SATCOM for Net-Centric Warfare

MilsatMagazine

November 2019

The Enhanced Polar System Gateway at Clear Air Force Station, Alaska provides interconnectivity between the EPS satellites and mid-latitude users. EPS is a polar adjunct to the Advanced EHF (AEHF) system providing MILSATCOM coverage at latitudes 65 degrees N and above. (U.S. Air Force Photo)

PUBLISHING OPERATIONS

Silvano Payne, Publisher + Executive Writer
Simon Payne, Chief Technical Officer
Hartley G. Lesser, Editorial Director
Pattie Lesser, Executive Editor
Donald McGee, Production Manager
Andy Bernard, Sales Director
Teresa Sanderson, Operations Director
Sean Payne, Business Development Director
Dan Makinster, Technical Advisor
Wendy Lewis, Contributing Editor
Paul Sims, Contributing Editor

SENIOR COLUMNISTS

Richard Dutchik, Dutchik Communications
Chris Forrester, Broadgate Publications
Karl Fuchs, iDirect Government Services
Bob Gough, Goonhilly Earth Station
Rebecca M. Cowen-Hirsch, Inmarsat
Ken Peterman, Viasat
Giles Peeters, Track24 Defence
Koen Willems, Newtec

THIS ISSUE'S AUTHORS

Terri Moon Cronk
Ken Joyce
Charlie Kawasaki
Paul Sims
Senior Airman William Tracy
Airman Jonathan Whitely

SatMagazine is published 11 times a year by Satnews Publishers, 800 Siesta Way, Sonoma, CA, 95476 — USA.
Phone: (707) 939-9306 / Fax: (707) 939-9235

FEATURES

ADVERTISER INDEX

Advantech Wireless **Technologies**

25W to 50W

PAMIR

80W to 125W

DENALI

150W to 250W

CASCADE

300W to 500W

TAURUS

800W to 1kW

SUMMIT

1kW to 10kW

New line of
Solid State Power Amplifiers & BUCs

Ku, C and **X Bands – GaN** and **GaAs** configurations

ADVANTECH
Wireless Technologies

advantechwireless.com

DISPATCHES: *USAF's SMC's Rogue Cubesat mission launches*

The Northrop Grumman NG-12 Resupply Launch, with the Cygnus spacecraft aboard, lifts off from the Wallops Flight Facility in Virginia. Image is courtesy of NASA.

The U.S. Air Force's Space and Missile Systems Center and its mission partners successfully launched the Aerospace Rogue Alpha/Beta Cube satellites on November 2, 2019.

Lift-off occurred at 9:59 a.m. ET from NASA's Wallops Flight Facility, Wallops Island, Virginia. The Cygnus capsule will mate with the International Space Station and the satellites will remain there until deployment in early 2020.

The Aerospace CubeSats have officially achieved their priority mission of developing a small LEO constellation in just 18 months.

The satellites will now collect data on cloud backgrounds to inform future LEO missions. The USAF will also use this program's data to investigate potential uses of the capability.

The Rogue CubeSat Program, a dual smallsat program co-developed by the U.S. Air Force Space and Missile Systems Center and The Aerospace Corporation, finished preparations for launch and was fully integrated onboard Northrop Grumman's Antares Cygnus launch vehicle at Wallops Island, Virginia, on November 1.

Colonel *Dennis Bythewood*, Program Executive Officer for Space Development, said the successful launch of the Aerospace CubeSats marks a huge achievement for SMC and its partners. This mission has set a precedent for speed and will also provide us with much needed data for future space development programs.

The cubesats were designed, built, and tested by The Aerospace Corporation, a national nonprofit corporation that operates as a federally funded research and development center dedicated to advancing the nation's missions in space.

The Rogue Cubesats design emphasizes Commercial-off-the-Shelf (COTS) sensors, non-exotic parts and features a high-speed laser communications system that will enable downlinks of large image files. These dual smallsats will also use novel wavelengths for infrared sensing.

The mission priority is to investigate the feasibility of developing small and low-cost satellites as a means of rapidly reconstituting a proliferated LEO constellation.

Rogue has succeeded so far by meeting its targeted 16-month design, build, and test timeline.

The satellites will also work on jump starting LEO cloud scene processing and provide test data for new short-wave infrared band satellites.

Northrop Grumman's Cygnus spacecraft berthing with ISS. Image is courtesy of NASA.

WALTON DE-ICE

Portable Radome

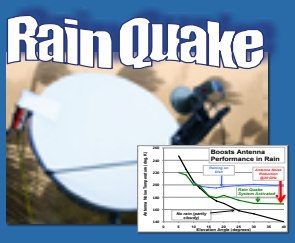
New LEO / MEO Design

The **Portable Radome** makes satellite networks more survivable and deployable into extreme and harsh environments. Protect transportable antennas and equipment from, snow, ice, burning sun, sandstorms, torrential rains, up to 85 mile-per-hour winds, and more.

- Single-person setup in less than an hour — conventional radomes can take days.
- New LEO/MEO design for full-arc / elevation angle performance. L, C, Ku, X, & Ka.Bands.

The industy's most powerful, cost-effective De-Icing. For antennas from 3.7 to 32 meters.

Sheds off snow before ice forms. Huge — up to 100 X — energy savings compared to conventional systems. 0.6 to 6.3 meters.



Minimize Signal Loss due to Rain Fade. Reduce data loss — by 20X or more.

+1 (951) 683-0930 I sales@de-ice.com I www.De-Ice.com
WB Walton Enterprises, Inc. P.O. Box 9010 San Bernardino, CA 92427, USA

DISPATCHES: *A rollercoaster approach to satellite re-positioning*

When a natural disaster strikes or a national security emergency breaks out, every minute counts.

However, it can take a satellite in LEO 100 minutes to make one of the many passes needed to provide global coverage.

Larger satellites can provide continuous coverage of greater areas but require higher altitudes and still only cover roughly one-third of the Earth.

In critical, fast-moving situations, space operators can find themselves challenged by the stubborn inflexibility of satellite positioning, which, despite numerous technological advances, still requires satellites to rotate or orbit into viewing range to image a target.

The Aerospace Corporation is testing a new approach that leverages atmospheric drag to provide dynamic satellite re-positioning, enabling on-demand responsiveness to emerging situations on the ground.

This new concept, known as Project Rollercoaster, is an alternative to the current, static method of satellite imaging that leverages maneuvering and the atmospheric drag of LEO to rapidly and efficiently alter satellite ground tracks.

"*If you want to get eyes on the ground, this will enable you to get there in a very short timeline*", said ***Travis E. Swenson*** of Aerospace's Flight Design and Optimization Section. "*The idea is you could deploy one of these Rollercoaster vehicles, use a chute and safely change your orbit so that you could image an area of interest much more responsively than you could have otherwise.*"

The Project Rollercoaster methodology is divided into three sequential phases: ***burn***, ***drag*** and ***coast***.

To initiate the process, a small maneuver is executed to lower perigee which alters the satellite ground track, giving the spacecraft access to higher density atmosphere.

Next, the satellite deploys panels or chutes to further modify its ground track using drag.

Lastly, the drag devices are stowed or jettisoned, and the satellite continues to orbit until the target flyover is achieved.

This enables global visibility access within a significantly reduced timeframe and with greatly reduced fuel requirements.

The technology required for Project Rollercoaster has already been demonstrated via cubesats, and computer simulation has upheld its feasibility.

If successful, the Project Rollercoaster method could allow for prompt surveying of natural disasters, provide intelligence during a national security emergency, and serve a host of other intelligence applications.

Rollercoaster could also facilitate targeted ocean re-entry of spacecraft, substantially reducing instances of land impacts while also enabling the orbit rephrasing required to avoid spacecraft collisions. This could ultimately enable the targeting of specific landing zones and the reduction of re-entry footprints.

Aerospace's Flight Design and Optimization Section, in collaboration with iLAB, is already exploring the application of atmospheric lift to target flyovers at specific local times, and the possibility of achieving repeated passes over a target area.

Another advantage to Project Rollercoaster is that it allows for a flexible mission architecture.

For example, a number of relatively inexpensive smallsats could be stored onboard a Cygnus cargo spacecraft, orbiting in stasis until called into action to provide rapid assessments of dynamic situations.

Most importantly, Project Rollercoaster underscores the nation's need for space assets that can respond rapidly to emergent needs, paving the way for even more control of spacecraft re-entry.

As always, Aerospace is forging new ground in this area and others, while demonstrating the feasibility of a more resilient and efficient space enterprise in the process.

aerospace.org

25 YEARS

AvL TECHNOLOGIES 1994-2019

CONNECTING THE WORLD FOR 25 YEARS

NEW 2.2M ULTRALIGHT ANTENNA

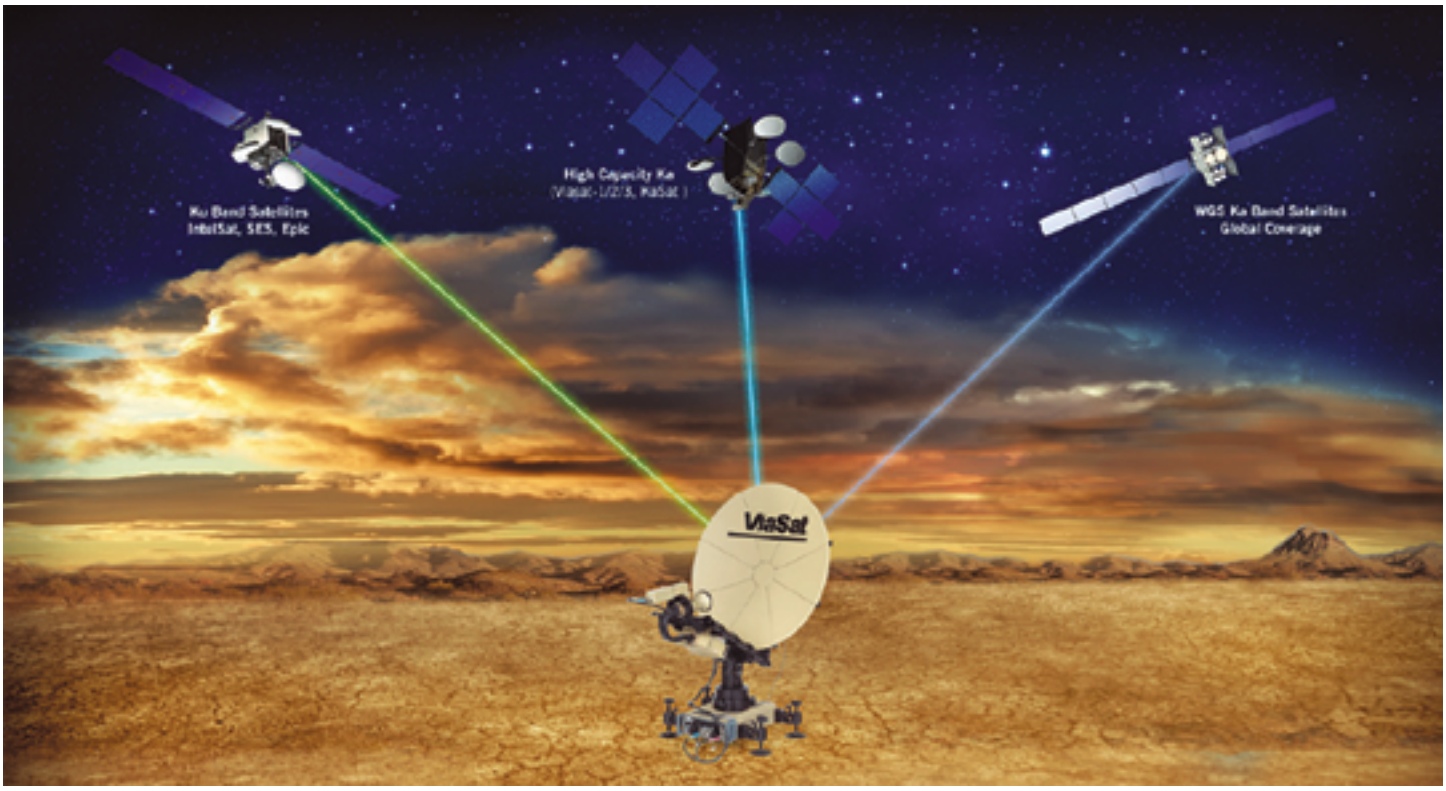
- The most compact 2m class antenna on the market
- Comparable performance to competing 2.4m antennas with small pack-up
- High-stiffness ultra-lightweight carbon fiber reflector and positioner base
- Quad-band: Ku, Ka, X and C
- Intuitive coarse/fine Az/El positioning
- Simple feed polarization positioning
- Can be assembled and on-network in less than 25 minutes
- Packs into two checkable transit cases with each weighing less than 100 lbs.

AvL TECHNOLOGIES

avltech.com

Visit AvL at SmallSat Symposium in Mountain View, CA

DISPATCHES: *Certification process begins for Viasat's MMT for UK MoD Skynet SATCOM system*



Viasat's AN/TSC-241 Multi-Mission Terminal (MMT)Transportable, Multi-Band Satellite Communications VSAT.

Viasat Inc. (NASDAQ: VSAT) has announced that the firm's Multi-Mission Terminal (MMT), the AN/TSC-241, has started the UK Ministry of Defence (MoD) Skynet SATCOM architecture assurance and certification process, which will authorize the terminal's operation on the Skynet X-band system as well as other government and commercial networks — Viasat expects to complete the certification process during December of 2019.

Viasat's MMT, being a tri-band, multi-network software-defined solution, delivers high-quality IP-based voice, video and data networking across multiple networks in both highly contested and benign environments around the world. Using a portable terminal design, the MMT is an ideal networking solution for forward operating bases, as it enables users to securely access networks and establish command post communications quickly and easily.

During the 2018 multi-national Saber Strike exercise, which trained U.S., NATO and coalition forces on security and threat preparedness, field personnel were able to use the MMT's integrated smartphone app to easily establish communications with minimal training. Other field-proven performance advantages of the MMT included:

- *Enhanced connectivity with a small footprint: Viasat's MMT provided forces with enhanced satellite connectivity with a very small logistical footprint. This enabled robust data to be sent to Beyond Line of Sight units, significantly enhancing situational awareness across the battlespace.*
- *Resilient, high-quality performance on multiple networks: The MMT, which incorporates Viasat's CBM-400 software-defined modem capable of TDMA/FDMA, over X-, mil-Ka-, Ku- and commercial Ka-band networks, produced robust throughput on high-capacity Ka-band networks. In addition, Viasat's MMT, through a simple waveform switch to Viasat's ArcLight waveform, also demonstrated proven satellite connectivity in the Ku-band with enhanced upload and download performance when compared to other legacy systems.*
- *Added flexibility: One of Viasat's MMTs operated entirely on standard military-use batteries during the Saber Strike exercise, demonstrating its logistical flexibility in an austere environment.*
- *Ease of use: Viasat's MMT was set up three separate times over the course of the 22-hour maneuver, demonstrating its portability and ease of use for U.S. and international coalition forces. When compared to other systems, the Saber Strike report noted improved ease of set-up/tear-down of the MMT, which can be done in 15 minutes or less.*

The MMT is designed to switch between both government and private sector assured, resilient, integrated networks (ARIN). In addition, the MMT's CBM-400 software-defined modem will allow customers to switch between multiple waveforms as well as multiple networks and upgrade to Viasat's next-generation Ka-band network. The CBM-400 is also the first software-defined, multi-waveform, certified modem available to U.S. and coalition military organizations.

