Next Generation Space Defense

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SPACE SYSTEMS COMMAND SETS A NEW LAUNCH RECORD FOR THE U.S. SPACE FORCE

Space Systems Command (SSC) marked a key milestone for the U.S. Space Force (USSF) last week, setting a new record with two notable launch accomplishments — placing USSF-67 and GPS III SV06 to orbit in only 61 hours. USSF-67 launched January 15th at 5:56 p.m. ET from Launch Complex-39A at NASA's Kennedy Space Center, and GPS III SV06 lifted off January 18th at 7:24 a.m. ET from SLC-40, at neighboring Cape Canaveral Space Force Station.

In addition to setting a new record, the two launches shared other achievements as well. Both USSF-67 and GPS III SV06 used previously-flown boosters; USSF-67 was the first NSSL Falcon Heavy to use two refurbished side boosters, which had flown on the USSF-44 mission on November 1, 2022.

The GPS III SV06 mission used a booster recovered and prepped from the Crew-5 Dragon Endurance mission to the International Space Station in October of 2022 for NASA, not a prior NSSL flight. For the program, that was another first as the Space Force continues to evolve its mission assurance processes while still satisfying flight worthiness, commensurate with national security standards.

"*With the successful delivery of GPS III SV06, I am pleased to report we set a new launch record in our space history," said Col. Erin Gulden, senior materiel leader, SSC Assured Access to Space Launch Execution Delta. The closest spacing between two National Security Space Launches (NSSL) of a given vehicle family was previously seven days; a record set in 2014 with United Launch Alliance's Atlas V 541 lifting the Defense Meteorological Satellite Program (DMSP)-19 from Space Launch Complex (SLC)-3 East at Vandenberg, and the National Reconnaissance Office Launch (NROL)-67 on a ULA Atlas V 401 from SLC-41 at Cape Canaveral. The integrated launch teams just delivered both USSF-67 and GPS III SV06 for the Space Force in just 61 hours! The teamwork and collaboration between the Launch Execution Acquisition Delta, Space Launch Delta 45, SpaceX and our NASA partners were vital to these accomplishments. We challenged and critically evaluated processes and procedures, minimized duplicity and improved synergies across the Falcon program product line*."

The Colonel added, "*The program management team, the 2nd Space Launch Squadron and 5th SLS, Air Force/Space Force launch support services (including Range, Safety, and Weather), our technical mission assurance partners from the Aerospace Corporation, our Systems Engineering & Integration team, NASA and SpaceX — all operated incredibly well together and seamlessly. Everything came together masterfully, ensuring we continue to deliver 100 percent NSSL mission success to our satellite customers*."

www.ssc.spaceforce.mil

Space Systems Command is the U.S. Space Force's field command responsible for acquiring and delivering resilient war fighting capabilities to protect our nation's strategic advantage in and from space. SSC manages an $11 billion space acquisition budget for the DoD and works in partnership with joint forces, industry, government agencies, academic and allied organizations to accelerate innovation and outpace emerging threats.

DISPATCHES

SPACE DEVELOPMENT AGENCY'S LAYERED NETWORK OF MILITARY SATELLITES IS NOW THE "PROLIFERATED WARFIGHTER SPACE ARCHITECTURE"

As of last month, the Space Development Agency's resilient layered network of military satellites and supporting elements is now the "Proliferated Warfighter Space Architecture" or PWSA

This architecture, formerly known as the "*National Defense Space Architecture*," was renamed to more specifically reflect the agency's mission to deliver needed space-based capabilities to the joint warfighter to support terrestrial missions through development, fielding, and operation of a proliferated Low Earth Orbit (pLEO) constellation of satellites. The spiral development and fielding of SDA's mesh network has matured successfully, but the constellations' original name did not accurately convey its current scope and purpose. The new constellation name became effective January 23, 2023.

Now integral members of the ***U.S. Space Force***, SDA continues the integration of its space acquisition and operations into the overall national defense hybrid space enterprise, including pLEO advancements to support no-fail missions such as end-to-end missile warning, missile tracking, and missile defense. Maintaining technological and military advantages in space for the warfighter requires developing a resilient hybrid architecture through an integrated diversification of orbits and proliferation of satellites.

The constellation name change will have no impact to the SDA mission. Leveraging speed, delivery, and agility, SDA will continue to quickly deliver needed space-based capabilities to the joint warfighter to support terrestrial missions through development, fielding, and operation of the PWSA.

AIRBUS TO PROVISION MILSATCOM FOR THE BELGIAN ARMED FORCES

Airbus has signed a contract with the Belgian Ministry of Defence to provide tactical satellite communications services for a 15 year period of time.

The Belgian Armed Forces will use channels of the Airbus UHF (Ultra High Frequency) military communications hosted payload on-board a commercial telecommunications satellite manufactured by Airbus.

As the UHF frequency band is a relatively scarce orbital resource, this offering will make up for the capacity shortage around the world. Airbus has already signed several firm orders for this capacity, well ahead of the satellite's scheduled launch.

The UHF payload will be operated from Airbus's Network Operations Centre (NOC) in Toulouse, France.

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

Military UHF MILSATCOMs are used by the armed forces for operations on land, at sea and in the air. They have a high level of interoperability and are therefore very useful for multinational and coalition operations.

The UHF band is very flexible and offers a lightweight, robust and highly secure means of communication. An extensive range of terminals for use on land, at sea and in the air is available to meet the needs of the various armed forces.

Airbus has unique experience in operating UHF MILSATCOM services. This new payload will enhance its portfolio throughout the lifespan of the satellite.

Airbus is the only armed forces private SATCOM operator to cover the full spectrum of military (UHF, X-band, Ka Mil) and commercial (L-, C-/Ku-, Ka-band) frequency bands and applications.

"*With this new UHF payload, Airbus will be able to offer a new UHF communications service, scheduled for launch in 2024, to the armed forces, particularly those of European countries and NATO allies*," said **Eric Even**, head of Marketing and Sales, Connected Intelligence, at Airbus Defence and Space.

www.airbus.com/

DISPATCHES

KRATOS RECEIVES MAYHEM HYPERSONIC MISSILE PROGRAM CONTRACT AWARD

***Kratos Defense & Security Solutions, Inc.* (Nasdaq: KTOS) *Defense & Rocket System Services* (DRSS) Division, in collaboration with *Kratos' Unmanned Systems Division*, has received a contract from its prime teammate and partner, *Leidos*, to support the *Expendable Hypersonic Multi-Mission ISR (Intelligence, Surveillance, and Reconnaissance) and Strike Program*, known as Mayhem.**

Artistic rendition of Mayhem, courtesy of AFRL + Leidos.

This new contract award will support the *Air Force Research Laboratory's (AFRL)* development of an air-breathing hypersonic weapon system over its initial 51-month period of performance. The initial task order will conduct the *System Requirements Review* (**SRR**) and *Conceptual Design Review* (**CoDR**) in a *Digital Engineering* (**DE**) environment.

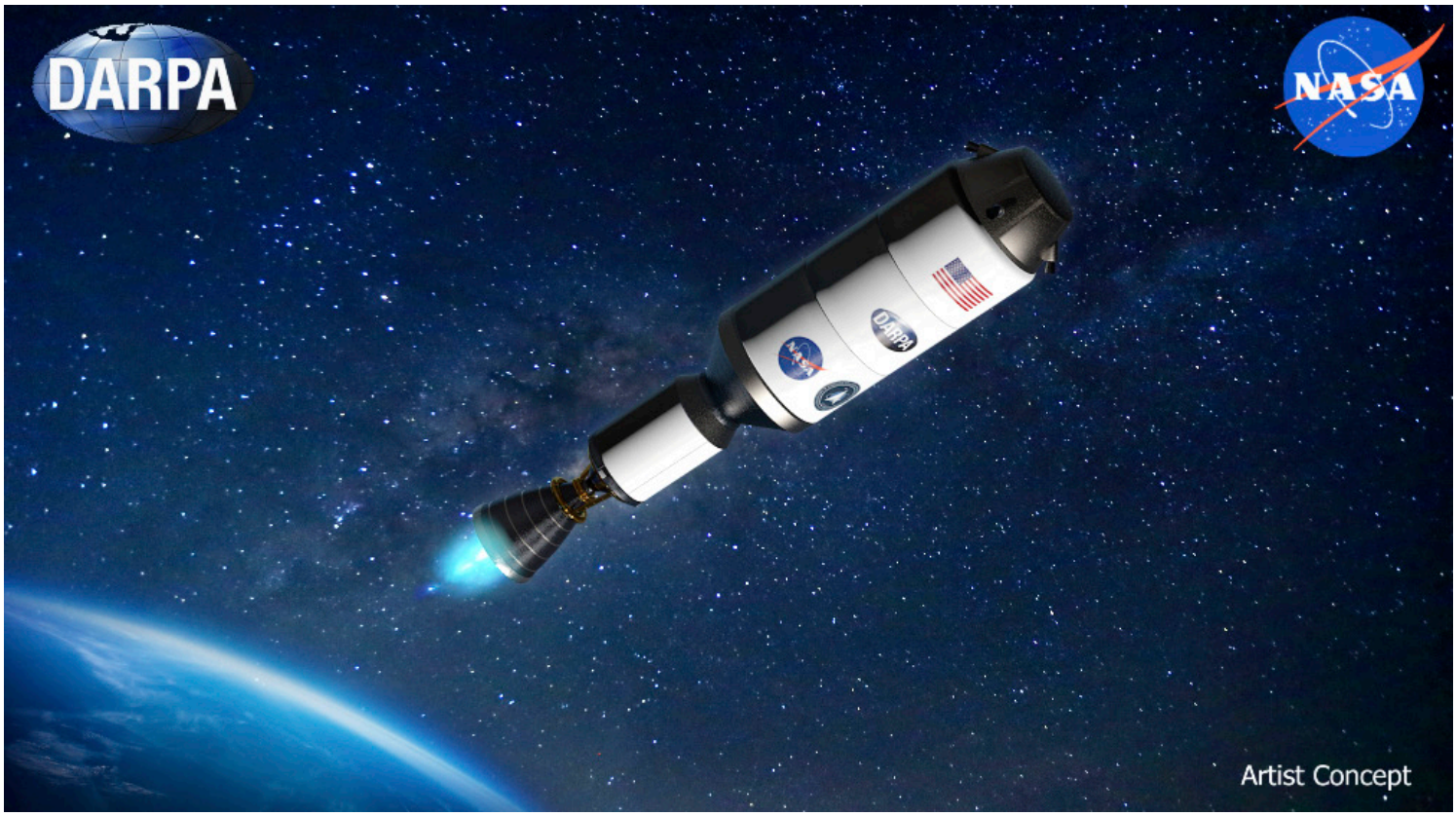
In partnership with Leidos, Kratos will serve as a member of the *System Design Agent* (**SDA**) team for the Mayhem program, which also includes *Calspan* and *Draper*. The SDA's goal is to design a system that allows rapid relevant technology insertions using the expertise and capabilities from a variety of industry partners.

The role of the SDA for this program will also include bringing the best of industry together to perform research and development necessary for production of air-breathing multi-mission hypersonic system prototypes. The SDA will oversee designs, prototypes, and tests to ultimately produce and deliver a technical data package for high performance, relevant hypersonic weapon systems.

Air-breathing hypersonic systems use scramjet engines to generate thrust, propelling the vehicle across long distances at speeds greater than Mach 5. The SDA team is tasked with designing and developing a large-class version that surpasses current air-breathing systems in both range and payload capacity and is responsible for delivering a hypersonic system design to include airframe, propulsion system, booster, avionics, and vehicle subsystems.

DISPATCHES

DARPA + NASA COLLABORATE ON NUCLEAR THERMAL ROCKET (NTR) ENGINE



DARPA, via its Demonstration Rocket for Agile Cislunar Operations (DRACO) program, is collaborating with NASA to build a nuclear thermal rocket (NTR) engine that could expand possibilities for the space agency's future long-duration spaceflight missions.

The goal is to test an NTR-enabled spacecraft in Earth orbit during the 2027 fiscal year.

An NTR presents advantages over existing propulsion technologies, such as sending cargo to a new lunar base, humans to Mars, and robotic missions even farther.

NTR propulsion offers a high thrust-to-weight ratio around 10,000x greater than electric propulsion and with two-to-five times greater efficiency than in-space chemical propulsion.

Nuclear thermal rockets have been built before, so DRACO has a head start. About 50 years ago, the technology was tested on the ground.

DRACO is now leveraging lessons learned from past NTR reactor technology, but instead of using highly-enriched uranium, DRACO is using high-assay low-enriched uranium (HALEU) fuel to have fewer logistical hurdles on its ambitious timeline.

As an added safety precaution, DARPA plans to engineer the system so that the DRACO engine's fission reaction will turn on only once it reaches space.

Fission, the same process used for nuclear power, is the splitting of atoms. It creates high levels of heat that can turn rocket propellant such as hydrogen from a liquid to a gas phase. In the NTR, that gaseous propellant is accelerated out a converging/diverging nozzle in the exact same way as a conventional chemical rocket engine.

The high performance of an NTR is enabled by the reactor passing its heat along to its rocket propellant. DRACO's proposed solid core NTR temperatures could reach almost 5,000 degrees Fahrenheit, requiring use of advanced materials.

The U.S. Space Force has signaled its support for DRACO with the intent to provide the launch for the demonstration mission.

"*DARPA and NASA have a long history of fruitful collaboration in advancing technologies for our respective goals, from the Saturn V rocket that took humans to the Moon for the first time to robotic servicing and refueling of satellites*," said Dr. **Stefanie Tompkins**, director, DARPA. "*The space domain is critical to modern commerce, scientific discovery, and national security. The ability to accomplish leap-ahead advances in space technology through the DRACO nuclear thermal rocket program will be essential for more efficiently and quickly transporting*

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

GENESIS epitomizes the latest in hardware and software technologies, making it the most feature-rich satcom SSPA in the industry. Initially available in 100W, 125W, 150W, 200W, and 250W variants, **GENESIS** delivers a host of high-end, including some that are unique to the **GENESIS** family:

- Secure SNMPv3 interface
- Modular construction – fast production & simple serviceability
- Full M&C capability with embedded Webserver
- Field-removable power supply
- Forward and reflected power monitoring & true RMS power detection
- Device-level monitoring for detailed fault analysis and diagnostics
- Embedded logic to manage a multi-amplifier redundant and phase-combined systems, negating the need for any external controllers.

Additional frequency bands and higher power-levels based on the **GENESIS** platform will become available in the coming months.

advantechwireless.com/product/ku-band-100w-125w-200w-250w-genesis-line/

material to the Moon and eventually, people to Mars."

"*NASA will work with our long-term partner, DARPA, to develop and demonstrate advanced nuclear thermal propulsion technology as soon as 2027. With the help of this new technology, astronauts could journey to and from deep space faster than ever – a major capability to prepare for crewed missions to Mars*," said NASA Administrator, **Bill Nelson**. "*Congratulations to both NASA and DARPA on this exciting investment, as we ignite the future, together*."

