SATCOM for Net-Centric Warfare

MilsatMagazine

OCTOBER 2018

Nicole Robinson, SES Networks

Command Center: Thomas L. Wilson Northrop Grumman Innovation Systems, and Space Logistics

Rebecca Cowen-Hirsch, Inmarsat Government

Command Center: Rear Admiral Richard A. Correll, U.S. Strategic Command

Matthew Prechtel, Kratos Defense

Karl Fuchs, iDirect Government

David Mitlyng, S15 Space Systems

Gary Shmith, EM Solutions

Koen Willems, Newtec

Dispatches

The launch of GovSat-1 in January of 2018 by SpaceX aboard a flight-proven Falcon 9 rocket from Cape Canaveral AFS.

Experience matters

Catch the Ka-band wave with CPI

- Nearly 5,000 Ka-band HPAs and Solid State BUCs fielded
- Largest selection of Ka-band amplifiers available
- Field proven, outstanding reliability
- Worldwide Ka-ready regional service centers

WATTS	BANDWIDTH	TECHNOLOGY
160	Up to 2.5 GHz*	GaN BUC or SSPA
40-550	Up to 4 GHz	TWTA
700	Up to 2 GHz	CC TWTA
800	Up to 300 MHz	Klystron PA

**Two 1 GHz selectable bands with optional BUC*

Download our app! Search: CPI Satcom

Download on the App Store | GET IT ON Google Play

KNOW WHAT MATTERS

CPI Communications & Power Industries

satcom products

CPI SMP Division | www.cpii.com | satcommarketing@cpii.com. | +1 (669) 275-2744

ADVANTECH
WIRELESS

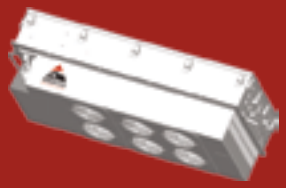
Second Generation GaN based SSPAs/BUCs in C, X, Ku and Ka-Band

250W C-Band
2nd Generation GaN SSPA/BUC

400W C-Band
2nd Generation GaN SSPA/BUC

300W-400W C-Band Rackmount
2nd Generation GaN SSPA/BUC

400W Ku-Band
2nd Generation GaN SSPA/BUC



1,250W Ku-Band
2nd Generation GaN SSPA/BUC

www.advantechwireless.com

PUBLISHING OPERATIONS

Silvano Payne, Publisher + Executive Writer
Hartley G. Lesser, Editorial Director
Pattie Lesser, Executive Editor
Jill Durfee, Sales Director + Associate Editor
Simon Payne, Development Director
Donald McGee, Production Manager
Dan Makinster, Technical Advisor
Sean Payne, Industry Writer

SENIOR CONTRIBUTORS

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

AUTHORS

Karl Fuchs
Rebecca Cowen-Hirsch
David Mitlyng
Matthew Prechtel
Nicole Robinson
Gary Shmith
Koen Willems

FEATURES

Dispatches ..... **4 to 29**

Innovative, Satellite-Based Solutions Are… **30**
Pivotal to a Government's ability to protect their nations,
by *Nicole Robinson*, SES Networks

Command Center: Thomas L. Wilson, ... **34**
Northrop Grumman Innovation Systems and President, Space Logistics

Military Mission-Critical Comms: SATCOM as a Service..... **40**
paves a path forward
by Rebecca Cowen-Hirsch, Inmarsat Government, Inc.

Command Center: Rear Admiral Richard A. Correll..... **44**
U.S. Strategic Command

From the Red Baron to RF Data: Pursuing Situational Awareness..... **48**
by *Matthew Prechtel*, Kratos Defense

All the Grit, All the Glory: **52**
Ruggedized satellite router withstands the elements
by *Karl Fuchs*, iDirect Government

Basics of Quantum Communications: Ready to Serve..... **54**
by *David Mitlyng,* S15 Space Systems

Ensuring Assuredness… in mobile satellite communications **58**
by *Gary Shmith*, EM Solutions

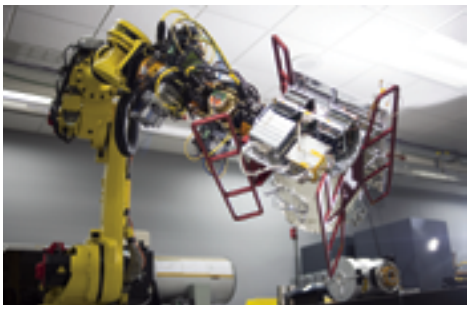
Five Ideas…For efficient, humanitarian, SATCOM networks **62**
by *Koen Willems*, Newtec

Global MilSatCom: A crucial dispersement of information for..... **68**
satellite defense communications

DISPATCHES

Raytheon's First SeeMe satellite delivered to DARPA

Raytheon Company (NYSE: RTN) has delivered the first Space Enabled Effects for Military Engagements, or SeeMe, satellite to DARPA.



Assembled on the company's advanced missile production lines, the new SeeMe satellite will provide greater situational awareness to soldiers on the ground.

DARPA's SeeMe program is designed to show that smallsats can be built affordably to give small squads timely tactical imagery directly from a small satellite. A future constellation of smallsats would deliver high-resolution images of precise locations of interest to the soldier's handheld device. Using their automated missile production lines, Raytheon can build large numbers of these highly reliable, smallsats quickly and affordably.

DARPA will integrate the SeeMe satellite onto a Spaceflight Industries payload that will be launched into LEO on a SpaceX rocket later this year. Military users will have an opportunity to evaluate the satellite's performance during missions in early 2019. Eventually, a SeeMe constellation may comprise several types of small satellites, each lasting one to five years before de-orbiting and burning up, leaving no space debris and causing no re-entry hazard.

www.raytheon.com

NEWTEC DIALOG
MULTISERVICE VSAT PLATFORM

EMBRACING THE COMPLEXITY OF GOVERNMENT & DEFENSE SATCOM NETWORKS WORLDWIDE

VISIT US AT

GLOBAL MILSATCOM 2018
NOVEMBER 6 - 8
LONDON

JOIN US

GOVDEF SEMINAR 2018
DECEMBER 4
BRUSSELS

#NewtecDialog
www.newtec.eu
Follow Newtec Satcom on

SHAPING THE FUTURE OF SATELLITE COMMUNICATIONS

Newtec Dialog®

DISPATCHES

Kratos C5ISR contract

Kratos Defense & Security Solutions, Inc. (Nasdaq: KTOS) has received a $4.2 million contract award for the production of approximately 50 specialized systems in support of a Command, Control, Communications, Computing, Combat, Intelligence, Surveillance and Reconnaissance (C5ISR) program for a National Security related customer.

Kratos Modular Systems Division, which received this contract award, is an industry leader in providing specialized systems in support of unmanned aerial drone system, missile defense, radar, satellite communications and other C5ISR platforms and programs.

Work under this recent contract award will be performed in a secure Kratos manufacturing facility.

www.kratosdefense.com/

ADVERTISER INDEX

ABS Global Limited **21**

ACORDE Technologies, S.A. **19**

Advantech Satellite **3**

AQYR (A Windmill company) **23**

AvL Technologies **71**

Comtech Command & Control / TCS **11**

Comtech EF Data **13**

CPI Satcom Products ..... **Cover + 2**

Economist Events **43**

EM Solutions, Inc. (EMS) **25**

Envistacom **7**

GovSat **15**

iDirect Government **9**

Mitec VSAT / Alga Microwave **6**

Newtec EU **5**

Norsat International Inc. **4**

Raytheon **72**

Satnews Digital Editions **57**

SMi Group: Marine Information Warfare 2018 ..... **69**

W.B. Walton Enterprises, Inc. **27**

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

DISPATCHES

SWARM'ing during RAF's 100th Anniversary

Paradigm's ultra-portable, high throughput SWARM terminal, operating on the Inmarsat Global Xpress network, delivers seamless connectivity for RAF100 Flypast.

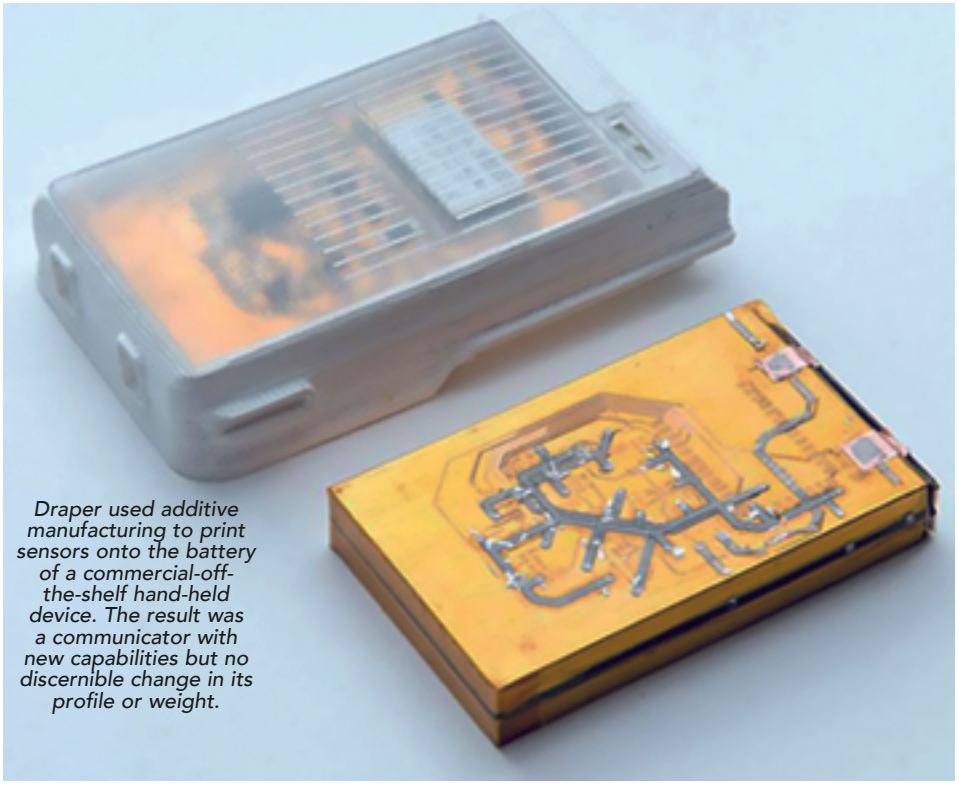
This high-profile event was staged in July by the RAF to celebrate their 100th Birthday and involved 100 aircraft from the past 100 years flying over Buckingham Palace and the skies of London. The small but powerful SWARM terminal from Paradigm ensured that the media feed could rely on constant communications throughout the day in the face of high demand from the public on the terrestrial 4G network.

Following the event, Squadron Leader Gordon Henderson remarked on the "*...outstanding level of service from the lightweight and easily operated SWARM terminal. By providing the Air Command Media team with access to Inmarsat's Global Xpress connectivity, they were able to continue uploading videos from the parade even as the 4G network in London begun to struggle.*"

The SWARM is small and light enough to be carried in a backpack and really easy to setup and deploy. Even a non-skilled user can set it up and be on the air in less than four minutes. Later this year, Inmarsat and the SWARM terminal will also provide satellite communication support for the RAF100 Himalayan Venture 18 (HV18), which will unite the RAF's past, present and future for its largest ever mountaineering expedition to the Himalayas.

www.paracomm.co.uk/
www.rafsportsfederation.uk/sports/himalayan-venture-18/

COTS solutions for the battlefield retooled by Draper



Draper used additive manufacturing to print sensors onto the battery of a commercial-off-the-shelf hand-held device. The result was a communicator with new capabilities but no discernible change in its profile or weight.

When the DoD announced their Additive Manufacturing Roadmap in 2016, technology companies saw endless possibilities.

If they could harness the potential of additive manufacturing (AM) to add features to antennas and sensors to off-the-shelf military equipment, such as phones and computers, the door would swing wide-open. However, in time, realizing the promise of additive manufacturing turned out to be more of a challenge than many thought.

Additive manufacturing, also referred to as 3D printing, is versatile, flexible, highly customizable and, as such, can suit most sectors of industrial production. Materials to make these parts and objects can be of a widely varying type. They include metallic, ceramic and polymeric materials along with combinations in the form of composites, hybrid or functionally graded materials.

The challenge remains, however, to transfer making the shapes and structures into obtaining objects that are functional. A great deal of work is needed in AM in addressing the challenges related to its two key enabling technologies, namely 'materials' and 'processes,' to achieve this functionality in predictable and reproducible ways.

Draper used additive manufacturing to print sensors onto the battery of a

commercial-off-the-shelf hand-held device. The result was a communicator with new capabilities but no discernible change in its profile or weight.

Military applications of additive manufacturing face a particularly high bar if they are going to be modified for the battlefield.

Products must be ruggedized, fit the warfighter, hardened and secure, according to *Chris DiBiasio*, Draper's group leader for advanced manufacturing, who says it is important to remember that, in many cases, the operators of the equipment are soldiers, and their primary function is protection.

DiBiasio manages Draper's **Additive Manufacturing Center** and he is familiar with modifying commercial off-the-shelf (COTS) computers, networking equipment and various technologies for the battlefield and other defense and commercial uses.

Among the top requirements is to work within the tight confines of already-adopted product and technology platforms. He noted that the challenge in additive manufacturing is how to add capability and functionality to an existing device or technology platform without adding too much weight, changing the device's size or compromising the device's native systems.

Draper recently put this idea to the test by using additive manufacturing to print sensors onto a COTS hand-held communicator. Draper produced a scanned image of the communicator's battery pack to find nooks and crannies where the new technology layer could reside, ported the image into a 3D CAD model, processed the CAD model with Draper's proprietary software, converted the data into instructions for the 3D printer and then printed an ultra-thin, multi-stack layer of electronics.

DiBiasio said that the scripts and algorithm streamlined the 3D printing process and reduced 3D printing and assembly from a week to only a day or two. The result was a communicator with new capabilities but no discernible change in its profile or weight.

Military use of COTS and additive manufacturing is on the upswing. The U.S. Air Force recently launched a trusted computing program to give military access to COTS microelectronics.

Elsewhere, the U.S. Army has announced plans to merge its additive manufacturing technology roadmap into an overarching DOD roadmap.

www.draper.com

Maxar's SSL in competition for DoD business

SSL is one of three companies qualified to compete for Department of Defense (DoD) business under the SSPEDI contract.

This new contract is one of a number of new programs with great potential in SSL's increasing U.S. government portfolio.

The DoD's contract is entitled *Small Spacecraft Prototyping Engineering Development and Integration — Space Solutions* (**SSPEDI**), is managed by *NASA's Ames Research Center* in California. This contract is under an interagency agreement with the DoD's Space Rapid Capabilities Office.

The SSPEDI concept establishes a rapid and flexible method for the DoD to acquire commercially-developed solutions for small to medium spacecraft and related systems from a pool of pre-qualified candidates.

As one of the awardees, SSL is eligible to compete for multiple future awards over the five-year ordering period of the contract, up to a cumulative value of $750 million.

To produce strong positive results, SSL is combining energies with *Maxar Technologies* and will closely partner with Maxar's geospatial insights company, *Radiant Solutions*.

Radiant will study next-generation systems for Intelligence, Surveillance, and Reconnaissance (ISR) and contribute its world-class mission engineering expertise to the company's solutions.

Richard White, President of SSL Government Systems, said that the company continues to gain momentum in growing the pipeline for U.S. government DoD and civil space programs.

SSPEDI is one of many successes over the last year. Recent progress and achievements that further the momentum in the U.S. government market include:

- *Expanding the scope of work on the NASA asteroid exploration mission Psyche, which is on track for its scheduled launch in 2022*
- *Reaching a major milestone in building the spacecraft bus and robotic arms for the Robotic Servicing of Geosynchronous Satellites (RSGS) program, developed through a public-private partnership with DARPA*
- *Progressing on schedule for both the spacecraft bus and robotic arms for NASA's Restore-L project*
- *Contracting with NASA's Jet Propulsion Laboratory to design and build critical equipment for a spacecraft that will explore Europa, an icy moon of Jupiter.*

The company also continues to work across the DoD, civil, and commercial space communities on several current programs and studies to ensure that the U.S. government agencies define next-generation space technologies:

- *Advanced space architectures for the U.S. Air Force's Strategic Enterprise Vision*
- *On orbit assembly and manufacturing in LEO and critical technologies for servicing and space exploration for NASA Next-generation missile defense concepts for Missile Defense Agency Secure MILSATCOM for the U.S. Air Force*

SSL's new technologies, tools, and its commercial focus all combine to develop innovative solutions such as its geosynchronous satellite platform, and commercial production capability to design and build small satellites for a broad range of applications, including high resolution remote sensing and communications.

The company also partners with MDA, DigitalGlobe and Radiant Solutions to provide end-to-end solutions, mission systems engineering, advanced signal and imagery processing, multi-intelligence analytics, and ground systems that simplify and speed decision-making cycles.

sslmda.com

www.af.mil/About-Us/Fact-Sheets/Display/Article/104513/rapid-capabilities-office/

Specialists in Deployable (Tactical) X/Y Leo Tracking Systems

Cost Effective
High Performance
Low Maintenance
High Reliability

X/Y ANTENNA PEDESTAL TECHNOLOGY
designed for precision tracking in support of Remote Sensing, Earth Observation and TT&C.

Split Case Deployable X/Y System

1.0-to-1.8 Meter Dish Sizes

L, S, C, X, Ku, Ka, and Q Bands

Ideal for tracking LEO, MEO, and GEO spacecraft

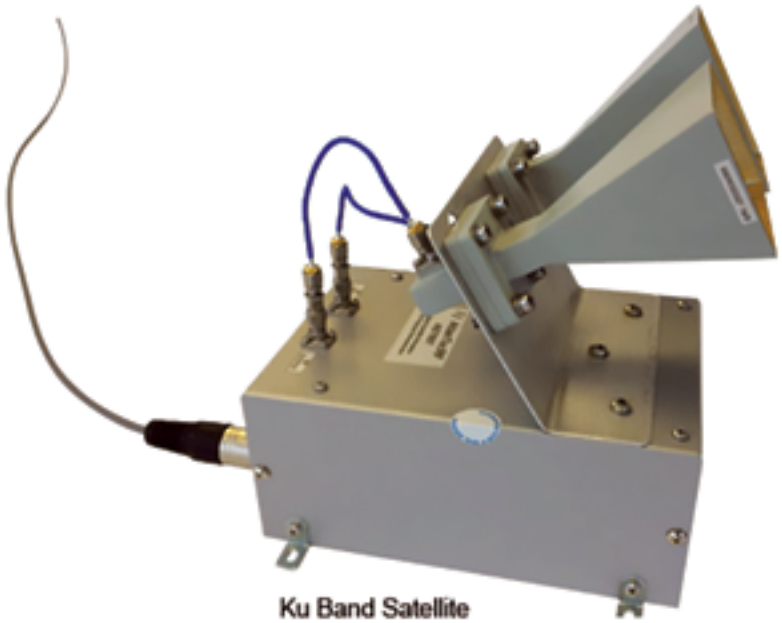
Deployable, trailer, truck and skid mount feature

Space & Component Technology
www.TrackMySat.com

1-866-264-0793
trackmysat@telecomsys.com

COMTECH
Command & Control Technologies

Simultaneous SATCOM Drone Sim from AtlanTecRF



Ku Band Satellite
Simulator Drone Payload

Atlantic Microwave has claimed a world's first, simultaneously, in two 'of the moment' technologies.

The company has announced the maiden flight of their DSS Satellite Simulator product on board an eight rotor drone. This a first ever airborne Satellite Simulator and is the first time in history, according to the company, that an unmanned aerial vehicle has been deployed in such a task.

Off-air testing of ground and vehicle based satellite communications systems has developed into a major industry need with the current explosion of SATCOM applications in multiple industries.

These systems cannot just switch on and hope for the best. The potential to upset fellow satellite users is risky and expensive and Atlantic's Satellite Simulator and Loop Test Translators have been saving the day for SATCOM operators worldwide during recent years.

Drones, similarly, have been taking the world by storm with uplifting applications both professional and amateur in use. By combining these two major advances, Atlantic Microwave has provided a service to customers that is currently unrivaled, while the first flight, which occurred in Denmark, used frequencies in the Ku-band for 'proof of concept,'

Atlantic is also offering similar payloads in Ka-band, which delivers greater bandwidth, X-band for the military, as well as future Q- and V-band operations.