Ken Peterman, President, Government Systems, Viasat, stated that certifying Viasat's MMT on the Skynet architecture, the UK MoD will be able to maintain the operational and information advantage needed in today's escalating threat environment. The MMT will provide the UK MoD with easy access to secure, resilient, high-speed, multi-orbit, multi-frequency band and multi-network SATCOM architectures, which will deliver the advanced connectivity needed to integrate into the battle-network of the future.

Steve Beeching, Managing Director, Government Systems, Viasat UK, add this software-defined, tri-band, multi-network terminal further exemplifies Viasat's ability to rapidly deliver cutting-edge technologies suited for MoD and coalition forces' unique mission requirements. The MMT builds on the company's ability to deliver ARIN and the information connectivity needed to power the battle-network of the future. Viasat wants the ability for customer to better connect their forces across today's rapidly evolving battlespace with the aim to help weaponize information.

www.viasat.com

DISPATCHES: *L3Harris VSAT obtains Inmarsat GX approval*

L3Harris Technologies (NYSE:LHX) has received Inmarsat Global Xpress (GX) Category 1 type approval for the company's Ka-band 60 and 96 centimeter Very Small Aperture Terminals (VSAT).

L3Harris' Panther II is the first terminal equipped with the iDirect 950mp core module to receive Category 1 type approval for operation over Inmarsat's commercial GX service.

GX is the world's first and only globally available, high-speed wideband network, owned and managed by a single operator.

The Panther II VSAT is fielded worldwide by customers who operate them over the Wideband Global SATCOM (WGS) constellation.

The Inmarsat GX Category 1 type approval now gives users the ability to own a single terminal that can be configured for use on a commercial Ka-band network.

Chris Aebli, President, Global Communication Systems, L3Harris, said obtaining Inmarsat type approval on the firm's Panther II terminal enables the company to provide customers with more end-to-end connectivity options and interoperability.

Keith Gammon, Director, Product Development, Inmarsat, added that as a long-time trusted partner to the U.S. government, the company designed Global Xpress with government mobile users in mind, thereby, boosting the effectiveness, flexibility and resilience of military satellite communication systems.

He added that with the Inmarsat type approval of L3Harris' Panther II terminal, expeditionary users now have more ways to access reliable and highly available commercial wideband capacity in parallel with their WGS network.

www.harris.com

DISPATCHES: *COTM satellite solutions to U.S. Army by Paradigm and 4K Solutions*

Paradigm and 4K Solutions have announced that their MANTA Comms-on-the-Move (COTM) satellite solution has been selected by multiple United States Army direct action units for deployed mobile operations.

The discreet, low-profile MANTA met the unit's specific requirements for a fully integrated system due to space restrictions on-board the vehicles.

The MANTA's integrated PIM® technology also provides crucial connectivity situational awareness for the soldiers, allowing full control over satellite selection and operation of the terminal, simplifying satellite operations.

The MANTA is the premier, proven solution for COTM and Comms-on-the-Pause (COTP) applications, requiring no specific satellite skill set from the user and with the added benefit of no mechanical moving parts, instead using software beam forming and tracking technology.

Operational from both DC and AC power sources, users can be transmitting and receiving in minutes.

4K Solutions' unique skill set enabled the swift integration of the MANTA onto the customer vehicles and into on-board networking equipment, enabling the unit to field the MANTA satellite terminal and provide vital in-theater communications.

David Theriault, President of 4K Solutions, said the MANTA terminals have allowed the soldiers to free up much needed cargo space in their HMMWV's and their tactical Polaris side-by-sides.

He noted that the Communications Non-Commissioned Officers (NCO's) are extremely pleased with the ease of install, ease of use and data bandwidth.

Ulf Sandberg, Managing Director of Paradigm, stated that it's very exciting to be adopted by a customer operating in truly demanding and challenging environments.

Sandberg noted that MANTA clearly demonstrates the operational simplicity and suitability of this simple to use high performance terminal for the military and government sectors.

He also added that 4K Solutions has been a very professional partner and a pleasure to work with.

paracomm.co.uk

4ksolutions.com

DISPATCHES: *The newest Space ISAC founding member is... Northrop Grumman*

The Space Information Sharing and Analysis Center (ISAC) and the National Cybersecurity Center (NCC) announced that Lockheed Martin (NYSE: LMT) has joined the Space ISAC as the newest founding member.

Lockheed Martin joins Kratos Defense & Security Solutions, Inc. (NASDAQ: KTOS), Booz Allen Hamilton (NYSE: BAH), MITRE, and SES as a founding member.

Clark VanBuskirk, Vice President of Advance Program Development for Lockheed Martin Space Mission Solutions, will serve on the Space ISAC board of directors.

The Space ISAC is the only space-dedicated ISAC and is made possible through the investment by its board and founding members. Lockheed Martin will contribute expertise managing space supply chain risk, threat intelligence across multiple domains and true end-to-end space-based cyber solutions, which serve a variety of customers and missions, to the Space ISAC.

ISACs are sector-specific, member-driven organizations stood up by the commercial sector with support from the federal government to collect, analyze, and disseminate cyber and physical security threats and risk mitigation information to critical infrastructure owners, operators, and members to increase resiliency.

The Space ISAC is the only space-dedicated ISAC and is made possible through the investment by its board and founding members. Lockheed Martin will contribute expertise managing space supply chain risk, threat intelligence across multiple domains and true end-to-end space-based cyber solutions, which serve a variety of customers and missions, to the Space ISAC.

NCC is recognized as a leader in cybersecurity and brings together leaders from across the globe at its annual Cyber Symposium. Together, NCC and the Space ISAC serve cyber influencers from the commercial sector, academia, government, and military and empower people to secure commercial, international, and military space communications from attacks on our global space assets.

They are jointly building a research and development capability, cybersecurity training curriculum, and an analysis portal. With the addition of the Space ISAC, NCC is offering training on secure GPS and hosts a dialogue on the importance of international and commercial satellites on military communication at the annual Cyber Symposium.

The initial founders of Space ISAC serve as board members. Each board member has a role in fulfilling the mission of the ISAC: to facilitate collaboration across the global space industry to enhance our ability to prepare for and respond to vulnerabilities, incidents, and threats; to disseminate timely and actionable information among member firms; and to serve as the primary communications channel for the sector with respect to this information.

Lockheed Martin Space creates technologies that power exploration, connectivity, and security from space. Major programs include GPS III and secure communications, human and robotic exploration of deep space, strategic deterrence and missile defense, weather and remote sensing, and commercial communications. Space is a key enabler that must be protected end-to-end — that's why Lockheed Martin recently rolled out a new way to evaluate how hardened space systems are using the Cyber Resiliency Level model.

Erin Miller, VP of Operations for Space ISAC at the National Cybersecurity Center, said the Space ISAC builds on a legacy of government-industry threat sharing, including Lockheed Martin's participation as a founding member of the Defense ISAC. Focusing on the unique challenges in space is a logical next step for a company that has extensive experience building many of the satellites and ground systems our nation counts on.

Clark VanBuskirk, VP for Advanced Program Development for Lockheed Martin Space Mission Solutions, added that software now defines the bulk of mission-critical capabilities and it's under constant attack. The U.S.'s ability to track, defend, and fight adversaries increasingly depends on how well we can field the best secure software and hardware.

The Space ISAC builds on Lockheed Martin's legacy of partnership with government on cybersecurity, which is increasingly important with new commercial and international space operators; it's vital all work together to defend a strategic domain for the nation's national security.

The need for a Space ISAC was conceived by the Science & Technology Partnership Forum in 2017 in response to recognized information-sharing gaps within the cybersecurity and space community. The Forum's goal was to enhance the community's ability to prepare for and respond to vulnerabilities, incidents, and threats; disseminate timely information; and serve as the primary communications channel for the sector with respect to this information.

The Forum shared this vision at the 34th Space Symposium in April 2018. In April 2019, the Space ISAC was announced during a classified session at the 35th Space Symposium in Colorado Springs, Colorado.

White House National Security Council Spokesman ***Garrett Marquis*** said of the Space ISAC's formation that this Administration strongly supports the formation of private-sector driven information sharing and analysis centers. The new Space ISAC aims to help gather, analyze, and disseminate critical cyber threat information related to space among the Federal, commercial, and international community and advances the 2018 National Cyber Strategy's priority to enhance space cybersecurity.

The White House's National Cyber Strategy, published September 23, 2018, states that "*the Administration will enhance efforts to protect our space assets and support infrastructure from evolving cyber threats,*" while working "*with industry and international partners to strengthen the cyber resilience of existing and future space systems.*"

Locating the Space ISAC at the NCC means Space ISAC members will have access to Colorado's space and cybersecurity ecosystems within the commercial and defense sectors and to the talents of the premier higher education institutions developing cybersecurity engineers.

To facilitate the Space ISAC's origination and organization as the founding member, Kratos Defense & Security Solutions, Inc., coordinated the organizational planning and federal government charter, funded the ISAC startup costs, and developed the operational plan for the Space ISAC.

NCC is a member-driven national community of cyber influencers from government, academia, industry, and military conceived in 2016 and located in Colorado Springs, Colorado. The NCC provides cybersecurity leadership, services, training, and policy advisement and awareness for public officials, business executives, and the workforce.

NCC's support to the Space ISAC will create a public-private alliance to serve the commercial sector, academia, government, and military and empower people to secure commercial, international, and military space communications from attacks on our global space assets. NCC also leads a collaborative effort to use blockchain technology to develop a secure mobile voting app and offering blockchain training.

National Cybersecurity Center CEO Vance Brown reported that this intersection of space and cybersecurity represents a unique public-private partnership at the tip of the spear and is in perfect alignment with NCC's vision to secure the world. The greatest threat to the nation's space assets is cyber interference. The NCC is uniquely qualified to facilitate the mitigation of cyber risks.

s-isac.org

www.northropgrumman.com

SPACEBRIDGE

BRINGING SATCOM TO THE CLOUD

ZERO OVERHEAD, FULLY MANAGED CLOUD-BASED SATCOM SERVICE

SpaceBridge delivers high quality dynamic SCPC BoD (Bandwidth on Demand) satellite connectivity as a fully managed cloud-based service – no hub or even teleport required!

Simply partner up with **SpaceBridge**, sign up for the period of time and amount of bandwidth desired, and you're all set. We'll provision your very own slice of our satellite infrastructure - equipment and optional bandwidth - CAPEX-free, with 24/7 management and technical support, maintenance; full visibility and control included.

Best of all, **SpaceBridge**'s pay-as-you-grow scalability will allow you to cost-effectively expand your satellite communication assets as you go.

Sign up today, and enjoy SpaceBridge's cost-effective, efficient and scalable satellite connectivity-as-a service!

- **High quality dynamic SCPC BoD satellite connectivity**
- **A fully managed, 24/7 cloud-based service**
- **OPEX only subscription engagement basis**
- **Optional teleport services**

SPACEBRIDGE
ALL THINGS CONNECTED

www.spacebridge.com

DISPATCHES: *National Guard disrupts cyberattacks across the U.S.*

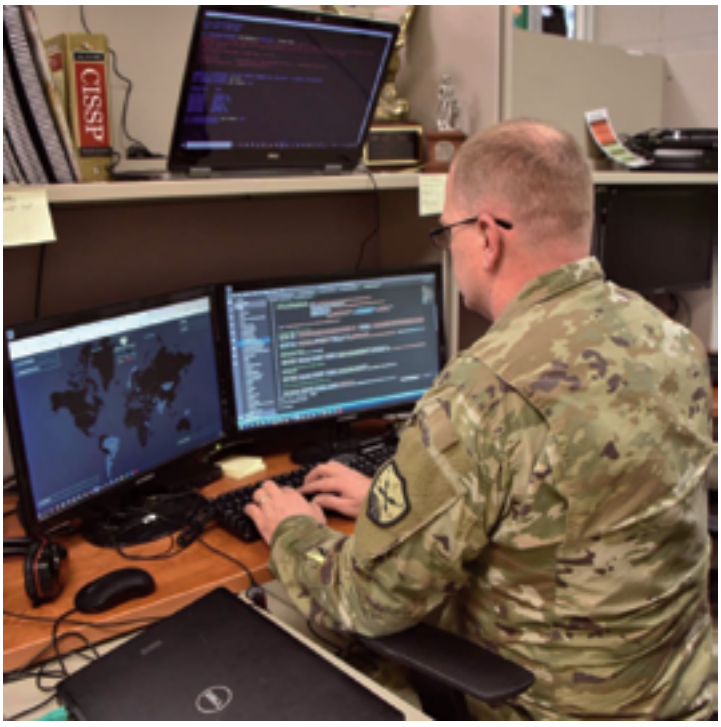
Air Force Airman 1st Class Thomas Schoening, a cyber transport systems airman, stands in the server room at the 153rd Airlift Wing, Wyoming Air National Guard Base, Cheyenne, Wyoming, in November.
Photo by: Air Force Staff Sgt. Jonathon Alderman, Wyoming Air National Guard.

Texas Army National Guard Sgt. Michael Russel analyzes network traffic during a Cyber Shield 19 training week class at Camp Atterbury, Indiana.
Photo by Army Staff Sgt. George B. Davis.

The National Guard is ready to mobilize its cyberdefenses in case of a potentially devastating domestic attack.

"*When I first joined the National Guard, cyber was not part of our vocabulary, but certainly now it is one of our daily battlegrounds*," said Air Force Gen. ***Joseph L. Lengyel***. "*Our adversaries and non-state actors use cyber activity to target personnel, commercial and government infrastructure and the effects can be devastating.*"

Lengyel, chief of the National Guard Bureau, talked about the Guard's cybermissions and capabilities during a media roundtable on Nov. 5 at the Pentagon. He said cyberattacks have occurred at both the federal and state levels.



Army Chief Warrant Officer 3 James Honeycutt, 169th Cyber Protection Team cyber operations technician, Maryland National Guard, reviews coding software Oct. 24, 2019, at the Anderson and Murphy Community Center, Laurel, Md., which serves as the Laurel Armory. The 169th Cyber Protection Team is a team of cyber professionals whose mission is to defend Defense Department information networks and assist in cyber defense outside of DOD when called.
Photo By: Air National Guard Senior Airman Sarah McClanahan, Maryland Air National Guard.

Earlier this year, a number of school districts and agencies in Louisiana and Texas suffered ransomware attacks. Ransomware is a type of malicious software designed to block access to a computer system until a ransom is paid. With the help of the Guard, schools opened on time and agencies were able to get back to work, Lengyel said.

"*[Ransomware] is obviously a new and emerging kind of enterprise. We are able to access superb civilians and skill sets, and they can bring capabilities that the military sometimes does not have*," Lengyel noted.

In Texas, 22 counties were attacked with ransomware during June, disrupting local service, said Army Maj. Gen. ***Tracy R. Norris*** of the Texas National Guard.

Norris said Texas' department of emergency management called the Guard, and officials assessed the attacks with a team of Guard soldiers and airmen.

"*It was a joint team that went out to assess [the damage]*," she said. "*From there, they picked different places to go [in] the counties for the recovery process. We thought it was bad in the beginning, and it couldn't have been much worse.*"

"*We already had a team in place and sent them out to assess, and we then aligned the team [based on] what the assessment showed*," Norris said.

Lengyel said the Illinois Guard is forming a cyber task force to assist the state of Illinois, as the need arises. The Illinois task force will involve Guard soldiers and airmen performing cyber, information technology and other military functions.

Indiana recently started a cyber battalion, and personnel will be trained to military standards for use in a domestic response capacity if they need to be, Lengyel said.

"*So, this will be part of the cyber mission force that will be part of the Army mission that, if needed, can be federalized and mobilized to do cyber activity for the U.S. Army or the U.S. Cyber Command*," Lengyel said. "*And when they're not mobilized, we can do our homeland mission.*"

Lengyel said many of these Guard members have cyber-related civilian jobs. He said it's an example of how the varied skill sets of Guard members contribute to national defense.