"*NASA is uniquely positioned to provide guidance on the challenging rocket engine and cryogenic fluid management specifications with liquid hydrogen to meet specific mission needs*," said Dr. **Tabitha Dodson**, DARPA program manager for DRACO. "*As the NTR uses propellant more efficiently, it offers more aggressive trajectories and creative burn profiles to move heavy cargo more quickly in the cislunar domain as compared to today's in-space propulsion methods. We will conduct several experiments with the reactor at various power levels while in space, sending results back to operators on Earth, before executing the full-power rocket engine test remotely. These tests will inform the approach for future operation of NTR engines in space*."

Dr. Tabitha Dodson also writes at the NASA NTR infopage...

The space domain is essential to modern commerce, scientific discovery, and national defense. Moving larger payloads into farther locations in cislunar space – the volume of space between the Earth and the Moon — will require a leap-ahead in propulsion technology.

The goal of the Demonstration Rocket for Agile Cislunar Operations (DRACO) program is to demonstrate a nuclear thermal rocket (NTR) in orbit.

NTRs use a nuclear reactor to heat propellant to extreme temperatures before exhausting the hot propellant through a nozzle to produce thrust. Compared to conventional space propulsion technologies,

NTRs offers a high thrust-to-weight ratio around 10,000 times greater than electric propulsion and two-to-five times greater specific impulse (*i.e., propellant efficiency*) than in-space chemical propulsion.

Phase 1 of the DRACO program involved two tracks.

Track A conducted a baseline design of an NTR reactor.

Track B developed an operational system concept to meet operational mission objectives and a demonstration system design that is traceable to the operational system but focuses on demonstrating the propulsion subsystem.
Phase 2 and Phase 3 of the DRACO program will carry a single performer forward to the flight demonstration, which is envisioned to take place by FY27.

This performer will be responsible for building the NTR and its demonstration system stage.

Phase 2 will involve a cold flow test of the rocket engine without nuclear fuel.

Phase 3 will involve assembly of the fueled NTR with the stage, environmental testing, and launch into space to conduct experiments on the NTR and its reactor.

ORBIT COMMUNICATIONS TO SUPPLY SATCOM SYSTEMS TO AN APAC NAVY

Orbit Communications Systems Ltd. (TASE: ORBI) has been awarded a multi-million contract by a leading integrator in South East Asia for the supply of OceanTRx 7MIL SATCOM systems for new naval military platforms.

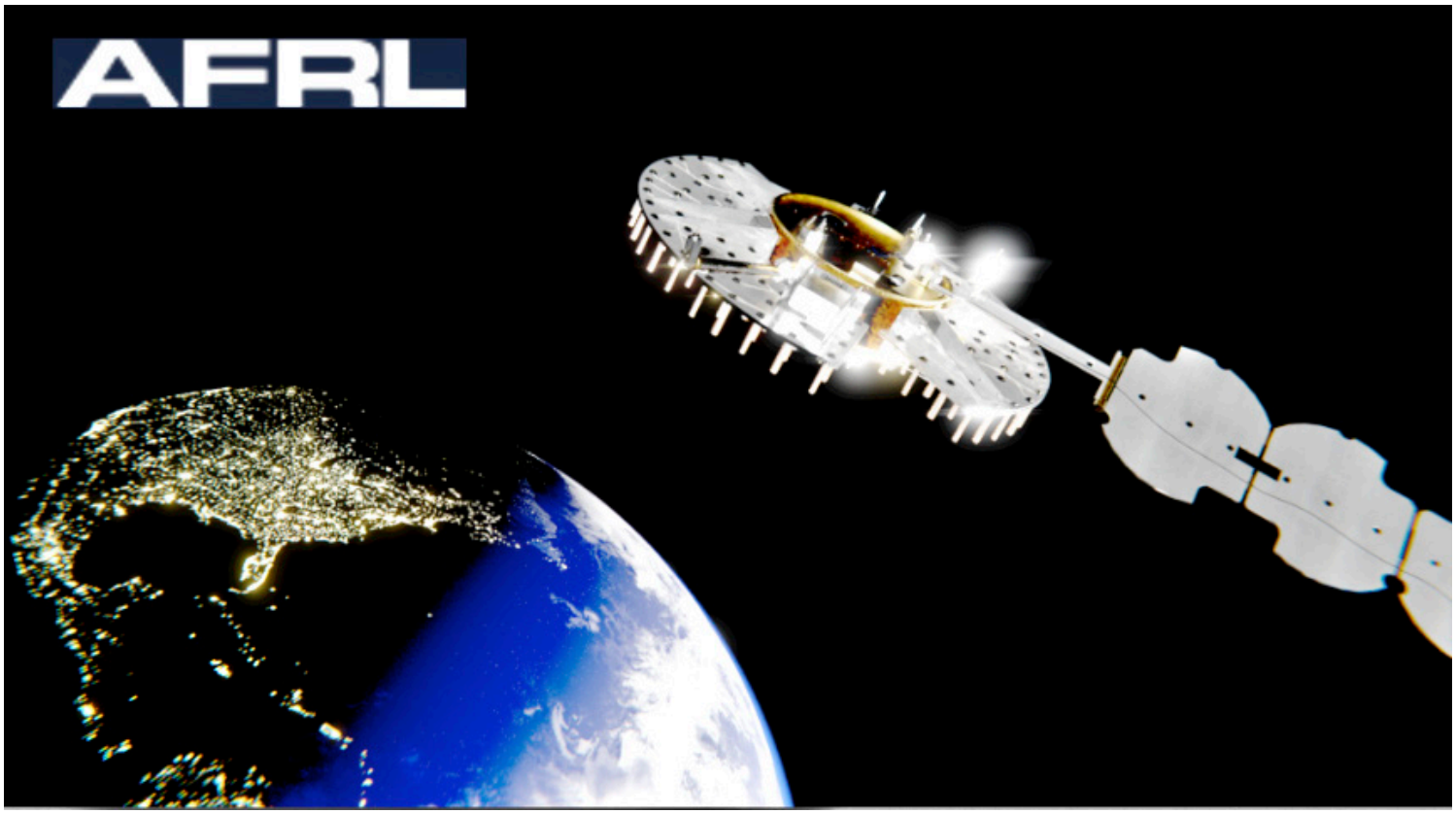
Prior to the signing of the contract, Orbit entered into a teaming agreement with the customer, mainly in the field of maritime SATCOMs, with plans to explore opportunities for cooperation in other regions and fields, such as ground/airborne SATCOMs and AMS. The agreement will also facilitate the improvement of local maintenance, service and support capabilities for new and existing customers.

Ocean TRx 7MIL is a new platform based on the Ocean TRx7 platform, but with advanced military features.

This satellite communication system is intended for use on marine platforms, supporting a variety of antenna system configurations. With a diameter of 2.2 meters, the OceanTRx 7MIL operates on X-, Ku-, Ka- and C-band frequencies, and enables simultaneous operation of a variety of frequencies for global activities.

The OceanTRx 7MIL can be connected to a unique Orbit switching matrix (OSM) which will allow multiple internal connections and switching of up to 8 antennas and 8 modems to according to customers' requirements. Designed for quick and convenient installation, maintenance and upgrade, the system provides defense customers with a combination of exceptional RF performance and availability.

USAF'S NTS-3 VANGUARD IS NOW CLOSER TO A 2023 LAUNCH



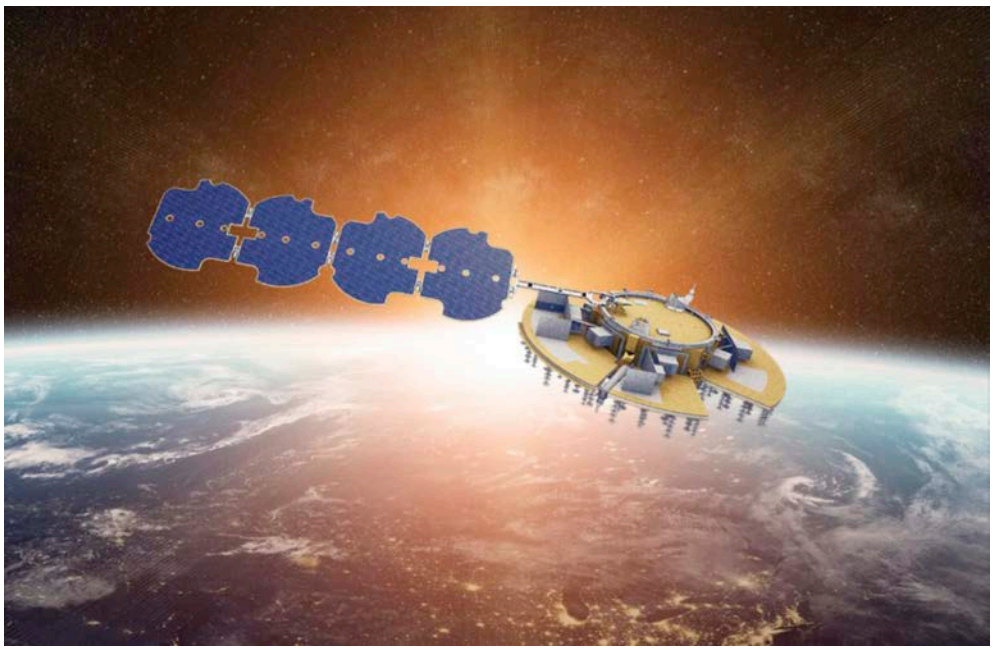
The Department of the Air Force's Navigation Technology Satellite-3, or NTS-3, Vanguard program has reached another major milestone in preparation for the satellite's launch in late 2023.

Industry partner ***L3Harris Technologies***, the spacecraft prime contractor, recently delivered the NTS-3 space vehicle to an ***Air Force Research Laboratory (AFRL)***, integration and test facility at ***Kirtland Air Force Base***, New Mexico.

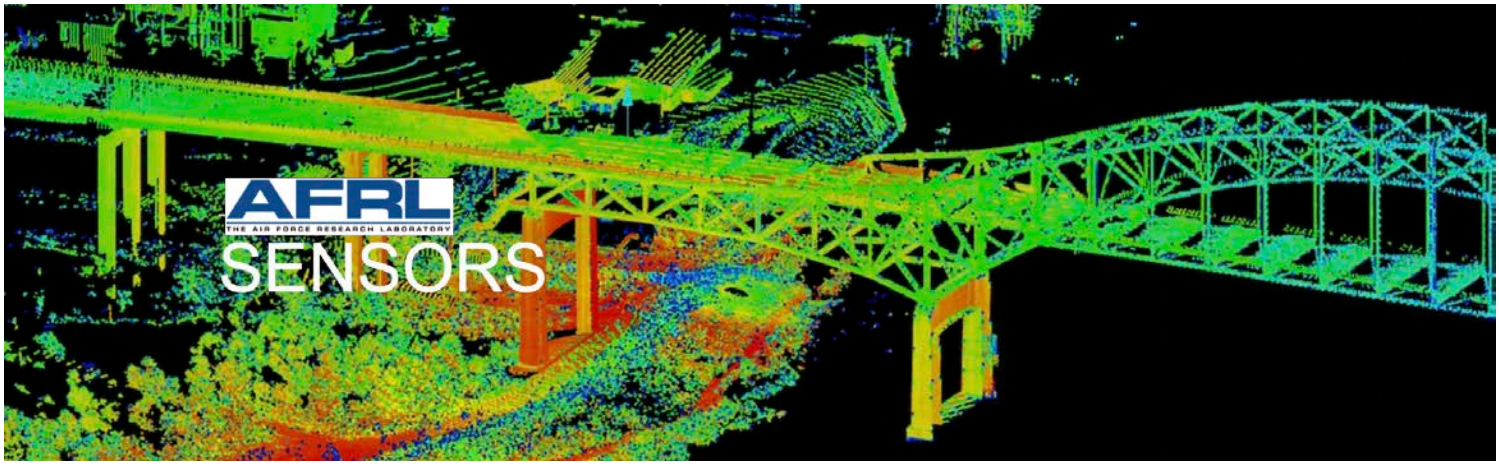
The satellite integrates an agile positioning, navigation and timing, or PNT, payload to the ***Northrop Grumman ESPAStar*** bus, to provide a space platform for AFRL and partner organization experiments and integrated capability demonstrations.

In 2019, the U.S. Department of the Air Force designated NTS-3 as one of the first three Vanguard programs to deliver innovative, game-changing capabilities to the warfighter at an accelerated pace.

NTS-3, which is managed by the ***AFRL Transformational Capabilities Office*** and has program partners in both the ***U.S. Space Force*** and ***U.S. Air Force***, will push the boundary of PNT technology to pave the way for a more flexible, robust and resilient architecture for satellite navigation.



Artistic rendition of the NTS-3 space vehicle, based on the Northrop Grumman ESPAStar satellite bus, is courtesy of L3Harris Technologies.

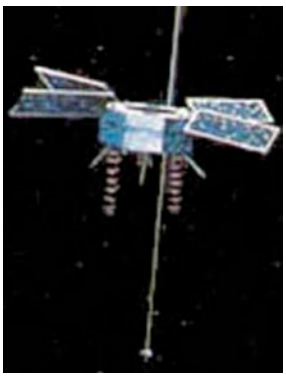


AFRL and L3Harris are now completing the remaining intra-payload and payload-to-bus functional and performance tests, including the first radio frequency broadcast tests of the novel PNT signals that will be demonstrated from near-geosynchronous orbit after the NTS-3 launch.

The ***Global Navigation Satellite System Test Architecture***, or GNSSTA, developed by the ***MITRE Corporation*** in partnership with the ***AFRL Sensors Directorate***, is crucial for meeting end-to-end, NTS-3 mission objectives.

GNSSTA is a reprogrammable, software-defined receiver that allows users to receive legacy GPS and advanced signals generated by NTS-3 and lays the groundwork for future operational receivers to provide the Space Force with options to prevent and respond quickly to common threats on the battlefield, such as GPS jamming and spoofing.

NTS-3 is the first U.S. experiment of its kind in nearly 50 years, since the ***Navy Research Laboratory's NTS-1*** and ***NTS-2*** spacecraft led the way for the ***Global Positioning System*** (**GPS**), constellation in the 1970s.



Artistic rendition of the NTS-1 satellite.

"*This major milestone marks the transition from space system development at contractor's facilities to the final stage of integration and test activities*," said **Arlen Biersgreen**, program manager, Navigation Technology Satellite-3.

Biersgreen continued, "*The AFRL team will be overseeing and working closely with L3Harris and other key industry partners to apply an effective combination of contractor and government resources to successfully complete this phase of the effort. This Vanguard not only aims to support GPS users through vital development of new technologies and techniques, but also to show how an agile and responsive U.S. satellite navigation architecture is paramount to defeating the most challenging threats to warfighter success, both today and through the coming decades*."

