

Next Generation Space Defense

MILSATMAGAZINE

March 2025



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Curt Blake, Senior Columnist

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Rick Lober, Senior Columnist

CONTRIBUTORS

Dr. Kateryna Sergieieva

Brad Smith

Simon Swift

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DISPATCHES



USSF selects L3Harris to continue modernization of the ATLAS Space Domain Awareness program

L3Harris Technologies (NYSE: LHX) has received a \$90 million follow-on, sole-source contract from U.S. Space Force Space Systems Command to further advance the nation's Space Domain Awareness (SDA), a top Department of Defense priority.

The USSF selected the company to develop, integrate and deliver a package of astrometric tools that will increase the capability of the **Advanced Tracking and Launch Analysis System (ATLAS)**, which integrates all SDA, space **command and control (C2)**, intelligence, operational and system readiness-relevant data to help drive course-of-action development and decisions.

This new continuation contract will modernize C2 by increasing the speed, accuracy and relevancy in tracking satellites and space debris.

The ATLAS modernization will improve the Space Force's ability to avoid operational surprise and ensure warfighters can quickly and accurately respond to emerging anti-satellite threats.

For more than 30 years, L3Harris has provided mission-proven solutions for the nation's space superiority mission to protect assets and increase warfighter readiness.

"We recognize Space Domain Awareness is critical to the Space Force and is essential to defending vital national interests," said Ed Zoiss, President, Space and Airborne Systems, L3Harris. "Our work on the ATLAS program will enhance space operations and will help prevent adversaries from disrupting, degrading and destroying U.S. space capabilities."



DISPATCHES

LOCKHEED MARTIN 



Lockheed Martin: Securing America's Southern Border

Lockheed Martin (NYSE: LMT) has successfully integrated its AN/TPQ-53 multi-mission radar (MMR) with the [Joint Task Force – Southern Border \(JTF-SB\) command and control systems in an operational environment, supporting U.S. Northern Command's \(USNORTHCOM\) southern border mission.](#)

The AN/TPQ-53 MMR's open architecture design allows seamless integration with a variety of sensors and systems, providing a unified operational picture. This flexibility enables the system to quickly incorporate new capabilities and cutting-edge software, ensuring service members have the necessary tools to respond to emerging threats before they can adapt.

*"The successful integration of the AN/TPQ-53 MMR in the southern border deployment showcases the power of collaboration between industry, government agencies such as the Department of Defense's Chief Digital and Artificial Intelligence Office and end-users in addressing complex challenges," said **Rick Cordaro**, Lockheed Martin's vice president and general manager of Radar Sensors and*

Systems.

"The AN/TPQ-53 MMR's proven performance and reliability have earned it a reputation as a trusted asset, and its open architecture design ensures it will remain a vital component of USNORTHCOM's mission to actively work with Customs and Border Protection to secure the southern border," Cordaro continued.

The USNORTHCOM southern border mission demands the capability to detect and track various threats, ranging from airborne to ground-based threats. The AN/TPQ-53 MMR is built to address this demand, offering agile and precise 360-degree scanning that can be deployed in under five minutes. The system identifies rapid threats, such as unmanned aerial systems, enabling service members to swiftly detect and respond with agility.

This integration with the JTF-SB follows recent demonstrations Northern Strike and Desert Guardian 1.0 highlighting AN/TPQ-53's ability to quickly adopt software updates and meet urgent national security priorities.

www.lockheedmartin.com/en-us/capabilities/radar-sensors.html

DISPATCHES



Teledyne delivers 100th infrared detector for the SDA's Tracking Layer

Teledyne Technologies Incorporated (NYSE:TDY) earlier this month announced the company's on-time and early deliveries for the **Space Development Agency's (SDA)** proliferated constellation with the delivery of the 100th large format focal plane module, counting deliveries from the **Tranche 0, Tranche 1, and now Tranche 2 tracking layers.**

Mission Sensors: The global tracking layer relies on infrared payloads to analyze threats from orbit. Teledyne's configurable manufacturing line delivers radiation-hardened, high-sensitivity sensors to meet threat detection requirements. These multi-megapixel resolution arrays significantly improve threat detection accuracy, and form part of the fire control countermeasures system against hypersonic weapons.

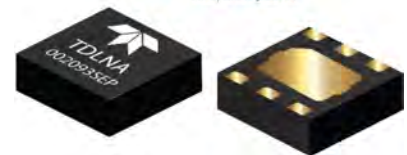
Proven Expertise: Teledyne's track record includes delivering space-grade focal plane arrays for prestigious instruments such as the **James Webb Space Telescope**, The **European Space Agency's Euclid** dark matter telescope, and the **Nancy Grace Roman** space telescope. Defense related deliveries, though often classified, encompass over a dozen successful missions. In addition to focal plane arrays, Teledyne will supply electronics and other components for the **Proliferated Warfighter Space Architecture (PWSA)** campaign.

Meeting space imaging needs across the spectrum:

Counting infrared as well as visible CMOS and CCD sensors sourced from Teledyne's

DALSA and **e2v** businesses, the

corporation has supported more than 260 total space missions, while close coordination across the global enterprise enables Teledyne to service emerging space imaging needs worldwide.



A new paradigm for the space focal plane industry:

"Five years ago, no one thought the focal plane technology could keep up with SDA's aggressive schedule, but our team innovated ways to meet the new paradigm," said Megan Tremer, President of the Space Imaging business. "As more proliferated constellations enter the planning and acquisition phases, Teledyne remains focused on scaling operations to maximize capacity, yield, and performance. Our proven track record and dedication to performance position us as the ideal partner for these critical missions."



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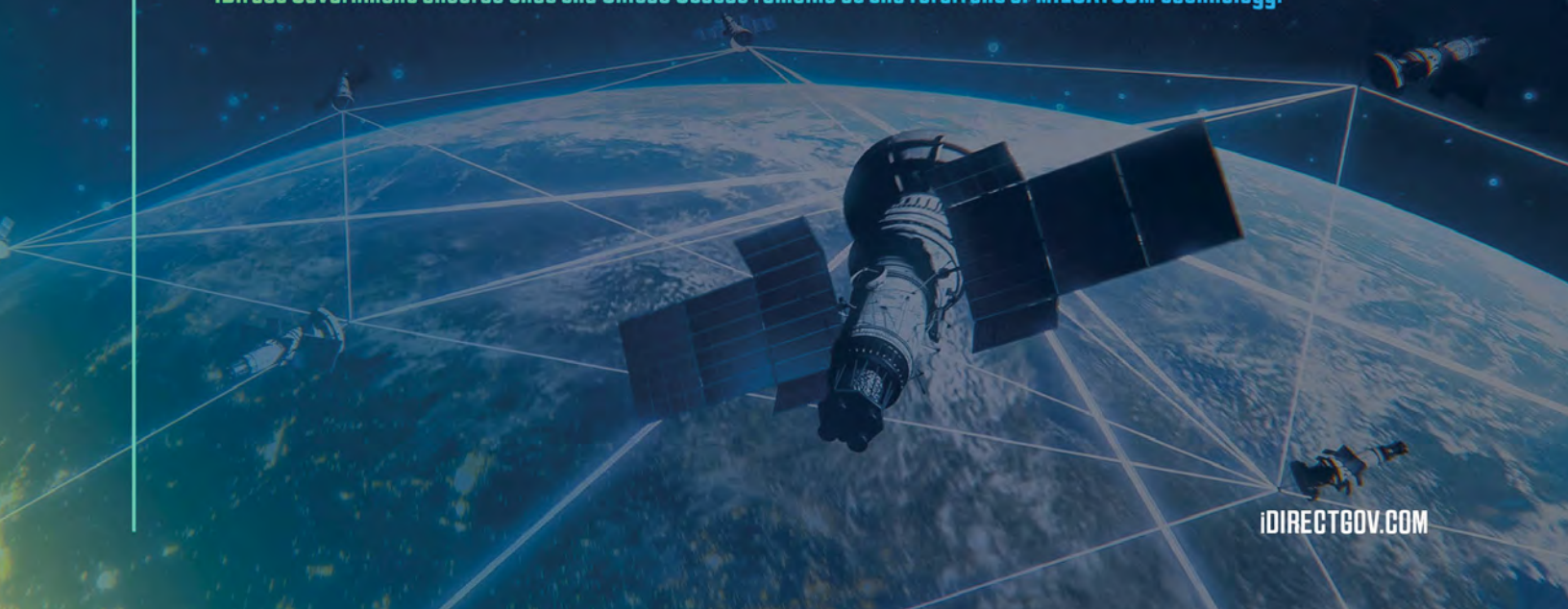
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DISPATCHES



