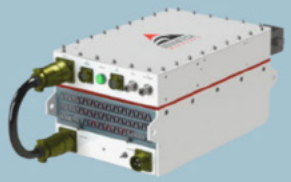
Next Generation Space Defense

MILSATMAGAZINE

January 2024



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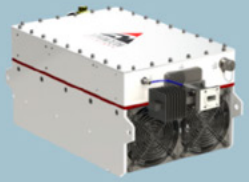

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DISPATCHES

Space Operations Command

National Geospatial-Intelligence Agency (NGA)

Raytheon

iDirect Government

Kratos + Rancher Government Solutions

Lockheed Martin Skunk Works

Department of Defense (DoD)

China

Lockheed Martin

DISPATCHES

Space Operations Command welcomes new commander

Lt. Gen. David N. Miller Jr., U.S. Space Force's Space Operations Command commander, speaks during a change of command ceremony at Peterson Space Force Base, Colorado, January 9, 2024.
Miller is SpOC's second commander since it's activation October 21, 2020.

The U.S. Space Force's Space Operations Command held a change of command ceremony at Peterson Space Force Base, Colorado, where Lt. Gen. Stephen Whiting relinquished command to Lt. Gen. David N. Miller Jr.

Chief of Space Operations Gen. *Chance Saltzman* served as the presiding officer for the ceremony. During his remarks, Saltzman spoke about SpOC's mission evolution and its vitality to national defense.

"*Our ability to adapt, to stay ahead of emerging threats and to seize new frontiers will be instrumental in maintaining our superiority in space in this era of Great Power Competition*," Saltzman said.

He added, "*These challenges will be expertly addressed because of our Guardians and the missions they execute under SpOC.*"

After assuming command, Miller spoke about his goals for his tenure as SpOC's commander.

"*As I see it, our task from the Secretary and the CSO is pretty clear: to build on and also build out the combat space power of this nation*," said Miller. "*We need to provide a United States Space Force service force provider to coordinate, prioritize and recommend to our CSO combat-sourcing solutions to solve the joint force's problems*."

Miller also expressed optimism for the command's future.

"*I am excited about this opportunity, but our work is far from done*," Miller said. "*We need to set our horizons high, and we will achieve the goals we set up*."

USSF **Space Operations Command (SpOC)**

DISPATCHES

NGA announces Luno A commercial data RFP worth million$$$

The National Geospatial-Intelligence Agency is soliciting proposals for Luno A, a $290 million indefinite delivery, indefinite quantity (IDIQ) contract to acquire unclassified commercial GEOINT-derived computer vision and analytic service capabilities.

This will be a five-year IDIQ with awards to multiple vendors, focused on monitoring global economic and environmental activity and military capabilities.

Luno A is a follow-on to the Economic Indicator Monitoring contract, which focused on managing the deluge of data by purchasing commercial data as services to integrate with NGA machine learning and AI efforts.

Luno A will expand access to data and services for the National System for Geospatial Intelligence, accelerate analytic workflow modernization objectives and integrate data and services into enterprise capabilities.

"*Because of the incredible success with the EIM contract, we've substantially increased our financial commitment to commercial capabilities with Luno A*," said *Devin Brande*, director of NGA Commercial Operations. "*As the quantity and quality of commercial data continues to increase, we must continue to partner effectively with industry to keep pace with state-of-the-art analytic capabilities and meet the increasing demands of our customers*."

Luno A will deliver data that enables NGA and NSG analysts to add context to analytic assessments, and have unparalleled insight into and data to quantify worldwide economic and environmental activity and military capabilities.

The unclassified nature of commercial data will ensure that Luno A products, data, and/or services are easily shareable with key partners and allies across the globe.

Luno A will focus on identifying unclassified computer vision capabilities, to include object detection, object classification, object segmentation, pattern detection, broad area search and area monitoring and feature mapping across six areas of interest:

- ***General change detection, climate security and natural resources***
- ***Feature identification***
- ***Infrastructure and high cadence transportation network monitoring***
- ***Facility monitoring***
- ***Incidental and fortuitous processing***
- ***Emerging products, data and services***

Additional information is available ***at this direct link*** as well as ***this URL...***

Raytheon building defensive microwave antenna systems for U.S. military

Raytheon, an RTX business, will design, build and test two high-power microwave antenna systems that will use directed energy to defeat airborne threats at the speed of light. The systems are designed to be rugged and transportable for front-line deployment.

Under the three-year, $31.3 million contract from the ***Naval Surface Warfare Center Dahlgren Division***, Raytheon will deliver prototype systems to the U.S. Navy and U.S. Air Force as part of the ***Directed Energy Front-line Electromagnetic Neutralization and Defeat (DEFEND) program***.

"*Non-kinetic defense systems are a key part of America's national defense strategy*," said *Colin Whelan*, president of Advanced Technology at Raytheon.

"*The new iterations of Raytheon's high-power microwave systems are cost-effective and reliable solutions that operate at the speed of light – enabling our warfighters to defend against faster and more maneuverable threats*."

Raytheon has been a leader in the use of high-power microwaves for nearly 80 years. The new HPM prototype systems build on Raytheon's decades of experience developing capabilities such as the Counter-Electronic High Power Microwave Extended Range Air Base Defense, known as **CHIMERA**.

Work on this contract is being conducted in Tucson, Arizona in partnership with the U.S. Air Force Research Lab, Naval Surface Warfare Center Dahlgren Division and the Undersecretary of Defense for Research and Engineering. Prototypes are expected to be delivered in fiscal years 2024 and 2026.

DISPATCHES

iDirect Government establishes Engineering Center of Excellence

iDirect Government (iDirectGov) has established the iDirectGov Engineering Center of Excellence at its Herndon, Virginia, headquarters to address EW and other transmission security (TRANSEC) developments.

The center, co-located with iDirectGov's existing engineering team, will enable the company to better respond to the ever-evolving EW and cyber threats, meeting defense and government requirements for faster-paced innovation to keep ahead of adversaries and bad actors that relentlessly target *military satellite communications* (**MILSATCOM**).

The center will leverage iDirectGov's specialized ***Communication Signal Interference Removal***™ (**CSIR**™) technology, which features crypto-agility, anti-jam and strengthened security for the tactical edge and warfighter.

Marking the company's continuous efforts to integrate and harness its engineering teams' intellectual properties and capabilities, the center represents iDirectGov's intensified focus on developing innovative and resilient solutions to address EW.

By combining its existing security professionals with its anti-jam-focused engineers, iDirectGov's defense and government SATCOM global customers will benefit from bandwidth-efficient, scalable and highly secure satellite solutions.

The center will create an additional platform for iDirectGov's engineers to develop holistic approaches to EW, cyber risk, TRANSEC, countermeasures and the overall company security solutions strategy.

This will enable the team to build solutions with advanced functionality, innovative form factors and tactical advantages for use on land, in the air and at sea, helping to ensure that the U.S. remains at the forefront of MILSATCOM technology.

Kratos + Rancher Government Solutions announce strategic partnership using the OpenSpace® software platform

Kratos Defense & Security Solutions, Inc. (Nasdaq: KTOS) and Rancher Government Solutions (RGS) have entered a strategic partnership to enable customers to seamlessly deploy and scale virtual ground systems using Kratos' software-based OpenSpace® Platform.

With increasingly complex and dynamic SATCOM and EO missions, satellite operators and government agencies are transitioning from fixed and proprietary hardware to flexible and scalable generic compute-based cloud environments. This enables a virtualized and software-defined ground system like Kratos' OpenSpace Platform to more cost effectively and securely support multiple missions simultaneously, deliver services faster and streamline operations.

Today, customers leverage a range of computing environments from bare metal, virtual machines to the cloud, making the deployment of software-based ground systems more complex and time consuming. Working together, Kratos and Rancher Government Solutions have enhanced the ability of the OpenSpace Platform, the first commercially available, fully virtualized and software-defined satellite ground system to be deployed more easily across customer environments.

By the nature of it being software-defined and containerized, the OpenSpace Platform is already much faster, and more flexible to deploy than traditional hardware-based satellite ground systems. As customer demands grow, the software-based OpenSpace Platform can reconfigure on the fly and deploy new services automatically and cost effectively in minutes. Software containers can be spun up and down and scaled on demand elastically using a single management interface from the Rancher Platform.

"*With Rancher, the OpenSpace Platform deploys its virtual functions including modems, channelizers, combiners, and more, as Kubernetes-based containerized software applications that act as independent and portable computing environments that can run and scale on any infrastructure,*" said *Brandon Gulla*, Chief Technology Officer at RGS.

"*Rancher serves as the Kubernetes management technology that supports the OpenSpace Platform's ability to automate the deployment, scaling, and management of our containerized workloads*," said *Anthony Semiao*, Chief Solutions Architect of the OpenSpace Platform.

