the hypersonic era in military operations are immense. But so are the abilities of innovators who work together to solve them.

That was the message when ***Wes Kremer***, president of ***Raytheon Missiles & Defense***, a ***Raytheon Technologies*** business, spoke to investors about how teams are working across the company to solve the myriad science and engineering problems that come with developing and defending against hypersonics, generally defined as weapons that fly at speeds of Mach 5 or greater.

"*We have to go faster. We also have to go farther. We have to be able to detect threats at longer distances. We have to be able to target at longer distances. We have to be able to close kill chains at longer distances*," ***Kremer*** said, using the military term for the process of defeating a target. "*We have to be able to do that across multiple domains. How we work across domains and how we solve those types of problems is one of the true synergies that we have in this business.*"

Here are some of the ways colleagues across Raytheon Technologies, with their deep expertise in areas including heat management, propulsion, missile development and surface- and space-based sensing, are combining novel problem-solving approaches with decades of institutional knowledge to give the U.S. military and allied forces an advantage in the era of hypersonic military operations.

HEAT MANAGEMENT

Hypersonic weapons, by definition, are about speed. They fly at a minimum of 3,800 mph, and that's where the engineering challenges begin.

The biggest challenge is the heat caused by friction as the air passes over the fast-moving vehicle. Many materials can't survive that kind of thermal stress. More heat-resistant materials tend to be heavy, very expensive, or both. Using them solves one problem but creates others:. A heavier airframe needs more propulsion to reach speed, which requires a more powerful engine and more fuel, which adds weight and increases cost.

Experts at Raytheon Technologies have been working for years to overcome those heat problems, and today they're applying that

This artist's illustration shows how hypersonic weapons heat up as they accelerate through the atmosphere.

This artist's rendering shows the Hypersonic Air-breathing Weapon Concept, which will integrate Raytheon Technologies' air-breathing hypersonic weapon with scramjet combustors from Northrop Grumman.

knowledge to hypersonics. For example, ***Raytheon Missiles & Defense*** is collaborating with ***Collins Aerospace***, another Raytheon Technologies business, to explore the use of advanced materials — such as those that protect engine coverings, brake assemblies and other parts of an aircraft from high temperatures — to help solve the heat-management problems that come with hypersonic flight.

Collins has been working with Raytheon Missiles & Defense on hypersonic solutions since the two became sister businesses under Raytheon Technologies. Now that collaboration is easier, it's an imperative under the company's strategy to use technologies and knowledge from one business to the benefit of another.

PROPULSION

Then, of course, there's the matter of making the airframe go that fast in the first place. The ***U.S. Department of Defense*** has stated it wants not only to boost-glide hypersonics (*which are boosted by rockets into the very upper edge of the atmosphere*) but also ***scramjet-powered hypersonics*** (*which use the fast-moving air around them to provide oxygen for propulsion*).

Raytheon Technologies is working with the U.S. military to strengthen its hypersonic strike capability. In June of 2021, the company received a $33 million U.S. Air Force contract to develop a solid-rocket boosted, air-breathing hypersonic conventional cruise missile that can be launched from existing fighter or bomber aircraft. This initiative is part of the initial phase of the ***Southern Cross Integrated Flight Research Experiment***, or **SCIFiRE**, a cooperative program with Australia to develop hypersonic capabilities.

The company is also working on an offensive system called the ***Hypersonic Air-Breathing Weapon Concept***, or **HAWC**, under a 2019 teaming agreement between the former Raytheon Company and ***Northrop Grumman***. They are integrating Northrop Grumman's scramjet combustors into Raytheon Technologies' air-breathing hypersonic weapons. In 2021, the ***U.S. Defense Advanced Research Agency*** successfully test-fired the industry team's HAWC missile.

DEFEATING THE THREAT

Part of the difficulty in defending against hypersonic weapons is that, apart from their speed and range, they're also extraordinarily maneuverable. One approach to countering that combination is to build defenses in layers, with sensors on land, at sea, in the air and in space to detect and track targets, and effectors such as kinetic and non-kinetic weapons to neutralize the threat.

The first opportunity to defeat a hypersonic missile attack is before it happens – an idea known in military terms as "*left of launch*." Part of Raytheon Technologies' approach in that area is the use of electronic warfare and directed energy, such as high-powered microwaves that can jam and disable offensive systems.

Because seeing a threat is key to defeating it, Raytheon Missiles & Defense is upgrading its surface radars with *gallium nitride* technology to enhance range and increase detection and discrimination for 360-degree sensing.

The 7th Space Warning Squadron has an enhanced Upgraded Early Warning Radar system with a greater capability to detect and track missile attacks against the U.S. and its allies, at Beale Air Force Base, California. (U.S. Air Force photo)

The business is also using lessons from the development of offensive capabilities in developing defensive systems. Though they serve different purposes, defensive and offensive systems have many factors in common including speed, materials and time to target.

The capabilities being developed will complement the already robust weapon systems Raytheon Technologies offers.