U.S. Space Forces - Korea stands up 1st forward operating CJSpOC in support of FS 2025

Above: A combined assault force of U.S. and Republic of Korea (ROK) special operations personnel conduct a direct action raid on a time sensitive target in an underground facility during a multi-day training event associated with exercise Freedom Shield 25 at a training site located east of Seoul earlier this month. The training event served as a capstone to two-weeks of various training that maintained the combined readiness and lethality of U.S. and ROK special operators. The routine training enables a peaceful and stable Indo-Pacific region through a strong deterrent force. (U.S. Army photo by Sgt. Taylor Zacherl)

U.S. Space Forces - Korea established its first forward operating Combined Joint Space Operations Center (CJSpOC) earlier this month, supporting exercise Freedom Shield 2025 and phase two of POLARIS HAMMER - KOREA.

Within the exercise environment, the CJSpOC facilitated the



operational command and control of combined space forces in the Korean theater to achieve the combined forces commander's objectives. It operated around-the-clock, enabling SPACEFOR-KOR,

along with Space Operators from the Republic of Korea and additional partner nations, to continuously coordinate, plan, integrate, synchronize and execute space operations, providing tailored space effects on demand.



This milestone marks the first time a CJSpOC has been rapidly stood up with forces deployed directly to support a combined exercise, enhancing real-time space domain awareness and operational support, and it was accomplished through a mix of commercial and defense technology, demonstrating how the commercial space sector's innovative capabilities provide pathways to enhance the resilience of Department of Defense space capabilities and strengthen deterrence.

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Meanwhile, the [U.S. Space Force Space Systems Command](#), based in Los Angeles, employed its *Tactical Surveillance, Reconnaissance and Tracking Program* (TacSRT) cell, using space assets to conduct ground reconnaissance and gather imagery.



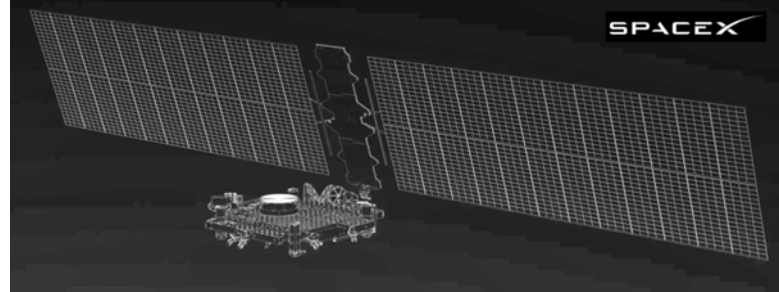
The TacSRT team provided warfighters with on-demand access to synthesized, publicly available information. Further bolstering CJSpOC's capabilities, the [109th Hawaii Air National Guard](#) contributed their space electronic support systems, *Night Owl Lite*, a geolocation system for signals intelligence, and *Beast+*, a system designed for analyzing jamming activities.

However, commercial capabilities do not replace classified military intelligence and space operations; instead they serve as an additional tool for **SPACEFOR-KOR**. Through these partnerships, SPACEFOR-KOR enhances its ability to protect and defend the space domain while maintaining space superiority alongside allies and partners.



FS25 is an annual exercise that aims to enhance the combined, joint, all-domain and interagency operating environment, thereby strengthening the alliance's response capabilities. It is a defense-oriented exercise featuring live, virtual and field-based training that engages alliance forces and governmental agencies.

The CJSpOC integrated five capabilities coming together in time and space to include a [SpaceX Starshield terminal](#), *Joint Commercial Operations Cell*, *Tactical Surveillance, Reconnaissance and Tracking Cell*, *Night Owl Lite* and *Beast+*. These capabilities, along with other USSF and multinational partner commercial assets, supported FS25 globally.



Provided by [U.S. Pacific Fleet Command](#), a Starshield terminal, a larger version of Starlink and tailored for government use, delivered commercial internet via satellite broadband. This capability proved essential for the CJSpOC, whose multinational Joint Task Force-Space Defense Commercial Operations cell included participants from Australia, New Zealand, Germany, and the Republic of Korea, with additional teams operating globally.

Leveraging commercial ground assets, these teams focused on tracking space objects and providing early warnings of potential adversary actions in space, aligning with the DoD's efforts to drive more effective integration of commercial space solutions into national security space architectures.

Everything is non-classified as we are using commercial internet to connect with commercial providers to provide products that we can then use for warfighter needs," said **Col. John Patrick, SPACEFOR-KOR commander**. *"By leveraging commercial we're able to double, triple or even quadruple the number of space sensors, satellites, people and overall data we have at our disposal and pivot to new technologies in months and days versus years and tens of years."*



Photo of the United States Pacific Fleet



DISPATCHES



U.S. Air Force to evaluate Northrop Grumman's InSight™ in support of the DAF Battle Network

Northrop Grumman Corporation (NYSE: NOC) was awarded a follow-on contract to help the U.S. Air Force connect airborne platforms with faster, secure communications solutions.

Northrop Grumman will deliver **NG InSight™**, a software-programmable, open systems compliant processor designed to keep warfighters connected and adaptable in rapidly changing mission environments.

Under this contract, the U.S. Air Force will continue to test and evaluate NG InSight™ capabilities for potentially supporting the future of the **DAF Battle Network**, the Department of the Air Force's contribution to the Department of Defense's *Combined Joint All-Domain Command and Control* initiative. As a part of the contract award, Northrop Grumman will:

- *Demonstrate how the NG InSight™ open architecture processor allows the integration of third-party technologies, ensuring future growth, sustainability and adaptability.*