DISPATCHES

Lockheed Martin Skunk Works rolls out the X-59 X-Plane

Lockheed Martin Skunk Works® (NYSE: LMT) rolled out the X-59, a unique experimental aircraft designed to quiet the sonic boom, at a ceremony in Palmdale, California. The ceremony marked a significant milestone in Lockheed Martin's and NASA's decades-long journey to solve one of the most persistent challenges of supersonic flight – the sonic boom.

"*We're thrilled to take on this challenge alongside NASA, whose quiet supersonic technology mission will have lasting, transformational impacts for people around the world*," said *John Clark*, vice president and general manager, Lockheed Martin Skunk Works. "*This project is just one example of the broader ingenuity of our industry as we continually strive to push the envelope of what's possible*."

Rollout ceremonies are a long-standing aviation tradition, and in the case of the X-59, it celebrated technical advancements, collaboration and innovation that stemmed from years of research, development and production of a one-of-a-kind technology demonstrator aircraft that will reduce the loudness of sonic booms to a gentle thump.

"*The entire X-59 team leaned into the expertise of both legendary organizations, NASA and Lockheed Martin, to ensure success for this program. I am extremely proud of everyone who made this historic moment possible*," said *Greg Ulmer*, executive vice president, Lockheed Martin Aeronautics.

Next, the aircraft will complete ground tests including engine-run and taxi tests before its next major milestone, first flight, later this year. After the aircraft is validated in initial flight tests, it will move into the acoustic testing phase.

This phase will include flights over populated areas to provide U.S. and international regulators with statistically valid data required to help approve new rules that could allow quiet commercial supersonic flight over land. This would cut commercial flight times to half of what they are today, transforming travel for people around the world.

For additional information, ***visit this direct link...***

Skunk Works LOCKHEED MARTIN

DISPATCHES

DoD releases their first-ever National Defense Industrial Strategy

The Department of Defense has released the organization's inaugural National Defense Industrial Strategy (NDIS) which will guide the Department's engagement, policy development, and investment in the industrial base over the next three to five years.

Taking its lead from the National Defense Strategy (NDS), this strategy will catalyze generational change from the existing defense industrial base to a more robust, resilient, and dynamic modernized defense industrial ecosystem.

"*The current and future strategic environment demands immediate, comprehensive, and decisive action to strengthen and modernize our defense industrial base ecosystem so it delivers at speed and scale for our warfighters*," Deputy Secretary of Defense *Kathleen Hicks* said. "*DoD's first-ever National Defense Industrial Strategy will help ensure we build the modern defense industrial and innovation ecosystem that's required to defend America, our allies and partners, and our interests in the 21st century*."

"*We are proud to release this ground-breaking strategy*," said Dr. *William A. LaPlante*, Under Secretary of Defense for Acquisition and Sustainment, added. "*The NDIS recognizes that America's economic security and national security are mutually reinforcing and, ultimately the nation's military strength cannot be untethered from our overall industrial strength. We must act now to build on recent progress and ensure we have the capacity to produce at speed and scale*."

While the NDS identifies risk to the industrial base, it also guides the Department to solutions. Recognizing that the defense industrial base must provide the required capabilities at the speed and scale necessary for the U.S. military to engage and prevail in a near-peer conflict, the NDIS strategy calls out challenges, solutions, and risks of failure concisely.

The strategy offers a strategic vision and path along four strategic priorities: resilient supply chains, workforce readiness, flexible acquisition, and economic deterrence. This proposed pathway to modernize the defense industrial ecosystem also recognizes that this effort cannot be a Department of Defense-only solution, repeatedly emphasizing cooperation and coordination between the entire U.S. government, private industry, and international allies and partners.

The full NDIS and a fact sheet are available ***at this direct link...***

The Tianxing-1 02 satellite is launched by China

China successfully launched the Tianxing-1 02 satellite into space atop the Kuaizhou-1A carrier rocket on Thursday, January 11.

The rocket blasted off from the ***Jiuquan Satellite Launch Center*** in northwest China's Gobi Desert at 11:52 a.m., Beijing Time.

The satellite entered the pre-determined orbit and the launch mission was a complete success.

Tianxing-102 is stated to be used mainly to carry out experiments, such as space environment detection.

This mission is the 26th flight of the Kuaizhou-1A carrier rocket.

ExPace is a Chinese space rocket company based in Wuhan, Hubei, China, and is a wholly owned subsidiary of missileer China Aerospace Science and Industry Corporation (CASIC), a Chinese state-owned company, and serves as its commercial rocket division.

ExPace is focused on smallsat launches.

NAVIGATING MILSATCOM IN 2024 A LOOK AHEAD

RINGING IN THE NEW YEAR BRINGS WITH IT REFRESHING IDEAS, ANTICIPATION, HOPE FOR THE FUTURE, AND PREDICTIONS. FOR MILITARY SATELLITE COMMUNICATIONS (MILSATCOM), THE TOP 2024 TRENDS AND PREDICTIONS CENTER AROUND RESILIENCY, SECURITY AND TECHNOLOGICAL INNOVATIONS.

Author: Tim Winter, President, iDirect Government

With the world currently seeming to be in disarray, the need for reliable and viable military satellite communications has rarely been as crucially important to our nation and our allies as today. Here's an iDirect Government (iDirectGov) look at the key MILSATCOM trends in 2024 and what's ahead to help defend our freedoms and interests.

SECURITY

Protecting the country's MILSATCOM networks from emerging threats is critical to the U.S. government. In 2024, there will be a continued and an increased focus on security and resiliency. A multi-layered, reliable, and resilient environment is paramount to deliver secure satellite transmissions to military users — anywhere and at anytime.

The MILSATCOM security technologies of today must provide a multi-layered and resilient solution. Tools such as ***transmission security*** (TRANSEC), ***communications security*** (COMSEC), and advanced anti-jam capabilities such as ***Communications Signal Interference Removal***™ (CSIR™) are becoming essential "*must-haves*" to ensure proper protection for data, voice as well as video transport.

These capabilities coupled with military standards such as — *NIST Federal Information Processing Standard (FIPS)140-2, Level 3*, *Security Content Automation Protocol (SCAP)*, *MIL-STD 810G*, *DO-160G* — all increase the resiliency of communication and data networks.

As cyber-attacks, ***electronic warfare*** (EW), and other intentional and unintentional jamming occur, countermeasure technology will be developed to solve these challenges. SATCOM platforms will have increased jamming protection to combat both ***blue-on-blue*** and ***red-on-blue*** *radio frequency* (*RF*) interference.

MULTI-ORBIT, MULTI-WAVEFORM TECHNOLOGY

The rise of multi-orbit and multi-waveform technology is translating into single platform, multi-mission capabilities. Some *Department of Defense* (DoD) missions require low latency and can use LEO/MEO-based satellite networks that support low latency missions. Other defense missions require more broadcast communications capacity where latency is not as important and, therefore, warfighters can access GEO SATCOM capabilities.

Additionally, a single defense-based platform that can serve multi-orbit networks will provide redundancy, should a network be offline for any reason. In this case, the iDirect Government single platform enables the warfighter to seamlessly switch to another operating network, providing redundancy.

In 2024, multi-orbit and multi-waveform capabilities will continue to mature. Integration and interoperability in the ground segment will start to take center stage in providing open architecture attributes that allow the warfighter to access various MILSATCOM network solutions.

SOFTWARE-DEFINED RADIO (SDR)

Building on our momentum with the recent launch of the *Revolution 450mp (man-portable) software-defined radio (SDR) modem*--and the *Evolution Defense 4.6 platform* — on which the 450mp operates — iDirect Government will continue to build on these highly reliable solutions.

The 450mp is the first 4-Series SDR, introduced with the new Evolution Defense 4.6 software. The Evolution Defense 4.6 platform incorporates improved security, including flexible key exchange for crypto agility, strengthened TRANSEC, and augmented CSIR technology. Additionally, the 450mp SDR will support multi-orbit and multi-waveform capabilities.

The 450mp SDR modem.

The potential flexibility and interoperability features with the 450mp SDR will provide the government end users with options for growth and future development. Not only will this yield continual operational improvements, but it will also provide an element of capital protection.

ARTIFICIAL INTELLIGENCE

Artificial Intelligence (**AI**) will continue to make inroads in SATCOM in 2024. In the years to come, we will see organic, demand-base, satellite network access, dynamic bandwidth allocation and greater automation in SATCOM networks.

With regard to resiliency, AI and ***Machine Learning*** (**ML**) will also assist in the determination of a jamming and/or interference evolution and the implementation of an appropriate solution. SATCOM networks will eventually "*learn*" how to defend themselves against complex security threats.

However, just as AI can be used in the battlefield by our friends and Allies, the warfighter may encounter adversaries who use AI to widen the attack surface at the tactical edge. AI can be seen as both a tool and a weapon. There is no question that the battlefield of the future will include AI-powered solutions.