Biersgreen said following those activities, the team will perform standard space environment tests that simulate the launch and space environments to verify the system is ready for the rigors of experimental operations in space. He added that experimental performance data from ground testing will be available for sharing with program partners during the next several months.

Dr. **Joanna Hinks**, the NTS-3 principal investigator, has worked closely with the Sensors team on the GNSSTA development and testing. "*The entire team is excited that earlier this month, we successfully generated signals on the actual spacecraft and received them with our experimental GNSSTA user equipment," Hinks said. "Showing the space segment and user segment working together like that is an important step to being ready to conduct experiments on-orbit*."

The Air Force Research Laboratory, or AFRL, is the primary scientific research and development center for the Department of the Air Force. AFRL plays an integral role in leading the discovery, development and integration of affordable warfighting technologies for our air, space and cyberspace force. With a workforce of more than 11,500 across nine technology areas and 40 other operations across the globe, AFRL provides a diverse portfolio of science and technology ranging from fundamental to advanced research and technology development.

DISPATCHES

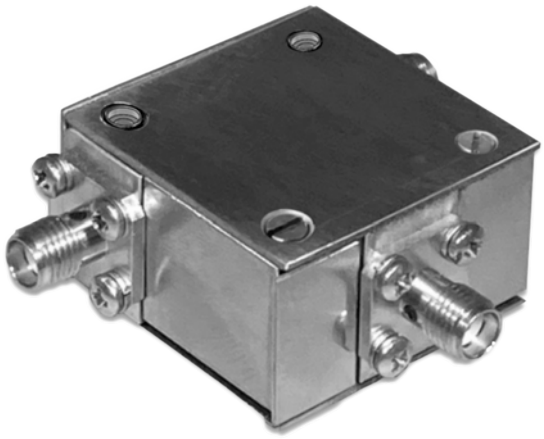
ITAR ISOLATORS AND CIRCULATORS IN L-, S- AND X-BAND FOR MILCOM + RADAR APPLICATIONS

Smiths Interconnect has announced the availability of additional engineering and manufacturing capabilities in the U.S. for the company's broad range of isolator and circulator components in -L, S- and X-Band.

Smiths Interconnect has been producing qualified isolators and circulators for over 20 years from its facility in Dundee, Scotland (UK).

Now the company's comprehensive range of high-power isolators and circulators for AESA radar applications, ground-based air surveillance radars, shipboard defense and airborne fire control is also available from the manufacturing site in Salisbury, Maryland, U.S.

These products are designed, manufactured, and tested to serve U.S. customers' requests that are subject to ***ITAR*** (*International Traffic in Arms Regulations*) and ***DFAR*** (*Defense Federal Acquisition Regulation*)regulations.



These high-power series of isolators and circulators are designed for phase and temperature stability, phase matching, and robust performance in a multitude of defence environments.

They can be configured with a variety of connector/interface configurations, and can be fitted with value added components, couplers, detectors and filters to name a few. The units are tested and verified using Smiths Interconnect's comprehensive in-house facilities.

"*The addition of leading-edge capabilities to our Salisbury site allows us to serve our customers in the US that our site in Dundee could not serve effectively for a variety of ITAR and export control reasons. This aligns with our reputation for excellence and our aspiration to be the partner of choice for cutting-edge connectivity solutions*", said **Tullio Panarello**, VP and General Manager of the Fiber Optics and RF Components Business Unit at the company.

Smiths Interconnect's isolators and circulators in L-, S- and X-band offer the following features:

- ◊ *U.S ITAR and DFAR compliance*
- ◊ *Optimized electrical performance*
- ◊ *Qualification for Solid State Power Amplifiers (SSPA)*

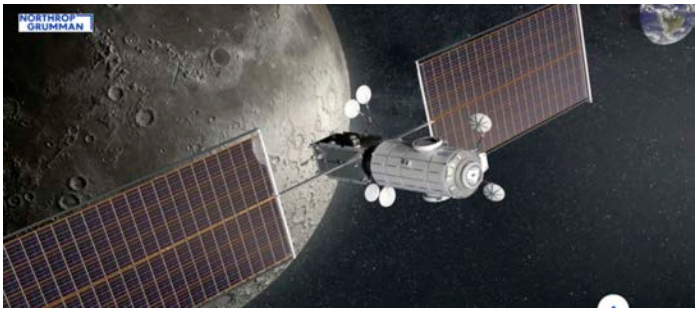
www.smithsinterconnect.com

smiths interconnect

NORTHROP GRUMMAN TO MODERNIZE + ADVANCE THE AFRL'S INTELLIGENCE INFORMATION GATHERING PROCESS

Northrop Grumman Corporation (NYSE: NOC) has been awarded a $406 million contract from the Air Force Research Laboratory Information Directorate (AFRL/RI) for the Intelligence Systems Infrastructure, Tools and Enhancements (InSITE) program to advance information collection and analysis across its customer set.

InSITE will modernize the AFRL/RI's intelligence information collection, sharing and analysis capabilities by implementing state-of-the-art, artificial intelligence (AI) solutions. This will enable warfighters to make faster, better-informed decisions to deny, disrupt or defeat threats across all domains and with our global allies.



Using its digital capabilities, Northrop Grumman will provide cloud-enabled applications to foster data exchanges across *U.S. Department of Defense* and Intelligence Community customer centers and satellite locations, including the **U.S. Space Force**'s recently established ***National Space Intelligence Center*** in support of "*One AFRL, Two Services*."

"*Our innovative solutions will meet today's advancing threats at unprecedented speed and accuracy, transforming decision-making and analysis*," said **Rebecca Torzone**, vice president and general manager, combat systems and mission readiness, Northrop Grumman. "*Building on our 40 years of support to the AFRL/RI, Northrop Grumman will digitally transform InSITE to meet its space domain awareness and counterspace intelligence mission priorities*."

THE SPANISH MINISTRY OF DEFENCE CONTRACTS INDRA FOR SPANISH AIRSPACE SURVEILLANCE + CONTROL CENTERS

The Spanish Ministry of Defence has awarded Indra a project to modernize and upgrade the nation's command, surveillance, identification and control (ARS) centers that are essential for combating potential threats to the country's airspace.

Indra will equip the ARS centers in *Torrejón de Ardoz* in Madrid (**GRUCEMAC**), *Zaragoza* (**GRUNOMAC**) and *Gando* in Gran Canaria (**GRUALERCON**) and the *Command and Control School* (**EMACOT**) with the company's next-generation ***AirDef*** air command and control system, which will contribute to the mission for the permanent surveillance and control of airspace national sovereignty led by the ***Spanish Air*** and ***Space Force***.

Indra Lanza 3D radar.

With this project, the Ministry of Defence will rely on Indra's proprietary development solutions, as it did in the late 1990s with the ***IARS*** system that is currently in service at the above named centers. This system, together with the ***Lanza 3D*** radars in the *Air Surveillance Squadrons* (**EVAs**), forms the backbone of airspace surveillance and control in Spain.

Thanks to the modernization of the ARS centers with the new AirDef system, which incorporates anti-missile defence for the first time, and the new and more advanced Lanza 3D radars that Indra will continue to deploy, Spain's status as a country with one of the most comprehensive and integrated air and anti-missile defence systems in the world and a global leader in this sphere will be reinforced.


Patriot air and missile defence system on display at Allied Air Command (© NATO AIRCOM)

AirDef, which is already operational in several countries around the world, has been designed to meet ***NATO***'s demanding air command and control requirements to facilitate its contribution to the ***Alliance's Integrated Air and Missile Defence System (NATINAMDS)***, ensuring its essential and ongoing mission during times of peace, crises and conflicts to safeguard

and protect the Alliance's territory, populations and forces against any air or ballistic missile threat or attack.

Meeting these requirements and positioning itself with one of the most advanced command and control systems in operation in NATO countries opens up the possibility of other nations adopting Indra's technology in keeping with the decision of the Spanish Ministry of Defence.

Indra's system incorporates the latest software and hardware technologies and architectures, which enhance sensor fusion, *recognized air picture* generation (**RAP**) and real-time air and anti-missile battle management, providing operators with multiple smart decision-making aids through advanced, geo-positioned and configurable graphical interfaces.

The above will be possible thanks to the native integration of the most advanced NATO tactical data links (*Link 16, JREAP, Link 22 and VMF*) between the operating entities, guaranteeing their interoperability with those that have been in service in recent decades (*Link 1, Link 11B and Link 11A*), which are also integrated into Indra's solution.

The implementation of the AirDef system at the ***Air Operations Center*** (**AOC**) of the ***Operational Aerospace Command*** (**MOA**) in Torrejón de Ardoz will also provide **BMD** (*Ballistic Missile Defence*) capabilities to manage the anti-missile defence, thanks to its integration into Indra's Lanza 3D ***LRR*** and ***LTR-25*** sensors (*similarly equipped with such capabilities*) and the tactical data links with the anti-missile weapon systems. The AirDef system will also provide the Air Operations Center with a NATO-interoperable tool to generate the **ATO**s (*Air Tasking Orders*) and **ACO**s (*Airspace Control Orders*) required for the planning of air operations.

The project also envisions the implementation of a voice over IP communication system and remote control of the state-of-the-art ground/air radios known as ***GAREX-300M*** at the ARS centers. This system guarantees maximum resilience and availability and introduces new architectures to permit security clearance for the separate management of classified and non-classified (red/black) information between operators and between aircraft and centers.

This new system is currently being deployed at ***NATO's Combined Air Operations Center*** (**CAOC**) in *Uedem* (Germany) with the aim of facilitating the coordination of the Alliance's air policing missions throughout European airspace north of the Alps, thus demonstrating its ability to facilitate air operations of the utmost complexity.
The project is complemented by the provision of a software maintenance center, key to the concept of autonomous logistic support for the air command and control system units.
The above constitutes a replica of the software and hardware architectures and it will facilitate security clearance maintenance, configuration control, the generation of new software packages, the execution of the different tests and the updating of the **IETP** manuals (*Interactive Electronic Technical Publications*).

In addition to further strengthening Spain's air defenses and placing it at the forefront of the field, this project will reinforce Indra's position as one of the most advanced defense-geared technological engineering companies in Europe and the world and a leader of the sector's digitalization.

Its state-of-the-art solutions for Land, Sea, Air, Space and Cyberspace range from operations with end-to-end defence systems and systems on board the most advanced platforms to training with cutting-edge simulation systems. As an expert in radar, electronic defence, command and control and communication technologies, Indra incorporates artificial intelligence, big data, virtual reality and combat clouds in its cutting-edge critical systems.

Indra is the national industrial coordinator in Spain of the FCAS, the largest and most advanced defence program in Europe, and the Spanish company that coordinates the largest number of projects in the European defence sector.

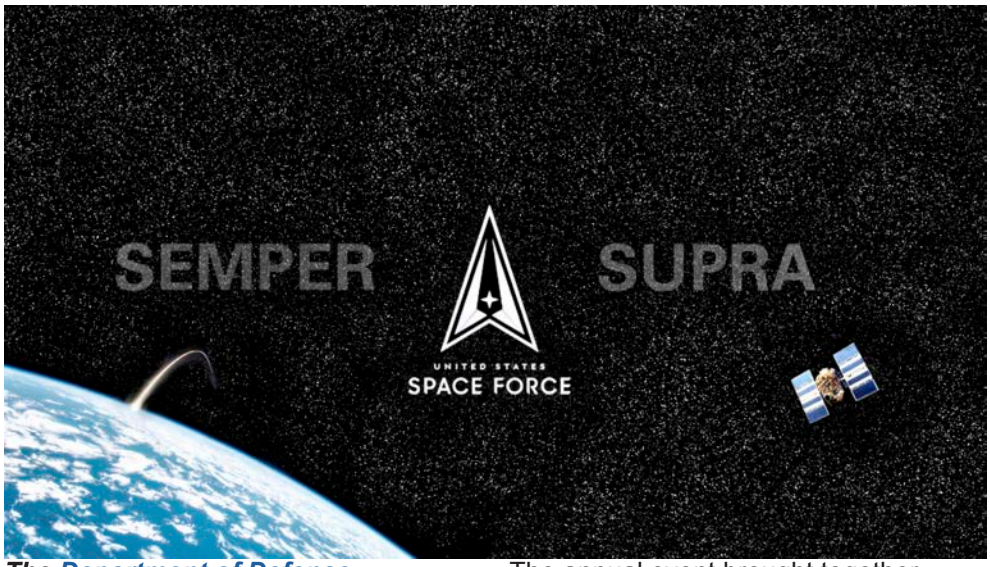
Indra also participates in a large number of European and international projects, such as ***Eurofighter*** and the ***A400***M. The company exports its radars to five continents and is the principal supplier to NATO.

"*We're proud to be able to use our technology to keep on helping to strengthen the security of our country and placing it at the cutting edge in the world. Indra's collaboration with the Ministry of Defence and the Spanish Air and Space Force over several decades is a story of shared successes that have gone beyond our borders, as we're sure will happen with AirDef, a system with 100% Spanish technology and excellent export potential, as we've already proven*," said Indra CEO, **Ignacio Mataix**.

www.indracompany.com

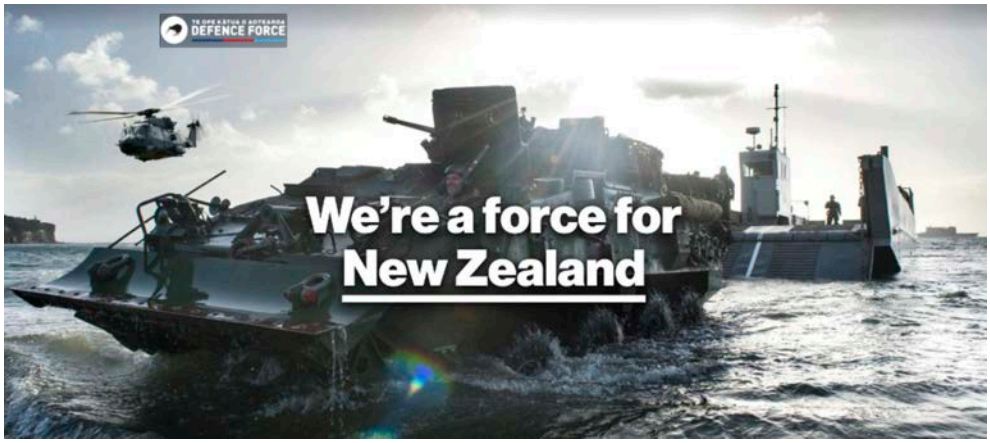
NATO Combined Air Operations Centre a Uedem (left) + Combined Air Operations Centre Torrejón (right)

SEVEN NATIONS MEET TO ADDRESS SPACE SECURITY



The Department of Defense participated in the annual Combined Space Operations (CSpO) Initiative Principals Board hosted by the New Zealand Defense Force and New Zealand Ministry of Defense in December of last year.