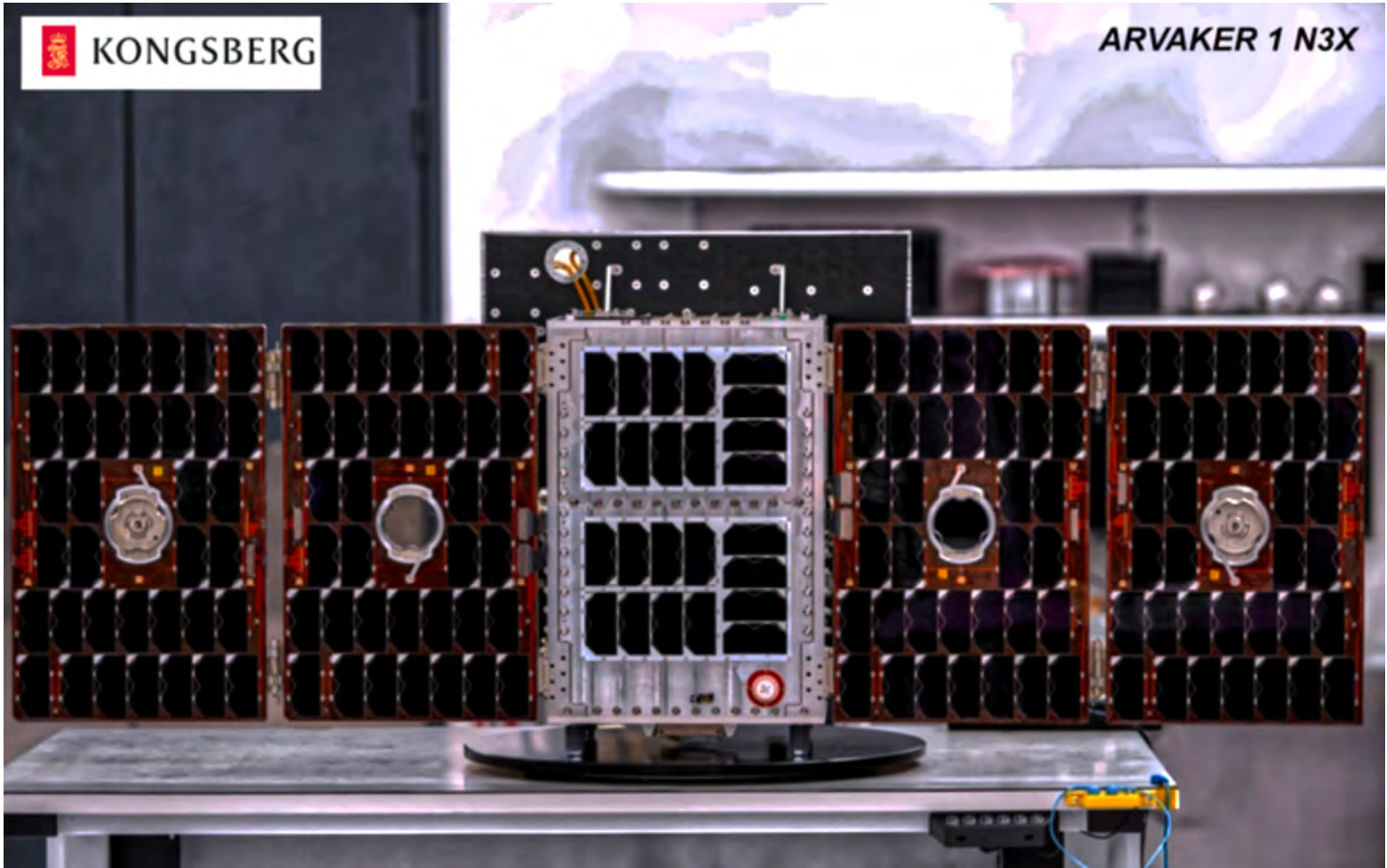
- *Provide engineering support to connect the system to existing U.S. Air Force communications networks, ensuring feasibility, functionality and compatibility to enable timely data-sharing across domains.*

Northrop Grumman was previously awarded a Software Programmable Open Systems Compliant (SPOC) contract and demonstrated the capability in a flight test, which connected with a ground station in a live, over-the-air test using advanced waveforms.

This new award marks the next step in delivering an ecosystem that integrates advanced networking and communications, cybersecurity and reconfigurability to enable a connected battlespace.

NG InSight™ offers a range of innovative, scalable and adaptable connectivity and processing solutions tailored to meet any mission environment's demands. Learn more about the NG InSight™ ecosystem [at this direct infolink.](#)

DISPATCHES



KONGSBERG Defence & Aerospace launches and is now operating their 1st satellite

Kongsberg Defence & Aerospace (KONGSBERG) has entered the space industry as a satellite operator and service provider after the company launched their first microsatellite from California. The satellite, named ARVAKER 1 N3X, was launched from the Vandenberg Space Force Base in California as part of the SpaceX Transporter 13 launch service.

In 2024, KONGSBERG was awarded a contract from the [Norwegian Armed Forces](#) on behalf of the Norwegian government to provide maritime surveillance data to cover Norwegian Areas of Interest. As part of the five-year contract, KONGSBERG will launch three satellites.

The data will be used by the Norwegian Armed Forces, as well as other Norwegian government institutions involved in maritime security such as the Coastal Administration, the Directorate of Fisheries, and the Norwegian Customs.

The MP42H satellites are produced by [Kongsberg NanoAvionics](#) and equipped with [Automatic Identification System \(AIS\)](#) receivers and detector systems, delivered by [Kongsberg Discover](#). It includes a navigation radar detector developed by the [Norwegian Defence Research Establishment](#) (FFI). Kongsberg NanoAvionics has manufactured and launched 40 satellites to date.

The satellites are operated by [Kongsberg Satellite Services \(KSAT\)](#), which will use their international network of downloading stations to provide high frequency and low latency surveillance data for both the Norwegian Government as well as international customers.

“KONGSBERG has been active in the space segment for decades, delivering high-end technology and solutions, but this successful launch marks a milestone for us as we will own and operate the satellites for the first time,” said Eirik Lie, President of Kongsberg Defence & Aerospace.

DISPATCHES

Ovzon



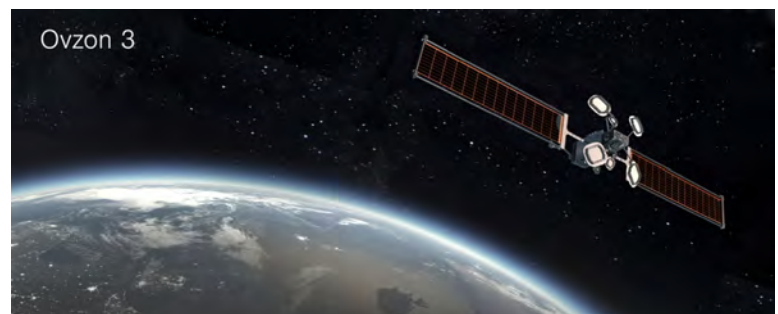
Ovzon's "High North Expedition" validates ability to meet NATO's Arctic requirements

Ovzon recently completed an overland expedition to the High North, successfully validating the performance, mobility, and resiliency of the Ovzon 3 satellite and the Ovzon T6 and Ovzon T7 mobile satellite terminals in demanding conditions more than 480km (300 miles) inside the Arctic Circle.

Ovzon demonstrated the ability of the Ovzon 3 satellite's On-Board-Processor to provide very low-latency, direct remote control of unmanned platforms 145 km inside the Arctic Circle. The High North Expedition was an attempt to push the envelope and test Ovzon's integrated satellite communication system all the way to the cliffs above the Barents Sea.

The Ovzon team was joined by representatives of four NATO countries with an interest in the High North to observe and conduct

independent testing of the performance of the Ovzon 3 satellite. The multi-day expedition entailed stops at each degree of latitude to collect test data for Ovzon's mobile satellite terminals, the Ovzon T6 and the Ovzon T7. Testing was also conducted on the unique features that the Ovzon On-Board-Processor offers, included in the Ovzon Orion SATCOM-as-a-service.



DISA DOC: LEVERAGING AI TO KEEP PACE WITH EVOLVING THREATS & EMPOWER WARFIGHTERS

Author: Marco A. Vilasana Jr., DISA Strategic Communications and Public Affairs

In an era of increasingly sophisticated cyberattacks and an overwhelming volume of data, the Defense Information Systems Agency (DISA) is harnessing the power of artificial intelligence (AI) to bolster national security and support the Warfighter, DISA Chief Engineer **Deepak Seth** said at the [2025 GovCIO Defense IT Summit](#).



Seth emphasized DISA's commitment to staying ahead of the curve with respect to AI, particularly in the face of emerging threats and the need to process vast amounts of data.

"When it comes to AI, we're operating in a rapidly evolving landscape," Seth said. "We're seeing an uptick in use cases. A day doesn't go by where we hear about new large language models and advancements in generative AI."