Atlantic Microwave, based in Braintree, U.K. has established itself as a global leader in satellite simulation with their antenna and cabled-in based products, which are supplied to major SATCOM operators, integrators and manufacturers on all continents.

Speaking at the product announcement at the Royal Festival Hall in London last month, Atlantic's CEO, Geoff Burling said, "*We are in an exciting age where new technologies are shaping our current and future lifestyles. At Atlantic Microwave, we embrace these advances and seek, innovatively, to create solutions in all kinds of communications industries.*"

www.atlantecrf.com

DISPATCHES

OPIR GEO payload competition

Lockheed Martin (NYSE: LMT) has selected Raytheon and a Northrop Grumman/Ball Aerospace team to compete as potential mission payload providers for the U.S. Air Force's Next Generation Overhead Persistent Infrared (Next Gen OPIR) Geosynchronous (GEO) Block 0 missile warning satellite system.

This payload competition between Raytheon and Northrop Grumman/ Ball Aerospace will be executed as part of the Phase 1 contract for the Air Force's Next Gen OPIR Block 0 GEO satellites. The competition includes development scope through the Critical Design Review (CDR) phase.

As part of a program heralded by the Air Force as a pacesetter for "Go Fast" acquisition, Lockheed Martin selected the two suppliers on September 28 — just 45 days after the company's own prime contractor award. The U.S. Air Force awarded Lockheed Martin the contract for rapid development of the Next Gen OPIR Block 0 GEO system on August 14. A final down-select is expected at the end of the CDR phase in 2020.

Next Gen OPIR is a new missile warning satellite system acquisition program that will deliver advanced capabilities to keep pace with adversary advancements. It will succeed the Space Based Infrared System by providing improved missile warning capabilities that are more survivable and resilient against emerging threats. The Air Force implemented Next Gen OPIR as a rapid acquisition program with Lockheed Martin targeting the first GEO satellite delivery in 60 months.

www.lockheedmartin.com

UK's MOD Signs Elbit Systems

Photo to the left: MORPHEUS Contract signing. Right-Stephen Woodger, UK MoD, Left-Martin Fausset, Elbit Systems UK CEO. Photo Credit: Elbit Systems UK

elbitsystems.com/pdf/torc2h/

The UK Ministry of Defence ("MoD") has signed on with Elbit Systems Ltd.'s (NASDAQ:ESLT and TASE: ESLT) subsidiary, Elbit Systems UK Ltd. ("Elbit Systems UK") which will provide the MORPHEUS Battlefield Management Application ("BMA").

The contract will be performed over a three-year period and is valued as an initial contract of circa £10 million (approximately US$13 million) and a potential maximum value of £40 million.

Under the contract Elbit Systems UK will provide the British Army with an operationally proven battle management application for both headquarters and tactical units, based on TORC2H™, Elbit Systems' command and control platform.

This application has been delivered to many customers worldwide, including to the Australian Defence Forces as part of its Land 200 Tranche 2 battle management system.

Martin Fausset, CEO of Elbit Systems UK, said that the company is proud to have been selected by the UK MoD to supply the MORPHEUS BMA providing a valuable capability for the British Army. In doing so, they will be bringing operationally proven capability and technological edge into the UK, adapting it for use and delivering it together with their

XTAR provides high data rates for SOTM, even when wet

XTAR, LLC's announced the results of a July demonstration at Fort A.P. Hill, Virginia, which was designed to provide a SATCOM on the move (SOTM) data link from a SOTM terminal to a hub Earth station at a data rate greater than 25 Mbps.

The goal was to show that high data rates can be achieved from small SOTM terminals without the use of High Throughput Satellites.

XTAR partnered with **Honeywell**, **Leidos** and **Newtec** to conduct this demonstration.

For the demonstration, XTAR used Honeywell's **Wavestorm AS-X**, which is a low profile slot array antenna, suitable for either airborne or ground-based applications.

The satellite used for this demo was the **XTAR-LANT** satellite located at 30 degrees West, which is an X-band satellite, compatible with WGS terminals, with global and spot beams.

A 26 Mbps satellite link was achieved between the terminal and a fixed 3.9m ground station.

A 2 Mbps data link was transmitted from the fixed ground terminal to the SOTM terminal.

The required space segment for the demonstration was 38.2 MHz with bandwidth efficiency of 0.73 bits/Hz, which is considered exceptionally high performance for a terminal of this size.

As heavy rain began to fall, the satellite link held strong.

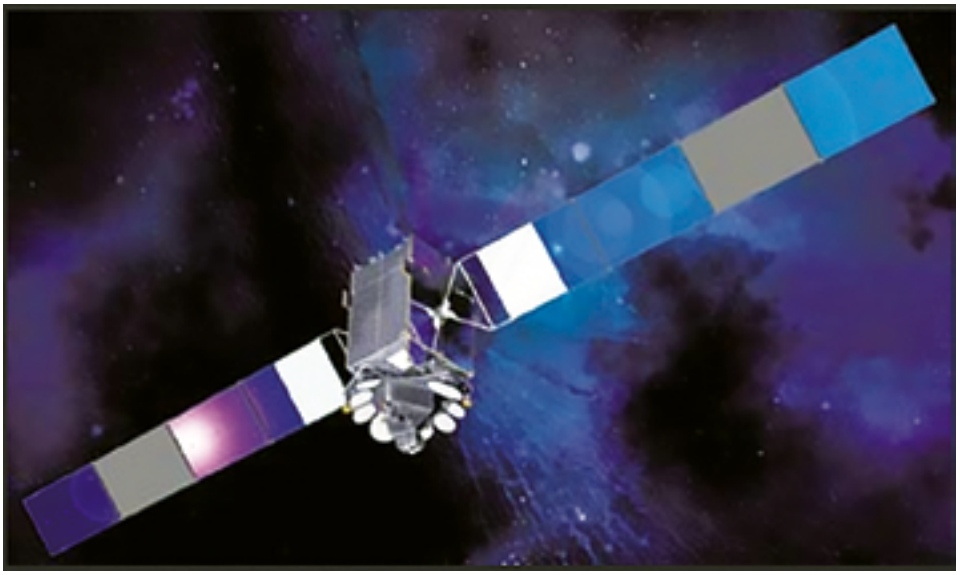
Jay Icard, President and Chief Executive Officer at XTAR, said that these results are yet another confirmation of the power of X-band. The frequency is efficient with small terminals, works well in mobile situations and remains strong in rain, wind or dust storms.

Results from this demonstration were similar to those conducted at Bridgewater, Virginia in October, of 2017 and strengthen the company's offering to its users.

As *Kelly Nicklin*, Vice President of Sales and Marketing explained, less bandwidth translates into lower costs and that is important for the company's customer.

XTAR only serves the government user that requires cost efficiency combined with resilient performance.

xtar.com



Artistic rendition of the XTRA-LANT satellite.

GOVSATCOM 2019

SAVE THE DATE

GOVSATCOM 2019
CONFERENCE FOR EU DEFENCE AND SECURITY

- FEBRUARY 14, 2019 -
@ EUROPEAN CONVENTION CENTER LUXEMBOURG

The **GOVSATCOM** Luxembourg conference is a key event on the agenda of the international governments, the institutions and satellite communications experts specialising in the fields of defence and security.

During this edition, the focus will be on EU GOVSATCOM developments: institutional updates, uses cases, integrated applications, cybersecurity threats & solutions, user perspectives, as well as a broader view of the geopolitical situation.

Register and find out more at:
www.govsatcom.lu/govsatcom/2019

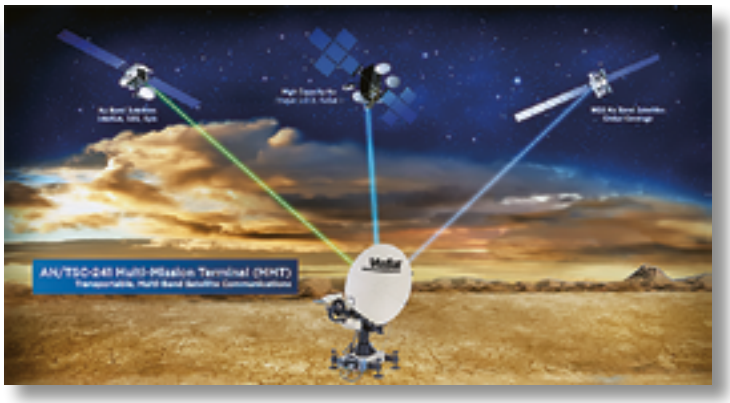
Viasat's Multi-Mission Terminal (MMT) proven battlefield ready

During the recent Saber Strike 2018 exercise, which was intended to build readiness across U.S. Army and NATO coalition forces, Viasat Inc. (NASDAQ: VSAT) proved the firm's Multi-Mission Terminal (MMT), known to the United States Department of Defense as the AN/TSC-241, is battlefield read and can help warfighters and first responders rapidly communicate during times of crisis.

With the Saber Strike field validation, Viasat's MMT is now battlefield-validated for immediate use and purchase across all U.S. and other Five Eyes (FVEY) military branches, including U.S. and international Special Operations Forces, the U.S. Army, U.S. Navy, and U.S. Marines.

Viasat's MMT delivers high-quality IP-based voice, video and data networking across multiple networks in both highly contested and benign environments around the globe. Using a portable terminal design, the MMT is an ideal networking solution for forward operating bases (FOBs) and emergency response operations, where warfighters and first responders can securely access networks and establish command post communications quickly and easily.

Set-up of the MMT proved simple during the field exercise, as field personnel were able to use the MMT's integrated smartphone app to establish communications in less than thirty minutes with minimal training—which also indicated potential costs savings for military customers.



The Saber Strike 2018 report detailed key performance advantages of Viasat's MMT, which included:

- *Enhanced connectivity with a small footprint: Viasat's MMT provided Saber Strike 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 produced robust throughput on high-capacity,*

- *Ka- frequency bands throughout the duration of the Saber Strike exercise. In addition, Viasat's MMT 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 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. The Saber Strike report noted the improved set-up/take-down of the MMT when compared to legacy terminals.*

The MMT is designed to integrate into Viasat's Hybrid Adaptive Network architecture, which allows users to seamlessly operate across different networks (both government and private sector), creating an end-to-end network that provides mitigation against congestion situations, intentional and unintentional interference sources and cyber threats through implementation of layered resiliency in highly contested environments. In addition, the MMT's Software Defined Modem (CBM-400) will allow customers to switch between multiple waveforms and upgrade to Viasat's next-generation Ka-band network in real-time.

Ken Peterman, President, Government Systems, Viasat, said that the innovative capabilities of the firm's MMT further illustrate Viasat's ability to quickly deliver cutting-edge technologies for warfighters today, while anticipating and addressing the mission needs of tomorrow. The Saber Strike 2018 exercise validates the performance advantages of this portable hybrid terminal across multiple satellite networks and ease of use for U.S. and international coalition forces.

www.viasat.com

www.eur.army.mil/SaberStrike

U.S.A.F. awards three EELV Launch Service Agreements

Artistic rendition of Blue Origin's New Glenn rocket in flight.

Artistic rendition of Northrop Grumman's OmegA Rocket. Image is courtesy of the company.

The U.S. Air Force (USAF) has awarded three Evolved Expendable Launch Vehicle (EELV) Launch Service Agreements to (in alphabetical order) Blue Origin, Northrop Grumman Innovation Systems and United Launch Alliance.

The award to Blue Origin will be for development of the New Glenn Launch System.

The award to Northrop Grumman Innovation Systems is for development of the OmegA™ Launch System.

The award to United Launch Alliance will be for development of the Vulcan Centaur Launch System.

The Launch Service Agreements will facilitate the development of three domestic launch system prototypes and enable the future competitive selection of two National Security Space launch service providers for future procurements, planned for no earlier than fiscal year 2020.

Through public-private partnership agreements, the goal of the acquisition strategy is to satisfy federal law by ensuring that the U.S. maintains assured access to space, with at least two domestic launch service providers and without reliance on non-allied rocket propulsion systems.

With the Congressional mandate to transition away from reliance on foreign rocket propulsion systems, and the planned Delta IV retirement, the USAF developed an acquisition strategy to accelerate National Security Space launch requirements.

The EELV program has successfully launched 72 NSS missions, dating back to 2003, using the Atlas V and Delta IV launch vehicles.

While the prototypes are being developed, the USAF will continue to competitively award commercial launch services contracts to providers who demonstrate the capability to design, produce, qualify and deliver launch systems and provide the mission assurance support required to deliver National Security Space satellites to orbit.

The USAF competitively awarded the Launch Service Agreements as other transaction (OT) agreements in accordance with the USAF's other transaction authority (OTA) for prototype projects.

Artistic rendition of United Launch Alliance's Vulcan Centaur rocket.

OT agreements are nontraditional acquisition arrangements that allow for shared investment to encourage innovation and promote the maturation of capabilities.

The use of OTA is consistent with guidance in the National Space Transportation Policy to "cultivate increased technological innovation and entrepreneurship in the U.S. commercial space transportation sector through the use of incentives such as nontraditional acquisition arrangements, competition and prizes.

The awards will be contracted through Air Force Space Command's Space and Missile Systems Center (SMC), located at Los Angeles Air Force Base, California. SMC is the U.S. Air Force's center of acquisition excellence for acquiring and developing military space systems.

SMC's portfolio includes the Global Positioning System, Military Satellite Communications, Defense Meteorological Satellites, Space Launch and Range Systems, Satellite Control Networks, Space Based Infrared Systems and Space Situational Awareness capabilities.

Secretary of the U.S. Air Force *Heather Wilson* said that this launch program is a great example of how tomorrow's Air Force is being fielded faster and smarter. The USAF is making the most of the authorities Congress provided and reliance on Russian-built RD-180 rocket engines will no longer be necessary. Leveraging domestic commercial space launch systems is good for the Air Force and a revitalized commercial launch industry is good for the taxpayer.

U.S. Air Force Chief of Staff General *David L. Goldfein* noted that since the early days of the space program, the U.S. Air Force has been a world leader in space launch. As space becomes more contested and the nation's adversaries develop new capabilities to thwart U.S. advantages, the USAF is fielding enhanced space capabilities to ensure the organization remains the best in the business.

Dr. *William Roper*, Assistant Secretary of the Air Force for Acquisition, Technology, and Logistics, said that he's excited to announce these creative partnerships that directly support the Air Force's strategy to drive innovation and leverage commercial industry. These awards are a leap forward in space launch capabilities, ensuring continued U.S. dominance in space.

Lieutenant General *John Thompson*, the Air Force's Program Executive Officer for Space and SMC commander, added that these awards are central to the Air Force goal of two domestic, commercially viable launch providers that meet National Security Space requirements. These innovative public-private partnerships with industry provide a path to develop launch vehicles to assure access to space, address the urgent need to transition away from strategic foreign reliance, and provide responsive launch capabilities to the warfighter.

www.losangeles.af.mil/About-Us/Fact-Sheets/Article/343702/space-and-missile-systems-center/

blueorigin.com/

www.northropgrumman.com

www.ulalaunch.com/

www.rocket.com

BAE Systems awarded mission tech contract by the DoD

The U.S. Department of Defense (DoD) has selected BAE Systems to compete for future research and development (R&D) task orders awarded under a nine-year, indefinite delivery/indefinite quantity (IDIQ) contract.

The contract provides fast, flexible, low-cost solutions across technical disciplines to meet the current and future technology needs of the U.S. military.

BAE Systems is one of 15 companies selected by the Defense Technical Information Center to compete for future R&D and support task orders expected to exceed $15 million.

These task orders will be awarded by the Air Force Installation Contract Agency/KD Offutt AFB, Nebraska and support the DoD Information Analysis Center Program Management Office. The ceiling value for all future work awarded under the IDIQ is $28 billion.

BAE Systems delivers a broad range of solutions and services enabling militaries and governments to successfully carryout their missions.

The company provides large-scale systems engineering, integration, and sustainment services across air, land, sea, space, and cyber domains. BAE Systems takes pride in its support of national security and those who serve.

Al Whitmore, the President of BAE Systems' Intelligence and Security sector, said that this large-scale contract provides the company with a tremendous opportunity to reach across BAE Systems and leverage the firm's own internal research and development investments to help the DoD solve its most difficult mission challenges.

He added that BAE Systems is excited to help the government leverage innovations in artificial intelligence (AI), machine learning, and directed energy technologies to enhance the security and effectiveness of our warfighters across physical and digital domains.

www.baesystems.com

Viasat's connectivity demo is successful at AUSA Conference

Viasat Inc. (NASDAQ: VSAT) has announced the availability of secure cloud-enabled artificial intelligence (AI) and machine learning applications over Viasat's global satellite communications (SATCOM) architecture and line of sight (LOS) tactical network technologies for warfighters on the move.

By offering a secure, integrated network of cloud-enabled solutions, Viasat can reduce warfighters' cognitive loads in order to make more accurate, informed, lifesaving decisions with accelerated speed across the battlespace.

At the recent Association of the United States Army (AUSA) conference in Washington, D.C., Viasat completed a successful connectivity demonstration focused on bringing access to advanced cloud capabilities to the tactical edge.

The demo, which was attended by a number of representatives from the U.S. Army, showed how Viasat's SATCOM architecture and LOS tactical network can provide a holistic communications solution by integrating Link 16, Mobile Ad-Hoc Networking, WiFi and LTE technologies to significantly enhance situational awareness at the tactical edge and fulfill emerging U.S. government concepts of operation.

Throughout the demonstration, Viasat's SATCOM network and LOS technologies provided a secure, high-speed, resilient backbone connection to link connected devices to media-rich AI and machine learning-based applications offered by a number of today's cloud technology providers.

Viasat will provide ubiquitous and secure SATCOM required to access cloud-enabled military applications via its Hybrid Adaptive Network (HAN) concept.
The HAN provides access to Viasat's end-to-end SATCOM innovations such as active cyber defense, layered resiliency and elite satellite capacity to support a range of operations requiring IoBT and cloud-based applications.

The HAN allows users to seamlessly operate across different networks (both government and private sector), creating an end-to-end layered, resilient network that is unique to Viasat and not offered by any other provider today.

Ken Peterman, President, Government Systems, Viasat, said that the company is partnering with global cloud computing leaders to bring advanced AI and machine learning-based operational capabilities to the warfighter — from predictive analytics and media rich intelligence, surveillance and reconnaissance data to prescriptive outputs.

Peterman added that through Viasat's modernized end-to-end communications network, the company will empower warfighters with advanced data-driven insights and operational capabilities that will allow them to make the most informed decisions possible — even in the fog of war. This demonstration shows the power of the Viasat SATCOM network and LOS innovations to deliver the next-generation internet of battlefield things (IoBT) to significantly improve military readiness and mission effectiveness.

www.viasat.com

Seamless and Secure
when it really counts

Government and military sectors face some of the most challenging environments in the world. This can vary from providing critical communication in natural disaster recovery situations to secured solutions for aeronautical and remote military outposts.

ABS provides secure, reliable cost effective solutions in some of the world's most hostile environments.

ABS – A Global Satellite Operator

Download our mobile app
ABS Satellite Fleet

Available on the App Store

Google play

ABS
www.absatellite.com

Meet our representative at MILCOM 2018 or email: **info@absatellite.com** to book a meeting.

Northrop Grumman and Australia's Deputy PM shovel sod

L to R: Colonel Michael Garraway AM, Commandant Army Recruit Training Centre, Ian Irving, Chief Executive, Northrop Grumman Australia, the Honorable Michael McCormack MP, Deputy Prime Minister, Wing Commander William Myatt, Department of Defence.

The sod has been turned for Satellite Ground Station East in Australia (SGS-E).

Northrop Grumman Corporation (NYSE: NOC) Australia hosted the Honorable *Michael McCormack* MP, Deputy Prime Minister, at Kapooka where they got out the shovels and turned over the dirt to commemorate the beginning of a new facility.

The Hansen Yuncken company is leading construction of SGS-E, with AECOM providing design and civil engineering support.

The construction will start later this year and is estimated to provide more than 100 jobs across 22 different trades.

The facility will provide the Australian Defense Forces (ADF) access to military communications satellites such as the Wideband Global SATCOM (WGS) constellation.

This access will allow ADF personnel deployed across the Indo-Pacific region to connect to strategic information communications technology networks in Australia.

Additionally, SGS-E will provide access to a range of commercial communications satellite services.

The SGS-E will be a major component of the Australian Defence Force's (ADF) future satellite communications (SATCOM) capability, delivered by Northrop Grumman Australia and Viasat under Joint Project (JP) 2008 Phase 5B2.