In addition to enhancing radars with advanced technology to better detect hypersonics, the company is exploring the possibility of sensor fusion, or networking sensors across domains through command and control to give an enhanced picture of the threat. This includes sensors on the ground all the way into space.

SPACE-BASED SENSING

The speed and range of hypersonic weapons has taken the task of defending against them into space, where sensors can detect a launch the moment it happens — or even before.

"*Every minute counts when it comes to hypersonics*," said ***Rob Aalseth***, mission area director for Missile Warning and Defense at Raytheon Intelligence & Space, a Raytheon Technologies business.

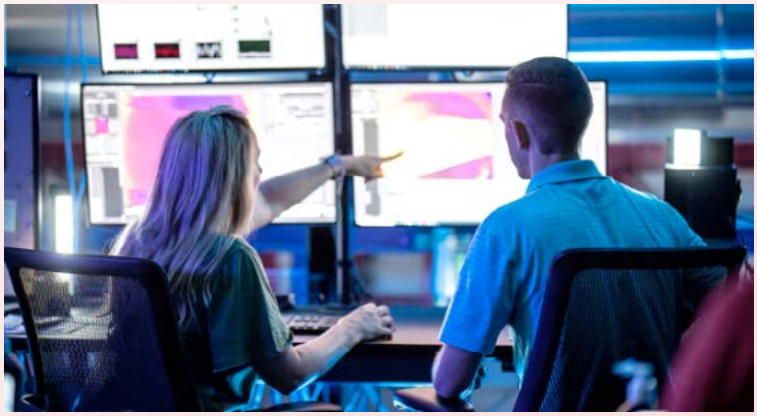
His team is developing a broad set of space technologies to detect, track and intercept hypersonic weapons in all phases of flight. "*What makes our company different is that we have end-to-end missile defeat capabilities in space, in the air and on the ground, and we can use our portfolio of capabilities and expertise to perform mission engineering across the entire hypersonic kill chain*," ***Aalseth*** said. "*We develop and build the hardware and software, and then integrate it, both in space and on the ground.*"

Those systems, he said, include optics and infrared sensors, command and control systems, ground mission management and the algorithms that process and analyze huge amounts of data. Raytheon Technologies' 2020 acquisition of ***Blue Canyon Technologies*** has also enabled in-house production of small satellites.

Constellations of smallsats are the foundation of a smarter and more resilient defense, Aalseth said. Rather than putting a large, exquisite and costly satellite into space — and making it an attractive target to adversaries — the idea is to distribute the work of missile defense among an arrangement of smaller, simpler and more expendable satellites.

Small satellite constellations can be built from satellites such as Blue Canyon Technologies' High Performance Commercial X-SAT Saturn ESPA-grande spacecraft, shown here. Constellations can improve the speed of sensing and reduce latency.

Beyond simply having the correct number of sensors in the right place, they also have to process information far faster than ever before. "*Latency is the key parameter to address when defeating hypersonic threats. It affects every other parameter,*" ***Aalseth*** said.



Raytheon Technologies is using digital engineering tools to accelerate hypersonic development.

On that front, Raytheon Intelligence & Space uses advanced missile detection and tracking algorithms that can perform highly precise missile track processing onboard the satellite in orbit.

"*All of the other systems to date have had to send the data to the ground for processing*," ***Aalseth*** said. "*That wastes time.*"

DEVELOPING AT SPEED

Delivering hypersonic capabilities presents another challenge: The U.S. military wants them faster than traditional acquisition processes would allow.

"*Threats are advancing at such a pace that previous timelines don't support what the warfighter needs, which are high-speed, long-range weapons to execute missions*," said ***John W. Otto***, senior director of Advanced Hypersonic Weapons at Raytheon Missiles & Defense. For that reason, Raytheon Technologies has adopted digital engineering methods, including building digital twins, or virtual replicas, and using modeling and simulation to gather predictive analytics.

"*Working in a digital environment allows us to eliminate testing, which is time-consuming and costly*," ***Otto*** said. "*The more advanced the digital models, the quicker we can get systems fielded.*"

Modeling and simulation relies on the fidelity of test data, which will improve with increased testing and sharing of data with industry partners, academia and allied nations.

Raytheon Technologies is working with the ***University of Arizona***, ***Texas A&M University***, ***Purdue University***, the ***U.S. Air Force Academy*** and other academic institutions on hypersonic research and testing, to include the use of wind tunnels to emulate flight conditions and accelerate development.

"*Collaborating with universities brings people and ideas together and helps lay the foundation for upcoming work*," ***Otto*** said. "*We also have an opportunity to shape the minds of our future workforce.*"

The university partnerships are helping create training curriculum, including applied research and new degree and certification programs, to develop future hypersonic engineers.

Sharing expertise, funding and infrastructure is critical to address current and future threats, Otto said, adding, "*We were the first to successfully test HAWC, so we're making a lot of progress … flying systems and learning from those activities, and that's helping us further improve our systems.*"

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