The annual event brought together counterparts from **Australia**, **Canada**, **France**, **Germany**, **New Zealand**, the **United Kingdom**, and the **United States**, with a focus on advancing collaboration and information sharing on space security topics.



CSpO is an initiative that seeks to generate and improve cooperation, coordination, and interoperability opportunities to sustain freedom of action in space, optimize resources, enhance mission assurance and resilience, and deter conflict.

During this year's event, defense leaders emphasized the need to continue to promote a rules-based international order and responsible behaviors in space, while collaboratively addressing challenges to the safety and security of space-related operations.

Participants from the U.S. included Dr. **John Plumb**, Assistant Secretary of Defense for Space Policy; U.S. Space Force Gen. **Chance Saltzman**, *Chief of Space Operations*; U.S. Army Gen. *James Dickinson*, Commander, **United States Space Command**; and Mr. *Damon Wells*, **National Reconnaissance Office** (NRO).

The CSpO Principals Board last met in December 2021 in the United States, reaffirming support to prevent conflicts extending to or originating in space and to hold accountable those who threaten the safety of the space environment.

In February of this year, the group released the "***CSpO Vision 2031***," outlining the initiative's overarching purpose and highlights its guiding principles, including: freedom of use of space, responsible and sustainable use of space, partnering while recognizing sovereignty, and upholding international law. *See the following pages for that report.*

These guiding principles steer the initiative's objectives and are supported by several lines of effort, from developing and operating resilient, interoperable architectures to fostering responsible military behaviors in space and sharing intelligence and information, all leading to the pursuit of a safe, secure, and sustainable space domain.

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Combined Space Operations Vision 2031

VISION

Partners in national security space operations leading as responsible actors and seeking and prepared to protect and defend against hostile space activities in accordance with applicable international law.

MISSION

Generate and improve cooperation, coordination, and interoperability opportunities to sustain freedom of action in space, optimize resources, enhance mission assurance and resilience, and prevent conflict.

THE IMPORTANCE OF SPACE

Space is integral to modern multi-domain military operations and provides strategic advantage. Space-based capabilities deliver a wide range of effects that underpin daily life, including communications, navigation, remote sensing, Earth observation, weather services, and financial transactions. Maintaining and supporting the availability of these capabilities are in the interest of each nation. Continued delivery of these capabilities requires complete access to and freedom to operate in space.

Space has evolved into a contested and congested operational domain. As space becomes more crowded, the security and stability of this critical domain are endangered. Some nations have developed capabilities designed to deny, degrade, and disrupt access to and utilization of space-based capabilities.

These nations have demonstrated the ability to hold space-based capabilities at risk and to target critical assets in an effort to reduce our military effectiveness in a crisis or conflict. Further, the lack of widely accepted norms of responsible behavior and historical practice increases the possibility of misperceptions and the risks of escalation.

The convergence of these factors creates compelling strategic and operational urgency that serves as a call to action. We share a desire to accelerate and improve our ability to conduct combined military space operations, as responsible space actors, in order to maintain security and prevent escalation in space and on Earth. We seek to be prepared to protect our national interests and the peaceful use of space.

SHARED GUIDING PRINCIPLES

The following guiding principles are shared broadly among the Participants in the Combined Space Operations (CSpO) Initiative Memorandum of Understanding:

- ***Freedom of Use of Space:*** *Militaries have an important role in contributing to international efforts to ensure freedom of access to and use of space. CSpO Participants work to ensure our national security space operations promote a secure, stable, safe, peaceful, and operationally sustainable space domain.*

- ***Responsible and Sustainable Use of Space****: The world is reliant on space- based systems -- activities in space have consequences across the spectrum of human activity. CSpO Participants pursue activities that endeavor to minimize the creation of long-lived space debris and contribute to the enduring sustainability of the outer space environment.*

- ***Partnering While Upholding Sovereignty****: CSpO Participants recognize and uphold the rights of each Participant to act and communicate independently and in a manner commensurate with their own national policies and interests. National efforts are synchronized, where appropriate, through clear and open dialogue.*

- ***Upholding International Law****: Each Participant conducts activities in accordance with applicable international law, including the Outer Space Treaty, the UN Charter, and, in case of armed conflict, with the law of armed conflict.*

OBJECTIVES

To realize our vision and mission, CSpO Participants affirm the following objectives to guide our national and collective actions:

- ***Prevent conflicts*** *– CSpO Participants seek to prevent conflict, including conflict extending to or originating in space. By strengthening coordination, building resiliency, promoting responsible behavior in space, enhancing partnership, and communicating transparently, we improve our national and collective abilities to prevent conflict and to promote security and stability in all domains.*

- ***Unity of Effort*** *– CSpO Participants seek to enable combined space operations by sharing information across multiple classification levels – from the strategic to the operational and tactical levels, and at a pace that is operationally relevant – through real-time synchronized networked operations centers operated by a workforce with common training.*

- ***Space Mission Assurance*** *- CSpO Participants seek to establish and maintain a robust, responsive, and interoperable space infrastructure enabling continued space effects in the face of adverse action or changes to the space domain. Ensuring the continued function and resilience of equipment, facilities, networks, information and information systems, personnel, infrastructure, and supply chains, we seek to deny the benefit of interference and to ensure the availability of CSpO Participants' national security mission-essential functions throughout the spectrum of military operations.*

- ***Defense and Protection*** *- CSpO Participants are committed to the defense and protection of our national interests and the space domain. This may include collaboration across a range of measures, such as: developing requirements for current and future systems to counter hostile space activities and to deter, deny, or defeat attacks or interference with the space enterprise; delivering the ability for combined, agile, and adaptive command and control through resilient, secure, interoperable, and sustainable communications; sharing appropriate intelligence and information; and timely and inclusive leadership dialogues and decision- making.*

LINES OF EFFORT

The CSpO Participants seek to achieve the shared objectives outlined above through several lines of effort (LOE). The following LOEs provide a framework to guide the national and collective efforts of CSpO Participants:

- ***Develop and operate resilient, interoperable architectures*** *to enable space mission assurance and unity of effort, through identification of gaps and collaborative opportunities.*

- ***Enhance command, control, and communications capabilities and other operational linkages among CSpO Participants*** *to support unity of effort and the ability to conduct combined and synchronized operations throughout the spectrum of military operations.*

- ***Foster responsible military behaviors in space*** *to promote conditions to maintain freedom of use, access to, and sustainability of the space domain, and to discourage irresponsible behavior and avoid escalation.*

- ***Collaborate on strategic communications efforts*** *to set the desired conditions in the information environment.*

- ***Share intelligence and information*** *to create a common understanding and support unity of effort.*

- ***Professionalize space cadres and training*** *to energize shared, common understanding of the space domain, share best practices, and increase our collective expertise.*

CONCLUSION

The CSpO Participants are committed to pursuing the above objectives and lines of effort in alignment with our shared guiding principles to achieve our national and collective interests. The expansive opportunities and challenges presented by the rapidly changing space domain require collaboration to enhance responsible behavior and promote a secure, stable, and sustainable domain.

Through our discussions and working group activities, we intend to implement national and collective efforts toward those ends.

COMBINED SPACE OPERATIONS CENTER
SPACE DELTA 5

MISSION: EXECUTE OPERATIONAL COMMAND AND CONTROL OF SPACE FORCES TO ACHIEVE THEATER AND GLOBAL OBJECTIVES.

Author: Joint Task Force-Space Defense

VISION

Department of Defense's premier space operations center, ensuring effects for the nation, joint forces, and allies…right effect, right place, right time.

The ***Combined Space Operations Center*** (**CSpOC**), based at ***Vandenberg Air Force Base***, California, reports to the ***Combined Force Space Component Command*** (**CFSCC**) and executes the operational command and control of space forces to achieve theater and global objectives.

CSpOC operates 24 hours a day, seven days a week; continuously coordinating, planning, integrating, synchronizing and executing space operations; providing tailored space effects on demand to support combatant commanders and accomplishing national security objectives.

The CSpOC is CFSCC's lead integrating space operations center and along with ***Joint Overhead Persistent Infrared*** (**OPIR**) ***Planning Center*** (**JOPC**), ***Missile Warning Center*** (MWC), and ***Joint Navigation Warfare Center*** (***JNWC***) provides a synergistic and multi-layered network of defense operations centers supporting ***U.S. Space Command*** (***USSPACECOM***) and **CFSCC** operations.

CSpOC also works closely with the ***National Space Defense Center*** (**NSDC**), ***National Reconnaissance Office Operations Center*** (**NOC**) and the national space operations centers or headquarters of **Australia**, **Canada**, **France**, **Germany**, **New Zealand** and the **United Kingdom**.

Under the direction of CFSCC, the CSpOC uses this multi-layered network to coordinate, command and control space effects for geographic theater commanders and allied partners across the globe — ensuring the right effect or capability is available to theater components at the right place and right time to achieve the theater mission.

Additionally, the CSpOC hosts a ***Commercial Integration Cell*** (**CIC**) representative to enhance cooperation with several commercial partners.

Space Delta 5 (**DEL 5**) is the ***U.S. Space Force (USSF)***command and control organization within ***Space Operations Command*** (**SPOC**) that is presented to USSPACECOM and CFSCC to accomplish the Combined Space Operations Center mission.

DEL 5's mission is: Prepare, present, and fight assigned and attached forces for the purpose of conducting operational-level command and control (C2) of space forces to achieve theater and global objectives.

Additionally, DEL 5 manages assigned weapon system architectures and ensure operations are intelligence-led, cyber-resilient, and driven by innovation, while postured to succeed in a Contested, Degraded, and Operationally-Limited environment.

USSPACECOM augments DEL 5 with **U.S. Air Force**, **U.S. Army**, **U.S. Navy**, and **U.S. Marine** space personnel and along with exchange officers from Australia, Canada, and the United Kingdom, they form the CSpOC.

The CSpOC and DEL 5 are composed of 4 divisions and 3 squadrons: *Combat Operations Division* (**COD**), *Strategy & Plans Division* (**SPD**), *Intelligence, Surveillance and Reconnaissance Division* (**ISRD**), *SATCOM Integrated Operations Division* (**SIOD**), *614th Combat Training Squadron* (**CTS**), *614th Air and Space Communications Squadron* (**ACOMS**), and *9th Combat Operations Squadron*.

COD ensures combat-relevant synchronization of forces to achieve desired effects

Accordingly, COD is responsible for four critical tasks: real-time monitoring of the space domain (*including status of space forces, threats to space operations, and changes to the space operating environment*), assessing the impact of changes in the space situation or space capabilities, developing credible courses of action for the re-planning and/or redirection of space force employment as appropriate, space control C2 fires coordination.

COD also ensures the execution of the current space force tasking is consistent with the CFSCC commander's intent and national caveats.

SPD is responsible for crisis action planning, deliberate planning, orders management and space C2 tasking coordination. SPD activities are primarily reflected in the *Space Operations Directive* (**SOD**), *Master Space Plan* (**MSP**), *Combined Space asking Order* (**CSTO**), *Mission Plans* (*as needed*), *Operations Assessments* (**OA**), and related documents.

ISRD provides the CSpOC with timely, predictive, and actionable intelligence to support all aspects of the space tasking cycle. The ISRD is responsible for coordinating intelligence support throughout the *Planning, Collection, Processing & Exploitation, Analysis & Production, and Dissemination* (**PCPAD**) *Cycle*.

Additionally, ISRD is the single point of contact to orient coalition space units, threat analysis, and theater updates. ISRD identifies threats to the use of space and predictive intelligence through indications and warnings.

SIOD is responsible for synchronizing, integrating, and coordinating information and activities across the *satellite communication* (**SATCOM**) enterprise in order to optimize collective SATCOM services to terminal users and associated warfighters worldwide.

614 CTS provides initial and advanced operations training, evaluations, and exercise coordination support for CSpOC operations. Certification processes, training program development (*for initial, mission, supplemental, recurring, and advanced training*) and procedural review and development fall under the purview of 614 CTS in support of CSpOC combat mission ready requirements.

14 ACOMS engineers, integrates, operates, sustains, and defends the information technology services and equipment that support the CSpOC mission. This includes all standard services provided through **NIPRNet**, **SIPRNet**, and **JWICS** as well as all other space unique systems and applications required to operate those systems.

The ACOMS also manages the *Communications Focal Point* (**CFP**) providing cyber support to all CSpOC personnel and mission systems. Finally, the ACOMS oversees development and execution of the *Mission Defense Teams* responsible for protecting CSpOC's vital mission systems.

9 COS is the *Reserve Associate Unit* (**RAU**) to ***Space Delta 5*** and is assigned to augment intelligence, planning and operations at the CSpOC.

9 COS provides operations continuity, corporate knowledge and surge capability as a force provider. Additionally, 9 COS is aligned to compliment Space Delta 5 in structure and augments in support of day-to-day, surge and contingency operations, as well as system/ training upgrade events.

The CSpOC is co-located with the ***18th Space Control Squadron***, a tactical unit within the ***Space Delta 2***, which delivers foundation *space situational awareness* (**SSA**) to assure global freedom of action in space.

COMBINED FORCE SPACE COMPONENT COMMAND

As directed by the Commander of U.S. Space Command (USSPACECOM), two subordinate commands were established August 29, 2019, to support the warfighting efforts of the command - the Joint Task Force Space Defense (JTF-SD), and the Combined Force Space Component Command (CFSCC).

The CFSCC mission is to plan, integrate, conduct, and assess global space operations in order to deliver combat relevant space capabilities to Combatant Commanders, Coalition partners, the Joint Force, and the Nation. CFSCC plans and executes space operations through four distinct and geographically dispersed operations centers, including: Combined Space Operations Center (CSpOC) at Vandenberg Space Force Base, Calif.; Missile Warning Center (MWC) at Cheyenne Mountain Space Force Station, Colo.; Joint Overhead Persistent Infrared Planning Center (JOPC) at Buckley SFB, Colo.; and Joint Navigation Warfare Center (JNWC) located at Kirtland AFB, N.M. Additionally, CFSCC executes tactical control over globally dispersed Air Force, Army, and Navy space units that command ground-based space capabilities and satellites in every orbital regime.

CFSCC's headquarters is co-located with the Combined Space Operations Center at Vandenberg SFB in California.

One of CFSCC's primary roles is to plan, task, direct, monitor, and assess the execution of combined and joint space operations for theater effects on behalf of the Commander, USSPACECOM in order to directly integrate with ongoing operations in other Combatant Commands. CFSCC also provides support to, and receives support from, Coalition operations centers including the Australian Space Operations Center (AUSSpOC), Canadian Space Operations Center (CANSpOC), and United Kingdom Space Operations Center (UKSpOC). Additionally, the CFSCC builds capacity through relationships with partner nations' militaries and civil and commercial entities to achieve combined force objectives.