Ian Irving, Chief Executive, Northrop Grumman Australia, said that Northrop Grumman and Viasat will provide the ADF a comprehensive and proven solution for taking full advantage of Australia's investment in the WGS communications system.

Their solution will also provide the ADF the flexibility necessary to accommodate future needs.

northropgrumman.com/

DISPATCHES

Two-channel handheld radios ordered by U.S. Army from Harris

Harris Corporation (NYSE: HRS) has received orders for 1,540 AN/PRC-163 two-channel handheld radios and related equipment and services as part of the U.S. Army's two-channel Leader radio IDIQ contract.

The AN/PRC-163 enables users to send information up and down the chain of command as well as across the battlefield network backbone and incorporates secure two-channel connectivity in a lightweight, easy to use, handheld rugged form factor.

The radio can simultaneously transmit voice, data and situational awareness through Mobile Ad-Hoc Networking applications, VHF/UHF line-of-sight, and legacy SATCOM.

The radios also offer a path to future software-only updates for MUOS, SATURN and other emerging waveforms.

The award builds upon the company's proven ability to engineer and deliver two-channel, next-generation handheld, manpack and vehicular radios.

Harris previously was awarded contracts by the U.S. Special Operations Command for next-generation handheld and manpack radios and was awarded a position on the Army's HMS Manpack IDIQ with its two-channel AN/PRC-158 manpack radio.

Dana Mehnert, President, Harris Communication Systems, said that the AN/PRC-163 is the most advanced software-defined handheld radio in the world today and will provide warfighters and commanders with unprecedented capabilities, including enhanced levels of command and control, and situational awareness. These two-channel Leader radio orders are an important milestone in the modernization of the Army's tactical network.

www.harris.com

DIA awards HELIOS contract to Northrop Grumman as one of nine selected firms

The HELIOS program provides the opportunity for continued innovation in science and technology for the Defense Intelligence Agency.

Northrop Grumman Corporation (NYSE: NOC) was one of nine companies that the DIA selected to provide critical support for its Directorate for Science and Technology (DIA/ST).

The HELIOS program provides the opportunity for continued innovation in science and technology for the *Defense Intelligence Agency*.

The agency made the award under its HELIOS Indefinite-Delivery/Indefinite-Quantity (IDIQ) contract.

Northrop Grumman will provide the agency with innovative capabilities for its science and technology missions. HELIOS is divided into two major technical areas. The aim of these areas is to enhance intelligence; provide strategic warning; and inform research and development, acquisition and operational activities.

Ginger Wierzbanowski, vice president, intelligence solutions, cyber and intelligence mission solutions, Northrop Grumman stated that Northrop Grumman is pleased to continue supporting the Defense Intelligence Agency through the HELIOS IDIQ. The company's work will help ensure the agency can identify, develop and execute the evolving technical capabilities that allow the intelligence community, combatant commands and other federal agencies to achieve mission success.

The $500 million contract ceiling allows Northrop Grumman to continue providing support to DIA in cross-cutting and multi-domain sensor and mission technologies, as well as full systems life cycle development and support.

The work will be performed in Cincinnati, Ohio; Fairfax, Virginia; Huntsville, Alabama and Tucson, Arizona.

northropgrumman.com/

DoD confers MUOS-capable airborne radio contract to Rockwell Collins

Rockwell Collins has been awarded the first long-term contract with the U.S. Department of Defense (DoD) to supply Mobile User Objective System (MUOS)-capable airborne radios and ancillaries for DoD platforms including fixed and rotary-wing aircraft, ships and ground installations.

A five year agreement through the U.S. Navy's Naval Air Systems Command (NAVAIR), the indefinite-delivery/ indefinite-quantity (IDIQ) contract for sixth-generation ARC-210 RT-2036(C) radios begins with a base award of $82.6 million in 2018 with four option years to follow.

The contract also includes fifth-generation ARC-210 radios and ancillaries, as well as associated data and services.

The ARC-210 RT-2036(C) can use the MUOS network to provide military forces with worldwide, crystal-clear voice, video and mission data over a secure high-speed Internet Protocol-based system.

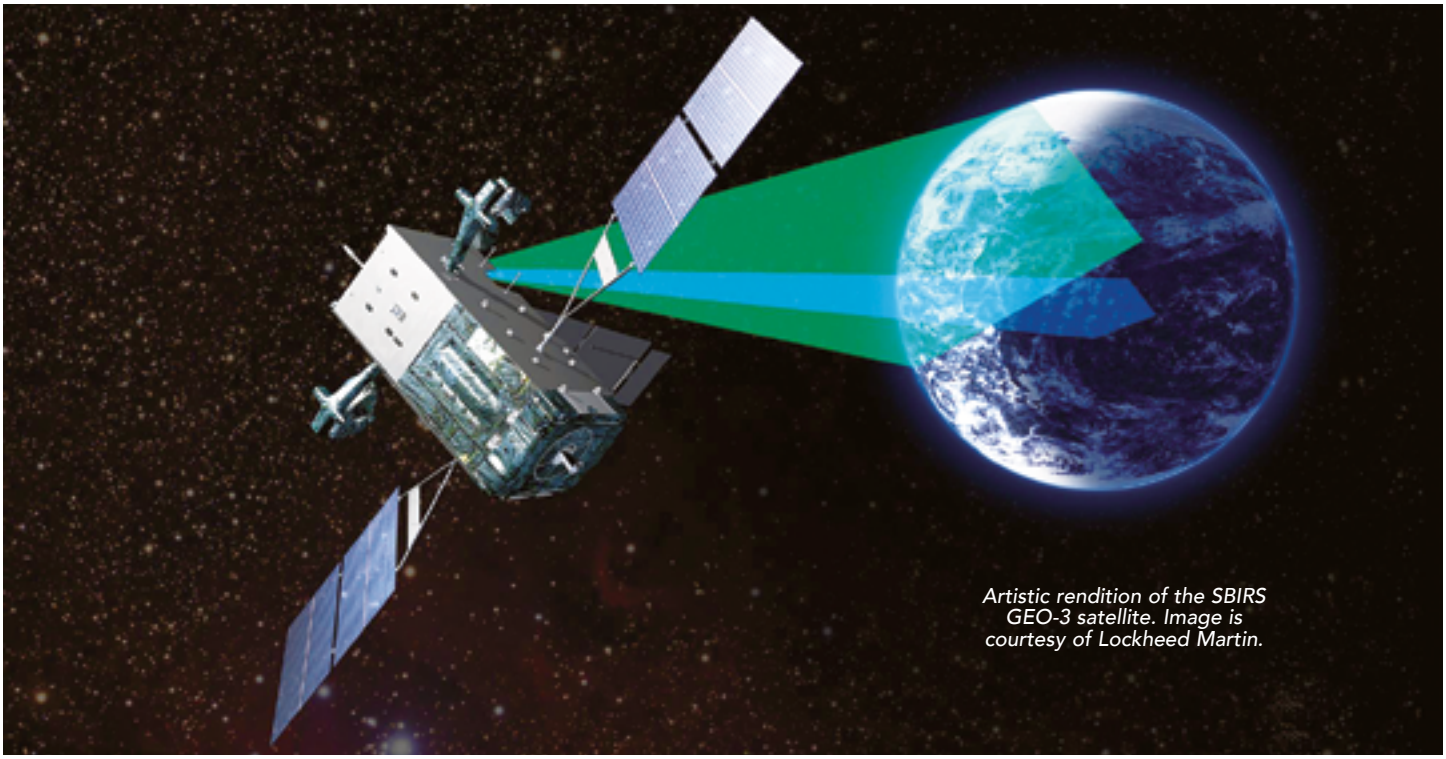
The radio is also part of Rockwell Collins' TruNet™ family of products that ensures secure connectivity between ground and airborne units.

As the sixth-generation solution, the ARC-210 RT-2036(C) features a software-defined radio architecture enabling multiple legacy and advanced waveforms, high-speed mobile ad hoc networking and beyond-line-of-sight connectivity capabilities. The radio will join the more than 45,000 highly-reliable ARC-210 radios currently fielded across the globe on more than 180 platforms.

Troy Brunk, VP and GM, Communication, Navigation and Electronic Warfare Solutions for Rockwell Collins, said that this is the next big step in arming warfighters with next-generation communications capabilities, including those available through MUOS, which brings greater overall capacity and signal quality for high reliability when it's needed most.

www.rockwellcollins.com/

"Good health report" for SBIRS GEO-3



Artistic rendition of the SBIRS GEO-3 satellite. Image is courtesy of Lockheed Martin.

A win-win, as this satellite for the U.S. Air Force was launched in January and now Air force Space Command is receiving data, indicating the good health of the satellite.

The *Space Based Infrared System* (SBIRS) *Geosynchronous Earth Orbit* satellite (GEO-3) successfully achieved Air Force Space Command operational acceptance.

SBIRS GEO-3 launched from Cape Canaveral Air Force Station aboard a United Launch Alliance Atlas V 411 booster on January 19, 2018.

Upon separation from the booster, satellite operations personnel began a series of planned Liquid Apogee Engine transfer orbit maneuvers to safely place the spacecraft into its final orbit.

GEO-3 reached its intended orbit and began spacecraft checkout activities by deploying the satellite's light shade, solar array wing assemblies, and antenna wing assemblies.

With the spacecraft safely on orbit, sensor testing and checkout activities began, leading to a tuned and calibrated payload ready for warfighter use.

Lt. Col. *Leroy Brown*, Jr., Program Manager for SBIRS GEO-3, stated that the achievement of operational acceptance means the spacecraft's infrared sensors are now considered fully operational and ready for warfighters. This is a huge win for the combined Program Office, Lockheed Martin Space, and Northrop Grumman team, as well as, the military, civilian, and civil users of the infrared data the SBIRS satellite constellation provides.

The GEO-3 launch marked the fourth launch of a Geosynchronous satellite, providing worldwide coverage as the Air Force replaces the legacy Defense Support Program missile warning and missile detection satellites that began operations over 45 years ago.

The Remote Sensing Systems Directorate at the U.S. Air Force Space and Missile Systems Center at Los Angeles AFB in Los Angeles, California manages the SBIRS program. Lockheed Martin Space Systems Company, Sunnyvale, California, is the SBIRS prime contractor, and Northrop Grumman Electronic Systems, Azusa, California, is the payload integrator.

The 460th Space Wing at Buckley AFB in Aurora, Colorado, operates the SBIRS constellation. The SBIRS program delivers timely, reliable and accurate missile-warning and infrared surveillance information to the president of the United States, the secretary of defense, combatant commanders, the intelligence community and other key decision makers.

The system enhances global missile launch detection capability, supports the nation's ballistic missile defense system, expands the country's technical intelligence gathering capacity and bolsters situational awareness for warfighters on the battlefield.

WALTON DE-ICE

We Cover the World

#1 in Antenna De-Icing Worldwide

Protecting Networks From Snow & Ice

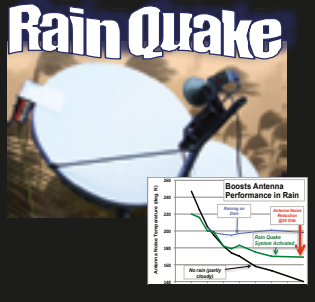
Protect Your Antennas from

Snow and ICE Outages

Earth Station Antenna De-Icing from 0.6 to 32 m.

Ka-Band Specialists

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



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

Better Satellite World Awards Dec. 3rd London

+1 (951) 683-0930
sales@de-ice.com
www.De-Ice.com

WB Walton Enterprises, Inc. P.O. Box 9010 San Bernardino, CA 92427 USA

DigitalGlobe's WorldView-1 satellite captures Hurricane Michael's attack on Tyndall AFB in Florida

Tyndall AFB's main gate and aircraft static display before and after Hurricane Michael. Satellite image ©2018 DigitalGlobe, a Maxar company

An overview of Tyndall AFB before and after Hurricane Michael.
Satellite image ©2018 DigitalGlobe, a Maxar company

DigitalGlobe's WorldView-1 satellite collected new imagery on October 11th of Panama City and Tyndall Air Force Base (AFB), Florida, that were in the forefront of the Hurricane Michael onslaught.

Some of the imagery of Tyndall AFB clearly shows the power of the hurricane — stripping off roofs, tossing planes around and destroying property all throughout the region. Note that DigitalGlobe's WorldView-1 satellite only collects panchromatic (black and white) imagery.

INNOVATIVE, SATELLITE-BASED SOLUTIONS ARE...

Pivotal to a Government's ability to protect their nations

By Nicole Robinson, Senior Vice President, Global Government, SES Networks

The drive for sophisticated communications applications in the defense and security space has significantly increased over the past few years, as well as the overall government demand for secure satellite communications (SATCOM) capabilities.

For example, five years ago, a data rate of 5 Mbps to support the sensors and capabilities of Intelligence Surveillance and Reconnaissance (ISR) platforms was more than sufficient. In five years, these same platforms will seek up to 100 Mbps to deliver live streaming, full motion video (FMV) to enhance situational awareness and safety.

The shift toward data-centric applications can be observed throughout various areas of defense and security activities – from mission-critical tasks at sea, land or airborne, to troops morale and welfare.

From the vantage point of SES Networks, an essential ingredient to the commercial industries' ability to innovate and enhance capabilities for defense and security needs, is early and close collaboration with the government counterparts to understand at the platform and application level what is needed for successful missions.

The company is proud to leverage partnerships, insights and engagement of the governments already today and are also factoring future governmental needs into upcoming capabilities, to support the data-centric needs of the future. Given the appetite for bandwidth and services that is continuing to grow in the defense and security sector, SES Networks appreciates the need to cater to these missions and leverage the company's fleet in two different orbits: Medium Earth Orbit (MEO) operating at 8,000 kilometers from the Earth's surface, and Geostationary Orbit (GEO), operating at 36,000 kilometers from Earth.

Today, governments can take advantage of SES' combined GEO and MEO fleet of more than 70 satellites that is providing global reach and flexibility. As some applications are increasingly latency sensitive, MEO is ideally suited to cater for these applications.

As the platforms are expected to consume more bandwidth, High Throughput Satellite (HTS) assets are of tremendous importance. These assets continue to be developed by SES and governments can avail themselves of them in line with the pace of evolving needs and mission architectures.

New Industry Benchmark

To meet the growing data demands, SES has invested in the next generation of the firm's MEO system, called O3b mPOWER. This is a satellite communications system that is truly flexible and brings unparalleled capacity, featuring more than 4,000 beams per satellite.

To be launched in 2021, O3b mPOWER is a multi-terabit scalable system that will further boost the usage of sophisticated applications for network-centric operations

Artistic rendition of the O3b mPOWER constellation.

via "*virtual fiber*" network literally anywhere, serving the on-demand needs for data and cloud-based applications. Like the current MEO constellation, O3b mPOWER is ideal for high-tech military operations, with multiple layers of active and inherent security.

The system will come together with innovative ground infrastructure and customer edge terminals, will be fully integrated with the existing SES fleet and will feature various technology advancements that include software intelligence and automation. O3b mPOWER beam-forming flexibility will enable government users to securely and autonomously manage beam capacity and location to support secure operations on air, land and sea.

Quicker Access via Hosted Payloads

In addition to investing in more powerful and flexible satellite systems, we also work closely with governments to understand their needs, and offer them innovative solutions already.

As an example, in the area of commercially hosted government payloads, the government is able to leverage available space and power on a commercial satellite to launch a dedicated mission more rapidly than with a military or

Another example of hosted payloads on SES' satellites. Launched earlier this year, SES-14 carries a hosted payload for NASA's Global-scale Observations of the Limb and Disk (GOLD) mission. GOLD will provide unprecedented imaging of the Earth's upper atmosphere from geostationary orbit to deepen scientists' understanding of the boundary between Earth and space. Launch

government-owned and operated program. The European Commission and NASA are well versed in these programs.

The technical capabilities of commercially hosted government payloads have been impressively proven over the past decade. However what's particularly impressive is the time and cost savings coming along with these business models.

For example, the **U.S. Air Force Commercially Hosted Infrared Payload**, or **CHIRP**, on board the **SES-2** satellite, delivered impressive R&D infrared staring capability from space, in 36 months from contract to orbit, at only 15 percent of the cost of a military owned and operated spacecraft to perform a similar mission.

Easier Access via New Models and Procurement Vehicles

When a mission's success is at a stake, the ability to bring enhanced communications rapidly is key, and SES increasingly sees governments opening up to models of procuring capabilities in the way that they have access to what they require, exactly when such is needed.

A recent example is the Blanket Purchase Agreement (BPA) between **U.S. DoD** and **SES GS**, where U.S. DoD customers will have the opportunity to access SES's industry-leading O3b MEO services worldwide. The BPA

scope of work comprises managed services, including HTS capacity and broadband services, monitoring and control services, satellite terminals, training and terrestrial backhaul.

Pooling and Sharing of SATCOM via GovSatCom

An innovative way for governments to have guaranteed and cost-efficient access to secure satellite communications when needed is to pool and share SATCOM systems.

SES is leading a consortium of partners within ESA's GovSatCom Precursor Program, **PACIS-1**, to advance creation of an architecture and service concept of pooling and sharing resources, to ensure governments access to secured commercial and governmental SATCOM networks at short notice.

The **European Commission** has taken an important step in the direction of calling on the capabilities of the satellite communications industry when it outlined an approach to securing their Space Strategy in the EU GovSatCom initiative (***www.eda.europa.eu/what-we-do/activities/activities-search/governmental-satellite-communications-(govsatcom)***).

The Commission recognized that space and satellite communications are key elements of infrastructure in meeting the defense and security needs and set on a path to plan and procure for SATCOM capability in a manner to assure access to this critical infrastructure.

Through this process, recognition was made clear that reliable and flexible connectivity is key when facing threats such as terrorism, cyber warfare, border control, and natural and technological disasters. Preventing such threats also requires coordination between governments. In this way, especially, SES is proud to support the GovSatCom initiative.

This program will help to reduce the fragmentation of demand and act as an anchor to guarantee access, coordinate requirements and ensure security as well as paving the way for active, cross-border cooperation, all the while serving national requirements.

Forming Public Private Partnerships

SES is also innovative in the way the firm serves governments — sometimes this means forming a partnership with a government.

A powerful example is a 50/50 joint venture between the **Government of Luxembourg** and SES, called **GovSat**. This J-V reveals the combined value and advantage of government involvement, which is serving their own

The launch of the GovSat-1 satellite aboard a SpaceX flight-proven Falcon 9 rocket from Cape Canaveral AFS, Florida, on January 30, 2018.

QUARTZ signing (At the table, from left to right: Magali Vaissiere, ESA Director of Telecommunications and Integrated Applications, and, Nicole Robinson, SVP Global Government at SES Networks). Photo is courtesy of ESA/Grimault.

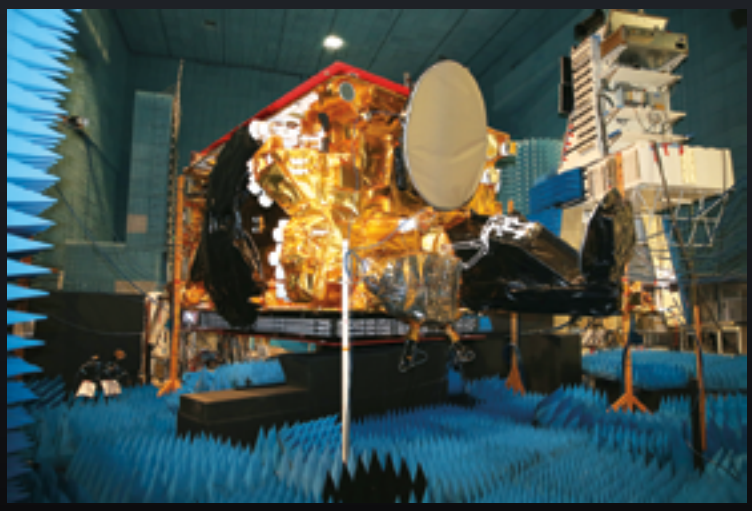
strategies, and NATO, as well as the ability to leverage private sector efficiencies.

GovSat's satellite, called **GovSat-1**, was launched earlier this year and is one of the most secure satellites on orbit today. GovSat-1 represents an international platform and is a true game changer: the satellite provides for many countries access to highly secure capabilities exclusively designed for governments and institutions.