Seth acknowledged the potential of **LLMs (Large Language Models)**, which are trained on massive datasets to generate human-like text and provide information. However, he also highlighted the importance of tailoring these models to meet the specific needs of the [United States Department of Defense \(DoD\)](#).

"What we've noticed is that responses from these large language models and the output of these large language models

sometimes lacks organization-specific context, or at times, they provide answers that are incorrect, a term that's referred to as hallucinations," Seth said.

To address these challenges, DISA is exploring innovative techniques, such as [Retrieval Augmented Generation](#) using vector databases, to ground LLM responses in accurate and relevant organizational knowledge sourced from authoritative datasets.

"The secret sauce here is, how do you have these large language models work on your information?" Seth said.

This approach, he explained, will enhance the accuracy of AI-generated insights as well as empower the workforce by freeing them from valuable time spent searching for information to get the job done. Seth also highlighted the critical role AI plays in cybersecurity, an area where the DOD faces increasingly sophisticated threats.

"The barrier to entry to launch a sophisticated attack has been dramatically lowered with AI," Seth said. "So, how do we keep up with all this? It's a cat and mouse game keeping up with adversaries who are constantly evolving and adapting their tactics to stay ahead of defenses."

The answer, according to Seth, lies in feeding AI models with high-quality, current and relevant data. Data plays a pivotal role.

"It's not just the quantity of data, it's also the quality," he emphasized. "Garbage in, garbage out, so data becomes key."

By equipping AI models with the right data, DISA aims to enhance threat detection, improve response times and ultimately strengthen the nation's cyber defenses.



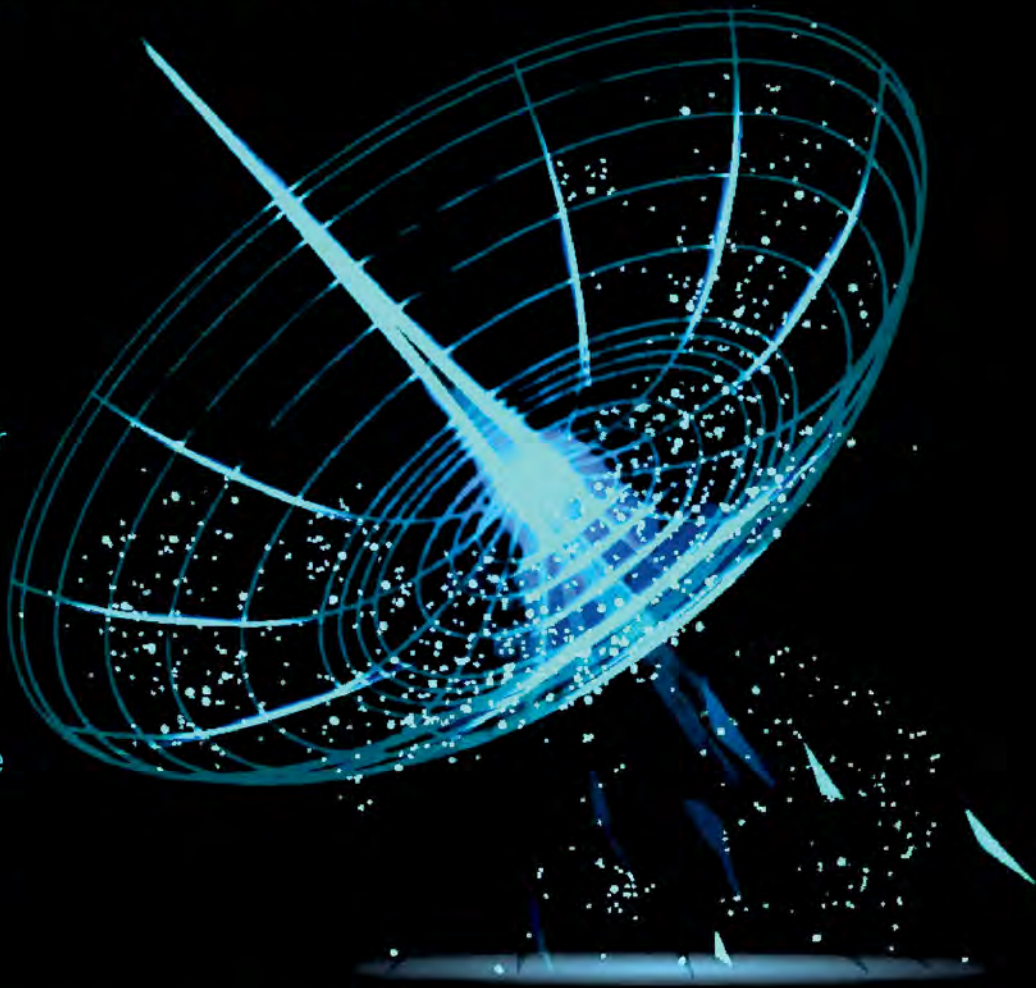
DISA Chief Engineer Deepak Seth speaks at the 2025 GovCIO Defense IT Summit. (Photo courtesy of GovCIO)

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NAVAL POSTGRADUATE SCHOOL'S LATEST CUBESAT LAUNCH FURTHERS INT'L COLLABORATION IN SPACE



NAVAL POSTGRADUATE SCHOOL

Author: Matthew Schehl, Naval Postgraduate School of University Communications



Earlier this year, the **National Reconnaissance Office (NRO)**—in

partnership with the **Naval Postgraduate School (NPS)** and the **New Zealand military's Defence Science & Technology (DST) unit**—launched **Otter**, an NPS CubeSat suite aboard the **SpaceX's Falcon 9 Transporter-12 rocket** from **Space Launch Complex-4E Vandenberg Space Force Base in California**.



Otter's mission: to explore new technological developments and experimental concepts to operate in an increasingly complex space environment.



The Otter launch occurred at a time of an upswing in space technology investment, particularly in the commercial sector. As NPS leans in on partnering with commercial entities in all **Naval Science and Technology Focus Areas**, the Otter spacecraft is a prime example of the benefits to its students from these relationships, noted **Dr. Wenschel Lan**,

interim chair of **NPS' Space Systems Academic Group (SSAG)**, an interdisciplinary academic association serving as the focal point for space-related research at the university.

"In working with our commercial vendors, we have lessons learned that we continue to share with our students—from acquisitions, to spacecraft integration and testing, and spacecraft operations—that are relevant and representative of both the successes and challenges for the aerospace industry," Dr. Lan said. "In gaining first-hand knowledge and experience with a space mission life cycle through these types of opportunities at NPS, our students are better prepared to serve as Space professionals in the Navy, throughout the DOD, and beyond."

Two hours after the rocket's successful launch and Otter's separation, Dr. Lan and her team were huddled in NPS' **Space Operations Center (SOC)**, the university's heart for interacting with space assets.





Launch photo of the SpaceX Falcon 9 Transporter-12 mission, courtesy of the company.

As the satellite arced across Canada into the Northern Pacific 515 km above the earth, the team prepared to make first contact.

“We’re tracking!” exclaimed **Alex Savattonne**, SSAG faculty associate for research involved with the daily management of the CubeSat missions, as the satellite’s beacon came into focus.



NPS students watching the Otter launch, photo courtesy of NPS.

Word reached the office of then 78th Secretary of the Navy, **Carlos Del Toro**, himself an '89 NPS alumnus with a master’s in **Space Systems Engineering**, who offered his congratulations.

“Well done to the NPS student-faculty team and all the partners involved,” Secretary Del Toro said. “The strength of NPS’ innovative space education program is a force multiplier, impacting critical talent development needs and shaping future technology concepts.”

Several days later, the Otter team tracked down the orbit plane, transmitted several commands and the data began streaming to the NPS SOC: good status was confirmed.