"*They can do things working in national defense they can't do in their civilian careers*," he said of Guard members.

Other attendees included vice director of domestic operations, National Guard Bureau; National Guard adjutant generals from Washington and Illinois; and the National Guard advisor to the commander of U.S. Cyber Command.

Article by Terri Moon Cronk.

DISPATCHES:

Satellite IoT tech tests completed

Thuraya and eSAT Global have successfully completed tests that validate eSAT's Global LPWAN (Low Power Wide Area Network) communications technology over Thuraya's satellite system.

Thuraya offers an expanding range of voice, broadband data and M2M/IoT capabilities for land, maritime and aeronautical applications.

These include cost-effective solutions, catering to a wide range of technical and commercial market requirements.

To date, only modest consideration has been given to the use of direct links to GEO MSS satellites for LPWAN connectivity for Internet of Things (IoT) applications.

eSAT's tests of its breakthrough technology over Thuraya's robust GEO MSS system reveal that this approach is not only practical, but also highly advantageous, and that low latency, low-cost LPWAN connectivity is about to become a reality with the use of Thuraya's cutting-edge technology.

The functionality of the eSAT system is enabled by the advanced capabilities of Thuraya's GEO MSS system. eSAT's disruptive approach ensures much lower costs and much higher capacity than many other satellite-based LPWAN systems.

It is also cost-competitive when compared to ground-based solutions, which are by their very nature, limited in their range of coverage.

The match between the Thuraya system and eSAT's services is now proven.

Michael Parr, eSAT's CTO, said the company is grateful to have worked with Thuraya to verify eSAT system's performance using Thuraya's system. The links operated just as the Thuraya team described, with the end-to-end, two-way connectivity being consistently achieved, directly from the first attempt.

Thuraya's Chief Strategy Officer, *Jassem Nasser*, added that Thuraya aims to be at the forefront of Satellite IoT and the company believes in its enormous potential to transform societies and industries worldwide.

He added that testing with eSAT is one of many steps the company is taking to address the Satellite IoT markets and looks forward to eSAT completing the development of their unique technology platform.

eSAT Global's Executive Chairman, *David Lyon*, noted, that eSAT looks forward to future success with Thuraya, bringing reliable, always available, Global LPWAN data connectivity to millions of IoT devices enabling practical applications such as environmental protection, public safety and fire prevention, asset and personnel tracking, and smart agriculture.

He added that this borderless mobility will also enable ongoing refinement of IoT applications through AI techniques applied to the massive data records that are to be continuously gathered over these GLPWAN communication links.

www.thuraya.com

esatglobal.com

THE NEXT GIANT LEAPS INTO SPACE

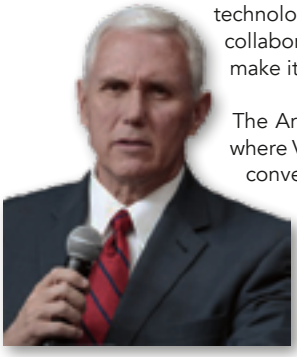
Experts share industry advancements at IAC 2019

By Paul Sims,
Contributing Editor, and Principal, Sims Communications

> *"Instead of a huge milestone event once every few decades, we're now seeing incremental breakthroughs every week in fields like Earth observation, weather analysis, and national security."— **Peter Beck, Rocket Lab CEO***

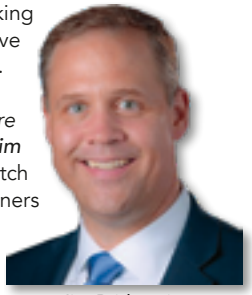
The 70th International Astronautical Congress (IAC 2019, Washington, DC) landed on U.S. soil for the first time in 17 years (53rd IAC 2002, Houston) to celebrate man's first steps on the Moon 50 years ago and the latest breakthroughs enabling new sci-fi-like missions back to the lunar surface and beyond.

When the Trump Administration directed NASA to return man to the Moon by 2024, four years ahead of schedule, NASA responded with its Artemis plan — leveraging the best available technologies and programs, corporate/government collaborations, and commercial launch vehicles to make it happen.



Vice President Mike Pence

The Artemis vision was on full display at IAC 2019, where Vice President ***Mike Pence*** opened the annual convention with a renewed call for American leadership in space exploration through cooperation with other nations. "*We will use all legal and diplomatic means to create a stable and orderly space environment that drives opportunity, creates prosperity and ensures our security on Earth,*" he said, speaking to the event's massive international audience.



Jim Bridenstine

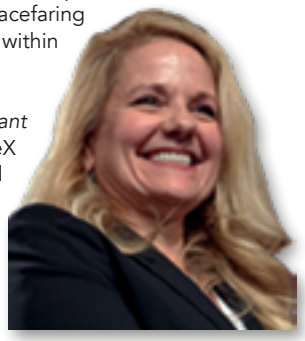
"*We need international partners. We can all do more when we work together,*" NASA Administrator ***Jim Bridenstine*** said during an IAC panel session pitch aimed at recruiting International Space Station partners to help land humans on the Moon in record time. "*If we're accelerating the Moon landing, we are accelerating the Mars landing,*" which he suggested can be accomplished by 2035.

It will take cooperation among commercial competitors, as well, to turn a lofty plan into reality.

Jeff Bezos

"*I am excited to announce that we have put together a national team to go back to the Moon,*" Blue Origin founder ***Jeff Bezos*** told attendees, unveiling plans to work with Lockheed Martin, Northrop Grumman and Draper to develop NASA's lunar lander.

SpaceX aspires to get the company's new Starship spacefaring vehicle to orbit within the next year.

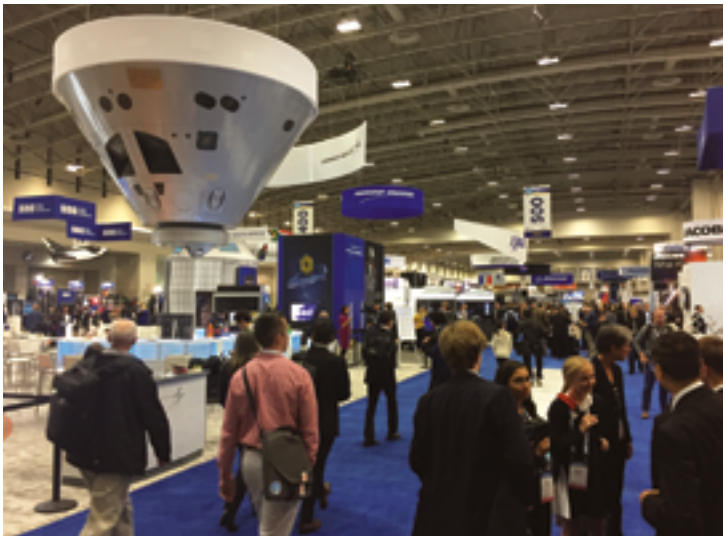


Gwynne Shotwell

"*We definitely want to land it on the Moon before 2022,*" SpaceX President and COO ***Gwynne Shotwell*** shared during an interview at IAC. "*We want to stage cargo there to make sure that there are resources for the folks that ultimately land on the Moon.*"

ULA President and CEO ***Tory Bruno*** agreed that ambitious initiatives will deliver.

More than 6,000 space professionals and enthusiasts from around the world attended IAC 2019.



ULA's Atlas and Vulcan Centaur rocket will begin launching from the same launch pad 41 at Cape Canaveral in 2021.

Tory Bruno

"*We're going to see that Artemis puts tremendous permanent infrastructure in place around the Moon that is going to enable new and exciting commercial activities on the lunar surface and in cislunar space,*" Bruno said during an interview with Satnews. "*That is going to be the next giant leap for decades to come,*" he declared, noting technological advancements or "*big steps*" are being made every day at ULA and across the industry to make space access more efficient and affordable.

Enabling Easier Access to Space

ULA is gearing up to facilitate a much higher launch frequency both at its rocket factory and on its launch pad 41 at Cape Canaveral. ULA's Centaur 3 upper stage "*is a handcrafted high performance work of art with 180,000 welds,*" said Bruno. "*To have our new Centaur 5 built and inspected with robotics, that's pretty cool and affords us much bigger scale.*"

As ULA transitions from its smaller Atlas rocket to the larger Vulcan Centaur, the company will launch both from the same pad for a few years, starting in 2021 when the first Vulcan Centaur is scheduled to lift Astrobotic's Peregrine lunar lander to the Moon.

"*The pad can handle a big rocket like Vulcan and a smaller rocket like Atlas the next day. That took a bit of cleverness,*" Bruno noted, "*We're not aware there's ever been a pad flying two different rockets.*"

While man's return to the lunar surface, the colonization of the Moon and manned missions to Mars may be the next giant leaps in space, countless developments by entrenched players like ULA and new space entrants such as small launch vehicle providers Rocket Lab and Firefly Aerospace are major steps in their own right — paving the way for immeasurable innovation.

"*The key difference between the current landscape and the 1960s is commercialization,*" said **Peter Beck**, Rocket Lab Founder and CEO. "*It's not one government player with one single-minded goal, we're now in a world of thousands of commercial players with niche objectives, technologies, and ideas. The pace of innovation in space is lightning speed, so instead of a huge milestone event once every few decades, we're now seeing incremental breakthroughs every week in fields like Earth observation, weather analysis, and national security.*"

Peter Beck

Rocket Lab is a launch vehicle company whose Electron rocket has been delivering diverse smallsat payloads to LEO for almost two years. "*By the end of this year we'll be demonstrating a launch every two weeks, with plans to scale up to a weekly cadence by the end of 2020,*" noted Beck, who plans to leverage reusability to step up frequency and efficiency as the company eyes missions to higher Earth orbits and the Moon.

"*One of the key differences for Electron's recovery is that we won't be attempting a propulsive landing,*" Beck said, referring to SpaceX's highly successful maneuver to recapture and reuse their much larger first stage. "*The mass/fuel trade-off doesn't make sense for a small launch vehicle. Instead, we're working toward capture under a chute.*" Beck indicated Rocket Lab is on track for a stage recovery attempt next year.

ULA's initial reusability plans for its Vulcan Centaur call for chutes to deploy on the engines only. "*It's far easier to get the engines back than an entire booster, because you can recover them behind a heat shield on a parachute,*" said ULA's Bruno. "*That's our approach for now. We have yet to see anyone make propulsive fly back economically practical.*"

Breakthrough Innovations in Spaceflight

Firefly Aerospace, a new launch vehicle and in-space services provider on the verge of launching their first small Alpha rocket from Vandenberg early next year, is also building the firm's larger Beta rocket to deliver bigger payloads to LEO, GEO, MEO and cislunar orbits, and eventually the Moon.. Firefly, like many launch providers, is using new age techniques and materials — from 3D-printed engine components to carbon-fiber composites for the entire airframe of Alpha.

Tom Markusic

"*Firefly represents a highly capable and cost-effective access to space solutions, as we create multiple platforms to enable a broad range of space missions*," explained Firefly CEO ***Tom Markusic***, who announced a collaborative partnership with Aerojet Rocketdyne at IAC 2019. Firefly is considering use of Aerojet's AR1 engine to power its Beta launch vehicle. Plus, the two companies are working on the development of Firefly's Orbital Transfer Vehicle (OTV) that is designed to ferry LEO satellites up to geosynchronous orbit.

Firefly is also developing their Gamma rocket plane, a reusable autonomous smallsat launch vehicle designed for horizontal runway landings. "*We're ready to initiate our dedicated and rideshare missions in 2020 aboard our Firefly Alpha rocket as we plan to play a significant role in enabling the next frontier, the global information revolution powered by the proliferation of small satellites in LEO and GEO*," said Markusic.

The on-orbit servicing of satellites has long been an elusive proposition; however, Northrop Grumman is among a shortlist of companies developing Mission Extension Vehicles (MEVs) to prolong the life of aging spacecraft and repair damaged or malfunctioning satellites in deep space.

Northrop Grumman's first-of-its-kind MEV was launched aboard a Proton rocket and released into orbit on October 9. Using its electric propulsion, the MEV will take about three-and-a-half months to reach geostationary orbit where it will dock with the Intelsat 901 satellite and provide the propulsion and attitude control needed to extend its life.

"*Intelsat 901 has been serving customers and orbiting the Earth since June 2001 and it is low on fuel but still very capable to meet our customers' business needs for years to come*," said Intelsat CEO ***Stephen Spengler*** during an interview at the ***Satellite Innovation 2019*** conference last month in Mountain View, California.

Stephen Spengler

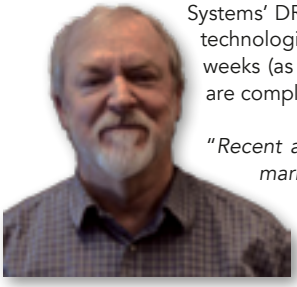
Life-size model of Blue Origin's Blue Moon lunar lander lands at the IAC 2019 event.

The IAC 2019 exhibit floor attendee lounge offers coffee and a reminder of the first giant leap into space.

The MEV will extend the spacecraft's life for five years, then the servicing vehicle could detach and help out additional, aging spacecraft. "*As these MEVs are further developed with robotics, we have a satellite that has a C-band reflector that never opened (Intelsat 28) and I'd love to see one of these service vehicles go up there with a robotic arm capable of putting that satellite into full service*," said Spengler. "*There are endless possibilities and opportunities that we can address as we make these new advancements in space with new satellite innovations.*"

New innovations in space are driven in part by experience — a big reason why established and new spacecraft manufacturers and launch vehicle providers are looking to firms like TriSept Corporation for launch integration and management expertise. TriSept has enabled the launch of more than 200 satellites over the last 25 years and the company is poised to play a lead integration role for a series of government and commercial missions over the next few years.

TriSept CEO ***Rob Spicer*** is especially focused on an upcoming mission early next year that is aimed at offering a solution to the mounting orbital space debris challenge. The company has brokered a rideshare slot aboard a Rocket Lab Electron and will serve as launch integrator for Millennium Space Systems' DRAGRACER mission devoted to testing new tether technologies designed to deorbit spacecraft in mere days or weeks (as opposed to months or years) after their missions are completed.



Rob Spicer

"*Recent advancements in both traditional and new space markets are mind boggling, many that I'm honored to say the TriSept team has had a big role in conceptualizing and developing*," Spicer shared, referring to cubesat rideshare innovations and orbital debris solutions. "*As we collectively move into the new space era with thousands of big and small satellites launching into LEO, MEO and GEO, we must also take important steps to ensure the responsible operation of these spacecraft.*"

Focused on the Future in Space

ULA's top guy is thrilled with the prospect of transporting multiple payloads for exciting future missions, as his team vies for NASA's Psyche operation – a journey to a unique asteroid orbiting the Sun between Mars and Jupiter. Whether NASA selects ULA for Psyche or not, to deliver an observation probe to the surface of what scientists believe may be the pure iron core of an early planet, the mission has had a significant impact on the design of ULA's Vulcan Centaur rocket.

"*Psyche is a preliminary indication of future multiple payload missions to come. As NASA sends a probe to a distant mass circling the Sun, it will also send four additional spacecraft to study Mars and other asteroids*," Bruno explained. "*We're optimizing our Vulcan rocket with missions like this in mind, with a bit more performance and flexibility so we have greater mass to take to higher energy orbits and a much larger payload volume to accommodate multiple payloads. What excites me the most about this new age in space innovation is that we're building on the momentum that was created over 50 years ago*," said Firefly's Markusic. "*That momentum continues to grow at such a pace that we can only imagine what the next half century holds.*"

"*Space is something that's never done. It's an endless opportunity that lures you in*," explained Rocket Lab's Beck. "*There's always something waiting to be discovered, a boundary to be pushed or a new capability to be developed. Space is almost a completely untapped opportunity, and creating better access to it invites innovation that will truly have positive and far reaching consequences down here on Earth.*"

Paul Sims is an award-winning reporter and industry professional with Sims Communications, where he specializes in traditional and new space, satellite, and connectivity markets. — visit www.simscomm.com.