Step-Change Technology

Cutting-edge innovation can be advanced through the synergy of R&D, industry and institutions to combat the threats of the future. To achieve this goal, stakeholders need to derive the correct technology and architectures that will be commercially viable and globally available.

Through a program called **QUARTZ**, or **Quantum Cryptography Telecommunication System**, the power of the combination pf the scientific communities' research work and private industry expertise, within the **ESA ARTES ScyLight** program (***artes.esa.int/scylight/overview***), will be witnessed.



The SES-14 satellite. Photo is courtesy of Airbus.

The SES-lead consortium is designing and developing a satellite-based **Quantum Key Distribution** (QKD) system and service architecture that will result in a powerful tool for providing safe and intrusion-resistant data exchange.

The list of potential applications and end users includes governments, institutions, banking industry, and other practices focused on data protection and security. Quantum technology is an area that should be further developed, and these innovations leveraged to help face the multiplication of cybersecurity threats and attacks.

The Way Forward

The development of applications, services and solutions for governments has been fueling innovative solutions in our sector.

Based on this experience, key takeaways are: ***the importance of early, frequent and open dialogue between industry and government to realize the potential of these partnerships for the taxpayer, as well as for the men and women of the armed forces***.

At the end, secure satellite-enabled connectivity solutions not only help fulfill missions, they transform people's day-to-day experience while on a mission, help to raise morale and welfare and, more importantly, save lives.

www.ses.com

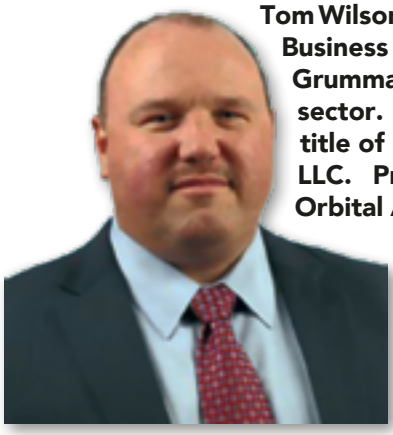
Nicole Robinson serves as the Senior Vice President of Global Government for SES Networks and the Managing Director of SES Techcom Services. In this position, she is responsible for the company's global business portfolio of government customers in the areas of defense, security, humanitarian, federal, civilian and institutional organizations.

In addition to these roles, Ms. Robinson serves as Chairman of the Board of Redu Space Services and Director of the LuxGovSat Board of Directors. In the 10 years since Ms. Robinson joined SES, she has served in a variety of Executive roles leading teams in the area of government product development, business development, government affairs and marketing.

Prior to joining SES, she served as the leader of the Strategic Communications function for the U.S. Joint Forces Command's Standing Joint Force Headquarters (SJFHQ) with General Dynamics as well as the U.S. Army Center of Military History. Ms. Robinson is known in the satellite industry for serving in a variety of leadership positions including two terms as Chair of the Hosted Payload Alliance as well as Vice Chair, Board level positions for the Washington Space Business Roundtable, Techcom and others.

COMMAND CENTER: THOMAS L. WILSON

Sector Vice President, Business Development, Northrop Grumman Innovation Systems and President, Space Logistics



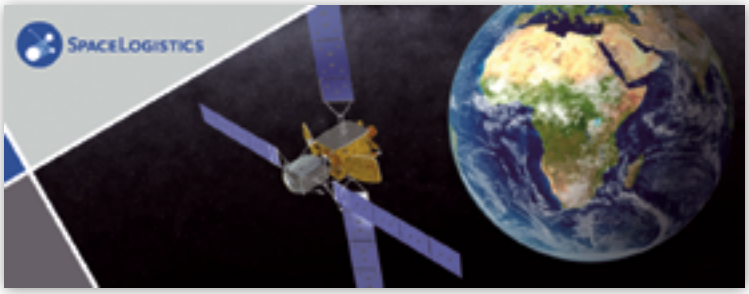
Tom Wilson is the Sector Vice President, Business Development of Northrop Grumman's Innovation Systems sector. Mr. Wilson also holds the title of President of Space Logistics LLC. Prior to the acquisition of Orbital ATK by Northrop Grumman, Wilson served as Orbital ATK's Vice President, Strategy & Business Development of the Space Systems Group.

Mr. Wilson is responsible for the business development performance of the company's Innovation Systems sector. Mr. Wilson also leads a wholly owned subsidiary, Space Logistics LLC, which is chartered with developing the on-orbit satellite servicing market including the development of a first of a kind autonomous robotic servicing vehicle. Mr. Wilson is responsible for all aspects of P&L execution and customer engagement.

After the merger between ATK and Orbital Sciences, Mr. Wilson also served as the Vice President and General Manager of the Civil and Defense Division of the Orbital ATK Space Systems Group. He also served as Vice President and General Manager of the Space Systems Division at ATK Aerospace Group. In this capacity, he was responsible for the overall management of a team of over 500 employees in Maryland, California, Virginia and Texas.

Previously, Mr. Wilson served as Vice President of Strategy, Business Development and Advanced Systems for the Space Systems Group at ATK. He was responsible for managing and coordinating business development and acquisition strategies, and aligning group capabilities with customer requirements. Mr. Wilson also held key management positions at Swales Aerospace, including Vice President, Corporate Development and Vice President, Space Systems Programs. He has over 15 years of government experience with the Department of Defense, where he was the Staff Director for the Congressional Commission to Assess U.S. National Security Space Management and Organization, held several positions within the Office of the Secretary of Defense, and with the Naval Center for Space Technology at the Naval Research Laboratory.

Mr. Wilson holds a Bachelor's degree in Aerospace Engineering from the University of Maryland.



Good day, Mr. Wilson. MilsatMagazine last chatted with you in the March 2011 edition… much has occurred between then and now, especially in regard to Orbital ATK's acquisition by Northrop Grumman. From the VP and GM of the then ATK Spacecraft Systems and Services to today as the Sector Vice President of Business Development for Northrop Grumman Innovation Systems as well as President of Space Logistics LLC. Would you please tell us how that transition has been for you and for the company and what do you see as the benefits to this melding of personnel and technologies?

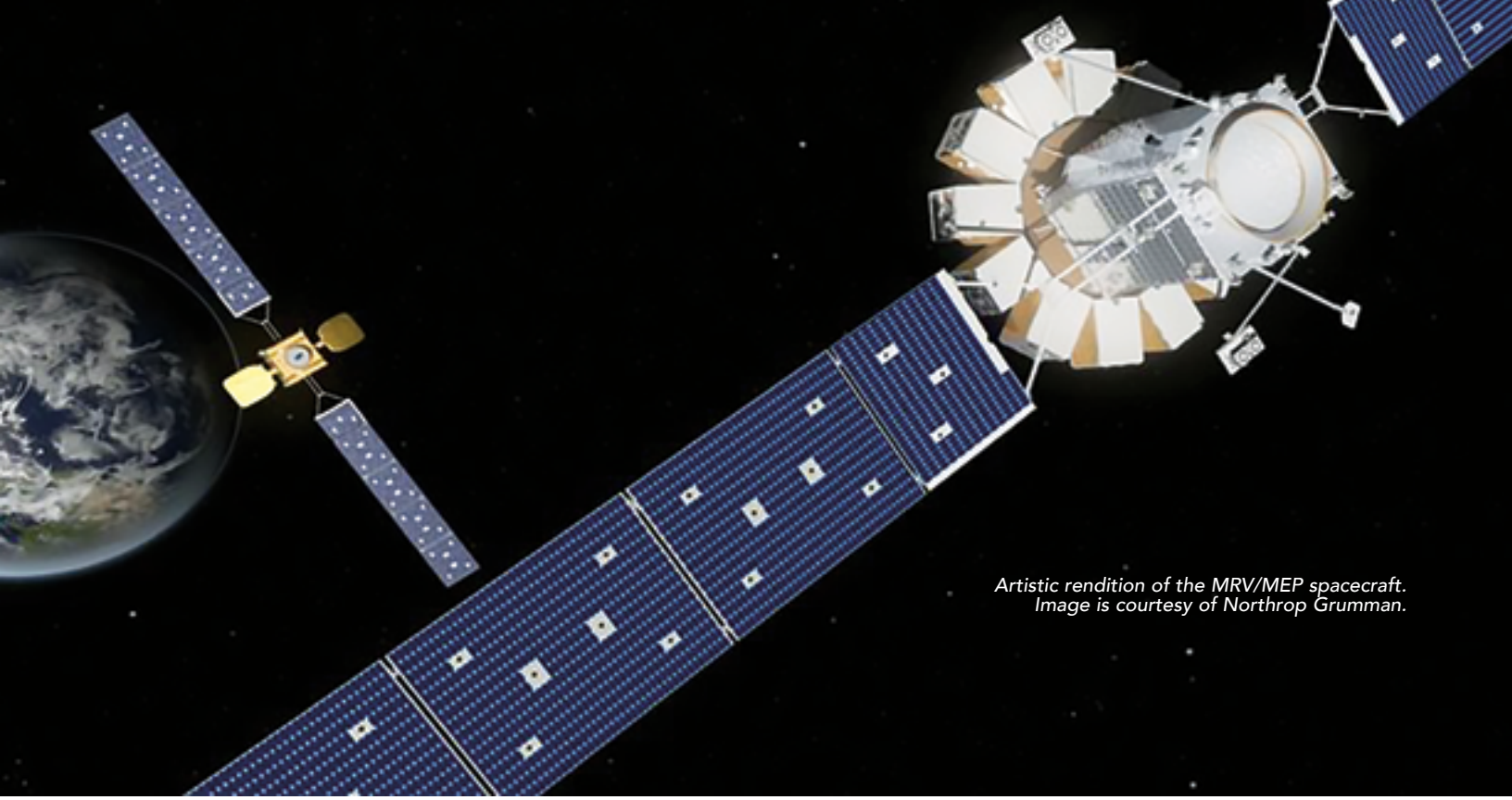
Tom Wilson (TW)
The transition has gone extremely well and we haven't missed a beat in developing and promoting our innovative satellite servicing products.

I am proud to report that Space Logistics is now a wholly owned subsidiary of Northrop Grumman and company leadership has been supportive of our approach to this market. As we saw in the merger between ATK and Orbital Sciences, the combined capabilities of both companies resulted in our ability to open a new market in space. As a result, we are preparing to launch the market's first in-space satellite servicing system next year.

I look for continued synergies and momentum within Northrop Grumman going forward as we grow and expand our presence in the emerging space logistics market.

What is the mission of Space Logistics and what can the industry expect from your company during the next several months from your team? Will you be focused on commercial, military/agency/government solutions or a combination of both?

TW
Our MEV-1 team is busy completing the assembly and testing of the MEV-1 for launch next spring.



Artistic rendition of the MRV/MEP spacecraft. Image is courtesy of Northrop Grumman.

This satellite will rendezvous and dock with the Intelsat 901 satellite to extend its life for five years. In parallel with this, we are busy designing and contracting customers for our next generation life extension system we call Mission Extension Pods which will be installed by our Mission Robotic Vehicle.

Currently, our customers are commercial satellite operators. This technology has many applications in the government, civil and national security markets, so, as of this writing, we are in discussion with our government customers.

What's the latest on the MEV-1 launch?

TW

Our MEV-1 vehicle is now in what we call single line flow.

This means all the components of the satellite have been integrated and the vehicle is undergoing environmental and integrated testing. This testing includes thermal vacuum testing that simulates the space environment, vibration, shock and acoustic testing that simulates the launch environment, and other forms of testing to ensure the workmanship and performance of the spacecraft as built.

Once this testing is completed, it will be delivered to the Baikonur Cosmodrome in Kazakhstan where it will be integrated with our launch co-passenger and then integrated with the Proton launch vehicle. The launch is expected to occur in the 1st half of 2019.

Capabilities	MEP	MEV	MRV
Station Keeping of GEO Client Satellite	✔	✔	✔
Attitude Control of GEO Client Satellite		✔	✔
Longitudinal Relocation of GEO Client Satellite	✔	✔	✔
Orbit Raise of GEO Client Satellite to GEO Graveyard	✔	✔	✔
Inclination Reduction of GEO Client Satellite		✔	✔
Proximity Operations Circumnavigational Inspections		✔	✔
Detailed Robotic Inspections			✔
Installation of Augmentation Modules			✔
Robotic Repairs			✔
Can Dock to Satellites Without LAE			✔

You've already sold another MEV product. What is the status of the MEV-2 mission?

TW
Yes, last January we announced a second life extension contract with Intelsat to extend the life of another satellite in their fleet for five years.

This contract allowed Space Logistics to order our second MEV (MEV-2) from our sister business at Northrop Grumman. The MEV-2 is a build to print of MEV-1 which allows us to reduce our build schedule to just 26 months or less.

This program is progressing on schedule with much of the equipment already arriving at the satellite manufacturing facility in Dulles, Virginia.

The launch of MEV-2 is scheduled for the 1st quarter of 2020 on an Ariane launch.

The MEV and core. Image is courtesy of Northrop Grumman.

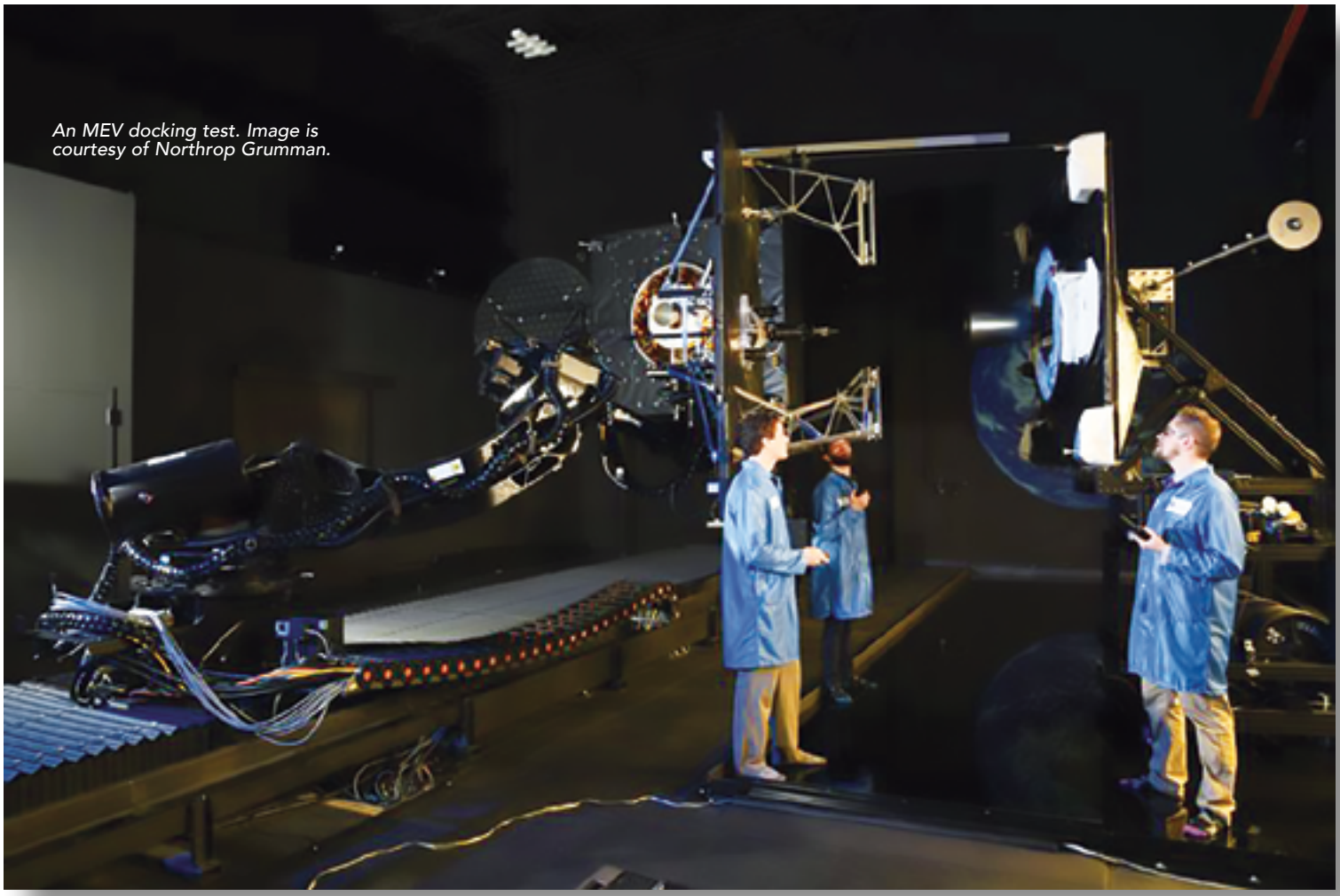
When discussing the hot topic of on orbit servicing, the competition for this market segment certainly is increasing across the globe. Why should operators consider the Space Logistic solutions as the one they should consider for their satellites? What makes your firm's technological solution so commanding?

TW
What differentiates the Space Logistics solution is our keep-it-simple approach and the level of heritage.

These two factors combine to enable us to offer the lowest risk solution to meeting our customers' needs. Our initial MEV solution uses a simple docked life extension approach that is based on our heritage GEO comsat satellite bus informed by our Cygnus spacecraft that rendezvous with the ISS.

Our next generation MEP/MRV system incrementally builds on these capabilities introducing very simple robotics and propulsion augmentation that does not require interruption of service or any complicated robotic surgery of the satellite to access fueling system.

Is Space Logistics working with external partners and, if so, what can you discuss regarding their complimentary technologies in supporting your firm's efforts?



An MEV docking test. Image is courtesy of Northrop Grumman.

TW

For both the MEV and MEP life extension services, Space Logistics is working closely with our clients spacecraft manufacturer to ensure that the MEV is compatible with the clients satellites to meet the objectives of our mutual customer.

The MRV includes an incremental introduction of new technology for Northrop Grumman, space robotics. We are currently evaluating several candidate partners that wish to work with us to supply this capability. However, at this time, our partner has not yet been selected.

Have you received all of your regulatory licensing and insurance for your products? If so, what message do you think that sends to the industry in terms of risk mitigation for these products?

TW

Our MEV is truly demonstrating the fundamentals of satellite servicing, not just from a technical and business case perspective, but also a regulatory and insurance perspective.

The U.S. government's heritage approach to meeting the requirements of the Outer Space Treaty (OST) Article 6 has been through the FCC for communications satellites and NOAA for remote sensing (earth observation) satellites. Our MEV's are truly the first of a new breed of "non-typical" commercial satellites that do not fit directly into either of these categories of heritage satellites.

However, after years of working with the U.S. State Department and the various satellite regulatory agencies, we have been able to establish a licensing approach that is accepted as meeting their obligations to the OST. This approach includes licenses from both the FCC and NOAA where in the FCC is regulating our radio transmission and GEO locations while NOAA is regulating our remote sensing capabilities which are used to perform our rendezvous and docking with client satellites.

We are now fully licensed to perform our launch and first rendezvous and docking! Another ground breaking business development for this program has been insuring our MEV. With significant help from our broker, Willis Towers Watson, we have successfully procured our launch plus one-year of in orbit operations insurance with the satellite insurance underwriters.

This insurance covers our initial rendezvous and docking with the Intelsat 901 satellite.

With our licenses, insurance, launch service, and the continued progress of MEV production, we have everything in place to begin this exciting new chapter in commercial space.

Innovation is driving new ideas and the technology is proving to be a breath of fresh air for companies and leaders, alike. What do you believe will be the result of such implementations over the next several months for Space Logistics and what new pathways will be opened for the space and satellite industry due to innovative research and advanced manufacturing, such as 3D printing?

TW
On orbit assembly is an important future capability that Northrop Grumman is developing and an important service offering for the future of Space Logistics beyond basic life extension.

Northrop Grumman is just concluding two important NASA contracts which conducted ground demonstrations of technologies we believe are central to in-orbit assembly and manufacturing.

The next phase that we are awaiting award from NASA is to conduct an in-orbit demonstration of several of these technologies. One of these key technologies includes our partner Made in Space which has been making excellent advances in their capabilities to manufacture parts in space.

Earlier this year, you introduced other satellite servicing products — MEPs and MRVs. Please explain the capabilities for these products, how they differ from the MEV and what customer feedback you've received.

TW
We are very excited to introduce our next generation life extension product which incrementally builds on the fundamentals of satellite servicing that our MEVs will demonstrate.