While NPS is known for having the most alumni of any graduate school becoming astronauts, NPS also has a strong history in developing standardized and modular nanosatellites, such as CubeSats, which have many benefits over costly traditional satellites.

Beginning with the **NPS Petite Amateur Navy Satellite (PANSAT)** launched into **Low Earth Orbit (LEO)** in 1998 aboard the shuttle *Discovery*, the NPS program evolved into CubeSat designs and launchers, now commonly used by commercial providers. Made up of 10 cm x 10 cm x 10 cm cubes called **units (U)**, CubeSats are relatively inexpensive to design, develop and deploy payloads into orbit and are ideal for applied education and research.

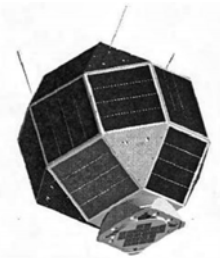


Illustration of the NPS PANSAT.

Otter is a 6U CubeSat built and operated by NPS on behalf of NRO. The smallsat’s primary payload, **Tui**, is a **DST**-built risk reduction platform for space-based maritime domain awareness capabilities

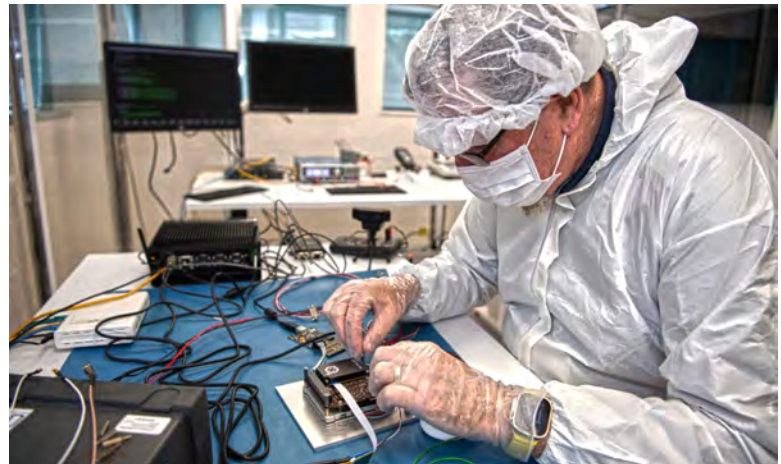
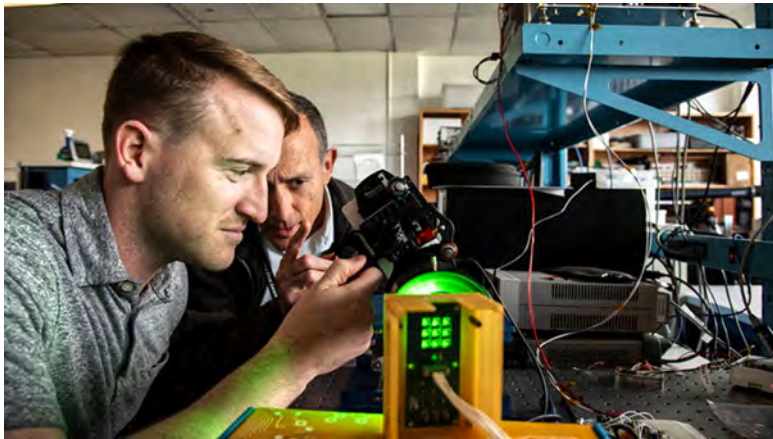


Photo of the made-in New Zealand Tui payload at the **DST Space Lab** in Auckland.

Two secondary payloads built by NPS, an X-band transmitter and an **LED on-orbit payload (LOOP)**, will help to develop and evaluate communication technologies and concepts of operations on future CubeSat missions.

“The NRO is always looking for innovative ways to advance our capabilities in space,” said **Dr. Aaron Weiner**, director of the NRO’s **Advanced Systems & Technology Directorate**. “This demonstrator, developed in coordination with academia and an international ally, showcases the value in rapidly qualifying low-cost, commercial off-the-shelf hardware.”



U.S. Marine Corps Capt. Alex Warren, a Space Systems Operations and Physics student at NPS, and Dr. James Newman, currently serving as NPS Acting Provost, prepare the LED on-orbit payload (LOOP) instrument for optical communication studies aboard the earlier-launched Mola CubeSat. (U.S. Navy photo by Javier Chagoya)

Otter is the second collaborative CubeSat mission run together with NRO and DST. The first, named *Mola*, launched in March of 2024 with Tui's predecessor, *Korimako*.

Two NPS-built payloads are also manifested on Otter—an X-band transmitter and the next iteration of LOOP to continue experimenting with line-of-sight communications by using two banks of LEDs, transmitting in green and near-infrared wavelengths, that are capable of modulating light for basic messaging.

More than 20 NPS students will have directly contributed to the Mola and Otter CubeSats as part of their master's and Ph.D. research.

Both CubeSat missions are directly supported by the NPS maintained and operated **Mobile CubeSat Command and Control (MC3)** network, a **Department of Defense (DoD)**-sponsored effort that began in 2011 at NPS. Since then, SSAG has cultivated partnerships with nine other tracking facilities nationwide, including three other DoD service universities, civilian institutions, industry partners, and governmental agencies. These all work together within a distributed operations network that shares tracking responsibilities via parallel ground stations.

Tui very much fits into this, according to Dr. Lan. The highly collaborative mission will provide space-based maritime awareness as well as serve as a pathfinder for policy development.

"The capability that we're developing is to add sensors in the space layer to be able to see what's going on in the water," she said. "It's not just a camera, but a lot of different phenomenologies that you can sense from space to then help paint the picture of what's going on."

The project also represents a risk reduction effort in the sense that it utilizes low-cost, off-the-shelf current technologies to explore the art of the possible.

"We're spending a small amount of money to buy down the risks so that when they actually do a full program of record, they're not going into it blind," Dr. Lan said.

The NPS-built payloads, the X-band transmitter and LOOP projects, also employ the latest in rapidly developing commercial technology. The X-band transmitter, operating in the microwave radio region of the electromagnetic spectrum, is ideal for space communications optimized for data-intensive payloads.

The LOOP project utilizes a ground-based optical telescope to observe the LEDs on the CubeSat to evaluate how to track objects in **Low Earth Orbit (LEO)**. Otter is a significant step forward toward the future goal of high-rate optical communications using the MC3 network.

Post-launch, Otter's operations are undertaken by NPS faculty and students.

"Our operations have changed since the launch of Mola," said Savattonne. "During initial commissioning, our team manually ran each pass opportunity to check the satellite's health and troubleshoot as needed. Currently, operations are predominantly automated. Mola is provided with a schedule for executing specific sequences, such as a telemetry downlink to one of the ground stations. Today's daily operations primarily involve monitoring the health of the entire system, including ground stations, cloud resources, and satellites."

Otter also builds on lessons learned from the Mola mission, he said. "One significant lesson learned is the critical importance of having comprehensive knowledge of all subsystems. Since we procured the satellite buses from a commercial vendor instead of constructing the entire satellite ourselves, it took our team some time to understand the complexities of each system. Mola facilitated our learning process regarding the efficient operation of Otter and served as a pathfinder for streamlining our flight operations."

"The Otter mission was a success not only in its launch, but also in the opportunities it afforded the NPS students who worked on it," said **Dr. Giovanni Minelli**, SSAG research associate professor and co-principal investigator for its CubeSat program along with Dr. Lan.

"Most importantly, it serves as a means of providing hands-on experience with the design, test, launch and operation of a real spacecraft to complement the theoretical coursework offered to our students," he said. "We believe practically applying lessons learned in the classroom helps cement understanding of difficult concepts and better prepares our warrior scholars for leveraging space to advance our military's priorities after graduation."