CFSCC provides space capabilities such as space domain awareness, space electronic warfare, satellite communications, missile warning, nuclear detonation detection, environmental monitoring, military Intelligence, Surveillance and Reconnaissance (ISR), navigation warfare, command and control, and Positioning, Navigation and Timing (PNT) in support of USSPACECOM and the other Combatant Commands. The CFSCC also executes command and control of assigned multinational forces in support of Operation Olympic Defender, as directed by USSPACECOM.

The United States and partner nations unequivocally recognize the strategic importance the space domain has on our economies, technology, national security, and defense. To that end, we collectively share the view that military cooperation concerning the space domain is vital to our countries' interests. Our respective nations are actively working together to address threats and shared interests in space; and to preserve access to the space domain for the defense of our nations and the future of humankind.

MISSILE WARNING CENTER

The Missile Warning Center (MWC) is a Joint operations center under U.S. Space Command (USSPACECOM) and Combined Force Space Component Command (CFSCC) with a 24/7 mission of delivering global strategic and theater missile warning and nuclear detonation detection in support of national leadership, Combatant Commanders, Geographic Commanders and allies.

The unit performs its mission by incorporating data from both space-based and terrestrial sensors in a world-wide missile warning network. The MWC is also responsible for change control, operational testing oversight, and sustainment advocacy for the $1.8 billion Integrated Threat Warning and Attack Assessment (ITW/AA) network.

The MWC operates a 24/7 operations center manned by Joint service military and civilian personnel from the Army, Navy, Air Force, Marines, and our Canadian partners. The unit is located at Cheyenne Mountain Air Force Station in Colorado Springs, Colorado.

JOINT NAVIGATION WARFARE CENTER

The JNWC was activated on Oct. 1, 2004 under the office of the Assistant Secretary of Defense for Networks Information & Integration. JNWC resides under Joint Functional Component Command for Space, becoming USSTRATCOM's lead for Joint Navigation Warfare capabilities integration.

MISSION: The JNWC's mission is to enable positioning, navigation and timing superiority for the Department of Defense, interagency and coalition partners.

VISION: A bold, empowered organization committed to PNT superiority, actively shaping the environment and embracing selfless service in the defense of the nation.

NAVWAR DEFINITION: The deliberate defensive and offensive action to assure and prevent PNT information through coordinated employment of space, cyber space and electronic warfare operations.

The JNWC integrates NAVWAR across the Department of Defense, and its first priority is providing operational support to the warfighter, providing NAVWAR subject matter expertise via 24/7 reachback and deployable teams. These teams provide geographic combatant commanders and joint force commanders expertise in planning and conducting NAVWAR operations across space, EW, cyberspace and intelligence, surveillance and reconnaissance operations, facilitating a common understanding of the friendly and enemy NAVWAR Order of Battle, as well as PNT-related successes and challenges in the battlespace.

The JNWC furthers the creation of NAVWAR knowledge for the warfighter by conducting PNT operational field assessments. The primary objectives of JNWC POFAs are to assess NAVWAR operational capabilities by prioritizing NAVWAR knowledge gaps based on warfighter requirements and to determine mitigations to NAVWAR operational vulnerabilities. The deliberate defensive and offensive action to assure and prevent PNT information through coordinated employment of space, cyber space and electronic warfare operations.

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NATIONAL SPACE DEFENSE CENTER

The National Space Defense Center is a partnership organization, strongly supported by both the Department of Defense and Intelligence Community, that develops and improves U.S. ability to rapidly detect, warn, characterize, attribute and defend against threats to our nation's vital space systems. The NSDC directly supports space defense unity of effort and expands information sharing in space defense operations among the DoD, National Reconnaissance Office, and other interagency partners. The NSDC is a subordinate center of U.S. Space Command's Joint Task Force-Space Defense, responsible for coordinating military, intelligence, civil, and commercial space for unified space defense operations.

The NSDC is located at Schriever Space Force Base, Colorado, and is a joint and interagency center that leverages unity of effort for: Data Integration / Bringing DoD and IC chains of command (Title 10 and Title 50 authorities) and systems to the fight / Conducting space Experiments, Exercises and Advanced Training / Supporting and synchronizing space defense Battle Management Command and Control (BMC2)

The NSDC mission in unified action with mission partners is to:

- *Conduct space superiority operations to deter aggression*
- *Defend space capabilities*
- *Defeat our adversaries throughout the continuum of conflict*

By creating a unity of effort, the NSDC has:

- *Formalized Partnerships across the spectrum of National Security space entities*
- *Established C2 mission systems that enable response to threats rapidly and decisively*

- *Established effective Indications & Warnings (I&W) and supplies Operational Intel*
- *Enhanced Mission Assurance for existing capabilities*
- *Defined Critical Information to be shared in a Common Operating Picture (COP)*

The NSDC executes missions with experts from the:

- *DoD military, civilians, and contractors- U.S. Air Force, U.S. Army, U.S. Navy, and U.S. Marine Corps*
- *Intelligence Community (IC) — seven agencies represented, civilian and military*
- *National Reconnaissance Office (NRO) — Cadre, military members, contractors*
- *End strength (including contractors) targeted at approximately 350 persons*

***Current Operations**: GSSAP; Threat Based Space Situational Awareness (SSA); Integrated Sensor Support Plan (ISSP); Limited Threat Intel; Limited Threat I&W; OL-V*

- *Initial capability, consisting of systems, tools and personnel to conduct experimentation focused on integrated operations and unity of effort, was established in October 2015*
- *Limited 24x7 operations began on 8 January 2018; added additional incremental operational capability throughout 2018-2019*
- *Current manning consists of over 245 military, DoD civilian, and contractor personnel*
- *MOD 17/19 construction complete and ready for occupancy in July 2019*

***Rapid Acquisitions and Prototyping**: The Air Force Research Lab (AFRL) has been tasked to provide a Joint Emerging Operational Need (JEON) effort for the NSDC to provide capabilities to integrate systems and information at a "system high" level. By operating at the highest security levels throughout the operations center, the NSDC will become a singular center for the full picture of space activities.*

- *14 initial JEON mission applications installation anticipated in 2019*
- *Air Force Rapid Capabilities Office (RCO) will leverage rapid prototyping on site and accelerated acquisitions of capabilities and systems*
- *As capabilities and systems mature, the RCO will hand over long-term sustainment operations to the Air Force Space and Missile Systems Center (SMC)*

***History**: Initially established as the JICSpOC on October 1, 2015, it was intended to improve processes and procedures, ensuring data fusion among DoD, intelligence community, interagency, allied and commercial space entities. On April 1, 2017, the JICSpOC was renamed the NSDC, to better clarify its role and eliminate confusion with the Joint Space Operations Center (JSpOC). On July 9, 2019, the NSDC dedicated its operations floor and a warfighter library to Senior Master Sergeant Harold Robert Mosley II, the NSDC's Command Senior Enlisted Leader in 2018*

18TH SPACE CONTROL SQUADRON

The 18th Space Control Squadron (SPCS) at Vandenberg Air Force Base, CA, is located 160 miles northwest of Los Angeles, CA.

***MISSION**: Defend freedom of action in space for the Joint Force, multinational partners and humanity. The squadron is tasked with providing 24/7 support to the space surveillance network (SSN), maintaining the space catalog and managing United States Space Command's (USSPACECOM) space situational awareness (SSA) sharing program to United States, foreign government, and commercial entities. The squadron also conducts advanced analysis, sensor optimization, conjunction assessment, human spaceflight support, reentry/break-up assessment, and launch analysis. In addition, 18 SPCS also oversees 18 SPCS Detachment 1, located in Dahlgren, Virginia.*

The squadron is jointly located with the Combined Space Operations Center in Building 8401 at Vandenberg AFB, California. The squadron operates Space Defense Operations Center (SPADOC) and the Astrodynamic Support Workstation (ASW) to task and receive observation data from the SSN and provide that data to DoD and non-DoD customers.

Approximately 64 military and 25 civil service people are permanently assigned to 18 SPCS. Around thirty military personnel are assigned to the operations flight, which is responsible for SPADOC and ASW operations. The remainder of the assigned military and civilian workers provide support and advanced functions in support of 18 SPCS operations.

The squadron enjoys a rich history of service. In 1966, the 18th Space Surveillance Squadron (SPSS) was activated at Edwards Air Force Base, California, and operated the BakerNunn Camera satellite tracking system until the deactivation of the squadron in 1975. The 18 SPSS was then activated in 1990 to become part of the 1st Space Wing, Peterson AFB, Colorado, and manage the worldwide GEODSS detachments. Following its activation, 18 SPSS was relocated to Edwards AFB, California, in 1995, renamed 18th SPCS in 2003, and deactivated in 2004. On July 22, 2016, 18 SPCS was reactivated at Vandenberg AFB, California, to perform the SSA sensor tasking mission.

SPACE DELTA 2

Space Delta 2 (DEL 2) prepares, and presents assigned and attached forces for the purpose of executing combat-ready Space Domain Awareness (SDA) operations to deter aggression and, if necessary, fight to protect and defend the U.S. and our allies from attack in, through and from space. DEL 2 is one of eight mission-oriented deltas within the U.S. Space Force.

Space Delta 2 is headquartered at Peterson -Schriever Garrison, Colorado, with mission personnel and functions distributed across Vandenberg Space Force Base, California, Eglin Air Force Base, Florida, Kirtland Air Force Base, New Mexico, Maui, Hawaii, Huntsville, Alabama, and Dahlgren, Virginia, in addition to multiple supporting locations around the world including Australia, Diego Garcia, and the Marshall Islands.

***HISTORY**: Space Delta 2 was activated July 24, 2020 during a ceremony at Peterson-Schriever Garrison, Colorado. DEL 2 is headquartered at Peterson-Schriever Garrison, operating location Peterson Space Force Base.*

***MISSION**: The DEL 2 mission its to prepare, present and, if necessary, fight to protect and defend the U.S. and our allies from attack in, through and from space.*

***VISION**: The DEL 2 mission involves three distinct areas of focus:*

- ***Prepare: DEL 2 prepares combat-minded warfighters and readies cutting-edge weapons systems for fast-paced multi-domain operations***
- ***Present: DEL 2 leads Space Domain Awareness operational planning and presents combat-ready forces and equipment in support of USSPACECOM***
- ***Fight: If deterrence fails, DEL 2, in coordination with allied and Joint Force commanders (JFCs) and inter-agency partners, will lead the protection and defense of our combined interests in the space domain.***

DEL 2 partners with ISR, Orbital Warfare and Missile Warning Deltas to maximize mission success. SDA includes the dynamic integration of ISR, metric observations, and environmental monitoring to enable space battle management and support multi-domain operations.

DISPATCHES

NORTHROP GRUMMAN ASSUMES FULL GMLRS ROCKET MOTOR PRODUCTION

Northrop Grumman Corporation (NYSE: NOC) will assume production of rocket motors for the U.S. Army's Guided Multiple Launch Rocket System (GMLRS), fulfilling the full contract production quantity — the company recently delivered its 15,000th rocket motor and 20,000th warhead to Lockheed Martin for final assembly.

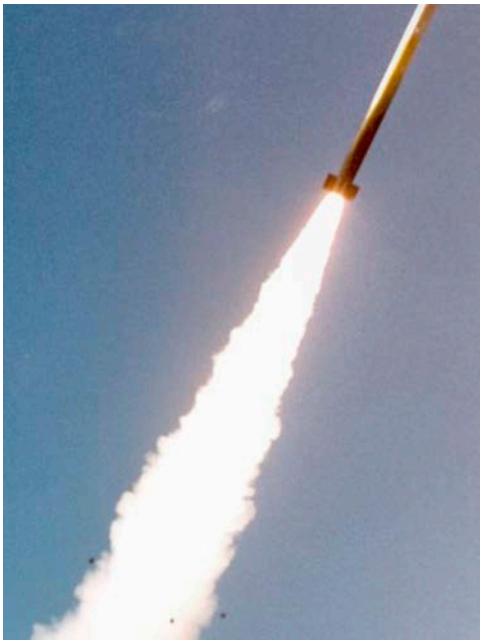
The propulsion system, once delivered to Lockheed Martin's Camden, Arkansas, final assembly facility, will be integrated into GMLRS missiles — a ballistic rocket designed to engage targets from 15 to 70 kilometers.

Northrop Grumman's safety enhancing, insensitive munition provides the system structural integrity under extreme conditions such as heat, shock and adjacent detonations. The ignition safety device further improves the weapon system's safety characteristics by preventing unwanted combustion.

Northrop Grumman designed and constructed a purpose-built manufacturing facility at the Allegany Ballistics Laboratory in Rocket Center, West Virginia., using lean manufacturing and digital engineering techniques which enables a robust and resilient Defense Industrial Base.

The facility provides for the efficient design, development and production of this critical weapon system component.

"*We are proactively investing in production facilities and technologies in support of producing even higher rates of rocket motors faster and more affordably to meet our customer's anticipated demand*," said **Jim Kalberer**, vice president of missile products, Northrop Grumman. "*We are leveraging our capacity and modern manufacturing facilities to deliver critical military needs*."



"*Northrop Grumman is a trusted supplier of GMLRS rocket motors with robust manufacturing capacity to meet the demands of our customer,*" said **Jay Price**, vice president of Precision Fires for Lockheed Martin.

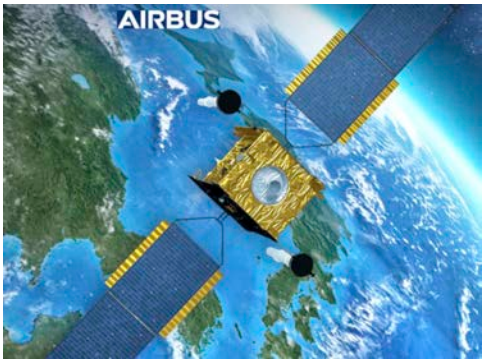
SPEEDCAST WINS APAC TELEPORT SERVICES CONTRACT FROM AIRBUS AND THE UK MOD

Speedcast has been awarded a contract extension by Airbus to provide gateway hosting services offering secure access to the Airbus SKYNET military satellite system from the Asia-Pacific (APAC) region.

Airbus is the trusted partner for the UK's secure military satellite communications (MILSATCOM) program.

In 2016, Speedcast built two 11m antenna systems at one of the company's leading teleport facilities in Australia and has successfully provided secure hosting and maintenance services since that time. This contract award extends this successful partnership.

In 2019, Airbus celebrated a remarkable 50 years of providing global secure military satellite communications to the UK Ministry of Defence, marked by the 50 year anniversary of the first SKYNET satellite.



Artistic rendition of an Airbus SKYNET satellite on-orbit.

"*Australia is an ideal geographical location to access the SKYNET fleet from the Asia-Pacific region, and Speedcast's facility serving this project is rated Tier 4 by the World Teleport Association, so it's one of the best in the Eastern hemisphere*," said **James Trevelyan**, Senior Vice President of Enterprise and Emerging Markets at Speedcast. "*Australia is also a Five Eyes intelligence alliance partner*."