THE TACTICAL EDGE

How COTS can accelerate development

By Charlie Kawasaki, Chief Technical Officer, PacStar

AI-based applications should be architected to perform computations on bandwidth intensive (that is, large) data, locally, on MDCs — reducing the requirement for high bandwidth connections to central datacenters or cloud resources.

Artificial Intelligence (AI) enabled applications in tactical environments have the potential to substantially transform how armed forces conduct maneuver and operations, saving lives, reducing costs, and enabling warfighting overmatch.

At their core, AI enabled applications will have the ability to analyze vast quantities of data generated by a proliferation of sensors such as video cameras, electronic warfare sensors, signal sensors, cyber sensors and more. Effectively trained and protected, AI enabled applications will be able to process this data, analyzing for patterns, anomalies, objects, and behaviors — faster, more accurately, less expensively, more safely and more tirelessly than humans.

This article explores how the Department of Defense (DoD) can think about COTS technology for tactical use of AI, which military applications can benefit from AI, key challenges, as well as primary steps to deploy AI at the tactical edge.

Due to the broad nature of data processing problems that AI solve, today's militaries are looking to deploy AI in a large number tactical of use cases, such as:

- *Video processing with analytics object and threat detection — Natural language understanding and translation*
- *Cybersecurity threat analytics, vulnerability detection, adversarial ML*
- *Sensor fusion, solider health monitoring, and augmented reality*
- *Electronic Warfare (EW) signal processing and signal intelligence*
- *Autonomous and robotic systems operations and navigation*

- *Equipment predictive maintenance*
- *Battlefield situational awareness and decision support*

Most of these applications are made possible by innovations in sensor technologies which can produce exorbitant amounts of data through functions that extend beyond simple motion-detection and similar binary functions. Sensors now have the ability to scan large environments using multiple spectrums, identify moving targets, identify sounds such as gunfire, monitor temperature, pressure, vibration and humidity levels in real-time — and with the advent of inexpensive wireless long-range sensors and numerous, sensor laden autonomous systems — the future battlefield is poised to be covered with sensors at unprecedented scale.

View Every Soldier as a Sensor

One of the sensor platforms undergoing the most innovation are human sensors, technically warfighter wearable sensors. Leveraging AI to analyze myriad soldier data can be used for predictive health, and data generated by solider mounted sensors can guide quick and effective action.

The two-way flow of data for applications, such as facial recognition of enemy combatants, can inform both DoD decision makers and warfighters, thereby improving situational awareness and battlefield decision making. These sensor-based analysis capabilities will be critical in enabling the next generation battlefield that more quickly identifies threats to improve the safety and effectiveness of warfighters missions.

PacStar advanced communications in action at the 50th Signal Battalion (Expeditionary), 35th Signal Brigade. Photo is courtesy of the company.

This vision of the soldier as a sensor is quickly evolving, with U.S. Army rapidly developing and testing a variety of technologies under a concept called the Adaptive Squad Architecture, which brings together project managers from across multiple programs to develop an integrated, smart solider worn system of systems — and programs such as PM Integrated Visual Augmentation System already piloting networked, wireless, augmented reality systems with sensor fusion capabilities. These new systems use large portions of Commercial-off-the-Shelf (COTS) technology, to demonstrate how AI can deliver on the promise of AI benefits to the warfighter.

AI is Not Plug-and-Play for Tactical Applications

AI is already making an impact in battlefield environments and at the tactical edge. In recent public comments Lt. Gen. ***Jack Shanahan***, Director, Joint Artificial Intelligence Center (JAIC), referenced early uses cases with predictive maintenance.

JAIC is front and center in bringing AI to the tactical edge by ensuring the infrastructure is in place to support data and analytics requirements. Shanahan cites the 160th SOAR (Special Operations Aviation Regiment) and its entire H60 fleet, which is subjected to rough desert conditions in the Middle East where sand melts into the engine. They are using AI for predictive analytics, to predict and avoid potentially devastating fleet failures.

Though COTS can play a key role in accelerating emerging technology adoption including AI, defense applications for AI have unique requirements and constraints. While Lt. Gen. Shanahan reaffirmed they are taking a "commercial first" approach because of the pace of commercial sector technology development, he acknowledges AI isn't necessarily plug-and-play for DoD.

Unique and challenging systems and workflows means that, for COTS to work for AI, some lifting needs to be done to adapt the technology for specific military requirements. The ability for AI to be deployed and used in an effective role at the tactical edge is impacted by the nature of the use cases being addressed, the AI approaches used, and how the AI is architected.
Algorithms used in machine learning and AI applications require different skill sets than traditional algorithms and require experienced data scientists who know how to adapt data sets to train AI algorithms to learn from themselves.

Tactical defense AI implementors face these typical challenges in AI, rated to dealing data, such as acquiring and developing sizable, reliable training datasets, developing and tuning algorithms to deliver required accuracy levels and implementing measures to deal with false positives and negatives.

Fortunately, the commercial industry is investing heavily in tools that are available to DoD on a COTS basis, that streamline the data management, model building and model training processes.

However, tactical implementors of AI based systems face additional challenges unique to their environment, even among AI developers. While typical AI developers in the commercial industry can use enterprise data center or cloud-based computing resources to process and store massive volumes of data acquired via sensors — those resources are simply not available in tactical settings today — tactical organizations are not able to rely on WAN connectivity from sensor to enterprise datacenter — so parts or all of AI workloads need to be moved closer to the sensors. This requires an entirely new architecture to make AI effective in tactical settings and for unique DoD requirements.

The unique AI deployment challenges that tactical programs face fall into several categories, the first is what is known as DIL — Disconnected, Intermittent, and Limited bandwidth. Tactical networks deploy in areas with unreliable, slow, and threatened WAN connections — due to the nature of how they deploy. Where enterprise networks can frequently comprise multiple gigabit per second connectivity, tactical communications may be limited to satellite networks providing only 4 Mbps, at very high latency — sometimes for sizable teams. Clearly, attempting to transmit dozens of UAV sourced HD video streams over links like these, to enable AI processing in the enterprise datacenter or cloud, is untenable.

A second category of challenges for tactical programs is SwaP — Size, Weight and Power — of deployed equipment. Tactical programs today strive to improve mobility — speeding deployment time, reducing the number of vehicles required to transport equipment, providing more maneuver options for commanders, and removing soldiers from harm's way. Enterprise AI developers don't have those types of constraints. For example, a typical enterprise AI development server might have tens of thousands of GPU cores and consume thousands of watts of power, where a tactical server might be on a limited power budget of just a few dozen watts.

Using COTS to Deploy AI at the Tactical Edge

Relative to custom-built hardware and software, COTS technology offers military organizations the potential to reduce costs and shrink the acquisition timeline. This is particularly valuable for emerging technologies where the commercial industry is investing heavily in technologies that are horizontal, but also adaptable to meet DoD unique requirements.

Organizations looking to achieve the benefits of AI-enabled applications in tactical settings can now take advantage of new COTS developments, putting in place the foundations needed to overcome the unique challenges faced in tactical settings, including adopting distributed AI applications running on small form factor, hardware accelerated platforms developed specifically for tactical use.

Bring Your Data Center with You

Thanks to DIL, warfighters can't rely on being able to communicate with their data centers (or cloud) at home, so can't rely on giant compute resources being available for AI... unless they bring those resources to the fight. The good news is that small form factor COTS modular data centers (MDCs) that can be deployed dismounted, in command posts, ground vehicles, aircraft, and FOBs are now becoming available.

Designed using small form factor hardware, this addresses SWaP constraints, and allows warfighters to tap into emerging technologies at the tactical edge — including many of the AI- based applications discussed above. Some systems can be customized to optimize for high amounts of compute or storage, depending on the use case and types of sensors providing data.

Combined with software that can replicate data in clouds or datacenters, MDC solutions can be an organization's infrastructure to deploy AI workloads closer to the sensors, ensuring the benefits of AI, and preparing for the arrival of AI applications able to distribute the computational workload throughout tactical networks.

Bring Your COTS AI Accelerators with You

AI experts understand that machine learning and processing data in video streams requires high performance computations, and that certain types of computations lend themselves to highly efficient acceleration through the addition of supplemental hardware such as GPUs.

While it's not feasible for tactical organizations to deploy GPU enhanced servers containing tens of thousands of GPU cores at the edge of the network, advances in COTS embedded, rugged power-efficient GPUs make possible the prospect of distributing and accelerating AI workloads at edge.

Organizations seeking to field tactical AI should look for compute platforms that can add GPU acceleration to their capabilities, to be ready for the new generation of AI-enabled applications designed and optimized for GPUs at the edge.

Start Your Design with Distributed AI in Mind

Using MDCs equipped with GPUs, organizations can put in place the hardware foundation that can overcome SWaP and DIL challenges. AI's remaining challenges, standing in the way of "plug and play" for tactical DoD, is the need for distributed AI-based applications. Programs looking to deploy AI in tactical settings should begin by looking for solutions that can be adapted to distributed architectures.

Specifically, AI-based applications should be architected to perform computations on bandwidth intensive (that is, large) data, locally, on MDCs — reducing the requirement for high bandwidth connections to central datacenters or cloud resources. They should also be architected to run in a completely disconnected environment. Ideally, warfighters at the edge with marginal connections only transmit metadata or abstracted data over WAN connections.

In some architectures, warfighters at the edge may only execute "runtime" versions of AI models — restricting machine learning operations to upper echelons with substantial computational resources, and the expert staff to supervise the machine learning processes.

AI is Just Around the Corner

Organizations looking to taking advantage of newly developing AI applications, or looking to "future proof" their network modernization programs should consider developments in COTS modular data centers and COTS AI accelerators — which are mature enough for fielding now, and ready to host the myriad of applications on the way.

pacstar.com

Charlie Kawasaki is the Chief Technical Officer at PacStar.

PROFILE: USAF'S 23RD SPACE OPS SQUADRON, DET.1

Providing strategic value

By Airman Jonathan Whitely, Airman 1st Class, and, Senior Airman William Tracy, both with 50th Space Wing Public Affairs

The 23rd Space Operations Squadron, Det. 1 is located more than 700 miles north of the Arctic Circle. The detachment is the northernmost Air Force Satellite Control Network site and is responsible for collecting data and pushing commands to AF satellites. U.S. Air Force photo by Airman 1st Class Jonathan Whitely.

Members of the United States Air Force (USAF) 23rd Space Operations Squadron detachment 1 at Thule Air Base, Greenland, take pride in saying "Detachment 1 is the best one," because of the integral support it provides to our nation and military daily.

Captain ***John Bang***, 23rd SOPS Detachment 1 (Det. 1) commander, said the detachment was established in 1961 to support the Polar Orbiting Geophysical Observatories satellite program, earning the site its POGO nickname.

The detachment's primary duty is to provide telemetry, tracking and commanding operations to the United States and allied government satellite programs.

"*Our parent squadron is located in New Hampshire and they work in conjunction with the 21st and 22nd SOPS as a part of the Air Force Satellite Control Network*," he said. "*Det. 1's role is to manage the Air Force Satellite Control Network for national use alongside our parent squadron and its other geographically separated units.*"

The AFSCN is what connects the USAF's space operators to satellites, allowing them to collect data and push commands to the satellites.

Det. 1's 30 American and Danish contractors work to provide satellite connectivity for users in the polar region of the world.

"*Without Det. 1, there would be a challenge in creating constant communications with certain assets*," he said. "*We wouldn't be able to collect data and push commands as frequently and as often as we'd like [if we weren't here].*"

Despite being in a remote location 700 miles north of the Arctic Circle, Bang said the unit has provided five years of error free support, or contacts, with satellites.

The detachment's primary duty is to provide telemetry, tracking and commanding operations to the United States and allied government satellite programs.

Capt. John Bang, 23rd Space Operations Squadron detachment 1 commander, stands in a tunnel leading to a radar at Thule Air Base, Greenland, October 9, 2019. The United States and its allies use Det. 1's capabilities for navigation, research and development, weather, warning, intelligence and satellite communication missions. U.S. Air Force photo by Airman 1st Class Jonathan Whitely.

"*The ops are run by people*," he said. "*Everyone keeps our mission running from the engineer to the operator. We operate 24/7, 365 to continue [the mission]. Our operators will be here regardless of the weather and even stay overnight if it's needed.*"

Although coming into work regardless of weather may seem normal, the Arctic's strong winds, unpredictable snow storms and an average winter temperature ranging from 13 to 20 degrees below zero, can make the journey to work dangerous.

"*Because of our location, we're not only able to provide coverage for the polar region of the Earth, but [we can] contact certain satellites anywhere from 10 to 12 times a day*," said Master Sargeant ***Marcus Smith***, 23rd SOPS det. 1 chief.

The 50th Space Wing holds the title of "***Master of Space***" and will continue to maintain space and cyberspace warfighting superiority, a mission which 23rd SOPS Det. 1 is integral in assuring.

This base is far north — so far north that the northern lights are south — this remote unit is nearly situated on top of the world in the ice fields of Thule Air Base, Greenland.

As the northernmost U.S. armed forces installation, Thule AB's unique location allows Detachment 1 to efficiently and frequently track satellite movements overhead.

Relaying this information in a timely manner is vital to the USAF's Satellite Control Network (AFSCN), and as part of Schriever Air Force Base's network of geographically separated units, Detachment 1 serves as a testament to its worldwide outreach.

Providing telemetry, tracking and commanding operations for the U.S. and allies through its mission, Detachment 1's northern location allows contact with polar orbiting satellites 10 to 12 times a day — much more frequently than other AFSCN tracking stations, which are limited to sparse daily contact.

"*The location enables the mission*," said Major ***Uri Mandelbaum***, Detachment 1 commander. "*Without being in this area, we wouldn't have nearly as much visibility and connection with orbiting satellites.*"

The unit is a crucial part of Thule, which also hosts the 21st Space Wing's 821st Air Base group, plus a handful of previously mentioned Danish and Greenlander contractors.

This small community provides a close-knit backdrop for the important satellite tracking and operations missions held there, said Master Sergeant ***Andrew Martin***, detachment chief.

"*There is an incredible sense of esprit de corps and community here I haven't found anywhere else*," said Martin. "*It's a very small base, we only have about 100 active duty personnel here. Although small, everyone looks out for each other.*"

Thule has seen a significant downsize since the Cold War era, when more than 10,000 military personnel worked on base, always on standby due to the looming Soviet presence.

The base has a museum and other remnants serving as a reminder of Thule's olden days, said Martin. Among the relics is an old munitions warehouse and a shelter which has an office space that is part of a bunker complex — all well preserved in the arctic climate.

"*It's like frozen history, there is nothing else like it*," the Master Sergeant said.

Now dedicated to satellite operations, the general mission of the base has changed, but the unique conditions of the arctic remain the same. Base personnel experience months of incessant darkness, as well as months of sunlight, subzero arctic temperatures, and isolation, the nearest town being Qaanaaq, 75 miles northwest of Thule with a population of only 600.

"*It's an austere environment, it isn't exactly hospitable*," said Martin. "*We deal with a lot of communication issues with everything so far north. There are difficult aspects of being here but the good outweighs the bad by far.*"

Despite the challenges, Thule's critical location is an exceedingly important asset of the Department of Defense (DoD); however, its vital mission would be nonexistent without the crucial efforts of Detachment 1 and other base personnel.