“Furthermore,” Dr. Minelli said, “the CubeSat program grants students the chance to advance technologies jointly developed by international government research institutions. The students get to be involved in a mission with real stakeholders, requiring the successful operation of the spacecraft, its payloads, and the supporting ground infrastructure to collect and disseminate experimental test results to our strategic partners. An ideal training opportunity, this ‘rubber meets the road’ process is also used for the high-value operational missions our students will work on throughout their careers.”

The LOOP project is a prime exemplar of this, with both iterations spanning the Mola and Otter missions.

LOOP was originally developed for Mola by **Marine Corps Maj. Dillon Pierce** to address a gap in the payload manifest as part of his doctoral research at NPS. Using his education from NPS as a Space Operations Masters student, he quickly designed, built, and tested a flight-ready payload. The Marine Corps infantry officer is on track to earn his doctorate this June. His work, sponsored by the **Marine Corps Warfighting Laboratory**, aims to fill critical operational capability and capacity gaps, with significant anticipated impacts on future military operations.

“What I truly fell in love with was the hands-on aspect of the applied research within the SSAG,” Maj. Pierce said. “Coming into the lab and being able to apply theory to real-world capabilities, such as building rockets and CubeSat payloads, is fascinating. It provided me with a deep understanding of the technical concepts learned in the classroom and demonstrated how to apply those concepts to address the operational challenges facing the military today.”

Maj. Pierce was delighted to see the LOOP project evolve with a second iteration for the Otter mission, which he passed on to **Dr. James Newman**, NPS acting provost, SSAG professor and former Space Shuttle astronaut, who was able to upgrade its capabilities to include InfraRed LEDs and higher data rates.

Work on LOOP was also carried out by **Navy Lt. Charles “Chuck” Bibbs** for his master’s degree in Space Systems Operations. Lt. Bibbs, currently attached to **Naval Special Warfare Basic Training Command (NSWBTC)**, is a SEAL phase officer at **Basic Underwater Demolition/SEAL (BUD/S)** training in Coronado, California.

Lt. Bibbs was specifically involved with the planning, preparation and execution of environmental testing for LOOP, including thermal vacuum and vibration testing, as well as the integration of the total Otter payload.

“This experience gave me an appreciation for the entire lifecycle of a payload,” said Bibbs. “Upon joining the team, I was introduced to the

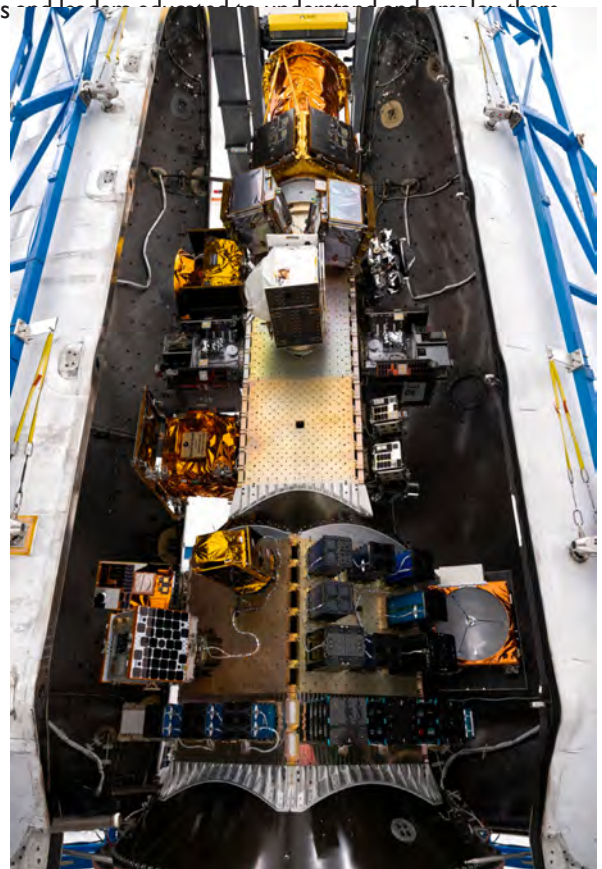
remarkable collaborative effort that brought this particular payload to life, and I gained a clear understanding of where my contributions fit within that timeline. It was fascinating to see how NPS works with other countries and commercial entities to drive innovation for defense purposes.”

Lt. Bibbs also commended the SSAG faculty’s excellent alignment of the department’s research efforts with course objectives. His work on Otter was conducted as course projects for the **AE483 I Spacecraft Systems II** curriculum in the M.S. Space Systems Operations program.

“This experience was formative because, like the military as a whole, I have a significant interest in space and would like to involve myself in those efforts in the near future,” he continued. “Additionally, by working on this project I better understand the nuances of requirements, procurements, and fielding large-scale projects. This experience provided skills that will assist me in a wide-range of military duties that do not necessarily have to be space-related.”

Maj. Pierce and Lt. Bibbs’ observations cut to the heart of NPS’ mission: to provide defense-focused graduate education, including classified studies and interdisciplinary research, to advance the operational effectiveness, technological leadership and warfighting advantage of the Naval service.

As a naval command with a graduate university mission, NPS uniquely synchronizes mid-career student operational experience and education with applied research and faculty expertise to deliver innovative warfighting solutions



The NPS Otter positioned in the Falcon 9 fairing.

THE ROLE OF COMMUNICATIONS IN THE FUTURE BATTLEFIELD



Author: Christian Rex-Nielsen, Head of Defense Programs, Quadsat



The modern battlefield today is quite different than the battlefield of a few years ago. Military forces are working to quickly adjust to the new environment as they catch-up with an evolving and highly crucial environment.

We are witnessing a growing need for everyone to be able to talk to each other on the battlefield at the same time. However, while ensuring effective and seamless communications remains important, it is vital that troops remain undetectable.

How the military achieves that will likely change over the coming months. Simultaneously, we will see industry and innovation playing an increasing role in influencing and changing the way troops communicate as well as the actual course of warfare.

RE-IMAGINING BATTLEFIELD COMMUNICATIONS

We have learned from recent warfare situations that the planning of entire battlefield operations from a comfortable building before combat is initiated is no longer possible. Plans need to be made with urgency, in minimal timeframes and, more often than not, during the battle itself. This means that one of the most important factors for modern warfare is the ability to disseminate orders across the battlefield in realtime.

Ensuring effective electronic defense means ensuring spectrum is hidden and protected, while enabling unrestricted access for troops on the ground and back at home. Current methods involve a highly-staffed group of communications vehicles to communicate and disseminate any communications from behind the lines to the troops.

This is not an efficient use of resources, as these personnel could be better deployed elsewhere and the need for expensive equipment to be constantly maintained. Over the coming months we will see an emphasis from military operations to re-imagining battlefield communications to make them more effective, while ensuring they remain undetectable

There are really only two possible options in the foreseeable future when it comes to new ways to approach this challenge, each of the options bringing upsides as well as downsides:

1. Closed loop 5G networks

I could see a scenario where the military steps away from its reliance on SATCOM and instead relies on closed loop 5G networks. 5G enables highly secure communications, making it possible for troops to stay in touch without those discussions being intercepted.

However, 5G has some major disadvantages that might rule that technology out of the mix. One of the most significant warfare scenarios is that 5G is easily detectable with a spectrum analyzer. If all of the 5G connections are live at the same time, and given that battlefield formations follow specific patterns, it will be far too easy for an enemy to create a detailed map of exact locations of an entire troop using the 5G information.

The other downside of a closed loop 5G network is that it doesn't allow the communications to return to behind the lines, leaving troops operating blind or still needing another way to communicate to base.