BALL AEROSPACE ENTERS FINAL STAGES OF BUILDING USSF'S WSF-M SATELLITE

Ball Aerospace has completed the spacecraft bus for the Weather System Follow-on-Microwave (WSF-M) satellite, the U.S. Space Force's (USSF) next-generation, operational, environmental satellite system.

The company also finalized environmental testing on the ***Microwave Imager (MWI)*** instrument and has started final space vehicle assembly, integration and testing.

Upon delivery, WSF-M will provide mission data to ***Department of Defense's (DoD)*** environmental prediction systems that support all warfighter domains.

In addition, it will broadcast real-time, actionable environmental intelligence to on-going military operations across the globe.

At the heart of the WSF-M payload is the Ball-built, MWI sensor that takes calibrated, passive, radiometric measurements at multiple, microwave frequencies to measure sea surface winds, tropical cyclone intensity and additional environmental data.

The ECP sensor will provide critical space weather measurements. WSF-M was designed to mitigate three high-priority ***DoD Space-Based Environmental Monitoring (SBEM)*** gaps: ocean surface vector winds, tropical cyclone intensity and the space weather gap, LEO energetic charged particles. It will also address three additional SBEM gaps: sea ice characterization, soil moisture and snow depth.

Ball Aerospace was recently awarded the contract modification to develop and build the second WSF-M space vehicle, expected to be completed by late 2027.

Ball Aerospace has played key roles on numerous operational weather satellite programs. The company's ***Ozone Mapping and Profiler Suite (OMPS)*** instruments are operating on the Ball-built ***Suomi NPP*** and ***NOAA-20*** satellites, launched in 2011 and 2017, respectively.OMPS is also on board the ***Joint Polar Satellite System-2 (JPSS-2)***, which launched on November 10, 2022.

Ball is on contract with NASA to build two additional OMPS instruments for ***JPSS-3*** and ***JPSS-4***. The Ball-built ***Ion Velocity Meter (IVM)*** space weather sensors are flying on five of the six ***Constellation Observing System for Meteorology, Ionosphere and Climate-2 (COSMIC-2)*** satellites, a joint program with the **U.S. Air Force**, **U.S. Space Force**, **Taiwan's National Space Organization**, **NOAA** and the **University Corporation for Atmospheric Research** that launched in 2019.

"*The nearly simultaneous completion of the spacecraft bus and instrument testing mark a significant milestone for the WSF-M program*," said **Hope Damphousse**, vice president, Strategic Operations, Ball Aerospace. "*We are moving forward with spacecraft integration of the MWI sensor, along with a government-furnished Energetic Charged Particle (ECP) sensor, which will be followed by a suite of space vehicle performance and environmental tests*."

GOVERNMENT SATELLITE REPORT (GSR)

SES S&D's Senior V.P. on the state of COMSATCOM

Author: David Pesgraves

2022 was a groundbreaking year for the COMSATCOM industry. From the deployment of critical satellite communications technologies during the Russian-Ukraine conflict in Eastern Europe, to the launch of revolutionary, cutting-edge satellite constellations, the powerful capabilities and solutions that commercial industry can provide to the federal government and the military were on full display for the entire world to see

However, successes are usually accompanied by setbacks and challenges. Even after witnessing these incredible use-case wins for COMSATCOM integration and adoption, the federal government has still been slow and hesitant to fully implement and deploy these satellite technologies that can support the U.S. Department of Defense's (DoD) mission of providing its military with a resilient space architecture.

Though officials frequently point to this space architecture as a top priority for the department, the government acquisition process of commercial space assets — which could truly propel the U.S. ahead of its foreign adversaries and near-peer competitors – was still sluggish and arduous in 2022.

To learn more about the trends, progress, and challenges the commercial satellite industry faced within the federal acquisition space in 2022, and to get an outlook on how COMSATCOM can support the federal government and the DoD's mission requirements in 2023, the Government Satellite Report was able to catch up with ***SES Space & Defense***'s *Senior Vice President of Strategic Development*, **Jay Icard**.

Jay Icard

Over the past year, what overarching trends is the commercial satellite industry seeing and experiencing as it pertains to government acquisition? What successes has the industry experienced? What new challenges have come up?

JAY ICARD

We've seen the government shift away from the lowest price technically acceptable procurements to using best value, which is good! The number of networks has remained flat, meaning the commercial industry repeatedly competes for the same contracts. Having said that, the U. S. Space Force awarded some significant COMSATCOM contracts last year, such as the CSSC II contract for the U.S. Navy, which is over $900M ceiling — not a small effort.

They also released some new solicitations, such as the Global X-band Blanket Purchase Agreement (BPA), which should prove to be an enabling contract for MILSATCOM-COMSATCOM integration in the near future.

One concerning challenge that has been popping up these last few years pertains to the current talent pool. If you look at the needs for talent on the government acquisition side, they need personnel to develop the requirements with their customers. They need personnel to evaluate the proposals, but it's becoming increasingly difficult to find experienced personnel that wants to work on COMSATCOM acquisitions.

It's not common for people to go to college and major in COMSATCOM engineering. The government and industry compete from the same resource talent pool. Our industry is not something you can learn in a couple of months.

The 2016 "*Analysis of Alternatives*" study, mandated by Congress, required the Department to look at how military and commercial systems could collectively provide a resilient enterprise architecture. The study found that leveraging both military and commercial systems into an integrated hybrid architecture would save taxpayer dollars. That said, we need government professionals that understand the SATCOM acquisition business.

U.S. Space Force and U.S. Space Command are working to integrate COMSATCOM, and they choose from that same talent pool, because there's still a finite number of professionals with the required skillsets. It's an industry-wide dilemma. I've had a number of discussions with Space Force, Space Command, and industry leaders about this topic.

What are the possible solutions for those skill gaps in the workforce?

JAY ICARD
We've spoken with Space Force about immersion. For example, in the past, there have been immersion programs where civilian or military personnel would spend time at a vendor's facility within an operations or engineering team to learn about how the vendor works and operates. I participate in the U.S. Space Command's *Commercial Integration Cell (CIC)*, a group of ten industry partners that work with the command to improve the operational effectiveness of space operations. Within the CIC, we have explored several ideas about bridging that skills gap.Immersion of personnel is one of the ideas that are out there. We know it is an effective method, but it requires a deliberate plan that makes sense for all parties to invest the resources to make it successful.

Has the government and military made any headway with tearing down the bureaucratic challenges that hinder commercial satellite acquisitions? Has there been any progress or new challenges that have come up? How can government and industry work together to make the process faster while meeting military requirements?

JAY ICARD
I believe the government is working on it. They have stabilized their organization and where the COMSATCOM purchasing organization is going to sit within Space Systems Command.

Along with assuming full acquisition and procurement authorities for COMSATCOM, Space Command should work with Space Force to create *Program Objective Memorandum* (POM) budgets for select procurements of COMSATCOM.

For example, the government should consider the POM budget for ground infrastructure and network configuration projects to use existing commercial space assets and place into service MILSATCOM-COMSATCOM roaming configurations discussed in the Space Force Vision for SATCOM.

But in general, Space Command and Space Force should see where the POM process can be used to ensure a stable and methodical approach to accelerating the availability of COMSATCOM solutions for military requirements. We're not talking about billions and billions of dollars. Small investments could create a lot of capability with COMSATCOM integration in a short amount of time. But first, the organization needs to be set, and the roles and responsibilities tightened up, and I think they have that now.

Has establishing the U.S. Space Force and having one centralized service for space simplified the commercial satellite acquisition process?

JAY ICARD
I believe it will, and I think the measures of success are straightforward. When presented with a mission need from a service or COCOM: *1) Have we reduced the time to acquire a COMSATCOM service?* 2) Have we reduced the time to activate a COMSATCOM service? Those are the fundamental measures of success. If I have a need for a certain amount of throughput or network availability in a specific area — How long did it take me to acquire? How long did it take you to activate? That's where the rubber meets the road.

What are the top SATCOM needs and requirements that the military and government are looking to fulfill in 2023?

JAY ICARD
First, we must address where we anticipate conflict and where there may be surge needs. That's first and foremost. Are we ready to surge? Do we have the capacity in place to fulfill a surge requirement? In any other networking discipline, it's busy hour traffic management. Are we ready for the busy hour traffic?

Second, do we have plans to fulfill the future capacity needs? As our capacity consumption grows over the next five years, do we have enough MILSATCOM and COMSATCOM to fulfill that need? Where are the gaps? What are the plans to fill those gaps?

And it could be that we have the space assets to fill the gaps. But do we have the ground assets configured to utilize the space assets that are available to us? Do we have the contracting mechanisms to access the space and ground assets in a timely manner?

The 2023 National Defense Authorization Act (NDAA) was signed on December 23,2022 — there is a portion that directs the DoD to lay out a strategy and requirements for the protection of DoD satellites. How can the satellite industry assist in realizing these strategies and requirements for a more resilient and defendable national security space architecture, as the law states?

JAY ICARD
Accelerate the employment of COMSATCOM integration into military missions, making the enemy's targeting calculus more complicated. It's a low-cost and near-term solution to protect MILSATCOM and COMSATCOM assets.

Suppose an enemy focuses their resources into a space asset and successfully disables it. In that case, they will only affect a small percent of the traffic if effective COMSATCOM integration has been employed.To me, that's been the priority for years now, and that's the purpose of COMSATCOM integration.

I think the other "tests" we ask in an effort to accelerate COMSATCOM integration include: Are we utilizing the contracts that we have? Are we using our assets and skills and implementing those capabilities now and in a short timeline with small amounts of money? Or are we studying to do it five years from now? Are we studying a problem that we could solve with small and timely investment that could have real mission effects in the near term? I think that is a test that all of us in the industry and in the policymaking side need to ask ourselves.


David Pesgraves

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

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

SOLVING SPACE MANUFACTURERS CYBERSECURITY CONCERNS WITH SECURED DIGITAL ENGINEERING

Author: Author: Eric Conway,
Senior Vice President Technology,
BigBear.ai

The space sector is booming. By 2040, experts predict the industry will reach $1 trillion in annual revenue. But with the proliferation of commercial space launches also comes cybersecurity concerns.

Throughout this commercial space boom, digital engineering has become an integral component of the manufacturing process. Using digital twin technology to model, design and build space systems in a simulated environment enables manufacturers to test and fail fast without suffering financial blows.

However, those virtual digital environments often do not include cybersecurity research capabilities. Traditionally, digital engineering and cybersecurity have been considered separate domains rather than practices that go hand in hand.

To get the most out of these environments, combining digital engineering and cybersecurity into one solution—***Secured Digital Engineering***—will decrease costs for manufacturers, improve development speed and bolster the security of space assets throughout their lifecycle.

Realizing the fully formed vision of Secured Digital Engineering and establishing the inclusion of cybersecurity research in digital engineering will require an industry-wide understanding of these environments. However, manufacturers need to have buy-in and thoughtfully implement high-fidelity models that mimic complex cybersecurity attacks before the true value of Secured Digital Engineering can be realized.

THE FOUR MAJOR COMPONENTS OF DIGITAL ENGINEERING ENVIRONMENTS

Fully realized Secured Digital Engineering environments consist of four major components:

*1 — **Modeling and Simulation** — These are the current everyday applications of digital engineering. Commonly used for products that require the development and testing of processes to mimic extreme operational environments, expensive hardware components or highly complex scenarios. Modeling and simulation are proven risk reduction practices.*

*2 — **Digital Twinning** — When a digital twin computer-based simulation is engineered properly, it can serve many different virtual purposes, including anomaly detection and resolution and design updates.*

*3 — **Cyber Evaluation Platform** — This component delivers cybersecurity effects to different parts of the model through a cyber delivery platform, red team platform or simulation. Through this platform, research teams can launch virtual cyberattacks to test the simulation for different vulnerabilities. From there, the data stream can be analyzed to see how the attack was delivered and understand its impact so teams can offer solutions for how such an anomaly could be detected moving forward.*

*4 — **Data Collection Storage and Analytical Toolkit** — The final piece is the data collection storage and analytical toolkit. This stage of the platform collects and compiles the data from the first three components in a central location. From there, data scientists can sort through and process the data and leverage AI and machine learning-led analytics to identify how the found anomalies would affect the entire spacecraft.*

Once fully realized, these environments provide significant value to manufacturers. However, for them to function at the highest possible level, high-fidelity models are required.

HIGH-FIDELITY MODELS NEEDED FOR TANGIBLE RESULTS

The ability to conduct Secured Digital Engineering is directly related to the level of fidelity in the modeling system. The better the model, the stronger the results. However, given that cyberattacks are highly complex and dependent on specific characteristics of the system they are attacking, models must have the fidelity to mimic the characteristics of cyberattacks or risk having little applicable use.

To provide meaningful results, the fidelity of the simulation must be thoughtfully designed and routinely updated to ensure reasonable accuracy. Likewise, model deficiencies must be considered and improved when necessary. Simulated data models can offer real-world confidence and validation before the start of the manufacturing process but only under the proper simulated environments. For these models to function best, it is essential to consistently assess the simulation to ensure that the environment matches the tangible real-world project.

Without high-fidelity models in place, manufacturers increase both the risks and impact of cyberattacks. Systems may be put out of service for an extended period of time, which can prove costly and disrupt downstream military or commercial operations.

For instance, earlier in 2022 on the eve of its invasion of Ukraine, the Russian government conducted a cyberattack against a commercial satellite operator which cut satellite broadband service in Ukraine including connectivity for the country's defense staff. In today's world, where space is the new battleground, preventing such attacks and disruptions is ever critical.

THE MINDSET NEEDED FOR ADOPTION

While spacecraft manufacturers often acknowledge the importance of cybersecurity research, they have yet to make it a priority when using digital environments. In the same way that every component of a spacecraft is tested for radiation ahead of space deployment, these parts need to be evaluated for cybersecurity vulnerabilities.

The fully realized version of Secured Digital Engineering will be able to run 100 simulations, identify where significant abnormalities were detected and then build engineering safeguards to protect these systems against these vulnerabilities moving forward. To reach that point, however, there needs to be industry recognition of the value that cybersecurity research can provide to the manufacturing of space components, both for individual parts and full systems.

Tracking the software development process for the ***Department of Defense*** (DoD) serves as a good example of how technology over time can evolve to include cybersecurity protocols.

Development Operations (**DevOps**) have long used automation as a repeatable process to improve the quality and delivery of products but it took 15 years for that process to infuse security checks as a standard practice, now known as ***DevSecOps***.

The same will likely be true for adopting cybersecurity research into digital engineering environments, but ultimately, the benefits — such as lower costs, increased project completion speed, and drastically improved security of space assets — will convince manufacturers that Secured Digital Engineering is a worthy investment.