COMMERCIAL-OFF-THE-SHELF (COTS) + STANDARDS

The DoD should continue to leverage COTS technology when and where able. With COTS and the industry agreeing upon standards, there are increased options for interoperability and seamless operations. Additionally, when considering the speed of development and adoption, commercially available technology can be highly advantageous.

We're seeing this unfold in a few ways. First, these solutions are available to the defense community on a faster timeline than custom developments. Cooperation with the DoD on a COTS solution benefits both the DoD and the vendor community. The DoD can leverage available COTS technology without waiting for new solutions to be developed and tested for reliability.

Second, implementing COTS solutions that are field proven usually saves the DoD monetary outlays for new technology.

However, to meet the security requirements of the DoD end user, advanced security features to enable robust MILSATCOM networks for the warfighter must be implemented within COTS hardware. These features are usually specialized, must be "military grade" and include advanced capabilities to include anti-jam, low probability of detection and other resiliency focused elements.

Going forward, security needs to be at the forefront of any development and design activity. MILSATCOM networks must be secure and able to operate in complex, contested environments.

AHEAD FOR 2024

In 2024, iDirect Government's focus will be on incorporating multi-mission, multi-waveform and multi-orbit technology into our next-generation platform.

The industry will continue to develop multi-orbit, dynamic capabilities to support advanced mobility requirements and operational efficiencies for the warfighter. Resiliency and security will be necessary for all next generation networks, platforms and ecosystems.

The market can continue to expect innovative solutions from iDirectGov. Our ever-evolving product portfolio and enhancements will bring security, flexibility, agility, and efficiency to warfighters, first responders, disaster recovery personnel, and field operators.

IN PERSPECTIVE

Specialized innovation and solid investments in secure solutions are ahead as we negotiate the connectivity pathways. This is a specialized process that does not end in 2024 but will continue well into the future.

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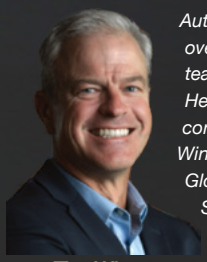


Tim Winter

Author Tim Winter is President of iDirect Government. Winter oversees the corporate strategy and leads the iDirectGov team to bring solutions to military SATCOM (MILSATCOM). He brings more than 20 years of experience in the satellite communications arena. Prior to joining iDirect Government, Winter served as Vice President of Global Accounts and Global Government and Defense at parent company ST Engineering iDirect. Winter managed all strategic global account engagements and capture pursuits for International Defense opportunities. Winter served in the U.S. Navy and flew P-3 Orion aircraft as a Naval flight officer on active duty for eight years. He continued his service in the United States Navy Reserves, flying P-3 aircraft and the BAMS-D UAV through 2022. He recently retired from the U.S. Navy with the rank of commander.

— SPACE SYSTEMS COMMAND BRIEFING — IT'S ABOUT TIME

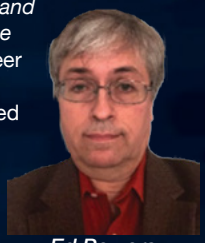
50 YEARS LATER, THE ATOMIC CLOCKS ON GPS SATELLITES CONTINUE TO KEEP THE WORLD IN SYNC

Author: Lisa Sodders, Space Systems Command

Many think of navigation when they consider the Global Positioning System (GPS) — turn-by-turn directions beamed effortlessly to their cellphones, for example. However, the first use for GPS satellites — and still the most common use today — has more to do with timing than location.

GPS is a constellation of orbiting satellites that provides ***position, navigation, and timing*** (**PNT**) data to military and civilian users across the globe. The system is operated and controlled by ***Space Delta 8***, a component of U.S. Space Force, headquartered at Schriever Space Force Base, Colorado.

"*GPS can't operate without precise time, and it provides precise time to everyone in the world*," said ***Ed Powers***, a senior engineer with ***The Aerospace Corporation***, a federally funded research and development center committed exclusively to the space enterprise.



Ed Powers

Powers spent 20 years working as the manager of the GPS timing interface to the ***U.S. Naval Observatory*** and worked on many studies on GPS timing use cases. During his 32 years of government service, he also spent time supporting the **GPS SV** (***space vehicle***) clock development and its associated timekeeping system while at the ***U.S. Navy Research Laboratory*** (**NRL**) and the U.S. Naval Observatory.

"*The U.S. Department of Homeland Security has done studies of the 16 critical infrastructure sectors in the United States — and the majority of them are dependent on GPS in some way, shape or form*," Powers said. "*Most of them are actually dependent not on positioning, but for timing. The power grid, communications, banking, and finance are three that come to mind immediately*."

December 17th marked the 50th anniversary of the ***Defense Systems Acquisition Review Council*** (***DSARC***) granting the **U.S. Air Force** approval to proceed with the development of the ***Navstar Global Positioning System*** (**GPS**). The constellation of satellites reached initial operational capacity 30 years ago, on December 9, 1993.

"*GPS operates with a network of atomic clocks on the satellites in space, and keeping those clocks synchronized to a common time reference allows it to be used as a ranging source*," Powers said. "*And that's how everybody's GPS receiver operates: they use those precise atomic clocks on board the satellite — they're stable to a single nanosecond over the course of a few hours and a few nanoseconds over the course of the day*."

The GPS satellites send data via radio frequency to receivers on the ground that can then compute the locations of the satellites and the precise time the signals were sent, making adjustments for delays caused by the atmosphere and other phenomena, Powers said.

So useful is this data that other nations are starting to build out their own global or regional systems, including ***GLONASS*** (*Russia*), ***Galileo*** (*European Union*), ***Beidou*** (*China*), ***QZSS*** (*Japan*) and ***IRNSS*** (*India*). Of these, the U.S. GPS system is widely considered to be the Gold Standard.

Modernizing GPS to make it work better in times of peace and to ensure its resilience in times of conflict is the responsibility of the ***U.S. Space Force***'s ***Space Systems Command*** (**SSC**).

Col. ***Matthew L. Spencer***, commander of SSC's newly established ***Positioning, Navigation, and Timing Systems Delta***, said the delta is working to bring on next-generation capability for GPS, including updates to provide better jamming and spoofing resistance, "*but more importantly, to have that position be assured, so that the operator out in the field can be assured that they're not being either spoofed or jammed*."

Col. Matthew Spencer (right) assumed command of Space Systems Command's Positioning, Navigation, & Timing System Delta on December 8, 2023, activated by Maj. Gen. Jason Cothern (left), Space Systems Command, deputy commander, at Los Angeles Air Force Base in El Segundo, Calif.

U.S. Space Force photo/Van De Ha.

Timekeeping has always been critical for national defense, and it's not surprising that GPS started out as a military technology, proving particularly effective during **Operation Desert Storm**, where it enabled U.S. coalition forces to out-navigate the enemy and fire with pin-point precision.

"*When we saw the effect of GPS during Operation Desert Storm, not only did we take notice, but so did our enemies and they've been attacking or figuring out ways to deny us access to GPS*," Spencer said, adding that his delta is working with commercial industry to explore options for alternate PNT data — just in case.

"*When I was out in the field, doing a test, I talked to a young Army sergeant and his point to me was, 'I know there's some things we're doing to deny GPS to the enemy, but if it in any way affects my ability to get GPS, don't do it. I'd rather have my GPS, because that's the way I fight*.'"

"*It's gone from a user in the military thinking, 'I don't need to get a radio signal from space to tell me where I am — I have a compass to where airliners won't leave the runway if they don't have their GPS up and running. It is ingrained and embedded to everyday life. GPS is foundational to how we live*," Spencer said.

How did people keep time before GPS? Not as precisely, Powers said. Atomic clocks — which measure time by measuring the resonant frequency of atoms — were invented in the late 1940s — and in order to synchronize those clocks, people would do portable clock trips by carrying a portable clock from A to B to C to synchronize the sites relative to the traveling clock. Those first clocks were large and heavy.

The advent of reliable GPS timing signals also has been a huge benefit to research laboratories all over the world, particularly if they are doing research in areas such as high-energy physics and need to measure things in nanoseconds — one billionth of a second - or picoseconds — one trillionth of a second, said ***Tom Powell***, a technical fellow with The Aerospace Corporation.

Tom Powell

"*Laboratories that were measuring things very precisely would have their own atomic clocks*," Powell said. "*In the 1970s, if you needed relative time predictable to within a few milliseconds or nanoseconds, you probably would have to go out and buy some expensive cesium beam or hydrogen maser clock. But once GPS came along, all you needed was an antenna and a relatively inexpensive GPS receiver and suddenly you have UTC (Coordinated Universal Time) within 10 nanoseconds*."

Telecommunications were some of the earliest uses for GPS timing data, Powers said, and today it helps to ensure that when you're talking to someone hands-free on your cellphone in your car that the call doesn't get dropped.