This next generation system uses a Mission Robotic Vehicle (MRV) to deliver and deploy Mission Extension Pods (MEPs) onto GEO spacecraft. The MEP's are a small and simple propulsion augmentation device which, once installed, the owner of the client vehicle can operate to supplement the propulsion system of their vehicle and thereby extend its life by 3-10 years depending on the mass of the client vehicle. Additionally, a MEP can be relocated, by the MRV, from one client vehicle to another should the operator wish. This feature creates considerable flexibility for our customers fleet management plans.

The MRV is an MEV which has been extended to carry the robotic arm and 10 MEPs. Both vehicles derive significant heritage from our MEV. Once the MEPs have been installed, the MRV will be available to perform MEV type services and relatively simple robotic inspection and repair missions.

We have been speaking with many customers about our MEP's and have received very positive feedback and interest. In fact customers have come to us and in total have identified 15 specific spacecraft of interest for this service in the 2021-2023 timeframe. Our objective is to be on orbit delivering our first MEPs in 2022.

What's next on the technology roadmap for Space Logistics?

TW
When Orbital ATK began the MEV program in 2016, we were very careful to choose the name of our new company that would provide the service.

While our initial service offering is focused on life extension, we decided to call the company Space Logistics because we envision deploying new capabilities as the technological risks are burned down and the commercial demands mature. The MEV is demonstrating the fundamentals of satellite servicing and the MRV/MEPs will demonstrate fundamentals of in-orbit assembly and repair; both while providing a valuable commercial service.

In line with these commercial endeavors, we have already begun burning down the risks of the next generations of capabilities to expand further into in-orbit repair and augmentation, in-orbit assembly of large space structures, and efficient "through space" transportation using next generation solar electric propulsion systems.

As one example, just this month we completed a NASA public-private-partnership we called the Commercial Infrastructure for Robotic Assembly Services (CIRAS: ***www.northropgrumman.com/Capabilities/SpaceLogistics/Documents/CIRAS_Factsheet.pdf***), to develop key technologies that are needed to manufacture and assemble large space structures on orbit.

What, now, brings a true sense of accomplishment to you as you review your career challenges and success? This question was also asked of you five years ago and perhaps your thoughts concerning your career have now changed.

TW
My true sense of accomplishment lies in the mission success our team has had over the past two decades.

There is nothing better than when we deliver value for our customers and enable their success, especially when other lives stand in the balance with missions that focus on U.S. National Security.

www.northropgrumman.com

www.northropgrumman.com/Capabilities/SpaceLogistics

MILITARY MISSION-CRITICAL COMMS

SATCOM as a Service paves a path forward...

By Rebecca Cowen-Hirsch, Senior Vice President for Government Strategy and Policy at Inmarsat Government Inc., and Senior Contributor

From the service's beginning, the U.S. Air Force's Analysis of Alternatives (AoA) promised to usher in a new era of satellite communications (SATCOM) — one that would more effectively leverage commercial services in an integrated architecture.

The analysis anticipated adopting improved business models to enable diversity and redundancy to include alternative satellite paths with robust, resilient capabilities needed to operate in a complex environment.

The AoA, of course, is intended to evaluate and propose the way forward for a follow-on wideband communications system to, in part, replace the legacy Wideband Global SATCOM (WGS) system. Following the AoA initiation in December 2016, a commercial working group formed to gather perspectives and input from industry leaders to inform the best ways to move forward.

This engagement with the commercial sector was not only unprecedented for an AoA, but it also represented a significant recognition of what the private sector brings to the military's operational picture. For those participating in the working group, they have seen top executives work with government leaders to develop a "blueprint" to leverage the best of what industry can offer, and seamlessly integrate these capabilities into the future Department of Defense (DoD) SATCOM architecture.

In June, there was the release of some conclusions from the AoA, which initially gave pause: while the Pentagon announced that there were "*opportunities to expand the use of commercial (communication satellites)*", also disclosed was that most military satellite terminals are not compatible with modern SATCOM technology. The study leads posited that it could, in fact, take decades to replace all 17,000 DoD wideband SATCOM terminals.

While it is generally acknowledged that legacy terminals are incompatible with the more capable technologies available today and in the future, it is also well understood that many, perhaps even most, require replenishment and replacement. Given the increasingly dynamic operational and threat environment in space, it is not reasonable to stall the much-needed transformation of the SATCOM architecture based on a sunk cost argument — or stated differently, allowing the tail to wag the dog.

The ideal satellite architecture will change and this change will ultimately support long-term, mission-critical needs and set the stage for the future of SATCOM. This calls for a progressive approach to get where the military needs to be — sooner rather than later. Much like President Kennedy famously and so eloquently stated about our space initiatives in 1962, we do these things "*not because they are easy, but because they are hard, because that goal will serve to organize and measure the best of our energies and skills, because that challenge is one that we are willing to accept, one we are unwilling to postpone.*"

On the commercial side, we have demonstrated that we are, indeed, unwilling to postpone. We have devoted ourselves to this transformation for years and are moving at the speed necessary to meet both today's, and future requirements.

On the terminal side, many are making significant investments in modular flexible terminals to replace vertically integrated systems that are inflexible and have operational limitations which inhibit the desired integrated architecture. Within a military context, industry can readily modify existing terminals where needed or replace with newer more capable ones that enable interoperability and roaming across networks for optimal flexibility. In our efforts, we are not thinking in terms of decades.

We prefer to "*go fast,*" as both U.S. Air Force General ***John Hyten***, Commander, U.S. Strategic Command (USSTRATCOM) and Director ***Betty Sapp*** from the National Reconnaissance Office, have both urged.

As we pursue these objectives at an accelerated rate, we strive toward a new business model that will prove essential for the military in the near-present and indefinite future: SATCOM as a Service. Engineered for global mobility, SATCOM as a Service provides an end-to-end, communication infrastructure from resilient satellite systems to a robust ground infrastructure, as well as terminals that are type approved to work on that network.

SATCOM as a Service is an end-to-end system, owned and managed by trusted commercial operators. Because the system is designed by experienced operators, it reflects on their history of successfully providing services to the public sector. It delivers mobile, high-throughput connectivity the way government users seek it: easily, affordably and operationally available — anytime, anywhere.

With no infrastructure charges or research and development (R&D) investment on their part, users travel from one location to another and simply "*plug in*" to get the global SATCOM connectivity they need, when they need it.

SATCOM as a Service is a fully integrated end-to-end solution that (terminals included) affords the government a more immediate opportunity to augment existing military SATCOM (MILSATCOM) with commercially-available terminals and network infrastructure.

This enables users to leverage heterogeneous networks for a high-performing, integrated architecture – along with the ability to tune into adjacent bands for absolute operational flexibility. SATCOM as a Service empowers DoD agencies to embrace a business model that is more affordable, adaptable and supportive of SATCOM available on demand, whenever and wherever needed.

Specifically, a government partnership with commercial providers built upon the SATCOM as a Service business model would deliver the following advantages:

Assured worldwide connectivity.
Government and military users must stand ready to deploy "anytime, anywhere." SATCOM as a Service gives them access to robust and secure SATCOM wherever they operate, over land, at sea or in the air. SATCOM is a critical enabler of operations, thus, it is rarely the purpose of the mission.

However, a poorly designed connectivity solution based on legacy broadcast-centric models will easily make it feel like that is the case. Through SATCOM as a Service, users benefit from a uniform worldwide seamless spot beam architecture for maximum mobility, ease of use, with greater resilience and potentially even frequency diversity, if needed.

Ease-of-use.
Unlike legacy fixed or consumer broadcast SATCOM which require significant engineering and design time to integrate terminals, modems, satellites and commercial teleports into a user experience, SATCOM as a Service alleviates these burdens for military users. This allows them to focus on the mission itself and not the network topology and administration.

Combatant commanders benefit from this ease of operation of their hardware, with less operator interaction from field service reps with a resultant reduction of operator-introduced failures. All of this minimizes troubleshooting and administration work, with end users benefiting from reliable, consistent access to command and control, email, video teleconferencing and the morale, welfare and recreation (MWR) network.

Industry-leading R&D without capital expense for the government customer.
When federal agencies build and oversee their own stove-piped satellite networks, they make large investments and long-term contractual commitments for hubs, modems and other infrastructure.

When technology advances or the environment require new versions, this often results in significant contract revisions, which may involve unplanned costs for infrastructure, software and even hardware. SATCOM as a Service avoids this, with industry overseeing the latest technology updates, making them available as part of the service delivery.

This covers the addition of new satellites, ground stations and secure enclaves, along with efficiency improvements and feature upgrades. SATCOM as a Service also includes the development of terminals in both commercial and military form factors which leverage the best technology industry has to offer. Once the technological improvements are implemented and tested, users simply connect and realize the enhanced operational benefits without capital expense on their part, to enjoy "always on" innovation and even accounting for backwards compatibility.

Affordable worldwide access.
Historically, when agencies operate their own network, they usually lease bandwidth to cover any potential region of interest. Leasing, speculatively, capacity across multiple regions of MHz (often redundant for coverage flexibility) – in addition to separate and inefficiently used ground infrastructure — leads to an opportunistic and expensive, often frustrating, guessing game in which a network planner attempts to forecast where and when coverage may be sought. Inevitably, they end up leasing unnecessary bandwidth in certain regions (paying for bandwidth they do not use) and under-leasing it in others leading to users not having adequate connectivity to perform data-intensive missions.

In contrast, SATCOM as a Service delivers guaranteed data rates to satisfy mission needs at a moment's notice, worldwide. In other words, there are no more guessing games or over-leasing and under-leasing. This frees up military members from administering disparate networks, allowing them to focus on critical operations, while maintaining full mission effectiveness through agreed service levels.

SATCOM as a Service is the DoD's path forward. It provides agencies the necessary express on-ramp to a fully integrated architecture with a rich, flexible set of multi-band, multi-node terminals, thus maximizing the diversity of their space assets and ground segment. With opportunities presented by the AoA, as well as ongoing, organizational budget and program planning cycles, it is time for government leaders to leverage the industry's commitment, investment and expertise to ensure they progress to the future instead of admiring the "*prophesies from yesterday*."

Let's look to the future where we need to go and get there fast.

Rebecca Cowen-Hirsch is the Senior Vice President for Government Strategy and Policy at Inmarsat Government Inc., a wholly-owned subsidiary of Inmarsat plc, the world's leading provider of global mobile satellite communications to the United States government. She is responsible for establishing Inmarsat's strategic direction, policy and advocacy with respect to U.S. government.

Ms. Cowen-Hirsch has more than 25 years of defense, aerospace and executive leadership experience. She served in the U.S. Department of Defense (DoD) as the Program Executive Officer for SATCOM, Teleport, and Services at DISA and the first Vice Component Acquisition Executive for DISA. She established the Defense Spectrum Office, serving as its first Director. She is a rated experimental flight test engineer and became the first female civilian Mission Commander for the Advanced Range Instrumentation Aircraft (ARIA) mission. She was awarded the Exemplary Service Medal for her service to the DoD.

The Economist EVENTS

SPACE SUMMIT

$400 savings for SatNews readers quote code SATNEWS15

Offer expires September 15th

The world is not enough

November 1st 2018

New York

Speakers include:

PETER BECK
Chief executive
Rocket Lab

LEROY CHIAO
Former astronaut
NASA
Author, "One Orbit"

JEAN FLOYD
Chief executive
Stratolaunch

ELLEN STOFAN
Director
National Air and Space Museum
Former chief scientist
NASA

Space commerce has exploded cutting across multiple industries and new generations. This interdisciplinary and inter-generational renaissance is the ultimate entrepreneurial dream.

Join Economist editors and 200 provocative thinkers, incumbent and challenger chief executives, industry experts, regulators and academics as they re-imagine a space economy focused on business opportunities left unfulfilled by traditional institutions.

Register to attend:
+1 212 641 9865
events@economist.com

Sponsorship opportunities available.
Contact **SyeedaBriddell@economist.com** for more information

space.economist.com

@EconomistEvents
#EconSpace

Diamond sponsor

Hewlett Packard Enterprise

COMMAND CENTER: REAR ADMIRAL RICHARD A. CORRELL

J5 Director, Plans and Policy, U.S. Strategic Command

Rear Admiral Rich Correll graduated from Rose Hulman Institute of Technology in 1986 with a Bachelor of Science in Chemical Engineering. He also holds a master's degree in international strategic studies from the Fletcher School of Law and Diplomacy.

His command assignments include the USS Topeka (SSN 754); Submarine Squadron (SUBRON) 11 in San Diego; and Submarine Group 7 in Yokosuka, Japan. He also served at sea on the USS Henry M. Jackson (SSBN 730), USS Hyman G. Rickover (SSN 709) and USS Buffalo (SSN 715).

His staff assignments include duty at the U.S. Fleet Forces Command as the director of Joint and Maritime Operations (N3), Strategic Systems Programs Headquarters, Naval Personnel Command, Naval Reactors Headquarters in the "Line Locker" and an assignment on the staff of the Office of the Secretary of Defense as the military assistant to the deputy under secretary of defense for strategy plans and forces and military assistant for the under secretary of defense for policy.

In July 2018, he assumed his current duties as the Director, Plans and Policy, United States Strategic Command. He is responsible for the development and implementation of national security policy and guidance, military strategy and guidance, space and weapons employment policy and concepts and joint doctrine as they apply to the execution of the command's global mission.

Correll served on U.S. Navy teams that have been awarded the Naval Unit Commendation, the Meritorious Unit Commendation and the Battle Efficiency E Awards.

Admiral, would you please outline your current duties as the Director of Plans and Policy for USSTRATCOM?

Admiral Correll

I am responsible for the development and implementation of national security policy and guidance, military strategy and guidance, space and weapons employment policy and concepts and joint doctrine as they apply to the execution of U.S. Strategic Command's global mission.

We have a team of dedicated Soldiers, Sailors, Airmen, Marines, and Civilian professionals that accomplish our mission.

Admiral, what do you see as crucial elements and technologies that need to be implemented to improve space-flight safety?

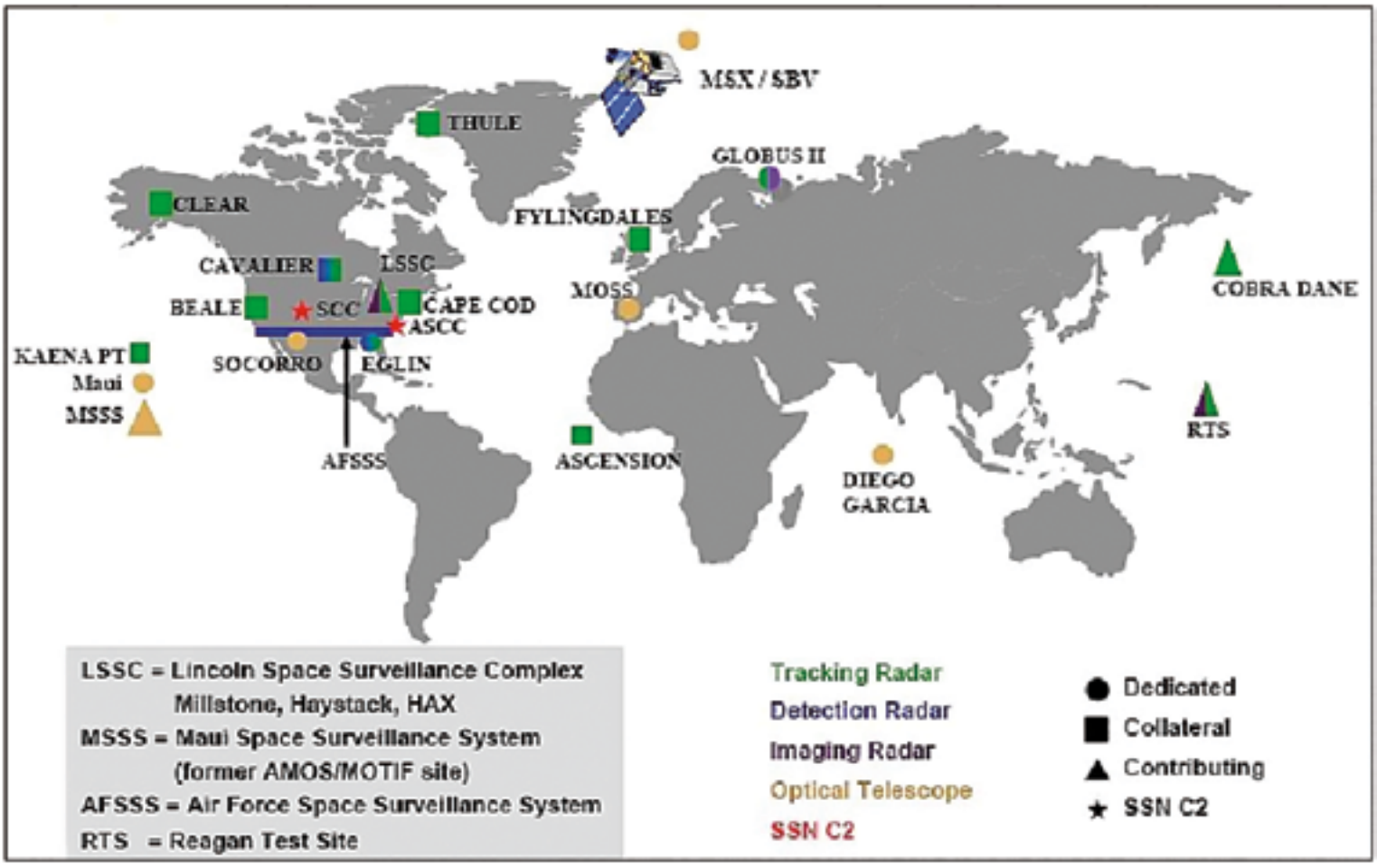
Admiral Correll

First and foremost, spaceflight safety is a global challenge and it is in everyone's best interest to continue encouraging safe and responsible behavior in space while emphasizing the need for international transparency and Space Situational Awareness (SSA) data sharing.

There are a number of efforts underway that are critical to improve space-flight safety. As increased satellite operations make lower Earth orbits (LEO) more congested, the United States will seek to develop a set of standardized techniques for mitigating the collision risk of increasingly congested orbits, particularly for large constellations.

Additionally, orbital debris poses a growing threat to military, commercial, and civil space operations. Debris mitigation guidelines, standards, and policies must be revised periodically, enforced domestically, and adopted internationally to mitigate the operational impacts of orbital debris.

What object sizes can be recognized by the Space Surveillance Network (SSN)? How are threats to spacecraft (military and commercial) determined and how does USSTRATCOM inform satellite operators of these potential encounters with space debris? What guidelines determine when to alert operators to engage in evasive actions?



Map of the global SSN (Space Surveillance Network). Image is courtesy of AFSPC.

Admiral Correll
The United States' Space Surveillance Network (SSN), using a combination of terrestrial and space-based radars and optical telescopes, can detect objects 10x10x10 cm., or about the size of a softball.

USSTRATCOM's Combined Space Operations Center (CSpOC) at Vandenberg Air Force Base, California, constantly monitors tens of thousands of objects in Earth orbit, predicts their future orbits and compares them against all objects in their database. The CSpOC compares the predicted orbital characteristics of all space objects to determine if two objects are going to closely approach each other using a process known as conjunction assessment (CA).