"*Having this presence in the arctic will become more and more important in the upcoming years*," said Mandelbaum. "*We are an important link in the chain which connects Schriever to their satellites in space.*"

The 23rd Space Operations Squadron, Detachment 1, achieved a milestone in February of 2019 and managed to maintain an error free streak that has been achieved since February 11, 2014, with more than 62,000 successful supports as of the first of the year.

A remote block change antenna designated as POGO-Charlie, operated by Detachment 1, 23rd Space Operations Squadron at Thule Air Base, Greenland July 26, 2016. Detachment 1 provides vital support to Schriever and the Air Force Satellite Control Network, providing telemetry, tracking and command technologies. Photo is courtesy of the USAF.

"*Error free operations maximizes system availability across the Air Force Satellite Control Network,*" said Major ***Jeffrey Rivenbark***, 23rd SOPS Director of Operations. "*More system availability equals more capacity to support the ever growing number of satellites on orbit today and into the future.*"

The 50th Space Wing geographically separated unit, known as POGO, averages 30 satellite contacts per day, with each contact requiring coordination between space operations centers throughout the wing and around the world. It's location as the northernmost U.S. military installation provides polar coverage for satellite missions.

"*Thule Tracking Station expertly performs telemetry, tracking and commanding operations support of U.S. and allied satellite programs in support of national defense,*" said Captain ***Brian Chambon,*** 23rd SOPS Det. 1 Commander.

Rivenbark emphasized the importance of this accomplishment.

"*POGO's location makes error free operations all that more crucial,*" he said. "*Contacting satellites involves precise timing, communication of technical data, and system configuration to ensure mission success. Maximizing the availability of these resources is, and has been, essential to the success of the AFSCN since its inception.*"

Rivenbark attributed the site's continued success to its Airmen's professionalism and hard work.

"*The key to this success is both the technical proficiency and professionalism of our operators, as well as the longevity they provide, some working as much as 17 years on site,*" he said. He added the error free streak is a direct reflection of the high morale and comradery between operators at POGO, despite the location's unfavorable conditions.

"*Temperatures dip below zero and there is no sunlight most of the year - additionally, the amenities that we enjoy stateside, such as mail and internet services, are slow and rare commodities,*" Rivenbark said. "*Yet, despite the austere and challenging conditions of working at POGO, the honor of holding an error free streak this long definitely goes a long way in instilling pride in the mission amongst those who work there.*"

Chambon said the error free streak was the highlight that marked the start of a promising year at Thule.

"*We have an upgrade planned for the future - once complete, this upgraded system will greatly increase the amount of satellite supports the site will be able to flawlessly execute on a daily basis,*" he said.

Rivenbark shared this excitement for the future and said despite the ever changing space and cyberspace warfighting realms, the station's error free streak is the one thing he is determined to keep consistent.

"*Without sites like POGO and the flawless operations executed by the operators there, space operators at Schriever AFB who depend on communication through the AFSCN would not be able to contact their satellites that aren't in direct line-of-sight of Colorado Springs,*" he said. "*Our operators there do a tremendous job executing 24/7 operations.*"

The Northern Lights shine over Thule Air Force Tracking Station, Greenland.
U.S. Air Force photo by Senior Airman Dennis Hoffman.

YOUR BRIDGE TO THE SMALLSAT FUTURE

Build It.

SMALLSAT SYMPOSIUM™

SILICON VALLEY 2020

WORKSHOPS: February 3rd, 2020

CONFERENCE: February 4th - 6th, 2020

SMALLSATSHOW.COM

A TALE OF TWO GEOINT MISSIONS

Views for mission success

By Ken Joyce, Director of Online Products, Maxar Technologies

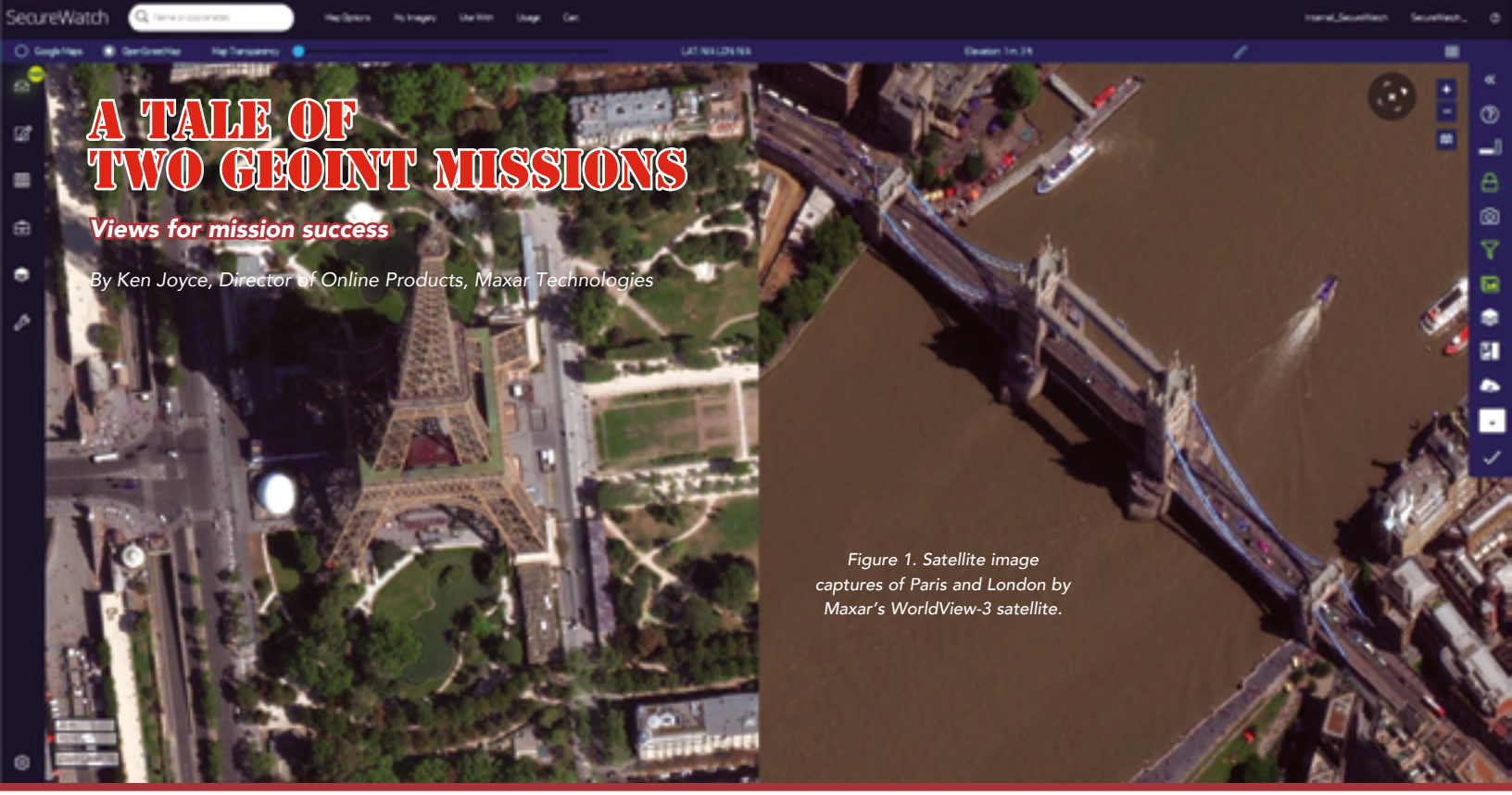


Figure 1. Satellite image captures of Paris and London by Maxar's WorldView-3 satellite.

In the two years since releasing the *SecureWatch* product, Maxar's subscription-based Earth intelligence product, the company has learned a great deal about how to serve customers who focus on national security.

The firm's product managers have spent hundreds of hours demonstrating our product to customers and training dozens of defense and intelligence agencies around the world. In that process, we gained a deeper understanding of customers' geospatial intelligence (GEOINT) missions and how those requirements can be met to ensure mission success. It boils down to the fact that defense customers primarily focus on two GEOINT missions:

- *Collection and maintenance of foundational intelligence (**Figure 2**)*
  Most defense and intelligence agencies are responsible for producing foundational GEOINT across broad areas by cataloging natural and human-made features such as terrain, lines of communication, civil and military facilities and critical infrastructure. This mission enables agencies to publish maps, manage GIS databases and to develop a holistic understanding of civil and military capabilities for the purposes of advising policy makers and planning and executing security missions.

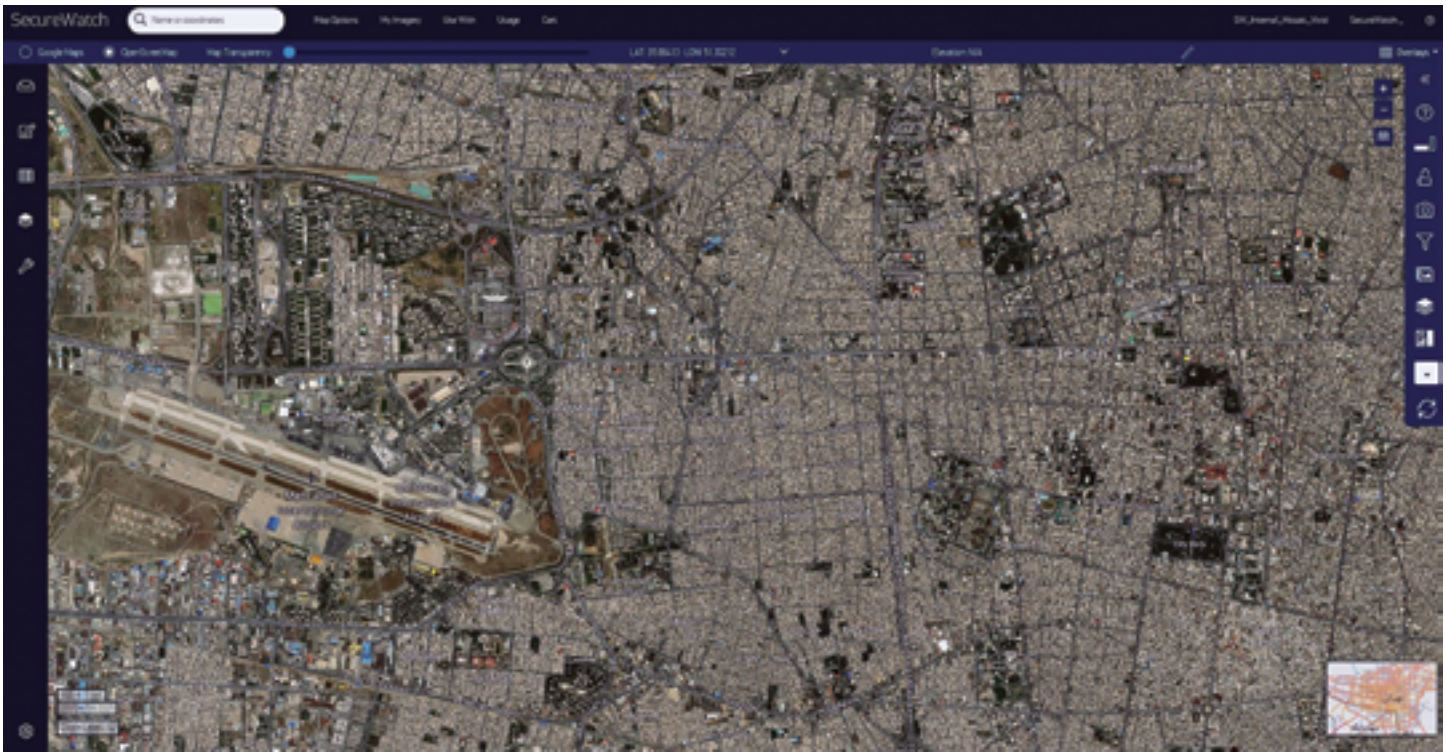


Figure 2. Example of broad area, foundational GEOINT collection in Tehran, Iran using SecureWatch with a streaming Vivid imagery mosaic.

- *Event and location-specific intelligence gathering (Figure 3)*
  Defense and intelligence agencies also study the geospatial context of event- and location-specific activities such military deployments and natural and human-made disasters. This mission enables agencies to develop an understanding of activity at key facilities and active events, which is accurate to the day, hour or even minute.

Mission Requirements

These two GEOINT missions have a complicated set of overlapping and occasionally conflicting requirements for a provider of geospatial intelligence. Our ability to balance requirements across both missions for a variety of customers is what ultimately delivers valuable products aiding the success of all of our customers' missions.

Figure 3. Example of location specific intelligence collection at a military site in Iran using SecureWatch Image Exploitation Mode. This is a WorldView-3 image from August 14, 2019.

Common Requirements

Foundational GEOINT and focused intelligence collection both require imagery from the overhead perspective. Since World War I, overhead imagery is what has provided an authoritative source of GEOINT and enabled data collection over small and large areas. For both broad and focused missions, overhead imagery must:

- *Enable clear visibility to the ground. Satellite imagery can be collected for any piece of the globe. However, cloud-free imagery is challenging to collect, especially in tropical areas. This requirement is best met using a combination of electro-optical (EO) and synthetic aperture RADAR (SAR) assets in order to deliver the all-weather flexibility of SAR with EO imagery's ability to clearly identify and classify objects.*

- *Provide sufficient resolution to distinguish features of interest on the ground. Both GEOINT missions typically require imagery with 50 cm ground sample distance or better to confidently identify objects and activities of interest such as military equipment and posture.*

- *Deliver reliable accuracy for geographic feature collection and interoperability between multiple data sets. Images must be collected and processed in a manner that enables the geospatially accurate collection of features in all areas of the world.*

Unique Requirements

Foundational GEOINT and focused intelligence also present unique requirements that must be balanced when considering how data is collected, processed and delivered. Consider the following:

- *Imagery Refresh Cycle (Figure 4, next page)*
  Foundational GEOINT collection requires relatively recent imagery over large areas. This enables analysts to create up-to-date maps and databases. For example, to create an accurate database of all critical infrastructure in Somalia, analysts could require imagery collected within the last 12 months covering all populated areas of the country.