"*The way that cellphones work is that there are cell towers with transmitters located at certain intervals, every few miles apart*." Powers said. "*You're actually transitioning from one cell to the next as you're driving down the highway, but it's invisible to you because the cellphones are precisely synchronized with GPS — not to the billionth of a second but to the millionth of a second level to the micro-second level. And that allows the call to switch seamlessly from one cell site to the next and you don't even hear a pop when it switches*."

Earlier-generation cellphones didn't report their positions when you dialed 911, but now, with Enhanced 911, emergency personnel can derive your position, even if you have GPS location services disabled on your phone, Powers said. "*As our networks got faster, the speed of transactions for things like the stock market and financial transactions got faster*," Powers said. "*When you make a stock market transaction the accuracy of the time stamping for each transaction is important, potentially affecting the trade price by a small fraction of a dollar for each share traded. When multiplied by millions of shares, the potential variation is millions of dollars*."

Ever logged on to your computer and purchased an item from say, the United Kingdom? GPS data is the reason your purchase price is converted quickly and accurately from the British pound to the current rate of U.S. dollars at the time of purchase — and how the UK retailer knows you are purchasing it from the United States.

On a recent trip to Sweden, Powell discovered that Sweden is virtually a cashless society; one of his colleagues had exchanged his U.S. dollars for Swedish Krona "*and he could not use any of his Krona while he was there. Every place we went, every restaurant, every museum only accepted credit cards and those transactions are instantly converted to the exchange rate using a precise timing application based on GPS*."

Want to set your wrist-watch or adjust all the household clocks for Daylight Savings Time? Decades ago, you might dial the "*Time and Temperature*" phone number to get the correct time — today, you can just compare it to the time on your cellphone — which contains a GPS receiver.

"Most humans can only set their watch to maybe a few seconds, maybe the nearest minute," Powers said. "*And then the watch has errors — they can wander over the course of days and weeks by seconds to minutes. So, if you really need good, solid synchronization to the one-second level then the GPS receive is a fairly efficient way of doing that*."

The power grid also relies on GPS, Powers said. "*Devices called phaser measurement units help align the power grid. Keeping the power grid alignment synchronizes the generation of power, allowing for greater efficiencies and robustness*."

GPS also plays a role in detecting seismic activity and identifying the epicenter of an earthquake, Powers said. "*(Scientists) can actually watch GPS receivers with an accuracy level enough that they can see the motion of the earth's crust, they can see the precursors to earthquakes. When there's a tsunami, there's a big wave moving across the ocean and it actually lifts the column of air above it. That column of air goes all the way up into the ionosphere and disturbs it. The resulting ionospheric disturbance can be detected by networks of GPS receivers and used to indirectly track these waves as they move*."

What will the future hold? Most likely, even more applications for GPS.

"*I would suspect that we'll be celebrating the 75th anniversary of GPS, and probably the 100th*," Powers said. "*GPS or space-based PNT will have changed in some ways; we'll probably improve some things, added signal-authentication features, but by 2050 it'll still look a lot like what we have today. The biggest change will be the use of additional sources of PNT and other Global Navigation Satellite Systems (GNSS) like the European Union's Galileo system, or the Chinese Beidou system. GPS is such a critical system. People thought there were a lot of uses for it, but they couldn't imagine what actually happened*," Powers said.

As humankind expands outward toward the moon and beyond, there is a lot of debate in the scientific community on how to handle cislunar timekeeping, Powers and Powell said. One option would be to place physical master clocks on the surface of the moon; another option would be to set up separate GPS-like satellites orbiting the moon.

"*It depends on the use case, the level of accuracy needed*," Powers said. "*If you're flying between the moon and the earth, you probably don't need one-foot accuracy, but you probably need one kilometer. When you want to dock two spacecraft, like when the Apollo lander needed to dock with the orbiting command module, you need very precise accuracy*."

Powell noted that if U.S. astronauts land near the moon's South Pole to look for water, "*there's not a lot of light and the sun is low, and you're in shadows all the time. Getting around won't be as easy as it was for the Apollo astronauts who worked the whole time in broad daylight*."

Having a functional lunar PNT system would make landing and navigating the South Pole much easier — and more accurate — as well as provide precise timing for any scientific experiments. Terrestrial GPS signals can be received on the moon, but they are very weak, Powers said, adding, "*It won't work for Mars, but it would work for the moon, to some degree*."

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 billion space acquisition budget for the Department of Defense and works in partnership with joint forces, industry, government agencies, academic and allied organizations to outpace emerging threats. Our actions today are making the world a better space for tomorrow.

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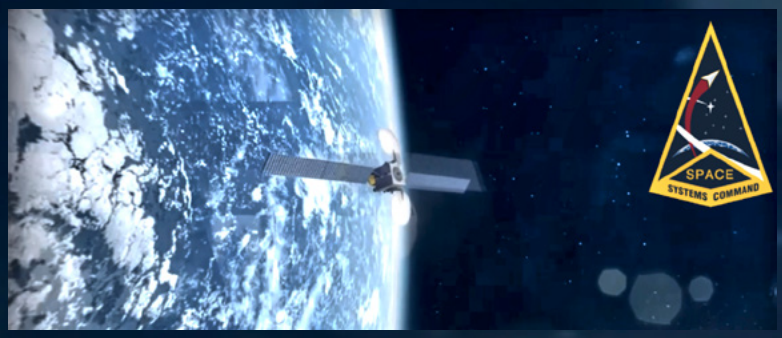

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COMMAND CENTER: ORI NAOR

VICE PRESIDENT, GLOBAL DEFENSE SALES, GILAT SATELLITE NETWORKS

Ori Naor

Mr. Ori Naor is Vice President, Global Defense Sales, for Gilat Satellite Networks. In this role, he is spearheading various innovative projects at the forefront of Military SATCOM. Previously, Mr. Naor served as Director of Programs & Business Development, Elbit Land Systems, and was responsible for securing significant defense contracts around the world. Prior to joining Elbit, Mr. Naor served in various operational and technology positions within the Israeli Defense Forces, achieving the rank of Lieutenant Colonel.

Good day, Mr. Naor. You have been involved in the defense industry for several years. What are your key observations?

ORI NAOR

Digital transformation in the military ecosystem continues to shape the future of the military communications market. Seamless collaboration and connectivity are crucial for helping defense agencies realize modern and effective operating methods; sharing vast amounts of critical information (including data, video, and voice) in real time makes military maneuvers more efficient and effective.

To achieve this new level of connectivity and operational continuity, across the battlefield and despite any enemy efforts to block communication, modern militaries are now, more than ever before, using satellite communications (SATCOM) to help ensure the successful completion of land, sea, and air missions.

This new paradigm, the net-centric battlefield, is achieved by implementing a globally interconnected, broadband communication network (*including infrastructure, systems, processes, and people*) that speeds up 2-way communications, allows resilient connectivity, and increases situational awareness. Terrestrial communication alone is no longer sufficient for today's ground, air, and naval forces which all depend on real-time communication. SATCOM is a key requirement to meet these growing needs.

Furthermore, in today's rapidly evolving landscape of military technology, there is a growing enthusiasm among militaries worldwide to leverage commercial technology, albeit with the necessary ruggedization and security enhancements. This shift is primarily driven by the realization that the "*civilian tech ecosystem,*" represented by industry giants such as **Microsoft**, **Amazon**, **SpaceX**, and others, is advancing at a remarkable pace, outpacing traditional defense industry timelines.

Military customers want to harness the agility and innovation of commercial technology, recognizing the imperative to keep pace with the ever-changing threat landscape and capitalize on the speed and scope of civilian technological advancements.

Gilat coined the term New Elastix Space Era to refer to the next generation of satellite communications, which includes multi-orbit constellations, software-defined satellites, and very high throughput satellites (VHTS.) What specific technological advancements are driving this evolution and reshaping how armed forces communicate and operate?

ORI NAOR

The ***New Elastix Space Era*** is changing the way we live by delivering the most advanced and widespread connectivity the world has ever seen and is defined by launches of very large, software-defined, multi-orbit constellations and satellite capacity that is growing faster than ever before.

Satellites are becoming smarter and the cost per megabit is decreasing quite quickly. ***Very High Throughput Satellites*** (**VHTS**) are unlocking opportunities for new applications and cloud technologies are maximizing operational efficiencies.

In the realm of military operations, where agility, speed, and data exchange are essential, satellite communications have always played a crucial role. However, the emergence of smart ***Non-Geostationary Orbit*** (**NGSO**) satellites has ushered in the next generation of possibilities and capabilities for military satellite communications.

NGSO satellites orbit the Earth at altitudes much lower than traditional ***geostationary*** (**GEO**) satellites, allowing for improved global coverage, reduced signal latency, and increased flexibility in managing communication services.

Cumulatively, this allows for improved throughput (performance) and opens

opportunities for new and improved applications. These advancements have brought about a transformative impact on how armed forces communicate, collaborate, and execute their missions.

Another trend in military SATCOM is the development of NGSO sovereign satellite networks. What are they and how do they differ from commercial satellite services?