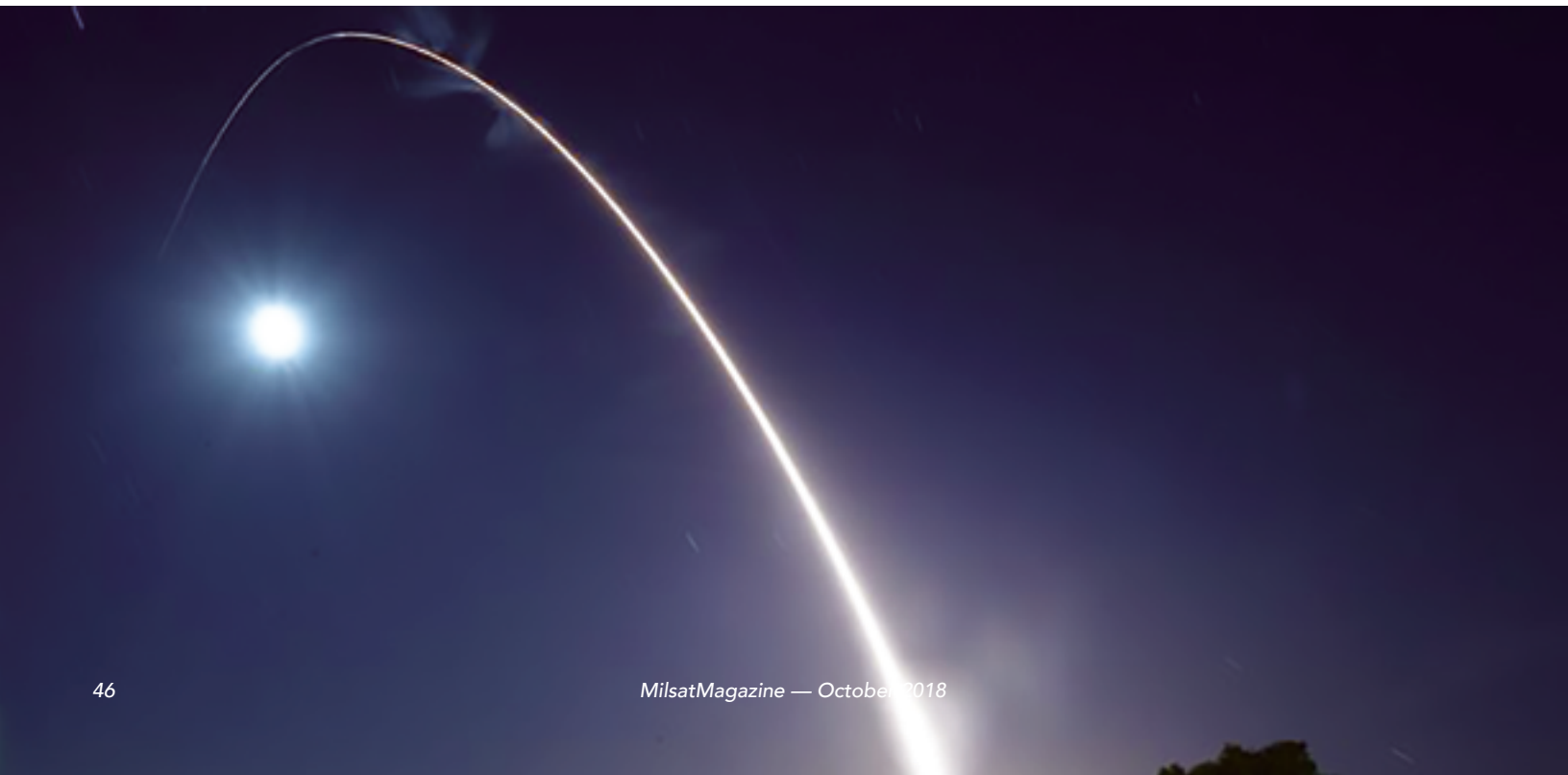
CSpOC conducts CAs during the launch, on orbit, and end-of-life phases for all satellites and other orbiting objects. When CSpOC identifies a possible conjunction, CSpoC will send a notification to the satellite owner/operator warning them of the potential hazard. It is then up to the satellite owner/operator whether or not to maneuver their satellite.

How will policies driven by your organization address such a growing number of smallsats and reduce concerns of collisions? Will additional personnel be required to decipher the ever-increasing influx of data from the Space Surveillance Network in order to produce reliable collision alerts?

Admiral Correll
Consistent with the principles as stated in U.S. Space Policy Directive-3 (SPD-3), the overarching goal is for the United States to continue to lead the world in creating the conditions for a safe, stable, and operationally sustainable space environment.

Toward this end, SPD-3 establishes nine goals to meet the Space Traffic Management (STM)-related challenges of the future environment:

- *Advance SSA and STM Science and Technology (S&T)*
- *Mitigate the impact of orbital debris on space activities*
- *Encourage and facilitate U.S. commercial leadership in S&T, SSA, and STM*
- *Provide U.S. Government supported basic SSA data and basic STM services*
- *Improve SSA data interoperability and enable greater SSA data sharing*
- *Develop STM standards and best practices*
- *Prevent unintentional radio frequency interference*
- *Improve the U.S. domestic space object registry*
- *Develop policies and regulations for future U.S. orbital operations*



An area of concern for the militaries, especially within the satellite and space arena, is locating and enlisting individuals who possess the necessary expertise to manage the intricacies of space ops. What support is the U.S. Navy, and USSTRATCOM, giving to middle, high school students as well as college students to further their training for careers into your critically-needed organization? What courses do you recommend students consider availing themselves of to initiate careers that will support our nation's future space concerns?

Admiral Correll
USSTRATCOM is very involved with academics across the nation and in the local community to increase the discussion about space. Echoing General Hyten, if we are not exploring, Americans aren't excited.

USSTRATCOM has an exciting and vitally important role to play in deterring adversaries while assuring allies and partner nations. Likewise, the U.S. Navy has a compelling mission in support of our country's security. The challenges and the mission draw talented young men and women from all over our nation to join our team.

The great thing is, we are talking more about space. You can see that in Congress, the White House, and within the Department of Defense. The more we recognize the importance of space and the possibilities it presents, the more excitement and curiosity young Americans feel. And that will motivate students to study science, technology, engineering, and mathematics in order to follow a career path for the future of the country.

In your opinion, Admiral, what are the greatest concerns our military and government face as the future unfolds within the space environs?

Admiral Correll
In my opinion, one of the greatest concerns we face is a lack of common standards and norms of behavior among the countries and corporations that own and operate assets in space.

As technology continues to develop, there will be fewer barriers to accessing space and an increase in the number of players in the domain. As space becomes increasingly congested we will need a mutual understanding of acceptable standards of behavior to ensure we all benefit from safety of flight in space.

While we have decades of experience in how to safely operate on land, at sea, and in the air, we are only just now beginning to develop a shared understanding of how to do so in space.

www.stratcom.mil

A USSTRATCOM UPDATE

United States Strategic Command and the Royal Thailand Air Force have signed an agreement for space situational awareness (SSA) services and data. Agreements like these lay the foundation that allows the United States to share information with allies and partners.

Rear Admiral Richard Correll, director of plans and policy for USSTRATCOM, signed the agreement, which bolsters the United States' and Thailand's awareness in the space domain. The bilateral relationship between the United States and Thailand dates back to 1818, equating to 200 years of friendship.

"Formalizing this relationship with our oldest Southeast Asian partner is crucial as space becomes more contested," said Adm. Correll. "Agreements like this one, between responsible nations, ensures safe and secure space operations."

Thailand joins 16 nations (the Netherlands, Brazil, the United Kingdom, the Republic of Korea, France, Canada, Italy, Japan, Israel, Spain, Germany, Australia, Belgium, the United Arab Emirates, Norway, and Denmark), two intergovernmental organizations (the European Space Agency and the European Organization for the Exploitation of Meteorological Satellites), and more than 70 commercial satellite owners, operators, launchers already participating in SSA data-sharing agreements with USSTRATCOM.

"Thailand signing these guidelines with the United States demonstrates their continued leadership within the [Association of Southeast Asian Nations] ASEAN organization and firmly establishes the Royal Thai Air Force in the Space Community," said Correll.

SSA data-sharing agreements enhance multinational space cooperation and streamline the process for USSTRATCOM partners to request specific information gathered by Air Force Space Command's 18th Space Control Squadron at Vandenberg Air Force Base in California. The data is critical for launch support, satellite maneuver planning, support for on-orbit anomalies, electromagnetic interference reporting and investigation, satellite decommissioning activities and on-orbit conjunction assessments.

USSTRATCOM has global responsibilities assigned through the Unified Command Plan that include strategic deterrence, nuclear operations, space operations, joint electromagnetic spectrum operations, global strike, missile defense, and analysis and targeting.

FROM THE RED BARON TO RF DATA:

Pursuing Situational Awareness

By Matthew Prechtel, Business Area Manager, RF SSA Specialist, Kratos Defense

Oswald Boelcke was considered by many to be the first to broadly promote and teach the concept of situational awareness (SA).

A German flying ace in World War I, he was one of the most influential tacticians of his day. He formalized his method, which he called the ***Dicta Boelcke***, in a set of simple dogfighting tenets that others in his flying company then slavishly followed, including *Manfred Von Richthofen*, better known as ***The Red Baron***.

Despite a quantum leap in technology and warfighting innovations since that era, many of Boelcke's dictums remain valid today — especially this one: Always keep your eye on your opponent and never let yourself be deceived by ruses.

Oswald Boelcke — First World War German flying ace.

Keeping an eye on your adversary seems like obvious enough tactical advice. However, in a dog fight, losing sight of the adversary was easy — the advantage could shift to the foe if a pilot allowed himself to be distracted.

"*Keep your eye on the enemy at all times, even if you think he is going down,*" said Boelcke, "*don't be fooled.*"

Pilots looking to escape from a losing fight sometimes would fake getting hit and attempt to simulate a death spiral. Boelcke urged squadron members to visually follow a spiraling plane down to the ground and, in some cases, land their plane and then go and search for the downed pilot.

Germany's WWI ace-of-aces, Manfred Albrecht Frelherr von Richthofen.

Always keeping your eye on your opponent and not being deceived by ruses is even more important and, arguably, even harder to accomplish these days, with the military theater extending across the globe and into space. Our eyes and ears have largely been replaced by sensors; ruses must be detected through machine learning and artificial intelligence.

Boelcke and other aces would look down from the sky to gain the situational awareness that gave them an edge. Now, we look up to the sky to gather intelligence, gain foresight and achieve a decisive advantage through space situational awareness (**SSA**).

Tracking the Situation

Maintaining space situational awareness depends primarily on two technologies, ground-based radar and optical telescopes.

However, satellites maneuvering in geostationary orbit are typically beyond the detection of radar and go unseen by telescopes in the bright light of day. Another sensor technology increasingly used to augment and enhance our ability to monitor *Resident Space Objects* (**RSO**s) is *Radio Frequency* (**RF**) data — the electro-magnetic spectrum used by space systems to communicate — which can provide a wealth of information traditional methods are unable to accomplish.

Passive RF sensing and orbit determination supplies precision satellite location information without the need for transmissions from the ground to the satellite, satellite cooperation, specialized satellite payloads or detailed knowledge of ranging signal structures and definition.

Together, these RF measurements can be useful in satellite detection, tracking, identification and characterization operations. This includes attribution, differentiating close objects, custody, and gleaning maneuver/operational prediction information when other sensor types cannot "see" the object of interest.

Passive RF sensing helps fill the blind spots through the detection of maneuvers and anomalies, day or night and in all weather conditions. RF data also can characterize behaviors, indicating whether an unexpected maneuver represents adversarial intent, or merely drift caused by an onboard malfunction.

Aware of the Ruse

RF data improves current SSA capabilities by keeping an eye on RSO at all times, limiting the ability of the opponent to deceive.

- *For example, satellite maneuvers can be detected in real-time and their location accurately identified in order to perform conjunction assessment, better inform collision avoidance and provide improved safety of flight.*
- *RF sensing data can also be used to characterize SATCOM transponder, payload and telemetry signals. By establishing a baseline of nominal or normal behavior of an active RSO, this can provide an indication when the satellite has deviated from its defined norm.*
- *Passive ranging and ephemeris generation can be accomplished by collecting and cross correlating RF signals at multiple ground antenna locations. The process is similar to the method GPS receivers utilize but in reverse. With each collection system calculating delay times from the transmitter, and using surveyed collection sites, the range and angles to the satellite can be determined and generate state vectors and accurate ephemeris on the RSO.*

Detecting Hidden or Unseen Maneuvers

Kratos has been observing satellites in the RF domain for more than 20 years and, with the latest technology, the company's global antenna and sensor network and the most experienced SSA specialists available, real-time identification of maneuver events can now be observed as satellites make small adjustments in station keeping or larger adjustments when changing orbital planes or other orbital parameters.

For example, the data that has been plotted in ***Figure 1*** clearly reveals maneuvering as discontinuity in the *Differential Frequency Offset* (**DFO**) measurements. Frequency shifts can be and are observed on wideband satellite payload signals, L-band command and control signals. (***Please see Figure 1 on the following page...***)

Maneuver detection is as paramount to situational awareness today as it was in Boelcke's time, even if the theater of operation has exponentially expanded in size, scope and complexity.

Detecting Unexpected from Normal Events

By applying pattern recognition algorithms and machine learning the attributes of satellites can identified and characterized, maneuvers or actions predicted and intentions discerned.

These analytics and AI can establish the normal expected behaviors of space objects, such as routine station-keeping and the frequency of maneuvers, and by extension, detect atypical or unexpected deviations to provide pre-emptive threat awareness and improved space traffic management.

Know Your Opponent's Intent

RF data signal characterization also can help determine the nature of an asset's transmission, whether its mission, for example, supports video broadcast or UAV operations, and whether a large spike in bandwidth and upload of certain traffic type is an indication or warning.

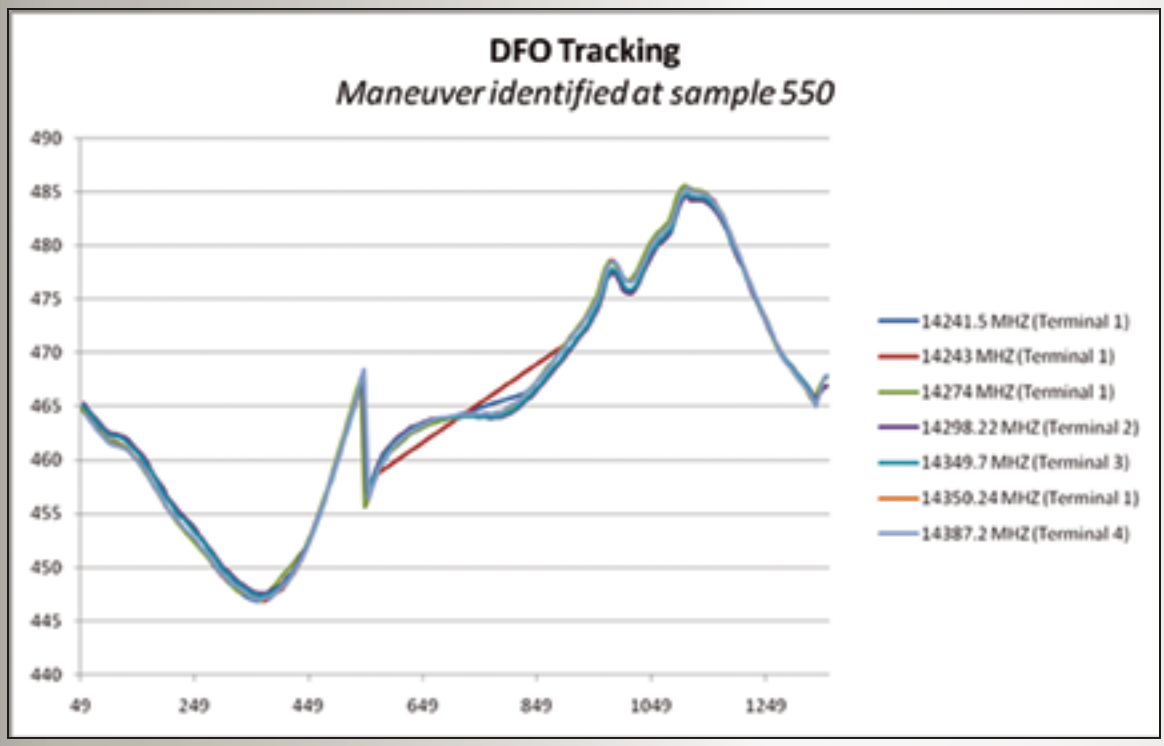


Figure 1. Maneuver Detection using DFO Processing

One approach at classification involves the clustering of similar signals into groups and then organizing them in such a way where their common features cluster them together (*Figure 2*).

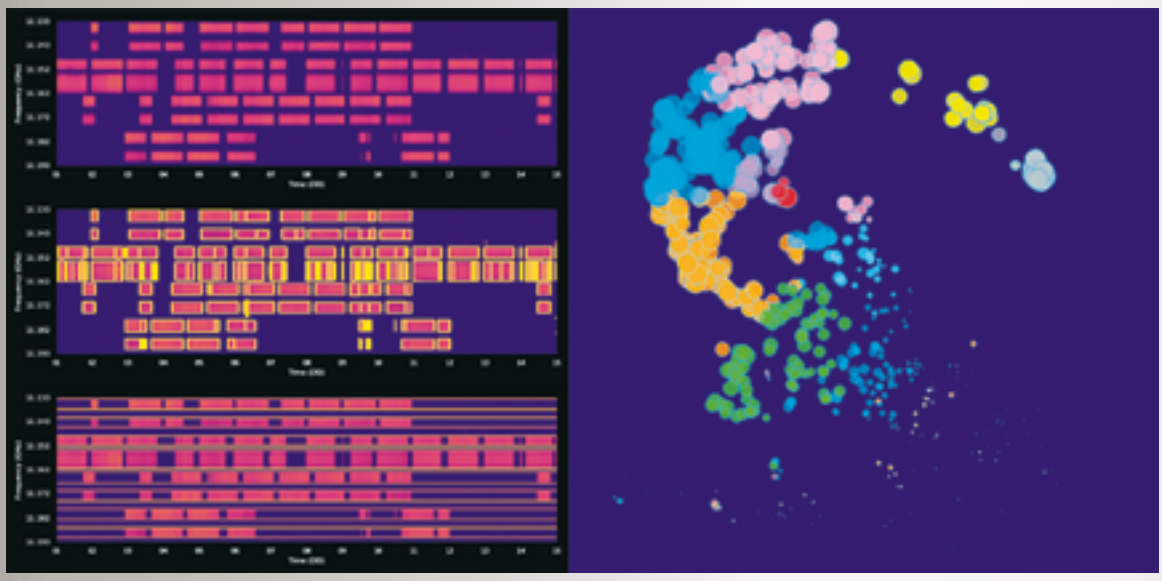


Figure 2. RF Signals clustered and organized by features.

As shown above in ***Figure 2***, the clustering of the spectrum access uses machine learning algorithms to uniquely identify and label RF channel accesses.

For example, if a particular type of unmanned aerial vehicle exhibits a particular RF signature, that signature can be decomposed into features (time, duration, center frequency, location, modulation type, etc.) and then labeled. Every occurrence of that label becomes searchable from a larger database of accesses. The additional patterns may be correlated to operations tempo, troop deployments, global crisis, or predicators to missile test events.

A New Era of RF Sensing

RF data has been in use for years to support space operations, from monitoring payload performance and usage, to detecting and geo-locating interference, and to supplement government monitoring networks.

In theory, this data always held significant value for SSA, but in practice was not available at scale due to limited sensor coverage and spotty infrastructure. Now, with global monitoring available, RF data can be collected for the complete geostationary arc at all times, 24/7/365, providing unique insights that elude detection or characterization by traditional sensors.

Kratos owns core technology and processes to advance space situational awareness with a commercial RF surveillance sensing network that includes an EMI monitoring system and a collection of passive RF sensors.

This global network (*see Figure 3 on the next page...)* provides SATCOM monitoring and geolocation services to commercial and government users to detect terrestrial interference on SATCOM transponders, and to geolocate the source of the interference using two satellite geolocation techniques.

Kratos' passive RF sensing network has worldwide locations, offering coverage with large geographic diversity between collection points. Each sensor site has access to network connectivity back to a datacenter or cloud network and is capable of highly accurate timed captures of digitized signals.

Figure 3. Commercial global RF monitoring sites.

With the Kratos solution, each antenna location hosts multiple sensors connected to a suite of specialized signal processing equipment to create a standalone network over encrypted links. The main datacenter in Colorado Springs, Colorado with global high bandwidth, pipes to Amazon Web Services EC2 instances where big data techniques and off-site data storage is managed.

Global Assimilation of Raw and Processed Data

Kratos' global network relies on sophisticated system architecture for both local processing equipment and Amazon Web Services EC2 instances.

The majority of the passive RF SSA processing is performed in software using Virtual Machines that host a variety of software modems, data recorders, DSP algorithms for blind characterization, and Time Difference of Arrival and Frequency Difference of Arrival (TDOA/FDOA) measurement logic. Local processing handles the raw signal data. The conceptual architecture is shown in *Figure 4*.

Data aggregation and SSA processing is performed and information such as maneuver detection, passive ranging, and EMI are assessed and conveyed through event feeds. Data scientists can then extract useful information from this complex data.

Always-on, Wider Awareness

Early patterns of satellite interference detected from RF SSA can be correlated with other events, such as cyber disruptions and upticks in social media activity, as precursors to hostile actions by rogue nation-states.