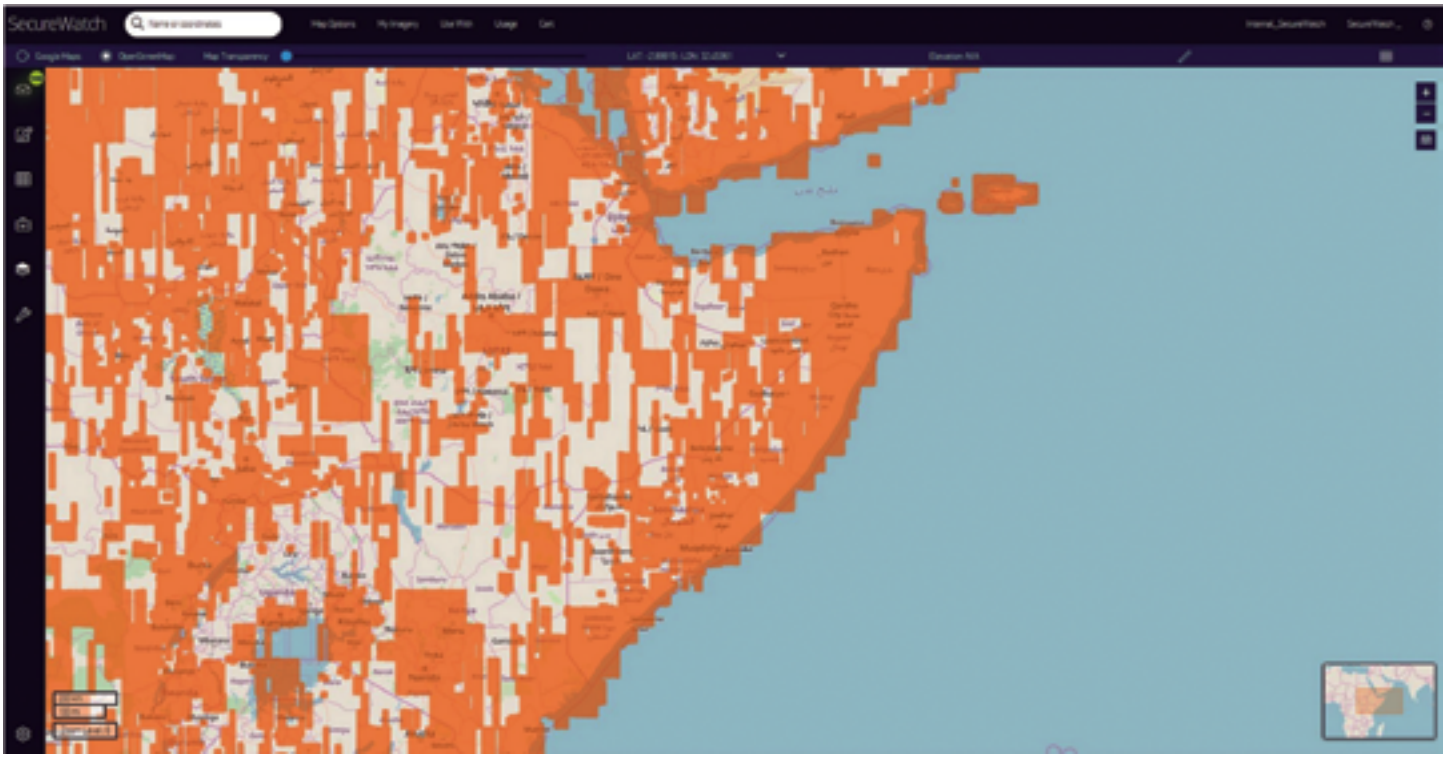


Figure 4. The orange strips represent Maxar optical satellite images added to SecureWatch within the last year that cover the populated areas in Somalia. This allows an analyst to create an accurate foundational GEOINT report on a topic such as critical infrastructure.

- *Focused intelligence (**Figures 5a, this page, and Figure 5b, next page**) requires imagery which is updated frequently over small areas, regardless of weather and light conditions. An example mission could require new imagery of the port at Mogadishu, Somalia, as frequently as possible to report accurately on activity.*

Maxar EO (Figure 5a, this page) and SAR (Figure 5b, next page) satellite images of the port at Mogadishu displayed in SecureWatch, which enable analysts to monitor activity regardless of weather and light conditions.

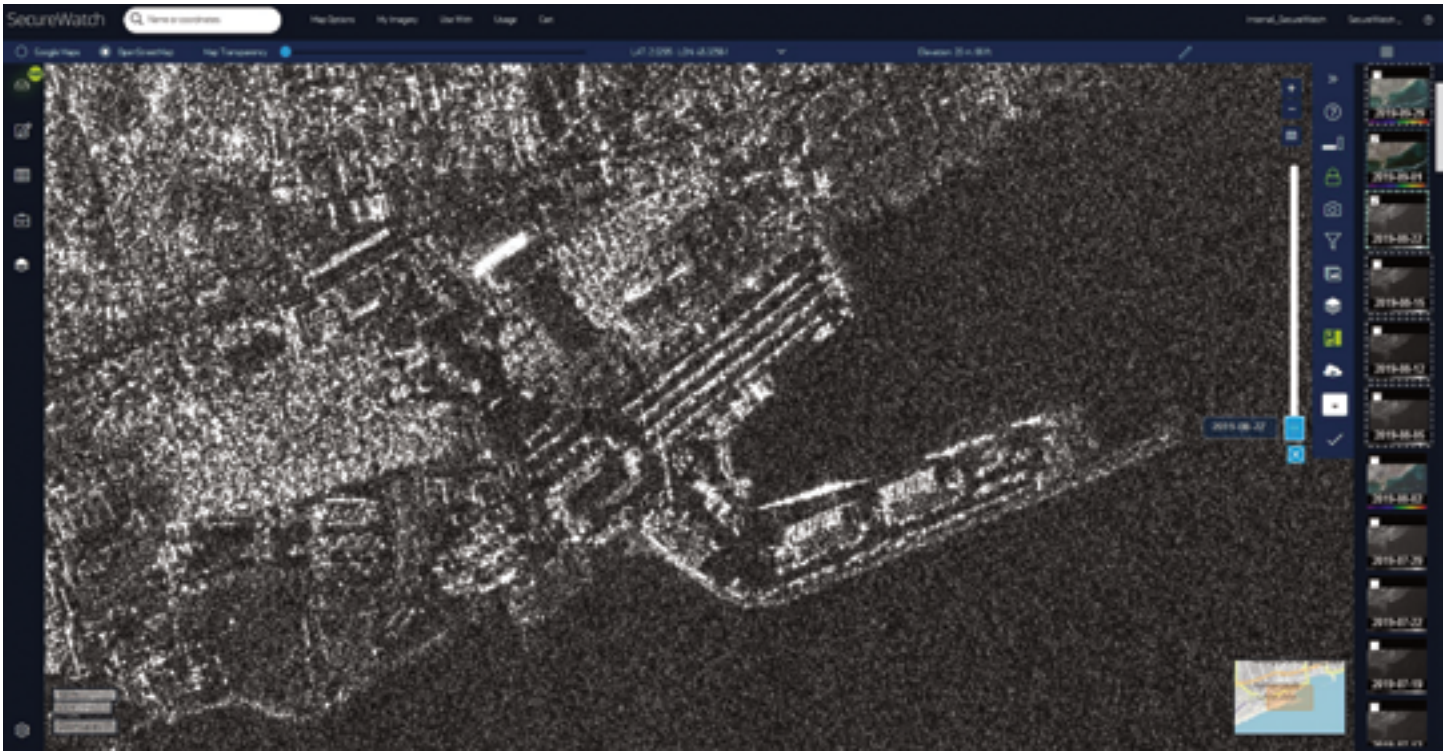


Figure 5b.

- *Image Processing (Figures 6a, this page, and 6b, next page)*
  To cover broad areas, foundational GEOINT missions require multiple images to be processed to remove inconsistencies between each image, like the removing of clouds, resampling to consistent image resolution, compensating for atmospheric effects and balancing light conditions. The process of blending multiple images enables both human and machine-based extraction to operate most efficiently over large areas.

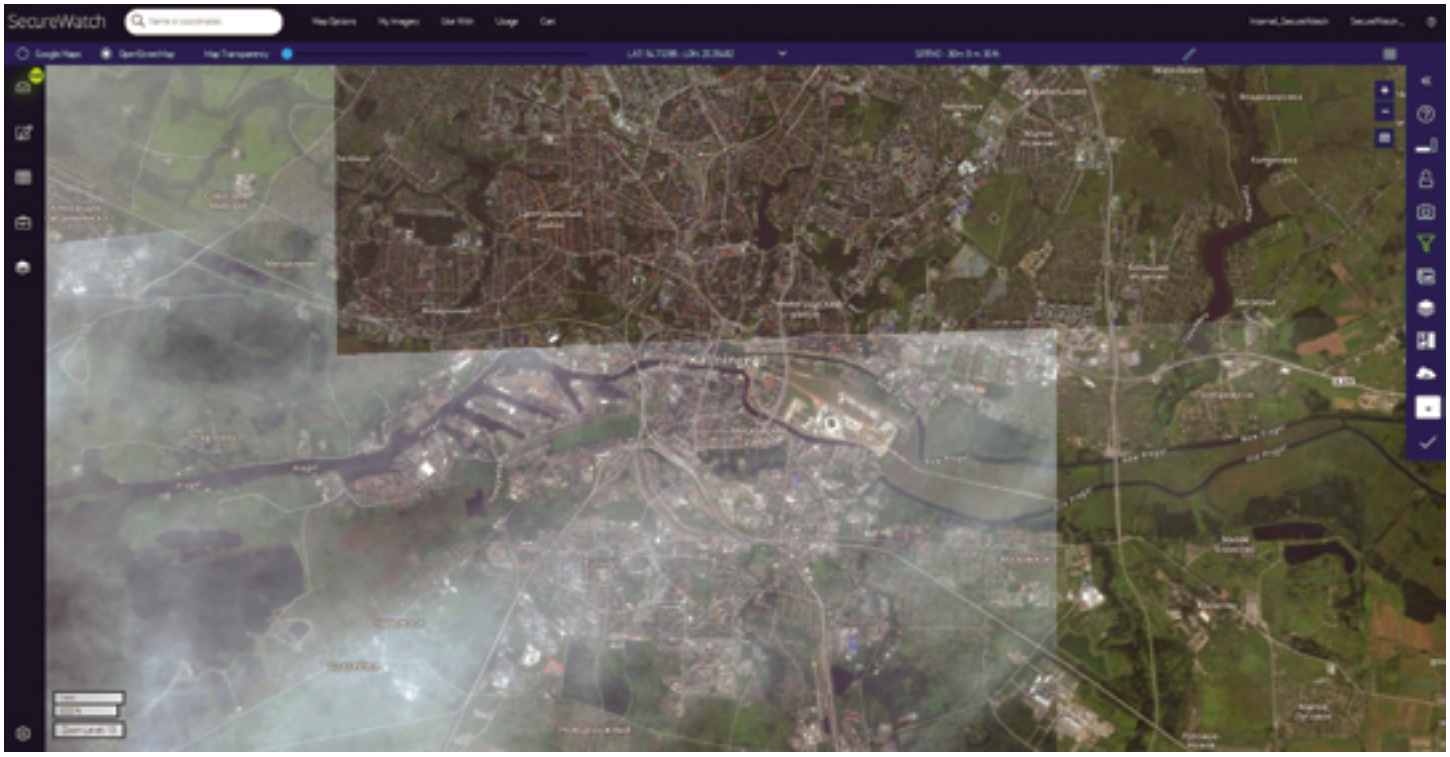


Figure 6a. This SecureWatch screenshot shows a mash-up of several unbalanced images layered over Kaliningrad.
On the next page, Figure 6b displays the images after being blended and balanced to create a single imagery mosaic, enabling machine-based and human feature extraction to operate most accurately and efficiently.

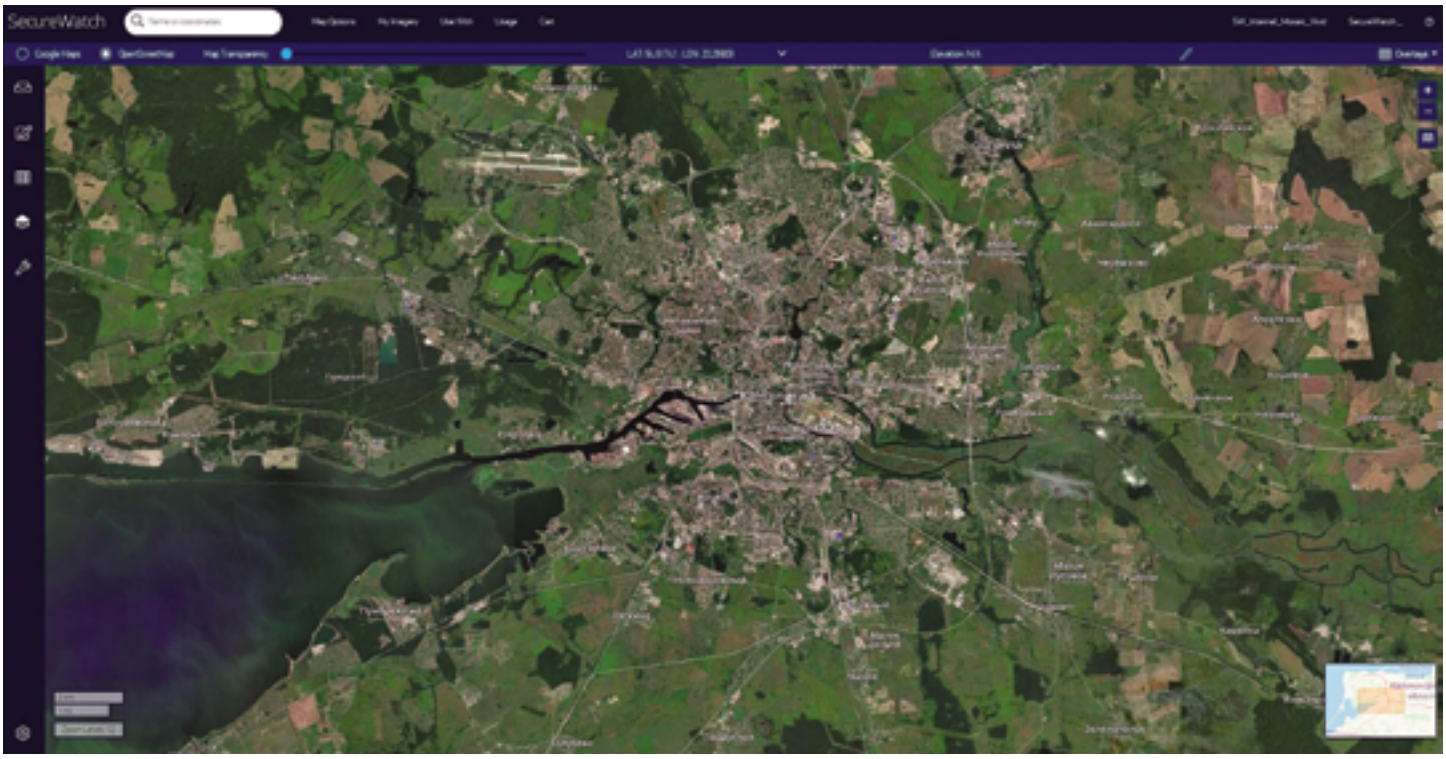


Figure 6b.