ORI NAOR

NGSO sovereign satellite networks are communication systems owned and operated by specific countries or governments, using satellites positioned in non-geostationary orbits. These networks are tailored to enhance communication capabilities for military, government, and national security purposes, setting them apart from commercial satellite services provided by private companies.

For instance, the ***IRIS2*** constellation, owned by the ***European Union***, will address pressing challenges by offering enhanced communication capacities to governmental users and businesses. It will ensure high-speed internet broadband in underserved areas, while supporting applications in situational awareness, crisis management, and the protection of key infrastructures.

Sovereign networks such as IRIS2 promise unparalleled communication capabilities and reduce vulnerability to adversarial disruptions, reinforcing defense capabilities and laying the foundation for secure and robust communication infrastructure in the future. The threshold to own and operate such constellations is decreasing, allowing more armed forces to use this concept.

What sets Gilat apart in the world of SATCOM technology for Defense and Government applications?

ORI NAOR

First of all, that would be our combat proven solutions — these solutions already support soldiers that are operating in the most demanding operational environments and the feedback loop has been instrumental in elevating the operational value of Gilat's offerings.

Through continuous refinement based on direct input from military users, Gilat has developed solutions that excel in terms of reliability and performance, ensuring that they meet and exceed the stringent requirements of modern warfare. This approach demonstrates Gilat's commitment to delivering battle-ready technology as well as underscores the company's ability to adapt to the evolving needs of the military.

Secondly, product technology resilience which showcases Gilat's approach to military technology that extends beyond advanced capabilities and cutting-edge solutions; it revolves around the core concept that resilience is a dynamic and evolving goal.

In the realm of modern warfare, staying one step ahead of the adversary is a strategic imperative as well as a crucial necessity. By remaining agile, adaptable, and forward-thinking, Gilat ensures that our solutions are not only resilient today but also equipped to meet the challenges of tomorrow.

This proactive approach aligns with the fast-paced nature of the military technology domain and reinforces Gilat's commitment to providing military forces with the tools and strategies needed to maintain a competitive edge in the ever-changing landscape of national defense.

The ***SkyEdge VSAT*** platform is one of the cornerstones of Gilat's SATCOM offerings. It is a full-scale, state-of-the-art SATCOM network designed to ensure mission-critical communications and C5ISR operations, meeting the needs of any modern defense organization.

With a rugged **MIL-SPEC** design, our field-proven system for land, sea, and air is suitable for any field condition, providing real-time feeds for any platform and compatibility with future unmanned and autonomous platforms.

It is important to note that the SkyEdge platform was originally designed for commercial use. Our military customers enjoy the speed and scope of commercial technology development with all the unique requirements of a military SATCOM system.

Furthermore, Gilat's ***point-to-point*** (**SCPC/MCPC**) modems provide **TRANSEC** and anti-jamming capabilities for multiple, ***Communications-On-The-Move*** / Communications-On-The-Pause (**COTM / COTP**) applications, such as armored vehicles and manpacks.

Another technology playing a pivotal role in modern warfare is the Unmanned Aerial Vehicle (UAV). What is Gilat offering for UAVs?

ORI NAOR

UAVs are a unique component in today's modern battlefield. These terminals must be designed to operate autonomously, accommodating scenarios where operators may not be in proximity to the vehicle. They should seamlessly integrate with the diverse flight patterns of various UAVs and seamlessly integrate into the multitude of UAV architectures that are in use.

Gilat recognizes the importance of lightweight SATCOM terminals designed to withstand rigorous conditions while maintaining robust and reliable communication links. Our proven, lightweight terminals for UAVs are optimized with advanced capabilities, increasing system robustness and reliability and engineered with advanced capabilities to ensure seamless data transmission and control.

What role do Solid State Power Amplifiers (SSPA) play in military applications?

ORI NAOR

SSPAs play a major role in today's next-generation, net-centric battlefield. Recently, we announced that our U.S.-based ***Wavestream*** subsidiary launched "***Endurance***," a new line of high-power, "*always-on,*" SSPA products (*photo:right*).

Wavestream's Endurance product line is positioned to lead the industry in linear power with its gateway-ready, fully redundant design that ensures the maximum available power for multiple carrier inputs.

The ***500W Ka-Wideband Block Upconverter*** (**BUC**) covers military Ka- and commercial Ka-bands and features hot-swappable components for a truly "*always-on*" satellite communication solution. As a high-power, high-performance, high-availability modular amplifier solution, Endurance is particularly innovative in its ability to replace existing SATCOM solutions currently serviced by ***Traveling Wave Tube Amplifiers*** (**TWTAs**).

Separately, we already have a successful ***proof of concept*** (**PoC**) of converting analog signals to digital signals using the ***Digital Intermediate Frequency Interoperability (DIFI) 1.1 Standard***. This standard will enable all manufacturers to build interoperable technologies that work in both open and closed network topologies, resulting in highly flexible networks and enabling the industry to respond rapidly to customer demands.

What are the benefits for defense organizations and governments to work with an end-to-end, in-house SATCOM solution provider?

ORI NAOR

There are quite a few benefits, — here are my top three...

End-to-End In-House Capabilities: Our one-stop-shop approach empowers us to deliver solutions that address our customers' specific challenges, rather than merely offering standalone platforms and technologies. By serving as a trusted partner, we alleviate the burden on our customers to assemble and manage an array of expertise and resources. We do that for them. We take on the role of piecing together the optimal solution, and when necessary, we incorporate components from outside of Gilat's portfolio if this provides the best value to the customer.

Focus on User Experience: For any tech-oriented system to provide value to its operators, it's imperative that the system be easy to use and allow the user to take it to its full potential. That requires an effective user interface. For optimal efficiency, SkyEdge provides SATCOM operators a much-needed network management system that enables full configuration, control and monitoring of all network elements and remote terminals, regardless of their physical location.

Optimized Resource Utilization: VSAT platforms optimize resources, streamlining operations and reducing downtime. After initial investments, long-term cost benefits emerge including reducing the total cost of ownership and lowering risk. In the Elastix Era – this requirement becomes even more important, as the degree of flexibility rises and with it the room for potential improvement. SkyEdge is category-leading in its capability to minimize the required bandwidth without compromise on performance.

What do you believe makes Gilat the trusted partner of choice for defense agencies and governments worldwide?

ORI NAOR

Gilat's track record, commitment to security, and continuous innovation have earned the trust of defense organizations across the globe. Our cutting-edge technology is a force multiplier in the net-centric battlefield, enabling defense agencies to fulfill their missions with confidence.

Gilat's end-to-end, in-house SATCOM capabilities are a testament to our dedication to providing the most reliable and advanced communication solutions for defense and government applications.

With ruggedized antennas, adaptable VSATs, secure modems, and resilient SSPAs, Gilat empowers military forces on land, sea, and in the air to achieve their mission-critical communication goals. In an era where seamless connectivity is paramount, Gilat's holistic approach ensures that defense organizations can rely on our SATCOM solutions in the most challenging and dynamic operational scenarios.

In my exploration of the world of SATCOM technology for defense and governments, I strongly believe that Gilat emerges as a leader in delivering advanced solutions for defense and government applications. The SkyEdge VSAT platform, point-to-point modems, lightweight UAV terminals, SSPAs, and end-to-end in-house capabilities make us the go-to-choice for secure and resilient SATCOM technology in today's net-centric battlefield. Gilat continues to shape the future of military communications, providing defense organizations with the strategic advantage they need to succeed.

Gilat's commitment to innovation and adaptability ensures that its technology remains relevant in the ever-changing world of modern warfare. Our solutions are designed to meet the stringent demands of defense organizations, providing the flexibility needed to address emerging challenges.

www.gilat.com

IMPROVING ISR MISSION SUCCESS RATES

THE GROWING ROLE OF CHANGE-BITRATE-ON-THE-FLY TECHNOLOGY

Author: Mark Rushton, Global Defence and Security Lead, VITEC

Intelligence, Surveillance and Reconnaissance (ISR) missions are rarely executed in controlled laboratory environments — quite the opposite. These platforms — from airborne drones to terrestrial and underwater remotely piloted vehicles (RPVs) — that carry ISR payloads are often deployed in the harshest of conditions and are connected to users and operators over wildly inconsistent communication networks.

The ability to ensure high-quality images, regardless of network conditions in a theater of operations, has emerged as a critical success factor for ISR activities that depend on video-based intelligence to establish situational awareness and support effective decision-making. This is where **Change-Bitrate-on-the-Fly** technology comes in.

CHANGE-BIT-RATE-ON-THE-FLY TECHNOLOGY WHAT IS IT + WHY IS IT ESSENTIAL TO ISR MISSIONS?

When talking about video streaming, the focus is often on bitrates, which are measured by considering how many frames are taken each second, along with the size of each frame — the higher the video quality, the more images are needed to process for each second of video, which, of course, results in higher bitrate requirements.