2. Phased Array Antennas

Given the downsides of 5G and the ease of detection, I think it is highly likely that we will see phased array antennas being installed as an alternative literally on every military vehicle. It is becoming easier than ever to obtain cost-effective phased array antennas and connect to a Low Earth Orbit network.

As the beam goes upward and the side lobes can, in theory, be hidden, they can then become undetectable with spectrum analyzers, making these antennas an interesting alternative, both for communication back to headquarters and between all of the troops on the ground.

However, they are not without their own challenges and the technology needs a additional development to ensure they can operate error-free. For example, many have beam forming issues and they are generally difficult to operate on multiple frequencies.

That said, there is a great deal of development and innovation occurring in this area that will likely help iron out some of those issues.

Industry: The 6th Domain of Warfare

The power of warfare is shifting. Previously, the power lay with the biggest and most powerful nation—now we are seeing billion and trillion dollar companies influencing the course of warfare. This has been recently apparent in the Ukraine where that nation embraced Starlink to stay connected.

Indeed, as we move toward either 5G or LEO satellite-based military communications, militaries no longer have control over their communications—they are now relying on industry in a way we have not seen before.

I believe as we continue to drive into 2025, we will see the role of industry grow further still, with companies holding many of the cards and having the power to change the outcome more so than even the nations themselves.

Actionable Data for Mission-Critical Military Operations

Indeed, we have seen in the conflict in the Ukraine, significant innovation was achieved, geared toward being able to manage the electromagnetic spectrum.

THE FUTURE BATTLEFIELD

In the future battlefield, military operators will need to learn how to be resilient and able to counter jamming, while ensuring a low probability of detection and engaging in effective, electronic defence, when necessary.

To accomplish that, operators will need to re-imagine battlefield

communications while accepting and embracing the role of industry to enable innovation and help them to obtain advanced technologies. I believe we will see at least an initial shift in mindsets to this paradigm during early of 2025.

quadsat.com

Author Christian Rex-Nielsen is the Head of Defense Programs for Quadsat



Christian Rex-Nielsen



This will alter the course of warfare options so greatly that we will begin to see this as the 6th domain of warfare, following air, land, sea, cyber, and space.

THE INCREASING VALUE OF INNOVATION

The role of industry will also encompass the extension of the technologies to ensure the military is operating with the latest and most effective innovations. Many military systems were procured several years ago and were based on an assumption that a military operator would dominate the spectrum, as was previously the case.

As that is becoming impossible, those systems will need to be updated and renewed to ensure fewer potential points of failure. At the same time, western forces are experiencing new forms of attack, with other nations proficient at jamming communication lines, for example.

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SPACE SYSTEMS COMMAND BRIEFING

SSC READYING FOR MULTI-BILLION-DOLLAR UPGRADES AT SPACEPORTS

Author: Brad Smith, SSC Public Affairs



As director of Launch and Range Operations for [Space Systems Command \(SSC\)](#), [Space Force Brigadier General Kristin L. Panzenhagen](#) is responsible for organizing, training, and equipping 22,000 government and contractor personnel at installations from California to Florida.

Her organization, part of the [United States Space Force \(USSF\)](#), manages the launch centers at both [Vandenberg Space Force Base \(VSFB\)](#) and [Patrick Space Force Base/Cape Canaveral Space Force Station](#). Combined, they handle the majority of all space launches in the United States, whether the [Department of Defense \(DoD\)](#)'s national security missions, U.S. government civil space efforts, or commercial industry. The team also supports NASA's launches from both coasts.

In addition to overseeing the safe launch of spacecraft ranging from military reconnaissance satellites to NASA's scientific probes to commercial comsats, the [Launch and Range Operations](#) team's responsibilities include some very basic needs.

"I care about wastewater. I care about the duct banks that protect our fiber optics. I care about power, and roads and bridges—it's not 'just' rockets; there's a lot of other things that we're responsible for," said Panzenhagen, an aeronautical and astronautical engineer who has served in the military for more than two decades. *"We—Space Systems Command—are the acquisition piece of it, and we are also the operational piece of it: providing the spaceports and the range capability to do the launch mission—and that's whether or not it is the national security space launch mission."*

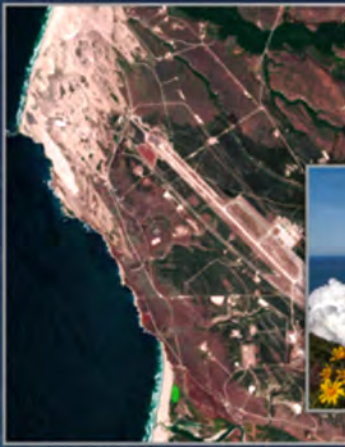
Panzenhagen wears multiple "hats," including serving as [program executive officer \(PEO\)](#) for SSC's [Assured Access to Space \(AATS\)](#) organization; as commander of [Space Launch Delta \(SLD\) 45](#), the USSF unit based at [Patrick Space Force Base \(SFB\)](#) in Florida; and as director of the [Eastern Range \(ER\)](#), which extends more than 10,000 miles from Florida through the South Atlantic and into the Indian Ocean.



“Space Launch Delta 45’s mission is to be the Spaceport that propels U.S. Dominance in space.”

Brig. Gen. Kristin Panzenhagen
Space Launch Delta 45 commander, and
Assured Access to Space program executive

Ready and Resilient Spaceports



Vandenberg Space Force Base, CA



Cape Canaveral Space Force Station, FL

She also has responsibilities for the **Western Range (WR)**, with headquarters at **Vandenberg SFB**, which extends from the California across the Pacific and Indian oceans. Both facilities are used for a variety of government and non-governmental programs, which leads to real benefits for the Space Force in terms of efficiency and reliability, officials said.

“Our partnerships allow us to deliver capability more rapidly to the joint force,” said **Lieutenant General Philip A. Garran**, SSC’s commander, whose responsibilities include Panzenhagen’s launch

organization. “Commercial industry has already done a lot and continues to be a critical partner. SSC’s partnership with industry has led to some incredible achievements.”

Along with the on-going mission assurance and launch responsibilities at the two federal spaceports, Panzenhagen’s staff is responsible for currently delivering on more than \$1.3 billion in infrastructure upgrades and construction, which encompass everything from roads and bridges to power and water.

Key Acquisitions Programs

National Security Space Launch



Rocket Systems Launch Program



Launch and Range Test Program



COMMERCIAL PARTNERSHIPS

U.S. industries are designing, developing, and testing commercially-funded launch systems, which incorporate reusability, advanced manufacturing, and multiple-payload delivery. As the NSSL and RSLP programs evolve, it is critical to maintain a vibrant, competitive, and affordable domestic launch industry and encourage technology development for both commercial and defense missions.



“I do want to emphasize there is more than enough capacity for what we need to do for national security,” Panzenhagen said. “What we’re trying to make sure we have the capacity for is to support the needs of the launch service providers that are also launching commercial missions because we—meaning the Space Force—get a lot of benefit from that.”

The benefits to the DoD and the United States of allowing all types of launches at the two ranges are significant, Panzenhagen said.

Panzenhagen added, “We get benefit from (Launch Service providers) smoothing out their processes, benefit from the research and development they’re doing in order to launch those missions, and benefit from the infrastructure that they’re investing in at the spaceports. When we talk about needing to increase capacity at the federal ranges, that’s what we’re talking about.”



U.S. Space Force Col. Mark Shoemaker, Space Launch Delta 30 commander, middle, alongside Vandenberg SFB leadership and project managers, join for a groundbreaking ceremony at Space Launch Complex 3 to mark the beginning of the Vandenberg Atmospheric Detection of an Electrified Range project at Vandenberg Space Force Base, Calif., March 4, 2025. The project will undergo the release of 14 electric field mills across base to enhance lightning detection for safer, more efficient launch operations by improving Lightning Launch Commit Criteria assessments. (U.S. Space Force photo by Senior Airman Kadielle Shaw)

RESILIENT AND READY SPACEPORTS

The needs are obvious: the Space Force supported a record 93 launches from either Kennedy Space Center or Cape Canaveral Space Force Station in 2024, up from 72 in 2023.