Synthesizing RF-inclusive analytics with other data sources can provide decision-makers the real-time situational awareness they need to respond to a range of possible scenarios, from maneuvering to avert satellite collisions to deploying waveforms to counter an expected RF attack.

Today, SSA is best assessed within a centralized network operations center, by someone at a console with access to the cloud. This delivers the ability to access and analyze all available information, from every possible resource and quickly share with decision-makers in near real time.

Although the technologies required are far beyond anything a World War I flying ace could imagine, *Manfred Von Richthofen, Oswald Boelcke* and others who first sought a battlefield advantage through the use of situational awareness would, no doubt, understand the ultimate purpose of all this – which is to gain an advantage, by having more situational awareness of an adversary than an adversary has of you.

www.kratosdefense.com/ssa

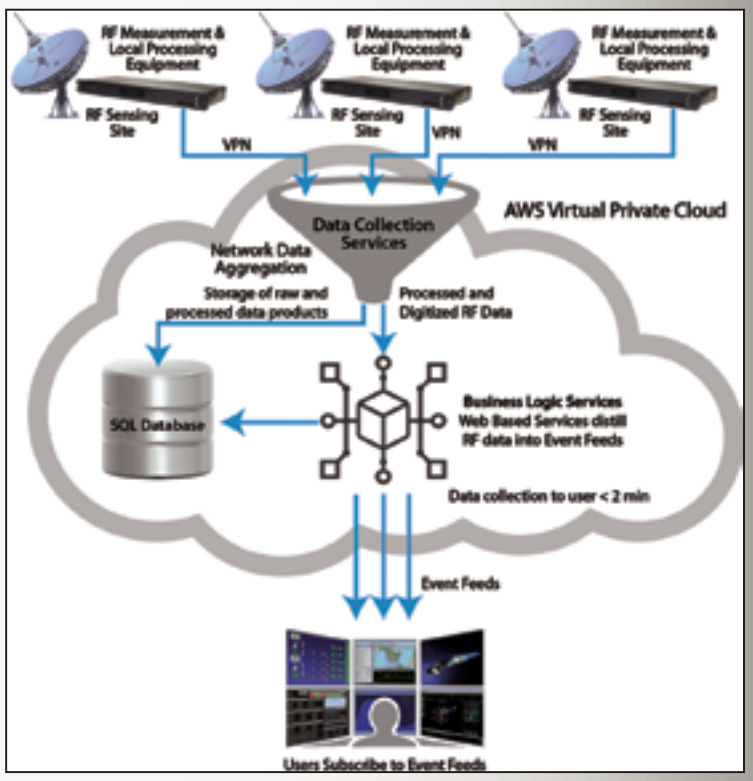


Figure 4. Data collection and processing.

ALL THE GRIT, ALL THE GLORY

Ruggedized satellite router withstands the elements

By Karl Fuchs, Senior Vice President of Technology, iDirect Government

The last place you want to encounter a weather-related satellite router malfunction is in the middle of nowhere, whether that be in the desert or jungle.

Let's say, for example, you're hiking in full uniform with a lot of SATCOM gear through a hot, dry, mountainous terrain to a specific predetermined location. Your one job is to set up a remote SATCOM station.

The heat is absolutely brutal — the temperature has reached 95 degrees Fahrenheit but it really feels like 115, especially under all that gear you're carrying.

In short, you're ***miserable***. You don't think it could get much worse, until you finally reach your destination and pull out your router.

The timing couldn't be more perfect — a massive dust storm, also known as a haboob, strikes out of nowhere. Dust, sand and all sorts of indeterminable debris swirls around you, caking everything with dust — including your SATCOM gear.

However, this is no ordinary dust storm, oh no — a thunderstorm comes crashing down soon after, turning all that dust into thick, gloopy mud. What was once clean, pristine SATCOM gear has quickly become something reminiscent of a mud pie.

Under any other circumstance, you would thrust your fists to the sky and curse the heavens for absolutely ruining your router after trekking what felt like two marathon distances in the hot desert climate.

But this isn't any normal circumstance and you haven't brought just any SATCOM gear. Instead, you knock the mud off your satellite router and power it on, no problem. The router cheerfully lights up, ready to complete the mission at hand.

This hardy satellite router, the **9050 OM**, was officially introduced by the iDirect Government (iDirectGov) team in May at the **SOFIC 2018** show in Tampa, Florida. The company's 9050 OM is a lightweight, ruggedized enclosure specifically designed to house and protect the company's powerful **950mp Integrated Satellite Router Board**.

The revolutionary element about this product is not its significantly reduced size, weight and power (SWaP), but rather the product's resistance to the elements. The 9050 OM is dust- and water-resistant, making it ideal to operate in either desert or monsoon-like conditions – or both, like the soldier in the story above.

Before its release, the 9050 OM underwent many rigorous rounds of MIL-STD 810G compliance testing to guarantee that it will stay operational even in the thick of the storm. iDirectGov test engineers heated the unit to 140 degrees Fahrenheit (60 degrees Celsius) before submerging it in 36 inches (91.45 centimeters) of water, which caused the unit's temperature to drop drastically.

This test allowed the potential for water to be sucked in due to the rapid change in temperature. After 30 minutes, test engineers removed the 9050 OM, and there was no evidence of water penetration into the unit. It was able to power up without any problems, working just as it was designed to work.

The 9050 OM also passed other tests, including vibration/loose cargo, shock, drop, immersion, dust, altitude and blowing rain. Although in extreme weather conditions, teams don't typically turn on satellite systems; there's just too much rain fade for any signal to get through.

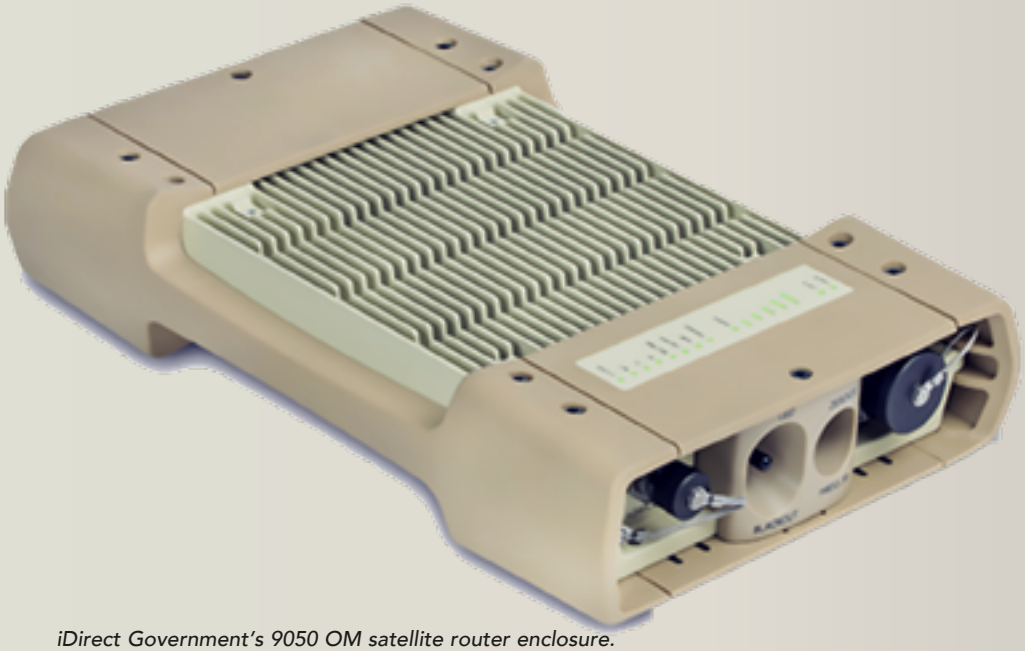
iDirectGov designed the 9050 OM for customers already using man portable terminals, such as the company's 950mp, and other customers operating with portable satellite terminals.

Because satellite communication systems operate outdoors, the firm saw the need to develop an enclosure unit that would allow customers to work without worrying about the weather conditions or carrying large, heavy transit cases to protect their equipment from the elements — or even survive being kicked out of an airplane.

For smaller teams, taking the less-is-more approach is ideal. With 9050 OM, the operator needs only to use an antenna and modem — no extra gear or transit cases are needed — and be connected in minutes.

This solution helps minimize the amount of gear to where an integrated satellite router board can operate in outdoor environments. The offering is designed to be completely enclosed and protected from the elements. iDirectGov even went a step further — the 9050 OM can basically be beaten up and abused yet still be operational.

Although the big selling point of the 9050 OM is its ability to withstand the elements, product engineers did not hold back on enhancing transmission security (TRANSEC) features. Since the 9050 OM is fully operational on the company's most powerful Major Defense-Based Release of **Evolution**



iDirect Government's 9050 OM satellite router enclosure.

4.2 software, it has all the TRANSEC bells and whistles customers require.

The 9050 OM is FIPS 140-2 Level 3 certified, WGS certification ready and boasts upgraded TRANSEC features, which include being able to detect and respond to attempts at physical access or modifications made to the cryptographic module. This takes the security level up a notch from Level 2, which only requires a tamper-evident coating or seals to be placed on products that must be broken to gain access to cryptographic keys and critical security parameters.

With a more secure FIPS certification comes an even more secure TRANSEC. Not only does the 9050 OM — like the rest of the company's 9-Series product line — support two-way TRANSEC, it also now supports one-way TRANSEC. Secure broadcast communications can be sent to receive-only terminals, helping to protect against man-in-the-middle attacks.

As a security measure, product engineers at iDirectGov added a zeroize button to the 9050 OM, which erases all security keys from the TRANSEC module, guaranteeing the adversary does not gain access to the network. Product engineers also included a LED blackout switch for nighttime missions, plus an antenna pointing meter to provide a visual indication of a receive signal from the satellite above.

Compared to similar products on the market, the 9050 OM is lighter and consumes less than 20 watts of power to operate — a considerable amount less than its competitors. Plus, the iDirectGov platform is more widely used in the defense marketplace when compared to other offerings.

According to the spec-sheet located on the iDirectGov website, the 9050 OM weighs only 6.54 pounds (2.97 kilograms) and can operate at temperatures as cold as minus 40 degrees Fahrenheit (minus 40 degrees Celsius) and as warm as 131 degrees Fahrenheit (55 degrees Celsius).

The 9050 OM is operational as high as 15,000 feet (4,572 meters) and can be stored as high as 50,000 feet (15,240 meters) in temperatures that range from minus 40 degrees Fahrenheit (minus 40 degrees Celsius) to 176 degrees Fahrenheit (80 degrees Celsius). Its network topology has DVB-S2 with Adaptive TDMA Returns, and it boasts maximum rates of 45 Msps downstream and 29 Msps upstream.

The 9050 OM features include:

- ***A transmit key line lowering battery consumption to extend the mission as needed***
- ***A blackout switch to turn off all LED lights for more discrete operations***
- ***Single data connector to support two LAN ports, console, GPS input and transmit key line***
- ***Antenna pointing meter to ensure the satellite terminal is properly peaked***
- ***The 9050 OM is passively cooled – no powered fans needed to cool down the product when it's in operation***
- ***External power supply designed for outdoor use along with the product***
- ***FIPS 140-2 Level 3 certified***
- ***WGS certification ready***

For more information on the 9050 OM, visit the iDirectGov website at ***www.idirectgov.com***.

Karl Fuchs is the Senior Vice President of Technology at iDirect Government (iDirectGov). Fuchs leads iDirectGov's team of federal systems engineers and serves as chief architect for new product integration. Fuchs has more than 20 years of experience in the areas of technology and the federal government and is a Senior Contributor to MilsatMagazine; ***kfuchs@idirectgov.com***.

BASICS OF QUANTUM COMMUNICATIONS

Ready to serve...

By David Mitlyng, Chief Operating Officer, S15 Space Systems

Quantum communications has been making headlines lately, with a lot of breathless announcements about the capability for delivering truly incredible levels of security based on the laws of quantum physics.

However, without a Ph.D. in quantum physics, it is difficult to sort out the science from the science fiction. The purpose of this article is to provide a primer on quantum communications geared toward the reader who wants to understand the current state of the technology and its practical application.

Why Quantum Communications?

If two parties (let's call them Alice and Bob) want to exchange a sensitive message over a long distance, it is commonly accepted that this message can be intercepted by an unwanted party (let's call them Eve, short for eavesdropper).

All current communications networks are known to be susceptible to covert interception, whether it is undersea cables, cellular networks, terrestrial fiber optic or coaxial cables, or satellite communications via RF or optical links. That is, all but one: quantum communications.

When Alice and Bob communicate via a quantum channel, any attempt at interception by Eve is known by both parties. While quantum communications does not necessarily thwart Eve, it does provide knowledge that Eve is present and the message has been compromised. This provides an unprecedented level of security. However, this technology is still in a an early demonstration phase, with truly practical systems possible within the next two years.

Quantum Communications in a Nutshell

How does this work? Quantum communications is similar to traditional optical, or laser, communications.

An optical communication link strives to provide high data rates through modulating a laser beam; a quantum communications channel strives to provide very secure communications by manipulating each individual photon on a beam.

Consider a typical free-space optical communications system available today, where a string of bits are modulated at a 10 Gbps data rate on a 1550 nm wavelength laser with 1 watt output power. At a constant output, this laser will produce roughly 7.8 x 1018 photons per second streaming from the satellite to the communication point on the ground. A successful data link is achieved when enough photons reach the detector at the end of a ground telescope to achieve a coherent link.

By contrast, a quantum communications channel uses the quantum property of individual photons to create a secure link. Instead of modulating the signal (which is essentially regulating the flow of photons), the quantum properties of the individual photons themselves are manipulated.

The quantum payload typically produces a much lower photon output (typically in the millions of photons per second) with much lower data rates. At a very basic level, the quantum property of each photon is prepared by Alice (the sender) and measured by Bob (the receiver). If Eve observes the photon instead of Bob, the quantum properties of the photon are irreparably changed, and Alice and Bob can verify this with a check. This is a vast oversimplification, of course; more detailed understanding requires a refresher course in quantum physics.

Quantum Physics and the Birth of Quantum Communications

Quantum mechanics affect all objects, large and small, but its effects are most noticeable in small particles, such as photons (the basic element of light), neutrons, protons, atoms and molecules.

What makes quantum physics such a difficult topic to comprehend is that the behavior of small particles is impossible to directly observe and counter-intuitive from our understanding of classical physics. The scientists that pioneered our understanding of quantum mechanics over the last century — ***Einstein***, ***Heisenberg***, ***Schrödinger***, ***Bohr*** — had to base their theories on experiments and complex equations. However, their work led to these central tenets of quantum mechanics:

- ***Wave-particle duality****: Photons exhibit both wave- and particle-like behavior.*
- ***Quanta****: Each photon has a discrete amount of energy, a quanta, that is a function of its wavelength.*
- ***Uncertainty principle****: The exact position and the exact momentum of a photon can never be simultaneously measured due to the wave-particle duality.*
- ***No-cloning theorem****: It is impossible to create an identical copy of an arbitrary unknown quantum state, which ensures that quantum information cannot be exactly copied.*
- ***Entanglement****: Under some conditions, groups of photons can be generated such that their properties are correlated beyond what is possible in classical physics. We refer to these "beyond-classical" correlations as "entanglement."*

These basic laws opened the door to a wide range of quantum research with the realization that quantum properties were a resource to be exploited. This lead to the concept of quantum computation, secure quantum communications and quantum metrology.

Quantum communication was the first quantum information task to be seriously developed and is technologically the most mature. At its core, quantum communication processes are based on either a prepare and measure or entanglement based protocols.

The best known **Prepare-and-Measure** protocol is BB84 (after the paper written by *Charles Bennett* and *Gilles Brassard* in 1984), which relies on the uncertainty principle and the quantum no-cloning theorem. The transmitting party, Alice, encodes random bits through the polarization of individual photons. Bob receives these photons, measures the polarization states, and, after protocol checks with Alice, verifies they both have the same unique, random, secure string of bits. Eve may intercept the photons and try to extract the information, but only Alice and Bob know the correct polarization to measure, any attempt by Eve introduces detectable disturbances.

Prepare-and-Measure has been demonstrated with low power lasers that emit very small numbers of photons (ideally, one) per pulse. Because of this, Prepare-and-Measure is also known as **weak coherent pulse**.

Entanglement-based protocols (such as E91, named after the 1991 *Artur Ekert* paper) takes advantage of quantum entanglement. Pairs of entangled photons are created and sent to Alice and Bob, who measure their correlated properties. If Eve intercepts one of the pairs, the entanglement is broken, introducing errors and making Eve's presence detectable.

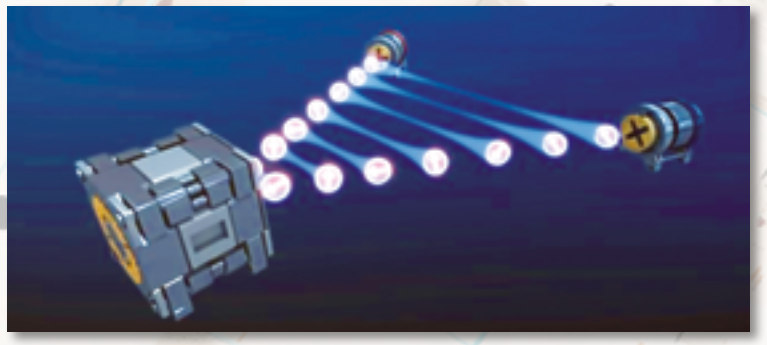
In contrast to Prepare-and-Measure schemes, entanglement does not require encoding states into the photons. Instead, both parties share a source of maximally entangled photon pairs, which is a truly random process. The distribution of entangled photons necessary for this process is also the foundation for a truly quantum network.

Shared entanglement is a basic resource for tasks such as quantum teleportation, quantum metrology and other applications of what could loosely be called the quantum internet. These applications aren't necessarily practical today but are interesting to the futurologist.

Practical Applications for Quantum Communications

To consider the practical application for quantum communication, you need to consider these characteristics:

- ***Randomness*** *– quantum communications can only create random strings of bits between the two parties, Alice and Bob. A pre-defined string of bits cannot be transmitted over a quantum channel, at least according to existing protocols.*



Entangled Photon Source. Image is courtesy of Centre for Quantum Technologies,
www.youtube.com/watch?v=LaLzshIosDk

- ***Low data rate*** *– current quantum communication systems are only capable of low data rates today, in the neighborhood of kbps.*

- ***Very secure*** *– the strings of bits are not actually transmitted, per se, but created as part of the quantum communications process. This is more secure than existing systems where messages are delivered across the open network, making it susceptible to interception.*

Because of these features, the most obvious application for quantum communications is the distribution of symmetric encryption keys, known as **quantum key distribution** (**QKD**). This allows for the distribution of secure shared randomness. One application is extremely secure keys that can then be used to seed other encryption mechanisms or directly to completely protect extremely sensitive information. Depending on the application, QKD can either augment or substitute high value secure networks, in which case the additional protocols require additional scrutiny from the cybersecurity community.

Quantum communications has also been considered for satellite command/telemetry and blockchain applications. However, it is safe to say that the parallel development of the technology and its application will continue to open more doors.

Current State-of-the-Art in Quantum Communications

Since the publication of the BB84 and E91 papers, scientists have successfully conducted numerous quantum communications demonstrations over fiber optics and through free-space both in lab conditions and in the field over existing fiber networks or with ad-hoc free-space optical communications.

The most advanced area of development today has been quantum communications over fiber optics using weak coherent pulse. Due to the attenuation in the glass, quantum links have been established between two nodes within short distances (less than 80 km.). For longer distances, quantum repeaters would need to be added. But the development continues apace by research labs and commercial companies across the world.

In contrast, space-based quantum communications provide better utility for the MILSAT community: providing secure communications to remote, hostile areas that are not served with fiber optics, or where those networks could be disrupted.

At this stage, only a few groups in the world have completed on-orbit quantum communication demonstrations.

The most advanced publicly-announced demonstration came from China last year. The **Quantum Experiments at Space Scale** (**QUESS**) proof-of-concept mission was launched on the **Micius** satellite in August 2016, where three key milestones were announced:

- *QKD between satellite and ground stations using BB84 protocol*

- *Entanglement distribution between satellite and ground stations*

- *Ground-to-satellite quantum teleportation*

More space-based demonstration missions are in the works, including the **Quantum Cryptography Telecommunication System** (**QUARTZ**) project, a ten-company consortium led by **SES** and the **European Space Agency** (ESA); the **Centre for Quantum Technologies** (CQT) **SpooQy-1** smallsat, and the **Canadian Space Agency** (CSA) **Quantum Encryption and Science Satellite** (**QEYSSat**) program.