Change-Bit-Rate-on-the-Fly technology is an increasingly important feature for the ISR community as it directly affects the quality and timeliness of tactical field intelligence. Receiving information too late due to network latency, or being unable to understand what is being analyzed because of dropped packets that result in fuzzy or pixelated images, can mean the difference between life and death.

In many ways, the need for Change-Bit-Rate-on-the-Fly capabilities reflects the technological progress that has allowed more sensors with greater capacity to be loaded on ISR platforms — such as drones or helicopters. Innovations around ISR have led to cameras that capture video images in stunning detail and sensors capable of detecting subtle temperature changes in the environment, including ground-penetrating radar. As a result, more information can be shared from a single ISR platform than before.

This does, however, create a challenge.

While devices to capture this wide array of data are becoming increasingly advanced, there are still challenges associated with the wireless networks used to access the data in terms of bandwidth, capability and change. Change-Bit-Rate-on-the-Fly is a technology can help address network constraints by adapting the bitrate as it changes.

THE CHALLENGES

The ISR community has done much excellent work in adopting standards across the technical elements needed to capture, share and act on digital intelligence. As a result, most platform and payload technologies can use almost any wireless network in the field to maintain connectivity — and, therefore, the flow of intelligence.

The agility and flexibility that enable drones and other ***Remotely Piloted Vehicles*** (**RPVs**) to use multiple networks means these platforms can dynamically switch from a cellular network to a satellite link and then to a terrestrial mesh network. However, as these platforms shift from one data carrier to another, they will likely experience a difference in bandwidth available to support the data traffic. **Sometimes, that delta can be quite significant.**

A cellular network might deliver up to 100 megabits in connectivity only to switch to a satellite signal that supports a fraction of that capacity. The other challenge revolves around the roving nature of ISR platforms. The quality and strength of wireless signals are better when platforms are near antennas. The signals weaken as the distance from antennas grows.

While the connectivity environment is highly dynamic – with bandwidth fluctuating from total capacity, only to be cut by half and then a third of capacity — the overall ISR objective of sharing the highest quality image possible remains the same.

That's why Change-Bitrate-on-the-Fly is a differentiator for IP video applications on ISR platforms. With it, we can make changes dynamically in real-time to ensure the continuity of images at the highest possible quality.

This cannot be emphasized enough, as video in a live environment is crucial for successful ISR. The technology represents a major improvement over previous ISR video capabilities. With Change-Bitrate-on-the-Fly, ISR teams can execute their missions with confidence.

STRATEGIES FOR OPTIMIZING IP VIDEO CAPTURE + DISTRIBUTION ACROSS ISR PLATFORMS

As tragic as it is, we are in a space where video has become a crucial asset in wartime. Accessing video-based intelligence at the correct time and place is a highly effective method for gaining information about the constantly changing military landscape.

As has been seen since the early days of the Ukrainian invasion, video plays a crucial role in showing hostile troop movements and the general disposition of the arena. Beyond simply capturing video, strategic and tactical decision-makers also benefit from the ability to quickly and appropriately share video-based intelligence. This capability has been critical in optimizing the efficacy of a smaller Ukrainian force by coordinating with global coalition partners.

Technological innovations have widely been credited for helping Ukraine even the odds against Russia's military might. Internet protocol-based video solutions are increasingly important in getting the best insights to the right people at the right time, especially in the context of C4ISR (***Command, Control, Communications, Computers (C4) Intelligence, Surveillance and Reconnaissance***).

Advanced C4ISR capabilities offer players in active theaters of operation an opportunity to secure and maintain strategic and tactical advantage through enhanced situational awareness and knowledge of the adversary and environment by shortening the time between sensing and response.

HOW THE WAR IN UKRAINE CHANGED THE ROLE OF VIDEO + ITS ROLE IN SUPPORTING C4ISR

As tragic as it is, we are in a space where video has become a crucial asset in wartime. Accessing video-based intelligence at the right time and place is a highly effective method for gaining information about the constantly changing military landscape.

As we have seen since the early days of the Ukrainian invasion, video plays a crucial role in showing hostile troop movements and the general disposition of the arena. Beyond simply capturing video, strategic and tactical decision-makers also benefit from the ability to quickly and appropriately share video-based intelligence.

Video for ISR has been critical in optimizing the efficacy of a smaller Ukrainian force by coordinating with coalition partners worldwide.

In the past, video applications have been governed by military specifications that were often unique to individual countries or coalitions, which made sharing sensitive intelligence difficult. However, during the war in Ukraine, NATO has set a standard and has been able to communicate essential video intelligence with the Ukrainian military and first responders. It has enhanced the ability to attack a target while protecting — and recovering — from hostile actions.

As important as the video content itself is, there is an even more critical element: **metadata**. Metadata is the information embedded within video files that allow users to identify the file's characteristics, making it easier to search, use and manage the video, while confirming the accuracy, credibility and utility of the intelligence captured.

Video metadata includes the date the video was created, the creator's name, location, date of upload, and even the camera ID. Based on these, and other critical data points, staff and leaders can validate data and ensure proper handling and dissemination of information based on policies designed to protect assets, sources and methods. For this reason, it is important to ensure interoperability at this metadata level.

Commercial-Off-The-Shelf (**COTS**) standards enhance and broaden the ability to share data as well as improve the effectiveness of Ukraine's defense. Streaming companies in the commercial space, such as **Netflix** and **Amazon Prime**, use video standards to compress data into formats that are streamed live, or packaged for efficient data downloads. Minimizing bandwidth while maintaining the best clarity and picture quality is a crucial business and economic factor.

Also a critical issue in military theaters of operation is the importance for ISR video intelligence to be shared across a range of devices. Compression standards allow ISR infrastructures to be agnostic to the networking and endpoint environment. As a result, while a wide variety of equipment is deployed in the field, the coalition partners supporting Ukraine can share data in a format that anybody can use. Using the standardized codexes used for streaming video makes this manageable.

THE ROLE OF METADATA + STANDARDS IN SHARING + CONTROLLING DATA

In wartime situations, such as the war in Ukraine, it is vital to implement the most stringent security measures to protect video intelligence by securing lines of communication through encryption and other strict security practices, including proper authentication and authorization.

IP video encryption is an essential layer of security that ensures data is safe — even if it is intercepted. There are many sources of video intelligence, including data that civilians provide. Citizens who are unable — or unwilling– to flee are making considerable contributions to intelligence efforts simply by using their cell phones to post videos.

To ensure their safety and ongoing participation in the intelligence-gathering process, measures must be put in place to protect citizens — as well as intelligence operatives, drone operators and military positions. It is especially important now, as Ukraine's counter insurgence and offensive operations gathers steam.

VITEC is playing an important role in providing military and security forces with the IP video solutions needed to achieve a desired outcome in the conflict. The company is a global technology leader in the IP video space with technologies that capture raw video and convert and compress feeds into data formats that can be encrypted and streamed across the data networks that support military defense efforts.

VITEC technologies are agnostic and highly efficient in terms of bandwidth use. This means video intelligence can easily be uncompressed, replayed, or recorded on any endpoint used by coalition partners across the different wireless networks in the field that support different data rates. In addition, VITEC software can share high-definition video in real time; regardless of the networks involved. Compared to existing offerings in the market, VITEC's technologies enable twice as much video transmission in the same bandwidth.

www.vitec.com

Author Mark Rushton is the Global Defence and Security Lead at VITEC.

VITEC is a global technology leader in the IPTV space, working within the Intelligence, Surveillance, Target Acquisition and Reconnaissance (ISTAR) arena for over 20 years.

Mark Rushton

GOVERNMENT SATELLITE REPORT (GSR)

USSF CTIO examines advancements in space-based AI

Author: David Pesgraves, GSR

In October of 2023, President Biden released an Executive Order (EO) dedicated to the safe, secure, and trustworthy use of artificial intelligence (AI).

Within this EO, the President ordered the development of a ***National Security Memorandum*** that "*…will ensure that the United States military and intelligence community use AI safely, ethically, and effectively in their mission, and will direct actions to counter adversaries' military use of AI*."

This EO could not have arrived at a timelier moment in the U.S., as near-peer competitors are currently making major investments in AI space capabilities that pose a growing threat to the nation's dominance and advantage in the space domain.

The U.S. government and military are highly aware of adversaries' investments in space-based AI military capabilities and are turning to the ***U.S. Space Force*** **(USSF)** to answer the call to defend American assets in space by building its own AI capability set.

The ***Mitchell Institute for Aerospace Studies*** recently hosted Dr. ***Lisa Costa***, *Chief Technology and Innovation Officer* (CTIO) of the ***United States Space Force*** (**USSF**), at a ***Schriever Spacepower Forum*** to examine the AI advancements adversarial nations have made in the space domain and to outline how the Space Force will maintain a technological advantage over U.S. near-peer competitors.