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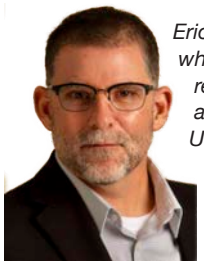

Eric Conway is the SVP of Technology at BigBear.ai, where he defines strategy and directs the investment, research and development of advanced AI-powered analytics and cyber solutions for clients including the U.S. Department of Defense, Intelligence Community, and Federal Civilian agencies. Eric is a recognized subject matter expert in cyber network operations (CNO) and cybersecurity with over 25 years of experience as a technical leader in cyber software systems engineering and offensive/defensive cyberspace operations.

Constellations

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Constellations' Best Military Podcast Episodes

The U.S. Department of Defense continues to be the single largest investor in satellite technology. Constellations' interviews with DoD leaders have focused on the needs and capabilities that are defining industry partnerships as well as the future of all-domain warfare.

Here are the top Constellations podcasts featuring guests from the armed forces.

PREPARING FUTURE GUARDIANS

MAJOR GENERAL SHAWN BRATTON
STARCOM

Major General Shawn Bratton

SPACE TRAINING AND READINESS COMMAND (STARCOM)

Training and educating the ***United States Space Force (USSF) Guardians*** of tomorrow is the biggest challenge facing *Commander of the Space Training and Readiness Command* (***STARCOM***) **Maj. Gen. Shawn Bratton**.

Speaking to Constellations on the one-year anniversary of STARCOM, Bratton discussed how the USSF is combining new technologies, simulators and live drills to train "*for competition and conflict in the space domain*."

ACCELERATING SPACE ACQUISITION

DR. FRANK TURNER
SPACE DEVELOPMENT AGENCY

Dr. Frank Turner

SDA SPACE DEVELOPMENT AGENCY

The ***Space Development Agency***'s (**SDA**) role in constructively disrupting the acquisitions process has been an important change for the ***Department of Defense*** (**DoD**).

SDA Technical Director **Dr. Frank Turner** addressed the agency's push to accelerate the process with a two-year spiral development approach currently being used to fast-track the development of ***Joint All-Domain Command and Control*** (**JADC2**) transport layer.

Constellations is your connection to the leaders, innovators and ideas that are shaping the future of space. Constellations was launched by Kratos in 2017 as the first industry podcast dedicated to space technology. Today, thousands of influencers in industry, academia and government subscribe to the Constellations podcast and digital publication as the authoritative link to voices from space.

BUILDING THE FIRST DIGITAL SERVICE

DR. LISA COSTA, CTIO
U.S. SPACE FORCE

Dr. Lisa Costa

USSF is the first service to be born in the digital age. *Chief Technology and Innovation Officer* **Dr. Lisa Costa** spoke to Constellations about what is involved in making the first digital service.

Costa addressed the strategy to support the joint forces with cutting-edge space technology, from engineering and operations, to leveraging the skills of an IT-fluent, STEM-educated class of Guardians.

LEVERAGING INNOVATION

MAJOR GENERAL BROOK J. LEONARD
CHIEF OF STAFF, U.S. SPACE COMMAND

Major General Brook Leonard is responsible for coordinating decision-making among staff in the warfighting component of ***USSF***. Brook described SPACECOM's focus on outmaneuvering adversaries through superior technology innovation, thinking and force organization. Rather than an incremental evolution, Brook emphasized "*revolutionary jumps in innovation*."

AFRL'S 'BIG IDEA PIPELINE'

COLONEL ERIC FELT
PAST DIRECTOR OF THE AIR FORCE RESEARCH LAB (AFRL), SPACE VEHICLES DIRECTORATE

Colonel Eric Felt

Colonel Felt described his organization's work as the "*big idea pipeline*" for national defense space. Felt, who now serves as executive director of the *Space Force's Architecture, Science and Technology Directorate*, discussed developments in cislunar operations, W and V-band communications and proliferated LEO as a game-changing capability for the warfighter.

DETERRING WARS IN SPACE

LIEUTENANT GENERAL JOHN SHAW
U.S. SPACE COMMAND

Lt. Gen. John Shaw

The "*sun never sets on space operations*," according to *Deputy Commander of U.S. Space Command,* **Lt. Gen. John Shaw** who spoke to Constellations about the role of USSF in projecting strength to deter conflict in space. Shaw was with USSF from its inception and addressed how the perception of space has shifted from a benign area of operations to a warfighting domain.

Author: Lisa Sodders, Space Systems Command Public Affairs Office

For 69 years, Space Systems Command (SSC) and its heritage organizations inconspicuously developed an impressive portfolio of "exquisite" capabilities.

These capabilities have not only given U.S. and allied warfighters a distinct advantage in every war-fighting domain, but also changed everyone's way of life, around the world.

For most people, this happened out of sight, out of mind, but competitors noticed and are taking action to reduce the U.S. advantage in space.

Competitor actions are dramatically altering the once-benign space environment, necessitating the ***United States Space Force*** and its implementation of a new strategy to make it difficult for adversaries to disrupt our space operations. This approach is consistent with the **U.S. Department of Defense**'s emphasis on integrated deterrence. In a word: ***resilience***.

As the Space Force enters its fourth year of operations, the benefits of the new service are becoming more visible, particularly at SSC.

This includes a focus on 100 percent mission success; satellites and systems delivered on time and on budget; and an increasing launch tempo.

A new SSC office was established last year to drive transition to an integrated and resilient space enterprise — the ***Space Systems Integration Office*** (**SSIO**) — led by Dr. **Claire Leon**, a senior civilian and government and industry expert.

Dr. Clair Leon

This is a dynamic time in the space industry with multiple forces driving the need for the SSIO. In order to ensure continuous space operations for the near term, it is necessary to connect systems not originally designed to operate together; and to develop and field advanced space capabilities at an unprecedented speed, Leon said.

This is driving the need for new acquisition organizations such as ***Space Rapid Capability Office*** (**Space RCO**) and ***Space Development Agency*** (**SDA**).

SSIO is chartered to integrate the disparate systems developed by SSC's *Program Executive Officers* and mission partners into a resilient and integrated warfighting enterprise that will deter competitor aggression and assure the uninterrupted delivery of all-domain combat power.

SSC's new space capabilities and systems are pivoting to architectures that are inherently resilient through proliferation and protection.

SSIO will help the Command achieve this transformation through delivery of an integrated investment strategy, an enterprise roadmap and enterprise enablers.

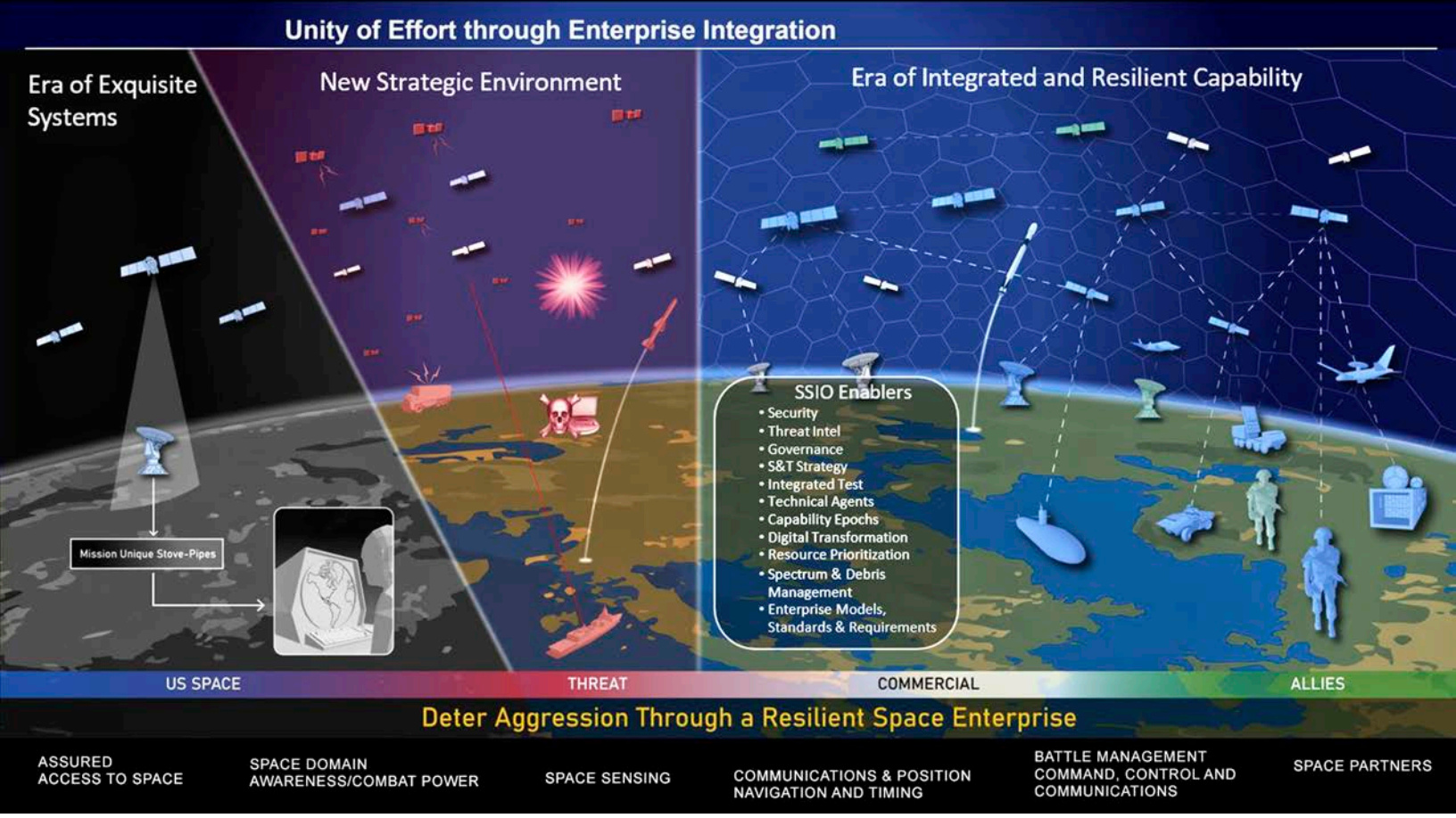
Armed with the mantra of SSC Commander, Lt. Gen. Guetlein to "*Exploit what we have; buy what we can; and build only what we must*," the SSIO is driving a great unity of effort across **SSC**, ***Space Training and Readiness Command***, ***Space Operations Command***, ***U.S. Space Command***, mission partners, industry and allies.

Previously, Leon served as the *director of Launch Enterprise* at SSC's predecessor organization, and was responsible for leading the acquisition, integration, development, production, operation and sustainment of the ***Evolved Expendable Launch Vehicle Program*** and the ***Rocket System Launch Program***.

In her new role, she is tasked with integrating the acquisition efforts of national security space programs, industry and allied partners into a resilient, U.S. space enterprise.

"*In past decades, we were designing 'exquisite' systems that were primarily in GEO (Geosynchronous Orbit) with some at MEO (Medium Earth Orbit); we thought of space as the high ground, and that we were not vulnerable*," Leon said. "*Today, there are threats to our space capabilities and we're pivoting to design systems that are inherently more resilient and less vulnerable*."

"*For example, the shift towards proliferated satellite systems in LEO (Low Earth Orbit) has numerous advantages*," Leon said. "*Satellites can be smaller and less expensive to build and launch. If a satellite in a proliferated constellation is lost, it's much easier to replenish than an 'exquisite' satellite in MEO or GEO*."



Getting important technologies into the hands of joint warfighters sooner rather than later is another priority for SSC, Leon said, using SDA's *proliferated LEO* project as an example: satellites are launched in iterations or "*tranches*" with an initial set of capabilities that can be tweaked or improved for later iterations. The enhanced designs can be delivered every two or three years instead of the decade-long refresh process of legacy systems.

"*The idea is to learn by getting capability on orbit quickly, then iterate the design as needed*," Leon said. "*In traditional programs of the past, you'd spend a couple of billion dollars, and it would end up being a 'can't fail' project with lengthy test programs, significant oversight, and investment in mission assurance. We're shifting to lower-cost proliferated constellations with initial capacity delivered faster and the opportunity to iterate to achieve increased performance*."

Operationally, proliferation provides technical redundancy, eliminating single points of failure across space, ground and user systems.

Another way to add resilience is through leveraging commercial and allied capabilities, and this is where SSC's many partnerships with commercial industry, other government agencies and allied partner capabilities come into play.

"*Some satellites are owned outright by partner countries*," Leon said. "*Other allied partners buy access to a percentage of the capability of a constellation instead of owning the actual satellites. Another model is to host U.S. payloads on allied satellites*."

"*Part of resiliency is not being dependent upon solely U.S. Space Force assets – we are assessing what additional commercial capabilities can be leveraged, what allied capabilities can be leveraged in addition to or instead of U.S. government systems*," Leon said. "*This approach adds resilience, so it becomes very difficult to deny the U.S. its mission capabilities, whether it's communications or space sensing or space domain awareness*."

> **"*We're shifting to lower-cost proliferated constellations with initial capacity delivered faster and the opportunity to iterate to achieve increased performance*."**

The SSIO also is the secretariat for the ***Program Integration Council*** (PIC), which includes ***Space Systems Command***, the ***National Reconnaissance Office***, the ***Missile Defense Agency***, the ***Air Force Rapid Capabilities Office***, ***Space RCO***, ***SDA***, and the ***Space Warfighting Analysis Center***.

"*We call it a 'coalition of the willing' – it's really to make sure that we are in sync*," Leon said. "*I can't tell our mission partners how to design their systems, and we don't control their budgets but we do discuss where we have touchpoints, and make sure we are coordinated. We meet to discuss our alignment and whether there are disconnects or assumptions requiring correction*."

"*We have many systems that were not necessarily designed to operate together that we need to knit together to be able to operate effectively. As we move forward, we plan to design systems that are inherently interoperable*," Leon said.

For example, the PIC approved integrating multiple mission partner systems' capabilities to create a federated *Command and Control* (**C2**) system approach to allow the combatant commanders to defeat critical threats; to plan coordinated space defense joint exercises; and to drive budget alignment across mission partners.

"*Our organizations are leveraging each other's strengths and capabilities*," Leon said. "*Space RCO designs prototypes to get capability into space quickly. Then the programs may transition to SSC to become Programs of Record if the capability becomes an enduring need*."

Another area of focus for SSC's SSIO is easing the burden on the space operations and warfighters.

"*One challenge of space operators is that many systems have unique, one-off ground systems*," Leon noted. SSC's ground teams are now focused on developing standards and implementing applications that can be adopted by different programs and customized as needed, Leon said. Examples include having a ground tech stack that can be adopted by multiple programs, and applications such as "*antenna-as-a-service*."

"*We're increasing commonality without requiring every program to do exactly the same thing unless there's a compelling need*," Leon said.

Efforts to adopt digital engineering across SSC face some similar challenges seen across the space enterprise — multiple programs, legacy systems and classification levels.