- *Focused intelligence collection (Figure 7) requires images that are as high-resolution as natively possible to minimize artifacts that might result in false positive or negative detections. In addition, images that are unfit for mosaic production due to atmospheric conditions or collection geometry may be highly valuable for studying a specific area.*

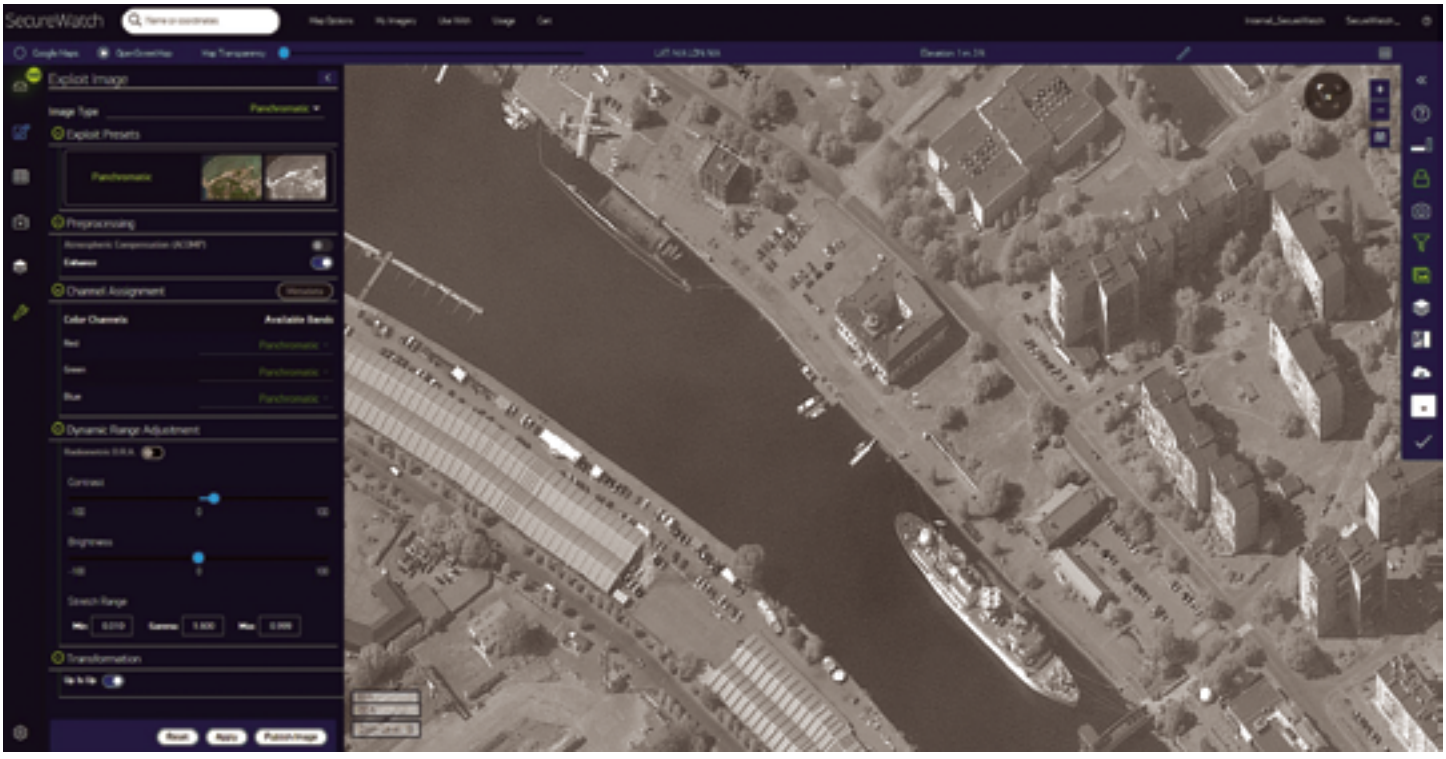


Figure 7. This recent WorldView-1 image of Kaliningrad was not used for mosaic production because it is panchromatic (black and white) and was collected at a high off-nadir angle. This image is still very valuable for an analyst studying facilities this area and is available in SecureWatch both online and with Image Exploitation Mode.

Meeting the Mission Requirements

Addressing these overlapping and conflicting requirements is a challenge. For a product team, this challenge presents opportunity: we aim to understand these requirements and develop productized capabilities at Maxar to address them. Here are some examples:

- *The Maxar Constellation (Figure 8)*
  Maxar owns and operates the world's most advanced constellation of commercial EO and SAR satellites, which collect both wide area and focused data. The active, five-satellite constellation images with the highest accuracy and resolution available commercially, as well as images in all weather and light conditions. A global network of downlink facilities and backhaul connections supports the constellation by delivering new images to our production facility within minutes of collection.

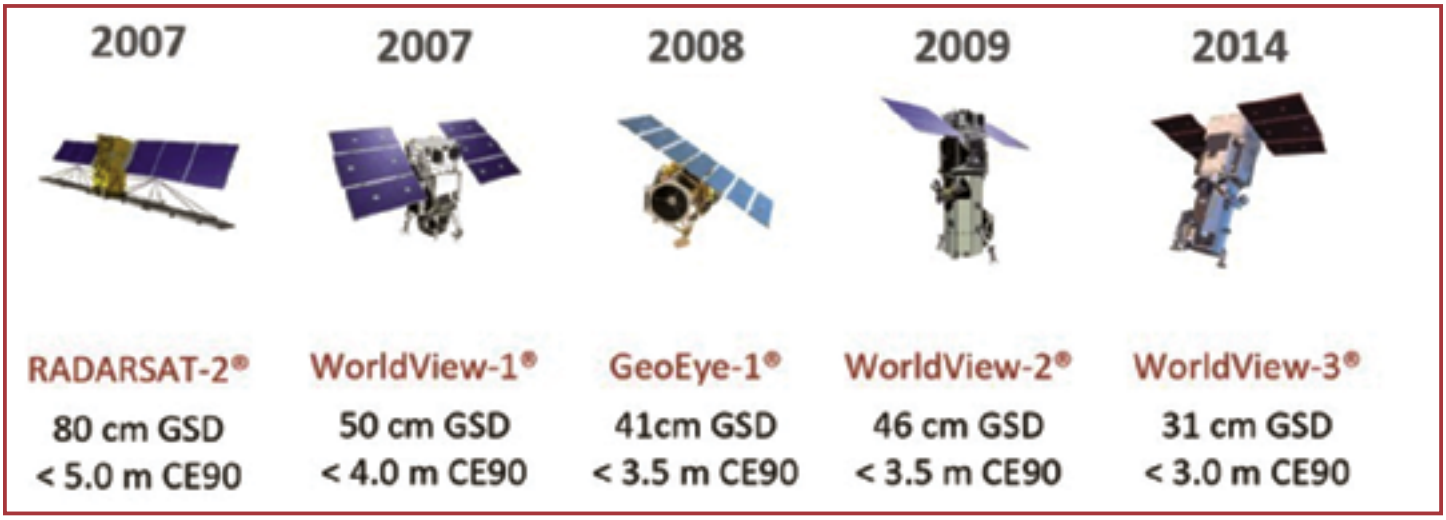


Figure 8.

- *Production and hosting of "The Daily Take" (Figure 9)*
  Maxar produces an average of 1.5 million square kilometers of new EO and SAR imagery every day, within strict time and accuracy requirements for focused GEOINT collection. Missions requiring the latest imagery to monitor active facilities and activities on the ground are served with the latest imagery.

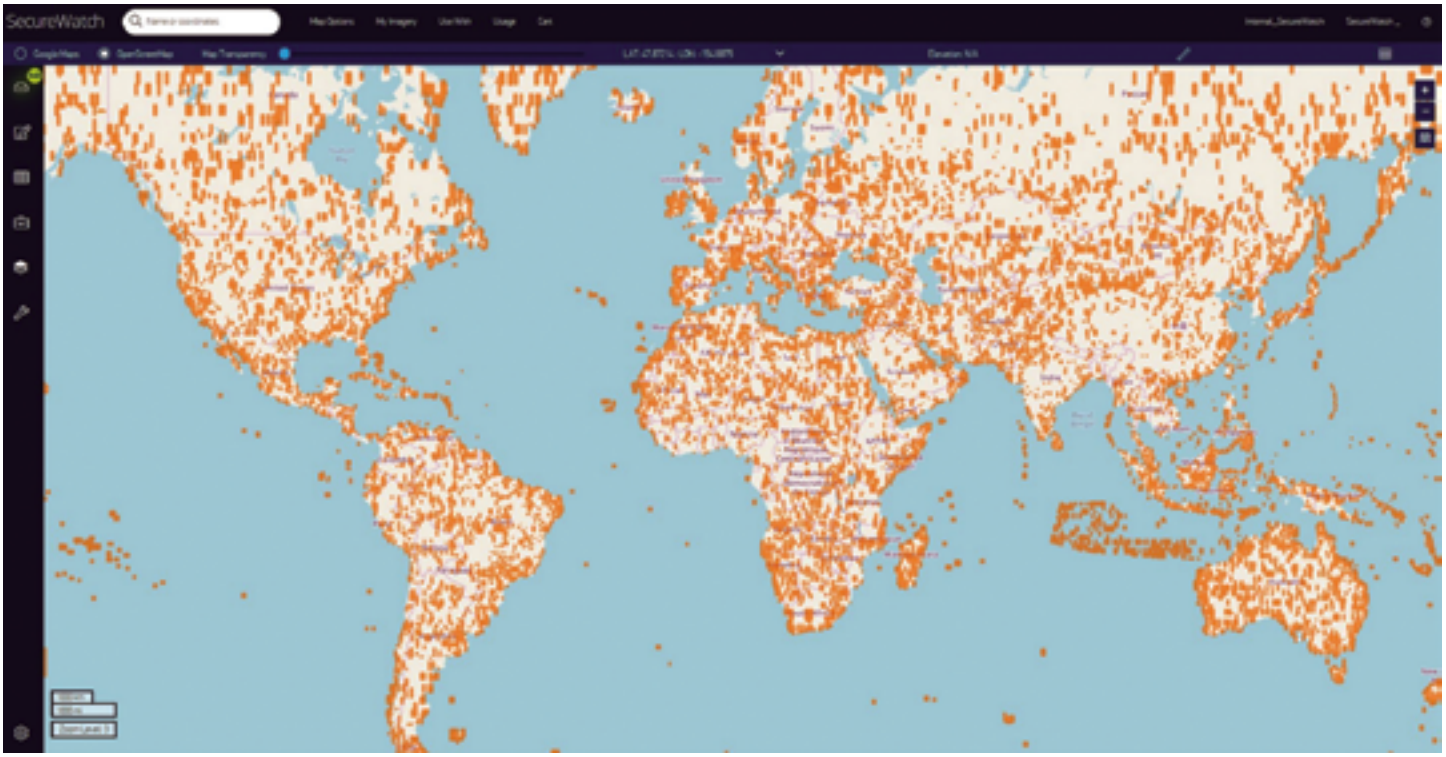


Figure 9. This graphic shows 30 days of Maxar's "Global Daily Take" EO images represented by orange polygons.

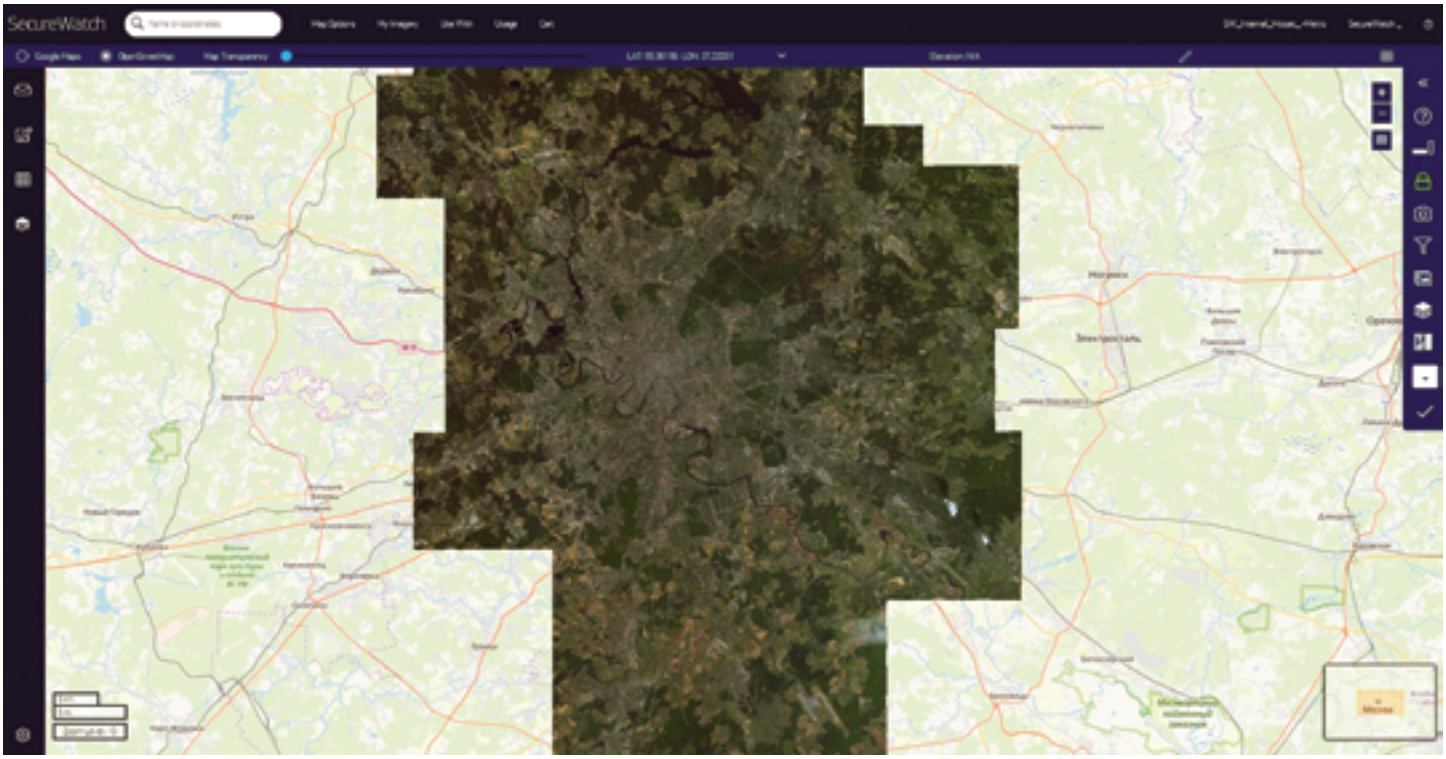


Figure 10 shows a single Metro imagery mosaic covering all of the Moscow metropolitan area with balanced, 30 cm resolution pixels.

- *Production and hosting of global imagery mosaics (Figure 10)*
  Maxar's global mosaic products, Vivid and Metro, provide the world's best imagery source for extracting geographic features by blending and balancing images from across our constellation. These wide-area images are ideal for both humans and machines to digitize features for foundational GEOINT.

- *On-demand archive access (Figure 11)*
  SecureWatch subscribers can access any non-private collection from Maxar's 20-year imagery library to download images that are processed in the ideal manner for their mission. For example, customers desiring map-ready images can order fully processed, ortho-rectified images. Customers desiring images with minimal distortion can order nearly raw images.

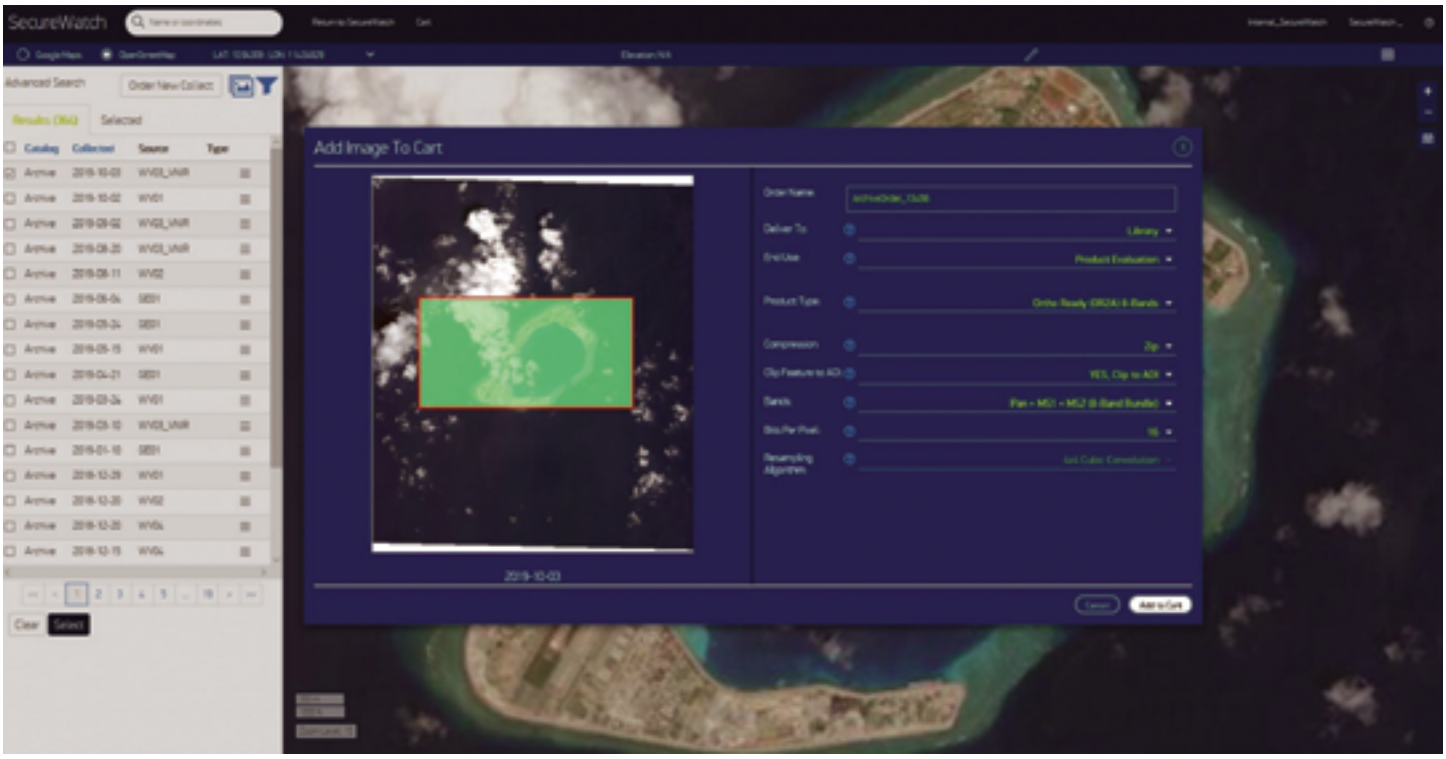


Figure 11. On-demand archive ordering in SecureWatch enables subscribers to order any of the 364 images of Subi Reef, dating from February 13, 2000 to October 3, 2019.