Dr. Lisa Costa

As CTIO of the Space Force, Dr. Costa oversees the development of strategy and policy to advance science, technology, and research of cutting-edge technologies that will digitally transform the Space Force. She is also responsible for leading teams working on the advancement of AI in the space domain, as well as determining the AI capabilities adversarial nations such as China are currently fielding and deploying in the domain.

CHINA + AI

Dr. Costa opened the forum by discussing China's approach to leveraging AI and ***Machine Learning*** (**ML**) in space. She explained that, in 2023, China is projected to spend $14.7 billion on AI, and that by 2026, that figure will increase to $26 billion.

"*That's an extremely large investment*," said Dr. Costa. *"Not only are they applying that to AI research, they're applying it to the operationalization of AI*."

She explained that, according to a recent **Pentagon** report to Congress, China is focused on AI domination in order to probe enemy vulnerabilities and advance the concept of intelligentized warfare.

From applications to robotics, China is seeking to develop an autonomous, orbital platform in space that can make determinations on who is and isn't an adversary through AI technologies. Through these investments in AI, China is effectively constructing an enhanced counter-space capability set.

"*The People's Republic of China (PRC) argue that the increasing frequency, complexity, and risks of space missions raise the need for incorporating AI and autonomy to support and protect China's space assets*," she explained. And according to Dr. Costa, China is already testing and fielding these space-based capabilities.

In April of this year, China held an experiment where they allowed an autonomous AI to control and operate a camera on an optical satellite for 24 hours. The test results revealed that the AI focused on two main areas: a region in Japan that houses U.S. aircraft carriers, as well as a contentious zone between India and China that is known to have "*skirmishes*."

According to Dr. Costa, these demonstrations and tests make it clear that China has — and will continue to pursue — new, space-based capabilities that can threaten the U.S.' advantage in the domain.

WHAT IS THE SPACE FORCE'S ANSWER TO THIS GROWING THREAT?

To keep up with the pace of China's growing AI capability set, the USSF is focusing on the digital transformation and modernization of the organization's existing space assets.

"*A lot of people think that because we are a new service, we got all new equipment*," said Dr. Costa. "*Well, that's not quite true*." Dr. Costa explained that the USSF has several satellite constellations that are currently operating on older networks.

"Working to modernize those capabilities is absolutely critical," said Dr. Costa. "*It's very difficult to build incredibly advanced AI modeling, simulation, and digital twins on top of old infrastructure*."

According to Dr. Costa, her office's first priority is to fix the "*tech debt*" of its system and network foundations in order to accommodate the amount of data throughput and processing that is required to have a space-based advantage.

Another priority that Dr. Costa's office is focusing on is upskilling current Space Force guardians to be "*super coders*."

Equipping guardians with the knowledge and skills to augment capabilities and systems through coding is a major advantage for the U.S., according to Dr. Costa.

"That combination of modernization of the foundation, with the real-time changes to capabilities by super coders, is a huge game changer," said Dr. Costa.

AI + DATA

One space-based challenge that both the U.S. and China share — as it pertains to space — is the quantity and quality of data that they must analyze.

"*It's a common problem that cuts across all of these areas, not only for China, but for us as well*," said Dr. Costa. However, in Dr. Costa's opinion, the data issue is one that is going to be fixed soon.

"I fundamentally believe this is going to be a very solved problem very quickly," she said. "*Why do I believe that? Machine learning and natural language processing are at a point now that computer-based tagging of large amounts of information, in real-time, is possible*."

Dr. Costa explained that computer systems and applications are more consistent and more efficient at marking up data than humans.

"*I believe this is going to be a real game changer in terms of being able to use AI in the operational space,*" said Dr. Costa.

To hear more from Dr. Costa on how the U.S. Space Force is leveraging data and space-based AI capabilities to maintain a competitive edge in the space domain, click the video below.

This article was first published on ***GovSat*** and is republished with permission of GovSat and ***SES Space & Defense***.

Author David Pesgraves is a Staff Writer to several other online publications and federal government agency

for GovSat Report, in addition dedicated to defense, military, technologies.

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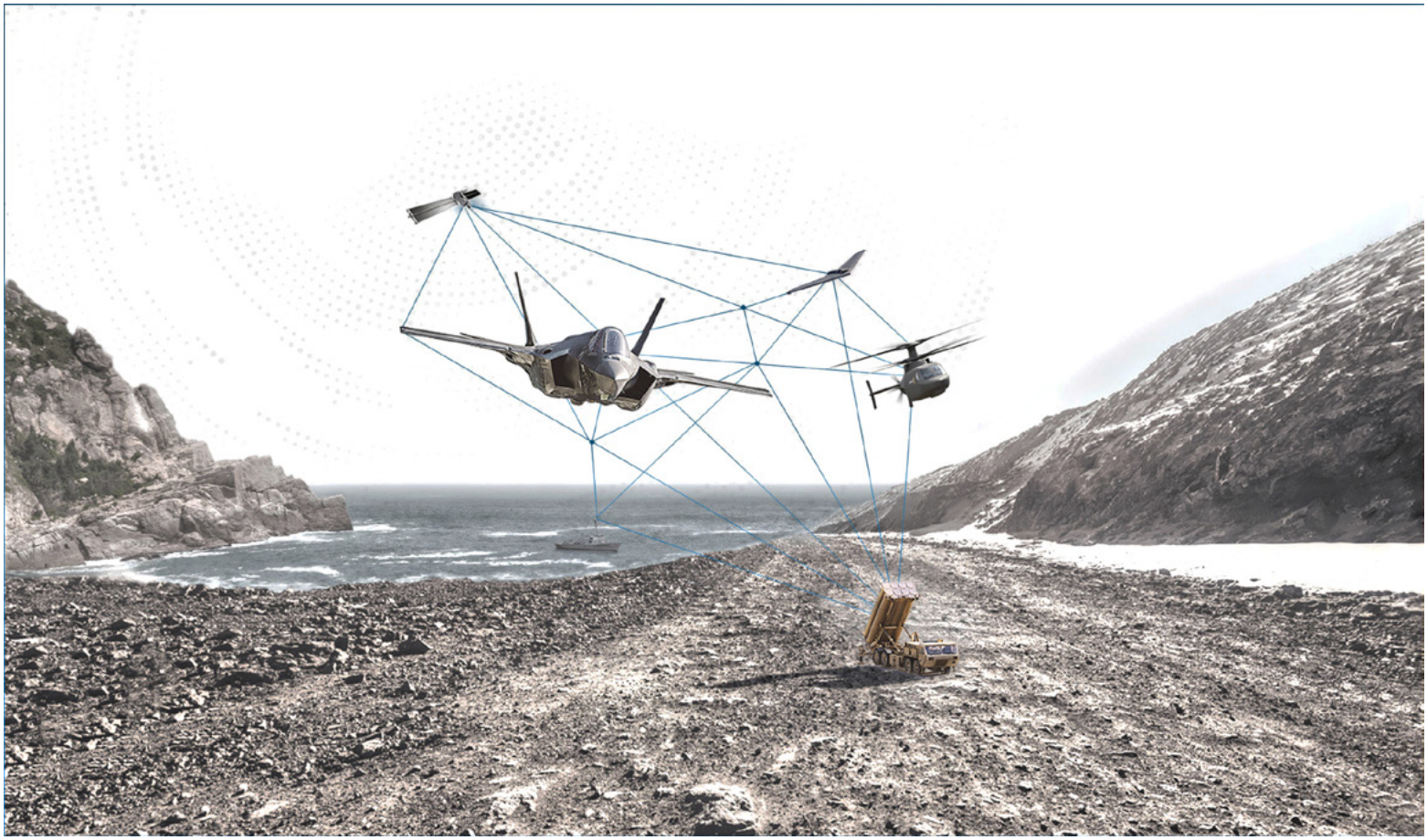
DISPATCHES

Lockheed Martin brings advanced comms out of the lab and into the field



For the first time, Lockheed Martin demo'd its Hybrid 5G-Tactical Mesh Network live in a multi-domain environment. This is a significant step toward ensuring the Department of Defense (DoD) has seamless access to critical information.

Working with leading commercial technology companies, Lockheed Martin proved the integration of existing technologies with enhanced capabilities that provide superior advanced communications operations and management tools for military applications.

The ***5G.MIL® Unified Network Solutions (UNS)*** were successfully tested across numerous mission simulations to establish stability and suitability for use in ***Joint All-Domain Operations*** (**JADO**) and ***Combined Joint All-Domain Command and Control*** (**CJADC2**).

The resilient 5G.MIL UNS tactical mesh network and Lockheed Martin's AI Factory machine learning operations platform were critical to successfully deploying these AI-based capabilities.