However, Leon said SSC is taking an evolutionary approach by embracing best practices and standards for Model Based System Engineering, looking to successful pilot programs to inform the next iteration of projects and working with SpOC and STARCOM to develop a single digital enterprise where system design, development, testing, training and operations can be seamlessly performed.

"*One goal is to transition design reviews via PowerPoint and Word documents to the use of core tools in a common digital environment to enable direct review of contractors' models and analyses*," Leon said. "*But that takes creating the digital environment, setting standards and capturing them in Request for Proposal, and bringing contractors on board. The transition requires both process and cultural changes*."

Many of the larger 'prime' defense contractors have converted to digital engineering internally, Leon said, and SSC can leverage that for its own transformation.

"*The Secretary of the Air Force has put out his operational imperative and that's driving concrete changes that will enable us to be ready in the contested environment*," Leon said. "*Space is critical to any future conflict, and we are adjusting investments and looking at key capabilities. We must pivot programs faster than ever before*."

"In order to rapidly develop the required capabilities, we identify which organization is best postured for success," Leon said. "*Sometimes Space RCO might be the acquiring organization, or SSC or SDA or the National Reconnaissance Office. We are mission focused on quickly filling gaps for the near-term fight, but the end state is a space enterprise that is integrated and resilient by design, that deters aggression and prepares our warfighters for any future conflict*."

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

Contact Space Systems Command at SSC@spaceforce.mil
Also,follow SSC on LinkedIn.

COMMAND CENTER: KEVIN STEEN

CHIEF EXECUTIVE OFFICER, ONEWEB TECHNOLOGIES

A recognized leader in the satellite industry, Mr. Steen most recently served as the Chief Executive Officer of iDirect, a market leading ground segment technology provider for commercial products and the U.S. Department of Defense. Upon stepping into the role as that firm's CEO in 2017, he oversaw the company's revenue and market share, doubling in size through organic and inorganic growth strategies.

Mr. Steen held multiple roles since joining iDirect in 2010, where he was responsible for driving the company's technology and innovation strategy. Under Steen's leadership, the company pioneered the satellite industry's first ground segment platform that supported a global network footprint, enabling the industry's transition to High Throughput Satellite (HTS) architectures and becoming the technology partner of choice for the top satellite operators and service providers.

Mr. Steen is known for his strong customer relationships, successful track record in balancing strategy against execution, and enthusiasm for developing exceptional leadership teams.

Good day, Mr. Steen. Would you please tell us what attracted you to OneWeb Technologies and what you are hoping to achieve in your role as the CEO?

Kevin Steen

OneWeb Technologies offers me a new adventure and opens the opportunity to get in at the ground level and make a real impact in a company. It is also exciting to think about the prospect to make a greater societal impact. Through our LEO connectivity approach not only can we connect the disconnected, but we also offer a positive impact to the world and future on a larger scale.

On the government side, an example might be protecting our troops and providing solutions that keep them safe. Another example is disaster recovery during a hurricane where we are enabling valuable communications for first responders, for those administering aid, or delivering food.

Or, perhaps more important to me is that we are providing a means of communicating with loved ones when you are in a location where connectivity was not previously available.

It is exciting to see how we can leverage technology to make these things possible.

What leadership experiences at ST Engineering iDirect will be of use to you in your role as the CEO of OneWeb Technologies?

Kevin Steen

My prior experience has helped me hone my leadership style overall. My approach always begins with defining a company or product's value proposition, and then working through

developing a strategy, and the corresponding execution plan, by looking at the landscape and determining options,

Your playbook should never be linear, and I've learned that strategies need to evolve and grow over time. To allow for that, you need a plan "A," "B," and "C" and to be flexible to adjust as needed — particularly if you want to grow and grow profitably. I'm also proud of the solid customer and vendor relationships I've established, and I also reflect on the experiences that building these relationships have brought. That's something I get the most out of personally, as I truly enjoy meeting customers, and working to understand and solve their problems.

It feels good to know your customers are counting on you — that means that the solution you provide is important. Finally, having built executive teams, I find it very rewarding to identify and attack problems together, and I will draw on my prior experience to do that.

Those are just some of examples of transferable skills I've gained and brought with me to OneWeb Technologies, along with prior experience within the satellite industry.

How does OneWeb Technologies differentiate itself from OneWeb?

Kevin Steen

It is important that the market understands who we are and how we are different from our parent company. OneWeb Technologies is the U.S. proxy company of OneWeb and our focus is the U.S. government. While we rely on our parent company to provide the satellites and the connectivity, we wrap our value-added services around them. We do not compete with them and are a wholly owned subsidiary of OneWeb that is governed by a separate board.

Why are LEO constellations important?

Kevin Steen

In addition to LEO's number one value proposition of low-latency connectivity, LEO constellations also enable latency-sensitive applications. Many applications today, in fact, are written assuming low latency terrestrial network connectivity.

LEO constellations enable the ability to meet that low latency requirement that GEO or MEO constellations are not able to achieve. Coverage is also important. Where GEO doesn't provide coverage far north over poles, depending on the orbital design LEO offers connectivity where historically there has not previously been the ability to connect.

LEO capacity also offers an enterprise play providing high-speed connections to corporations with critical infrastructure needs as well as to the mobile maritime or aeronautical industry, in addition to the U.S. government, which previously did not have flexible high-speed connectivity.

Finally, LEO has societal benefits including education, healthcare, telemedicine, and connecting the disconnected. For example, we recently rolled out connectivity solutions for schools, along with telemedicine in Alaska and northern Canada.

Specific to the government, we connected a military base in Greenland to support morale and welfare, providing them with access to email and the ability to leverage high speed internet connectivity to enrich their lives, which includes capabilities such as watching videos on a streaming service.

These advantages are complementary to the benefits that GEO constellations offer.

What are your thoughts on the proliferation of LEO smallsats and the concerns expressed by many in the industry regarding orbital collisions and resulting debris fields?

Kevin Steen

Interestingly, there were naysayers in the early days that said LEO constellations will "*never fly*" or make it. Now, we see two large, proliferated constellations in orbit and that's thanks to the engineers who solved incredibly complex challenges to make LEO constellations a reality.

Some people believe all LEO networks operate in the same narrow orbit that is similar to GEO; however, LEO constellations fly anywhere between 350 to 2000 km, with responsible planning that enables these constellations to coexist.

When it comes to debris fields, there are companies that see a value proposition and are coming into existence to clean up the debris. From my view, responsible planning is key and having companies participating with the bodies that regulate what is going up, enhances the process.

We are seeing approval for large quantities of satellites with governments looking to prove them out in stages. Things that are new are not always well received. So, building responsibility has its value and following what regulators say will go a long way towards enhancing safety.

As the CEO, formulating company strategies and then implementing some, they are certainly challenges of the highest order, as you well know from your past positions in the industry — how do you encourage and ensure your teams are 'in line' with your plans for OneWeb Technologies?

Kevin Steen

Communication and collaboration are key. It is important to make sure everyone is involved to provide their input at the outset, and that they are part of the framework for creating a company strategy. This includes ensuring that these same people are also included in the feedback loop of how that strategy is coming along.

There will always be lots of different perspectives involved and it is important to gain buy-in through clear communications and goal setting. Make no mistake, the communication piece takes a lot of energy, but if you don't keep it up, that's when things break down and people start to make assumptions or operate in a vacuum.

Constant communication is necessary with metrics that can be reported on regularly to be successful. The benefit is that, with the ongoing communication, adjustments can be made early and more effectively if necessary.

Given your experiences in the industry, when you review all that has been accomplished, what project(s) / mission(s) truly bring a smile of satisfaction to you?

Kevin Steen

I've personally enjoyed those projects where I've worked with customers who tried something new and were first to market. Relationships where we've been able to team up with a customer as a strategic technology partner, rather than just a vendor. There is a lot of planning and unknowns on a project like that, but it is rewarding to operate collaboratively to solve the unknowns together and adapt to any challenges along the way.

For example, while at iDirect, our customer, Inmarsat, launched their first global GEO constellation with three satellites. iDirect developed the first ground network that could support a global constellation focused on mobility. This was a first for Inmarsat and a first for iDirect.

As a partner, we worked collaboratively to solve complex problems and to deal with some of the unknowns. It felt good to be part of the team that won that contract, and part of the team that executed and delivered on what we said we would accomplish.

There is a lot of movement in the industry. What do you see as your customers biggest needs? What are they looking for?

Kevin Steen

Our customers biggest needs are secure, reliable, and resilient connectivity. In addition to the actual coverage, which is coming along quite well, the biggest gap currently are the terminals and the corresponding capabilities that customers need to meet their use cases.

Whether it is GEO or LEO, there is a need for a variety of terminals to optimize all of the different use cases out there. Whether it be a smaller and lightweight solution for a soldier carrying something in the field, versus a larger fixed solution for a base such as the one in Greenland, versus a terminal designed for mobility applications on naval vessels, or even something for aeronautical — there is a wide variety of need for terminals and there are not a lot of companies that can meet all of those needs right now. That means there is quite a bit of demand for terminals that will truly unlock the low-latency and mobile value of LEO, and at the same time make sure their network is resilient and secure.

At OneWeb Technologies, we are trying something new through LEO. We are working to meet customer demand, along with managing their expectations for an entirely new experience — their experience to date has been terrestrial or GEO. We are trying to meet that demand and deliver something that has never been done before.

There is a patience factor as with any new technology, and the industry has to make those investments and prioritize what it will bring to market when.

How do you partner with other constellations?

Kevin Steen

A front and center is the potential transaction between OneWeb and Eutelsat, which would combine LEO and GEO constellations. There is a natural complement of those two constellations blending together and they form an extremely powerful telecommunications network when you join them together as they each bring different value propositions.

For example, you can do a lot over LEO that you might not be able to do over GEO, particularly when it comes to offering connectivity over the poles, offering unmanned capabilities, or sending latency-sensitive information.

On the other hand, and when it is not latency-sensitive, or comes to sending large amounts of traffic or doing backhaul and trunking, that's where a big pipe such as GEO might come in handy.

When combined, LEO and GEO can be pretty powerful and can offer an incredible value proposition to a customer who may want both.

Government keeps looking to commercial players for solutions? How will this trend continue?

Kevin Steen

When it comes to satellite communications, the U.S. government has historically leveraged commercial technology that offers a wider variety of fantastic and innovative technologies. By partnering with the commercial market, the U.S. government also has the added benefit of gaining access to these technologies and bringing them to market faster than they can do themselves.

Leveraging commercial technologies also gives the government choices. There is a big debate around standards that enables the government to further leverage new technologies — we're seeing the government funding some of these programs to get the ball rolling. I see this trend only continuing as it offers a proven model that will continue with tremendous upside, and no downside.

Please offer our readers some prognostications as to what your company and the industry might experience during 2023?

Kevin Steen

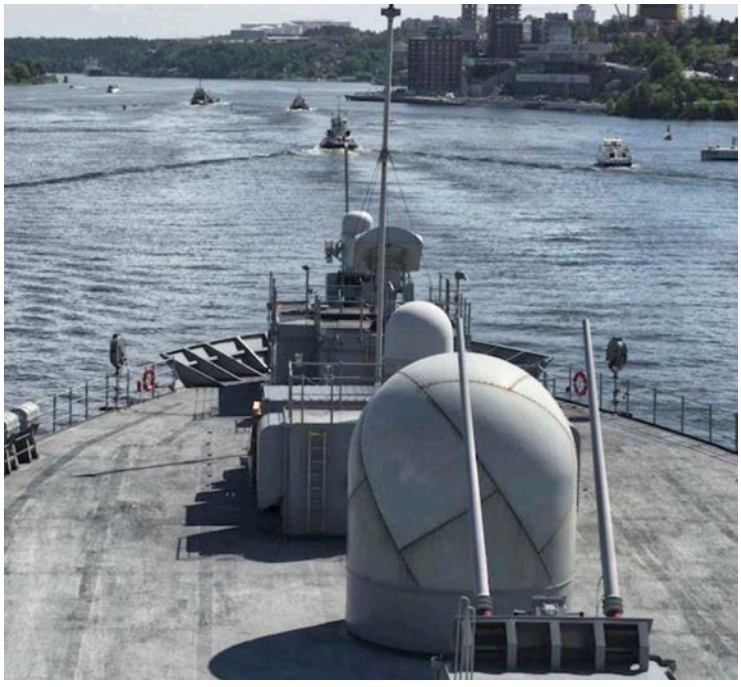
From a OneWeb perspective, you will see our global footprint continue to expand. By the end of 2023, we will have a global footprint of satellites launched and we will have full global service availability expected by the first quarter 2024.

We will have additional backup satellites in orbit to proactively be prepared for potential issues and we will expand our offerings as we deliver full global service availability. Specifically, we will begin to leverage that global footprint by expanding our secure interconnects for the U.S. government, along with continued government collaboration on secure and resilient connectivity solutions.

You will see the roadmap for OneWeb's next generation constellation become more refined and we will introduce incredible new solutions and offerings for OneWeb Technologies' customers.

As we achieve these milestones, company revenue will continue on its trajectory — the proposed merger with Eutelsat will — for the first time — combine GEO and LEO services. I'm incredibly excited for that to occur!

For the industry, we will see a continued adoption of LEO capacity in addition to hybrid networks, where terrestrial networks combine with satellite-based networks. I'm looking forward to seeing those use cases roll out including global mobility applications, IoT applications, unmanned vehicles, UAVs, logistics industries, and support for mission-critical capabilities for real-time latency sensitive applications. We'll see adoption grow for both commercial and government applications.



Finally, similar to when *"over the top"* first came out and there were large amounts of bandwidth that we didn't seem to know what to do with, there will be an application boom in the satellite industry. We're going to see incredible adoption as the coverage and capabilities expand and we currently can't even imagine what those applications will be.

Mr. Steen, what are some of the challenges that are ahead of the industry?

Kevin Steen

The beauty of the industry is that there are always opportunities to solve problems. One challenge I see shaping up, however, is the geopolitical landscape and whether companies will invest to support their local governments from a geopolitical perspective, or, will they support their commercial activities to expand infrastructure and grow the respective economies.

Another challenge I anticipate is relative to the pace that we can bring user terminals to market to capitalize on the opportunities that LEO technologies bring. Is there enough investment out there and are companies ready to invest in LEO oriented solutions?

Finally, relative to constellations such as Starlink and Kuiper, where they are closed and 100 percent proprietary, will the market readily adopt those? OneWeb Technologies' model is one where we work with an ecosystem of players and are much more open with a focus on finding the right solutions to meet our customer's needs by working collaboratively with partners. Will the market readily adopt the closed proprietary systems or prefer more of the open partnership approach?

To summarize, some of the bigger challenges that I foresee are the geopolitical landscape, the pace of investment, the pace of innovation, and prioritizing what applications to support and when. The challenge will not be *"are there opportunities created by LEO technologies"* but rather, "*which opportunities to prioritize based on the demand generated by LEO technologies*."

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