At Vandenberg, 2024’s launches totaled 51, a new record and an increase of 35% over the previous year. Planners forecast as many as 156 launches from Florida in 2025, with as many as 70 in California during 2025.

The reasons for the capital improvement projects at each base is equally obvious: both installations were designed and built as test centers in the early years of the Cold War and have developed into the operational facilities they are today, the busiest spaceports in the world, in fits and starts, as the number of launches has grown.

“First of all, our infrastructure is old,” Panzenhagen said. “Some of it, on the Cape side of the house, especially, was built in the 1950s and 1960s, and because it’s old, a lot of it is not sized for the rockets we’re launching today.”

There’s also the underlying reality that, because both complexes are on the coast for safety, the infrastructure each depends on is subject to the ravages of salt air, sea spray, and the weather common to the Atlantic and Pacific coasts.

“We have a huge corrosion issue,” Panzenhagen said. “It is very hard to keep your infrastructure up and running when you are in a saltwater environment.”

EASTERN RANGE NEEDS

The Eastern Range, headquartered at Patrick SFB on Florida's Atlantic coast, supports the space launch facilities at Patrick, Cape Canaveral Space Force Station, and NASA's Kennedy Space Center.



The Space Force's Space Launch Delta 45, or SLD 45, is the military unit that supports the two military installations (about 18,000 acres in total), and—at times—through some of the worst weather imaginable.

"We had a hurricane at the Cape (last year); the hurricane hit Wednesday into Thursday, we had the range ready to go on Saturday and we launched on Sunday," Panzenhagen

said. *"Resiliency is extremely important to make sure that - again— as a nation we have assured access to space. We need to be able to operate through a conflict scenario, and we need to operate through a natural disaster."*

Resiliency projects run from "hardened" structures with redundant power and water systems that can weather a hurricane, to "vertical" construction projects that replace existing assembly and administrative structures, moving those functions away from launch facilities to increase safety and allow for 24/7 operations.

"Rockets are bigger now, so the 'clear' areas are bigger than they used to be; if we have a fueled rocket and the people are in the building next door must stop what they're doing and leave - that is not an efficient way to do operations," Panzenhagen said. *"We are co-locating all of those more administrative and lab type facilities well away from the clear zones of the rockets, so we can have continuous operations."*

Other projects under consideration include transportation improvements, ranging from the network of roads and bridges on the bases to the railways, airfield, and harbor that serve the bases, as well as water conveyance and wastewater treatment facilities. In addition, as both launch complexes are close to federally- or state-protected parkland, beaches, and wildlife refuges, conservation and environmental issues are significant.

"There is a lot of water required to launch a rocket and then you got to do something with that water afterwards," Panzenhagen said. *"I have learned way more about water and wastewater and nutrient rich water in the last year than I thought I ever would, but these are extremely important things for us to do responsibly."*

Projects currently underway at Patrick and Cape Canaveral include:

- *Consolidated communications center*
- *Repaired communications duct banks*
- *New water and wastewater mains*
- *Relocated weather operations facilities*
- *Redundant power distribution systems*
- *Emergency power generation system*

Those planned for the near future include:

- *Consolidated headquarters facility*
- *Consolidated launch support facility*
- *Consolidated Cape munitions storage*
- *Warehouse facilities*

WESTERN RANGE NEEDS

The Western Range is centered on Vandenberg SFB on California's Central Coast; **Space Launch Delta 30**, or SLD 30, is the military unit that supports the installation. Vandenberg SFB covers more than 115,000 acres of California's rugged Central Coast, unlike the compact Florida bases, which poses some challenges of its own when it comes to infrastructure, officials said.



"Vandenberg's vast expanse is one of our greatest assets and a unique challenge," said **Colonel Mark Shoemaker**, commander of Space Launch Delta 30, responsible for the base's spaceport and Western Range. *"We have unparalleled potential for growth, but it also means we're constantly innovating to efficiently manage and secure such a sprawling installation."*

Like Patrick and Cape Canaveral in the early days of the Cold War, Vandenberg was planned as a missile test and development center; the base has since developed into an operational space launch center that is second only to the Florida complex in terms of launch operations. Vandenberg's launches are a similar mix of military, governmental civil, and industry satellites, which poses some specific challenges simply because of the mix.

"As the Western Range evolves to meet the demands of the modern space era, we're reimagining how a spaceport operates across an installation larger than most cities. One of our primary challenges is the bottleneck in payload processing space," Shoemaker said. *"We're balancing the needs of military, government, and commercial partners, all of whom are using the same facilities. This becomes particularly*

complex when payloads require different processing standards—from varying clean room specifications to distinct security protocols—which consumes a significant amount of our limited space resources.”

In 2024, Space Force was able to obtain extra funding from Congress to pursue commercial solutions to increase payload processing for the Western Range. A similar request, to address the same issue in Florida, is planned for 2025.

Projects currently in early planning and design at Vandenberg include:

- **Rebuilding the air traffic control tower and fire station to modern requirements**
- **Building a new Entry Control Facility for the South Base**
- **Improving the resilience of the electrical power grid**
- **Overhauling the harbor to support ships delivering larger rockets**
- **Expanding the core roads on South Base to accommodate the expected increase in heavy vehicle and rocket transportation traffic**
- **Variety of safety improvements to handle Vandenberg’s unique fire risks.**

A LOOK AHEAD

The Space Force has listed the various capital improvement projects under the umbrella ‘Resilient and Ready Spaceports,’ along with spaceport operations and defense-focused needs over the next decade.

“We did get a \$1.3 billion increase that covers the list up from 2024 to 2028, specifically for infrastructure, and so far we’ve been doing fantastic,” Panzenhagen said. “We are staying on track with the road map that we have. Currently, we have about 29 projects on contract already, for more than \$80 million.”

Some projects are already under construction; others are in the planning, design, or solicitation stages, with planned construction starts ranging from FY 2025 to FY 2034.

Like any construction management project, the need for architects and engineers to design the project, and then variables of construction material and labor costs over a decade, can make a huge difference in the final costs, officials said. Competition for skilled labor in a regional market can make a huge difference as well. In the Orlando area in Florida, for example, several large resort and recreation projects are planned for construction in the same period.

“In 2027 and 2028, we’re going to see an especially big ramp-up in construction,” Panzenhagen said. “Our demand for architecture, engineering, and construction services is going to be consistent over several years, so making sure we have the workforce in place, ready to meet that demand, is very important to us.”

Space Systems Command is the U.S. Space Force field command responsible for acquiring, developing, and delivering resilient capabilities to protect our nation’s strategic advantage in, from, and to space. SSC manages a \$15.6 billion space acquisition. www.ssc.spaceforce.mil



The weather officials had projected a good day for a launch, with a 90% chance of favorable weather conditions at the time of the launch.

Officials had been monitoring weather conditions with concerns related to *Thick Cloud Layers Rule*.

The [National Reconnaissance Office \(NRO\)](#) and [U.S. Space Force Space Systems Command \(SSC\)](#) partnered to launch NROL-69 on a [SpaceX Falcon 9](#) rocket through the [National Security Space Launch \(NSSL\)](#) program.

On Monday, March 24 at 1:48 p.m. ET, Falcon 9 launched the [NROL-69 classified mission](#) from Space Launch Complex 40 (SLC-40) at Cape Canaveral Space Force Station.

This mission carried a national security payload designed, built, and operated by NRO.



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