- *Online image exploitation (Figure 12)*
  The latest version of SecureWatch enables customers to extract the full power of multi-spectral pixels instantaneously in the online interface, without the need for additional software, image processing or download. These new capabilities give users control over displayed spectral bands, advanced processing like atmospheric compensation (ACOMP) and dynamic range adjustment (DRA).

Figure 12. Image Exploitation Mode in SecureWatch enables a user to perform multi-spectral analysis of a failed missile launch at Semnan Space Facility in Iran within the web browser. This is an August 31, 2019 WorldView-3 image displayed as a near infrared color composite, which makes the launch pad appear hot pink (instead of blue as the human eye sees it) and better reveals the explosion mark.

Conclusion

Advancements in imaging technology and cloud computing will continue to enable Maxar to better serve both foundational GEOINT missions and focused intelligence collection. As a result, customers can expect their required capabilities across Maxar and within SecureWatch to continue to grow — Maxar is particularly excited about growing the firm's ability to serve foundational GEOINT missions through a "*living global mosaic*," which will be continuously updated with the latest clear imagery. The company continues to improve all abilities to serve focused intelligence collection with increased imagery refresh intervals over active sites with the upcoming WorldView Legion constellation.

Contact the company to request a free, 30 day, SecureWatch evaluation.

BRINGING SMC'S SOFTWARE FACTORY TO LIFE

Section 31 has managed to achieve valuable warfighter outcomes and deliver capability in the short time span of its existence.

"*Extraordinary measures must be taken in the face of extraordinary threats*." In the iconic and fictional universe of the "Star Trek" television and motion picture franchise, this is the motto of an organization created under Article 14, Section 31 of the Starfleet Charter.

The intent was to establish a team that makes allowances for "*bending the rules*" to defend the world against the growing, unknown threats of space. Similar to the Star Trek universe, the U.S. Air Force (USAF) must prepare for those threats in reality.

Efforts to better prepare the USAF against the threats of the future space domain began around 2011 with the Joint Space Operations Center (JSpOC) Mission System (JMS) program.

"*The intent of JMS was to modernize and replace 40-year-old legacy systems with sustainable hardware and an open, evolvable software architecture*," said Maj. ***Matt Holland***, program manager in the Space and Missile Systems Center's (SMC) Enterprise Space Battle Management Command and Control (ESBMC2) and Section 31 Team Lead. "*This program would lay the foundation for a modern, predictive battle management and command and control system for space.*"

According to Holland, while the vision of this modernization effort had good intentions, over the years it was found to become increasingly complex and much more challenging than had been anticipated. The JMS program mirrored other USAF monolithic systems that were trapped in an acquisition process that was not catered to support modern software development.

Sound familiar?

"*There was an uncanny resemblance to another major Air Force effort that was canceled just one year prior; the Air Operations Center (AOC) 10.2 Weapon System modernization effort at the Air Force Life Cycle Management Center at Hanscom Air Force Base in Massachusetts*," said Holland. "*Either example alone was reason enough for the Air Force acquisition community to take a hard look at how these critical software acquisition programs are struggling to deliver the capabilities of the future. The two together have created a tidal wave of change.*"

By late 2018, the JMS program was redirected and a new and improved SMC effort sprung from its ashes under the moniker, 'Kobayashi Maru.'

"*This Star Trek-themed program was established in order to stand-up the next fast-paced software factory within the Air Force*," said Capt. ***Carlo Viray*** from SMC's ESBMC2 and Section 31 Director of Product. "*The new program is intended to mirror the development approach and speed of delivery as PEO Digital (formerly Program Executive Office Battle Management)'s effort, Kessel Run, but would focus on delivering space-based capabilities.*"

U.S. Navy Lt. Cmdr. Michael Brock, U.S. Air Force Master Sgt. Anamelie Salvador and U.S. Marine Corps Staff Sgt. Brian Day review sensor data from the Theater Watch Chief console within the Combined Space Operations Center at Vandenberg Air Force Base, California. With the assistance of the Space and Missile Systems Center's Kobayashi Maru program and Section 31 team from Los Angeles Air Force Base in El Segundo, California, CSpOC personnel operating under the Combined Force Space Component Command are supporting U.S. Space Command, providing the United States and its allies with space-related services like GPS tracking and missile warnings to help with ground-based missions. U.S. Air Force photo by Maj. Cody Chiles.

Kobayashi Maru currently consists of both the former JMS program office and the ESBMC2 program office out of SMC at Los Angeles Air Force Base (LAAFB) in El Segundo, California.

"*Named after the unwinnable Starfleet Academy training scenario for cadets devised by Mr. Spock, Kobayashi Maru was coined because this new SMC effort was commissioned to succeed at what some would view as a seemingly impossible task; delivering effective warfighting capabilities within a large, bureaucratic government program,*" explained Viray. "*Kobayashi Maru is out to prove that quickly developing and deploying effective software is in fact possible, and that efforts to deliver warfighting capabilities such as those originally intended for the JMS program could be achieved.*"

Kobayashi Maru aims to break barriers in the traditional acquisition construct and deliver capability in a truly agile way, showing that the USAF can operate at a similar tempo as the commercial software industry. With that vision in mind, there exists a small group of teams within the Kobayashi Maru program that are silently leading a software revolution within SMC and are delivering continuously to the Combined Space Operations Center and 18th Space Control Squadron at Vandenberg Air Force Base (VAFB) in California. This is "***Section 31***."

"*Section 31 is SMC's effort within the Kobayashi Maru program office to stand up an organic software development factory in Los Angeles, modeled after PEO Digital's Kessel Run program in Boston,*" said Holland. "*The team utilizes agile software development best practices such as extreme programming, user-centered design, lean product management, test-driven development, continuous integration and continuous delivery.*"

Section 31 began this journey starting in February of 2019 and, less than six months later, has stood up three separate product teams that are currently tackling various problems and resolving user pain points for the CSpOC and 18 SPCS at VAFB.

"*Section 31 is working with an industry-leading software company located in Santa Monica called Pivotal Software. Pivotal's vision is transforming the way the world builds software to help organizations like the Air Force achieve large scale digital transformation,*" said Capt. ***Davis Gunter***, another ESBMC2 program manager and Director of Platform and Services for Section 31. "*Instead of the government putting a company on contract to build a specific software solution and attempting to meet cost, schedule and performance parameters, Pivotal works side-by-side with Airmen on combined product teams to both build a valuable product for the warfighter together and to enable Airmen in software development best practices.*"

The benefits of this business model are critical to driving change within the Air Force and are enabling the organic capacity of Airmen building software for Airmen. The future vision for Section 31 is to have Airmen that are sufficiently enabled through their time working alongside Pivotal's developers that they can continue doing software development organically long-term.

"*The first product team has built a High-Interest Event Tracker that is meant for commercial, government, and allied space operators who own, operate, and command space assets,*" explained Viray. "*This application allows operators to monitor, track, and display information regarding potential satellite conjunctions, space launches, satellite de-orbits, re-entries, and other high interest space events. All of this provides Space*

Capt. Victor Woo, product designer from the Space and Missile Systems Center's Section 31 team (right) reviews software prototypes with Senior Airman Bailey Bourque from the 18th Space Control Squadron, and Mike Tevebaugh, senior product manager from Santa Monica-based Pivotal at Vandenberg Air Force Base, California. The Section 31 team is part of the SMC's Kobayashi Maru program that is focused on Airmen building products for Airmen while using industry agile software development best practices. (U.S. Air Force photo by Capt. Carlo Viray)

Situational Awareness consumers the awareness needed in order to prevent unnecessary harm or damage to global space assets."

The Section 31 team was able to achieve an authority-to-operate and deliver the first iteration of the application just 57 just days after kick-off.

"*Following a weekly update cadence and after eleven iterations of the application, the team received an official Operational Acceptance and adoption by both the CSpOC and 18 SPCS user community, officially deprecating a legacy component of JMS in just 170 days,*" said Viray. "*The current state of the application reduces a three-hour workload per day for operators to input this SSA data down to merely 15 minutes. Later iterations of this application will be developed to meet the needs of additional users within the space community.*"

This initial example of delivering a valuable tool to the operations community is what Section 31 is all about. Instead of spending numerous years trying to modernize a complex, monolithic system, this team was able to deliver an individual application that addresses a specific user-driven "requirement" in under six months.

"*The second product team under Section 31 is building a Radio Frequency Deconfliction tool for operators who require a centralized deconfliction support request tool that provides accurate and timely radio frequency windows for military, commercial, and mission partners,*" said Viray. "*This tool provides a consolidated workflow that reduces the overall time it takes to process radio frequency deconfliction requests, enabling operators' faster feedback with a minimal amount of errors. This team achieved its authority to operate in only 52 days and is continuing to iterate until the user community declares the tool operationally acceptable.*"

The third product team is focused on developing a tool for intelligence analysts who need to efficiently and effectively optimize data collection taskings for Ground Based Radars and other sensors. The application will focus on achieving outcomes that result in increased data accuracy, improvements in mission planning, and analysis.

Along with the three teams working with Pivotal, Section 31 has been building their platform operations team using Pivotal Cloud Foundry. Section 31's platform operations team is implementing lessons learned from Kessel Run's Enterprise Platform Operations Center, or EPOC, as one of Kobayashi Maru's two platform efforts that are working toward different solutions.

"*The platform team is dedicated to providing top level services to developers and users which results in a new way of delivering capabilities which requires developers to swiftly respond to feedback from users, and the platform team to provide predictable and reliable services to both customers,*" explained Gunter. "*This model is designed to rebuild war-fighter trust and align the goals and missions of operations and acquisitions.*"

Section 31 has been laser-focused on solving these high priority space situational awareness or theater support problems. The product teams are a testament that the Kessel Run's approach to organically building and delivering software and using industry best practices can scale to another domain such as space.

Section 31 is able to build new relationships and leverage existing ones due to a relentless dedication to the warfighter and continued support by organizations like the CSpOC, 18th SPCS, and 14th Air Force, all of which comprise the user community at VAFB.

Section 31 has managed to achieve valuable warfighter outcomes and deliver capability in the short time span of its existence. They have found a way to combat the threat of our inability to deliver capabilities.

How?

"*This is where the two sci-fi fantasies of Star Wars and Star Trek collide,*" said Viray. "*The successes mentioned above would not have been possible without the strategic partnership with PEO Digital's Kessel Run program. Section 31 has formed an alliance with Kessel Run to utilize many of the platform and services provided in order to work with software-based industry leading companies like Pivotal. It's Captain Kirk and Han Solo flying the USS Enterprise and Millennium Falcon in a two-ship formation.*"

This close collaboration between two USAF software organizations allows teams like Section 31 to not have to worry about working on the underlying technology and infrastructure since Kessel Run has already provided a viable solution to that difficult problem. This enables organizations to focus on solving problems and delivering warfighter capability as opposed to figuring out the numerous technical complexities beforehand.

"*As a result of this collaboration, Section 31 product teams can truly achieve continuous delivery and have the ability to implement changes of all types -- new features, configuration changes, bug fixes, and experiments -- into production, or actually into the hands of the intended users, safely and quickly in a sustainable way,*" said Viray.

Digital transformations aren't just built off the backs of technology. The foundation is from establishing a culture that is willing to experiment, ideate, fail and learn in order to challenge traditional acquisitions constructs. It requires a leap of faith and continued support by other people and organizations like the CSpOC, 18th SPCS, and the 14th Air Force.

Royal Canadian Air Force Capt. Jocelyn Labranche, 614th Air Operations Center Missile Warning Duty Officer, reviews data with U.S. Marine Corps Staff Sgt. Brian Day, U.S. Army Maj. Matthew Fechter and U.S. Air Force Senior Airman Devante Deschwanden in the Combined Space Operations Center at Vandenberg Air Force Base, California. With the assistance of the Space and Missile Systems Center's Kobayashi Maru program and Section 31 team at Los Angeles Air Force Base in El Segundo, California, personnel operating under the Combined Force Space Component Command are supporting U.S. Space Command, providing the United States and its allies with space-related services like GPS tracking and missile warnings to help with ground-based missions. U.S. Air Force photo by Maj. Cody Chiles.

"*Product teams continually engage with the user community, ensuring that the team is constantly working on the next most important thing, ultimately reducing waste and risk associated with the effort. Representatives from communities like operations, requirements, and test have shown the willingness to try something different and break out of the bureaucracy for the sake of the warfighter*," explained Viray. "*These organizations, along with Section 31, have formed a mindset that is focused on a shared goal of delivering warfighter capability. This shared commitment is what agile enables.*"

"*The U.S. Air Force cannot afford, financially or otherwise, to wait years just to provide a solution that no longer meets the needs of the space warfighter in present day*," said Holland. "*In contrast, three small teams leading a large-scale digital transformation to revolutionize the way software is being delivered for space is exactly what the space acquisition community needs.*"

The last six months are an example of taking extraordinary measures during times of increasing threats. Section 31's vision is to transform into an established software organization centered around Airmen building products for Airmen, with teams rapidly delivering mission-critical capabilities for current and future space operations.

Their mission is to enhance the future of space operations by continuously delivering mission-focused software that people love.

Milestones, such as operational acceptance of the High Interest Event Tracker or Radio Frequency Deconfliction tools, are only the beginning. Efforts like Kessel Run "*smuggling agile and Development Operations into the Department of Defense*" or Section 31 "*rewriting the rules*" to accomplish the mission, provide some hope to the Air Force enterprise that this model can be accomplished and sustained.

"*At the end of the day it's about building warfighter trust and achieving warfighter outcomes so that our Air Force can fight off the unknown threats of tomorrow*," said Viray.

This is also one of the reasons why Section 31 was recently honored as one of the U.S. Air Force Space Command's recipients of the 2019 Gears of Government Award in the Team category. This award is designed to recognize individuals and teams across the Federal workforce whose performance and dedication support exceptional delivery of key outcomes for the American people in the areas of mission results, customer service and accountable stewardship.

The team will now represent SMC and U.S. Air Force Space Command when they compete for the USAF level award.