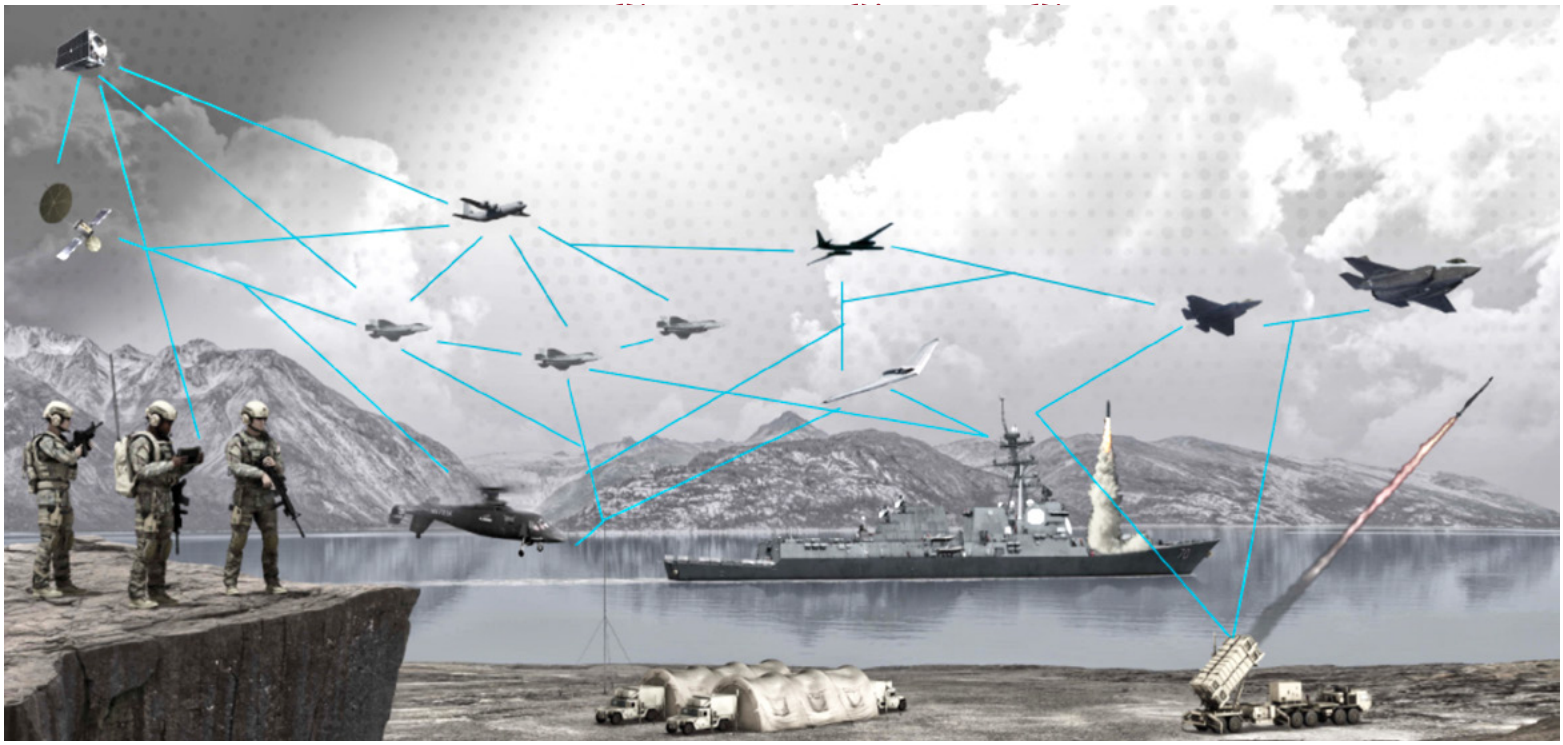
In this demo, Lockheed Martin's 5G.MIL UNS performed as a tactical and commercial multi-node hybrid network for land, air and space domains—demonstrating system capabilities, performance and operations for customers in a field setting—and achieving *Technology Readiness Level* (**TRL**) *6+*, meaning it is a fully functional prototype model.

The deployed hybrid network included five hybrid base stations with 5G, tactical datalinks and space backhaul. Fifteen individual capabilities were demonstrated across mission scenarios, covering interoperability, resilience, security and operations.

This exercise provided an opportunity to stress test the maturity and resilience of the independent hybrid network in a mission relevant scenario.

Lockheed Martin's solutions deploy, orchestrate and manage enhanced commercially available technologies from multiple embedded collaborators, including:

- *Intel's FlexRAN™ reference software and processor capabilities*
- *Verizon's adapted Mobile Onsite Network-as-a-Service (NaaS) solution and Single Pane of Glass (SPoG) Network Management tool*
- *Microsoft's Azure Orbital Cloud Access (AOCA), Microsoft's solution for cloud-to-edge via SATCOM, and Azure Government cloud environment at Impact Level 4 (IL4)*
- *Juniper Networks' Session Smart Router (SSR) technology and the 5G Radio Access Network (RAN) Intelligent Controller (RIC)*
- *Keysight's RF planning, configuration and optimization tools*
- *Radisys' End-to-end 5G Network Software*



Dan Rice, Vice President, 5G.MIL UNS Programs, Lockheed Martin, said, "*To stay ahead of evolving security challenges, military commanders need fast, secure access to critical information for decision superiority, no matter the circumstances. Collaborating with commercial and defense technology leaders is a key component of Lockheed Martin's 21st Century Security vision and accelerates our delivery of secure 5G.MIL® Unified Network Solutions to enable prompt, data-driven decisions across all operational domains*."

Caroline Chan, Vice President and General Manager, Network Business Incubator Division, ***Intel***, said, "*Disaggregated hardware and software from Intel allows Lockheed Martin to provide more secure access to essential data which is fundamental to next generation communication networks being deployed for Defense Industrial Base applications. Utilizing these commercially available optimized building blocks that helps ease integration and accelerates deployments*."

Jason Payne, Chief Technology Officer, ***Microsoft Federal***, said, "*This exercise demonstrates how 5G.MIL can enable immediate information and decision-making advantage at the tactical edge through the combined power of hyperscale cloud, hybrid communications and 5G technologies. This demonstration showcases the strength of the Lockheed Martin and Microsoft relationship to drive innovation for critical missions for our national security customers*."

George Riggins, Vice President, Public Sector Technology, ***Verizon***, said, "*We are proud of our strong relationship with Lockheed Martin and our work to successfully leverage innovations using 5G technology to produce new capabilities that will benefit the defense of our nation. By allowing users to transition between private, public and managed service networks, we are delivering reliable, mission critical connectivity so they can continue their mission across a wide range of environments*."

Greg Bourdelais, Vice President, Federal Sales, ***Juniper Networks***, said, "*We are pleased to provide innovative 5G SD-WAN solutions that empower our partners to achieve their goals, and we were honored to be a part of Lockheed Martin's 5G.MIL field demonstration showcasing the utmost efficiency and effectiveness in challenging environments. The recent demonstration stands as a testament to the power of network collaboration, showcasing critical performance and operational networking excellence required in meeting the highest standards and driving successful customer outcomes*."

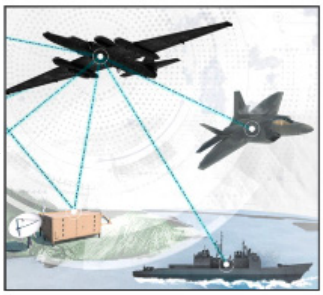
Munish Chhabra, Senior Vice President and General Manager, Software & Services, ***Radisys***, said, "*Radisys is pleased to have collaborated with Lockheed Martin in achieving this successful 5G.MIL Hybrid Mesh demonstration to advance military networking solutions. With our award-winning Release 17 Connect RAN and 5G Core Network Software on Edge with resilient mobility, high bandwidth video upload support, Radisys looks forward to continuing to work with Lockheed Martin and its partners to advance robust, reliable tactical communications in a hybrid network via terrestrial and non-terrestrial access*."

Vince Nguyen, vice president and general manager, Aerospace, Defense and Government Solutions, Keysight, said, "*Lockheed Martin brought together commercial 5G market leaders to collaborate, innovate and accelerate resilient, tactical solutions and use-cases to market for hybrid networking solutions. Keysight is proud to be a key contributor with its performance and validation capabilities*."

Lessons learned from this field demonstration are already being incorporated into Lockheed Martin 5G.MIL UNS. The company will continue to work with commercial collaborators toward an ***Initial Operating Capability*** (**IOC**) in 2024.

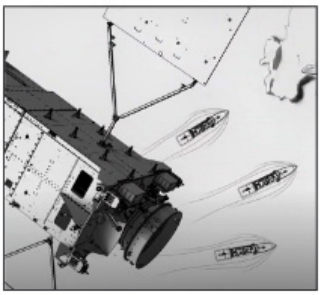
www.lockheedmartin.com/5G

5G.MIL® Solutions Power



Resilient Communications for Joint All-Domain Operations

Global Situational Awareness for Rapid Decision-Making



Space-Based Communications Backhaul and Reach-Back

Intelligence, Surveillance, and Reconnaissance (ISR) and Sensor Fusion Edge Processing

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