Ready to Serve

Quantum communications technology has now matured to the point where it is ready to serve the advanced needs of today's MILSATCOM communities. Architects of tomorrow's secure communications networks should consider quantum communications to fully take advantage of this rapidly advancing technology.

s15.space/

Prior to his current role as Chief Operating Officer at S15 Space Systems, David has more than 20 years of space experience at BridgeSat, Hughes Space and Communications, Orbital ATK and SSL. David has a BS degree in Aeronautical Engineering from Cal Poly SLO, a MS degree in Aeronautics and Astronautics from Stanford University, and an MBA from the MIT Sloan School of Management.

SATNEWS PUBLISHERS

DIGITAL EDITIONS

SatMagazine • MilsatMagazine • SatNews.com

» *Free subscription and access*

Timely news and editorial «

» *Complete archives*

Join at: *satnews.com/reg*

ENSURING ASSUREDNESS...

...in mobile satellite communications

By Gary Shmith, Global Sales Director, EM Solutions

In developing the firm's assured SATCOM-on-the-Move (SOTM) terminals, the EM Solutions team has worked closely with their defence customer, represented by the Australian Defence Science and Technology Group (DSTG), in order to understand their requirements as well as to cooperate with several collaboration partners.

In recent times. EM Solutions and the company's customers have completed the installation and set into operation multiple installations of the EM Solutions Cobra class maritime terminals. These terminals were developed specifically for requirements that simply could not be met by existing, off-the-shelf commercial systems.

In 2017, the EM Solutions **Dual Ka-band Cobra** terminals were deployed onto the **Australian Border Force Cape Class** fleet (***Figure 1***). In collaboration with Inmarsat and Intellian, the company was able to certify these terminals on the **Inmarsat GX** network as an alternate to operation on the **WGS** system.

EM Solutions subsequently completed installations of their leading-edge **Tri-band X/Ka Band Maritime Cobra** terminal (see ***Figure 2 on the next page***) for the **Royal Australian Navy**. These terminals simultaneously operate in X- and Ka-bands and can access capacity on the military and commercial Ka-bands.

Figure 1. A dual-Ka Cobra terminal operable on both WGS and Inmarsat GX deployed on an Australian Border Force patrol ship

Figure 2. A dual-Ka Cobra terminal operable on both WGS and Inmarsat GX deployed on an Australian Border Force patrol ship

The initial installations were followed with repeat orders for additional naval vessels.

The greatest innovation in the latest Cobra X/Ka-multi-band terminal is the antenna feed system. Optimized for the unit's electromagnetics, the system generates antenna pointing vectors from the X-and Ka-band beacons of the WGS satellite. The terminal communicates in the traditional manner at Ka-band, all the time supporting simultaneous communications on the satellite's X-band transponder, whenever such is required to protect against rain fade or to provide added capacity.

In addition, the system can fall back to tracking and operating on the alternative Inmarsat GX satellite system in the case of congestion or for other operational reasons. This helps to provide network survivability with assured communications in a contested environment as well sas rapid and automatic self-healing in the event of rain fade or other link outage by switching satellites or frequency band.

Meanwhile, the company has continued to roll out their land-mobile terminal, the **Taipan** (*Figure 3*), to a major European army (in X-band) as well as the firm's new amphibious **Salamander** variant (*Figure 4*) for an army in Asia.

By aspiring to the level of "assured" communications, EM Solutions continues to cement the firm's position as a company known for products that are unmatched in reliability and robustness. These two terminals can be configured for a range of platforms to suit either a small or medium vehicle or vessel, with simplified field repair and cost optimization, and provide universal stabilization under the most severe motion conditions, since the terminals can be used either on land or at sea.

Achieving Communications Resilience

EM Solutions CEO, Dr. *Rowan Gilmore*, describes Assured Communications as being like an onion's skin that possesses numerous protective layers.

Those layers include maximizing link availability through superior design, use of redundancy, frequency stealth,

Figure 3. A dual Ka-band Taipan terminal can provide resilient mobile satellite communications over almost any terrain, and fall back to commercial Ka-band frequencies on demand.

coding, limiting radio emissions in unwanted directions, and protection against interferers. These are particularly difficult to achieve with SOTM, but often it is while on the "run" that communications are most critically needed.

From the perspective of ground equipment, improving link availability by maximizing the link budget is a good place to start. The link budget determines the allowable fade margin, which can be maximized by using the highest power transmitters possible, most sensitive receivers, steered antennas to maintain maximum antenna gain, and best pointing accuracy to minimize pointing loss.

Time on satellite is probably the biggest contributor to the availability equation: minimizing the time for an on-the-move terminal to acquire or reacquire the satellite is crucial, as is maintaining the link under violent motion conditions.

A recent example highlights the advantage of exceptional pointing accuracy. At Ka-band frequencies, the drop off in receive performance can be substantial, with even the slightest mis-point off boresight — in particular for antennas greater than 500 millimeters in size. In an EM Solutions supported defence testing program on a HTS satellite, the data rates achieved from the EM Solutions Cobra 1 meter class terminals — which are designed for full mobility and use a proprietary monopulse tracking system — outperformed significantly larger (2.4 meter) auto-point Communications-on-the-Pause (COTP) antennas. A pointing error of just 0.32 degrees in the larger antenna is enough to reduce the gain to such that the data rate was actually worse than the Cobra.

In addition to link availability, redundancy can be improved in satellite communications by the use of multiple transmitters. Block Up Converters (BUCs) are usually the most failure prone component in the ground segment; using one of each for multiple satellite systems results in a system that can provide access to multiple transmit chains through independent components and provides an inherent increase in availability.

Frequency stealth might entail switching or spreading either the modem output or RF frequency. Changing to a lower frequency band can also protect against weather effects that can cause loss of the satellite link at the higher Ka-band frequencies.

Coding and other security precautions, such as encryption at the data layer, can protect against data theft, while ensuring the radio signal is highly directional with minimal RF spillover or sidelobes. This also protects against interfering signals through careful electromagnetic design and analysis and avoids 'theft' of signals or intrusion upon the radio layer. Such signals can also be unintentional or non-hostile; however, they can still cause link failure. For example, radar systems near the SATCOM ground equipment can often result in the total loss of communications capability.

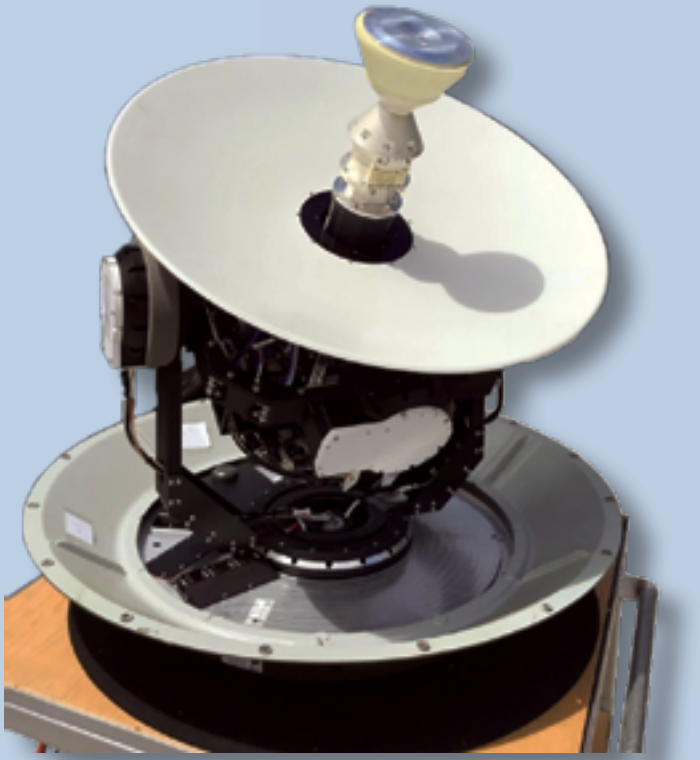


Figure 4. A Ku-band Salamander terminal capable of roll-on, roll-off operation on either land or sea.

Mitigating by terminal design against the effects of weather, satellite congestion, frequency jamming, and motion itself all add toward the objective of resilient communications.

The Added Challenge of Mobility or Tracking LEO

The gain and pointing performance of SATCOM antenna systems are important in preserving link availability.

With a mobile terminal that must point to a geostationary satellite, or alternatively a fixed terminal that must track a moving satellite such as a LEO, the tracking error measures the terminal's ability to keep the antenna boresight pointed directly to the satellite during operation. However, performance requires more than that — it must include the time taken to initially acquire the target satellite.

For SOTM applications, these requirements are challenging due to the complex engineering required to steer the antenna's transmit beam directly to the satellite with high availability during platform motion.

As mentioned earlier, EM Solutions proprietary '*monopulse*' technology is able to maintain the lock on a satellite without deliberately introducing an intentional mispointing error off boresight — as is inherent in '*step track*' systems — to search for the exact beam maximum, even after the satellite has been acquired.

Monopulse technology is a closed-loop system that measures the relative signal level in a higher order mode intentionally generated in the antenna feed, typically the TE21 mode. The system uses that mode's sharp null along boresight to derive a highly accurate corrective pointing vector to force the antenna back in line, without the need to introduce any deliberate pointing loss.

As a monopulse system directly measures the TE21 signal which is proportional to the deviation off-axis, such a technology also has the benefit of being able to accurately monitor and report the instantaneous pointing error to the user.

The availability of this information can be used to ensure the BUC is only muted when the antenna is confirmed as being off-axis, rather than, for instance, if the received beam is measured as temporarily weak, for instance due to a passing cloud.

Redundancy

Redundancy in hardware, frequency and satellite selection are three other ways to introduce resilience into the link — the choice of satellites and use of multiple bands can mitigate against weather effects, jammers, interferers, congestion, and even loss of a satellite.

The approach taken at EM Solutions is to engineer a satellite terminal that automatically switches between any of three satellite bands on different satellites, even while on-the-move. Although maritime terminals already exist with either commercial or military Ka-band capability, or with dual X-band and military Ka-band capability, none offer universal on-the-move capability (on land or sea) in a convenient size package that simultaneously operate in both X- and Ka-bands, or with fall back to commercial Ka-band (such as with Inmarsat GX) on demand.

This requires the use of separate BUCs for X-band and Ka-band; however, this is beneficial as the pair then adds increased hardware redundancy on top of the improved link redundancy. Such a combination brings the benefits of assured communications whenever a satellite is visible without manual changeover of hardware.

Significant Defence Factor

Good terminal design is a significant factor a defence user must consider to achieve assuredness through resilience and redundancy in mobile satellite communications networks.

All links in the network chain can contribute, but ultimately there are tradeoffs. EM Solutions has taken a variety of approaches to offer robust terminals that offer redundancy in design, exceptional tracking and mobility in multiple frequency bands, and fall back to commercial satellites. All of these help to strengthen the resiliency and assuredness of mobile military communications irrespective of the whether the requirement is on land, sea or air.

www.emsolutions.com.au/

FIVE IDEAS...

For efficient, humanitarian, SATCOM networks

By Koen Willems, Market Director, Government and Defense, Newtec, and Senior Contributor to MilsatMagazine

The frequency and risk of natural hazards is continuing to rise, while conflict and persecution are displacing a record number of people.

When an emergency or a disaster strikes, a coordinated approach by humanitarian organizations is required to enable fast and effective intervention.

During and immediately after a crisis, urgent action is required to save lives. At the same time, from the start of a humanitarian response, time critical interventions which lay the foundations for sustainable recovery an speedy return to longer term development are also imperative.

Moving from responding to emergencies to rebuilding countries, the focus shifts to long-term finance, capacity building for national governments and the empowerment of local communities to meet their own needs. During all these stages, telecommunications in general and satellite communications in particular are key contributors to the success of the humanitarian intervention and development activities.

Satellite communication is the only reliable method to exchange critical logistic, medical and situational awareness information with mission headquarters after a man-made or natural disaster.

In such events, telecom landlines and terrestrial wireless systems are lacking, destroyed, or overloaded by people sourcing help, information or trying to contact relatives.

In this article, five ideas will be introduced to increase the effectiveness of humanitarian operations and the efficiency of satellite communication networks to support these activities.

Translating Effective Humanitarian Operation Objectives to Efficient SATCOM Networks

The effectiveness of a humanitarian intervention is calculated on the smoothness of the operation, the amount of affected people that can be reached and how quickly organizations can provide first responder emergency services.

These objectives need to be translated into how an efficient satellite network should operate. However, in most cases, humanitarian organizations lack the resources and budgets to have dedicated satellite experts amongst their ranks who can assist in building and operating these networks over satellite or even perform installations in remote locations.

In most cases, humanitarian organizations and NGOs will rely on satellite service providers for managed services. But how can a humanitarian organization ensure it selects the correct satellite service and equipment that are relevant to the operations at hand?

The coordinated series of actions to prepare, manage and deliver humanitarian response are combined in a model related to the different stages in a humanitarian process, from the crisis or disaster to the development and capability building activities.

The successful implementation of such a humanitarian aid and development cycle is dependent on effective emergency preparedness, coordination with national/local authorities and humanitarian actors, information management and flexible, scalable and efficient satellite communication platforms.

Each stage in the humanitarian aid and development cycle requires a different type of service, throughput and traffic type that need to be exchanged with fixed, on-the-pause and on-the-move satellite terminals.

Having fragmented satellite services and different VSAT systems for the different stages in a humanitarian aid program would turn out to be a very expensive solution for humanitarian organizations and NGOs.

In short, humanitarian agencies need to consider a multiservice satellite platform that offers a combination of data, voice and video services, ranging from situational awareness information, internet access, logistics and administration to educational content which can be accessed from different types of terminals in disaster and crisis areas across the world.

Figure 1: Different services required during the different stages after a disaster.

Ideas for More Efficient Humanitarian VSAT Networks

It is time for game-changing approaches and innovative technologies from the satellite industry to support humanitarian operations and make them successful.

Here are some ideas to achieve effective humanitarian interventions through efficient VSAT solutions.

Figure 2: Five ideas for efficient humanitarian satellite networks.

1. **Time is of the essence**; support first responders in their quick deployment requirements.

The first 72 hours after a crisis or disaster are vital. Chaos reigns and a coordinated response is set up quickly during that time to save lives. Once the planning is done and the first responders are on their way towards the disaster or crisis area, the satellite network needs to be configured and prepared to cater for emergency communications, situational awareness reports and first logistics.
The first responders must be able to be deployed anytime, anywhere, and be assured that instant satellite connectivity is available.

Basically, the VSAT system must enable first responders to set-up their fly-away VSAT terminals once they have reached the disaster area and provide immediate connectivity to data, video and voice services over satellite. Planning and preparation are key, as is the speed the VSAT network can be configured, the availability of instant ground segment infrastructure elements, the satellite capacity allocation over the disaster area and rapid provisioning of services.

As such, the VSAT platform needs to be independent from satellite constellation and satellite frequency to be repurposed quickly over different humanitarian operations. Once operational, the SATCOM links are expected to remain available during the operation's length.

2. **Make VSAT terminals and networks easy to install and operate**; reduce human error whilst saving time and money.

Linked to quick deployment is the necessity for easy-to-install VSAT terminals and easy-to-operate satellite networks. Although it sounds like a no-brainer, a lot of current VSAT solutions still require a satellite engineer and time-consuming set-up of procedures to establish a first connection.

Making complex systems out of VSAT solutions increases the risk of mistakes and security breaches, creating interference on satellites which could ultimately hamper operations.

The VSAT platform needs to come with a set of tools and technologies to facilitate the easy installation of hubs and modems, as well as the ease to plan, monitor and manage the satellite network.

The quicker the terminal is up and running, the quicker the deployed humanitarian personnel can focus on their core operational tasks. This process ensures that each terminal works at maximum efficiency, reducing the interference and implementation risks.

A basic half-day training should be enough for a humanitarian employee with some IT knowledge to point and set-up the VSAT terminal through a comprehensive Graphical User Interface (GUI). Once the terminal is correctly pointed, the network and authentication management will take over automatically and provide internet connectivity in a matter of minutes.

3. The impact of the next crisis or disaster is difficult to predict; **the humanitarian SATCOM network must be scalable and flexible to face the variety of operations at hand**.

Many scientists and studies have tried to find ways to predict the next crisis or disaster using climate models, setting up seismic, volcanic, forest fire and tsunami monitoring networks and keeping track of political events and migration movements.

Although natural disasters are easier to predict today, the impact and aftermath of these events remain disastrous, chaotic and difficult to assess. The same goes for crisis management after political or social problems. From local events to disasters impacting multiple nations, first responders and humanitarian workers are often deployed to the furthest corners of the world.

Flexibility is the key requirement for humanitarian organizations when they look for satellite services. Both locally fragmented and global connectivity are imperative and the satellite services need to be adaptable to the situation at hand.

After the disaster, the parameters and service requirements might change constantly depending on the stage in the humanitarian aid and development cycle.

Having flexible satellites and services is not sufficient; they need to go hand-in-hand with a flexible and scalable VSAT platform. Only in such a scenario is the flexible pooling and sharing of capacity and assets possible.

The VSAT terminal can be installed on a vessel during a humanitarian mission seeking victims of human trafficking, fixed on the roof of a hospital to support AIDS prevention programs, or deployed and re-used as a fly-away terminal for a first responder after a hurricane disaster.

In all scenarios, the VSAT terminal will need to blend in with terrestrial network elements such as two-way radio, 3G/4G/LTE and Wi-Fi networks. Once installed, the VSAT terminal can serve as a temporary asset to provide mission critical communications in a first responder network or be part of a permanent disaster recovery back-up network operated by a local service provider

In the latter scenario, the VSAT network management system will be able to allocate part of the network to a local service provider in a Virtual Network Operator (VNO) structure for a development program to empower local governments and communities. The multiple types of VSAT terminals installed on different platforms are all connected to a single VSAT platform in a global and flexible satellite network.

4. Humanitarian workers cannot afford to fail even though they operate in the worst locations and conditions on Earth; the same is expected from satellite networks.

Humanitarian relief workers and first responders are deployed to the worst locations on earth. The local situation is chaotic and hostile, terrestrial communication infrastructure is missing and weather conditions can be a nightmare. Losing a satellite link might slow down interventions and endanger human lives.

Humanitarian organizations will demand satellite service providers to respect the most stringent Service Level Agreements (SLAs). Only VSAT platforms providing seamless, reliable and robust satellite links can be considered for running seamless humanitarian, mission critical communications.

The VSAT terminals must maintain connectivity and maximum service availability even in highly adaptive satellite networks with fading conditions and occasional interference.

In hostile environments such as conflict zones, satellite communications need to be secured and the location of the humanitarian camps or whereabouts of peacekeeping cannot be revealed.

5. Invest in cost-efficient SATCOM technology so humanitarian organizations can spend less on operating SATCOM networks and more on humanitarian aid programs.

Addressing the issues common to disaster recovery remain difficult as pre-disaster recovery planning is less salient to local officials, particularly when compared to pressing day-to-day activities and available budgets.

Most humanitarian organizations and NGOs survive on donations, development bank initiatives or government funding programs and are very conscious about their operational budgets. They prefer to spend their money on relief efforts that directly impact victims after a disaster or a crisis, rather than investing in infrastructure and overhead.

Ambitions to set up large development, educational or closing digital divide programs are mostly only partly realized or need to be halted because the underlying costs were underestimated.

Environmental and social responsibility is high on the agenda of the satellite communications industry. Innovative, efficient and affordable SATCOM technology can be accessed by humanitarian organizations for their first responder operations and to realize their large development programs.

Efficient SATCOM technology helps to save bandwidth costs and provide double throughput in the same available bandwidth. A wide portfolio of VSAT terminals, modems and service profiles on a single VSAT platform can help a humanitarian organization to tune its satellite network to the planned operations and programs while reducing Operational Expenditure (OpEx) and Capital Expenditure (CapEx) costs which can be reinvested in development and disaster recovery programs.

To the Rescue

These five ideas for efficient humanitarian satellite networks are implemented in the Newtec Dialog® VSAT platform.

This is exactly why the Newtec Dialog platform has become the first choice amongst humanitarian organizations, service providers and satellite operators running humanitarian networks.

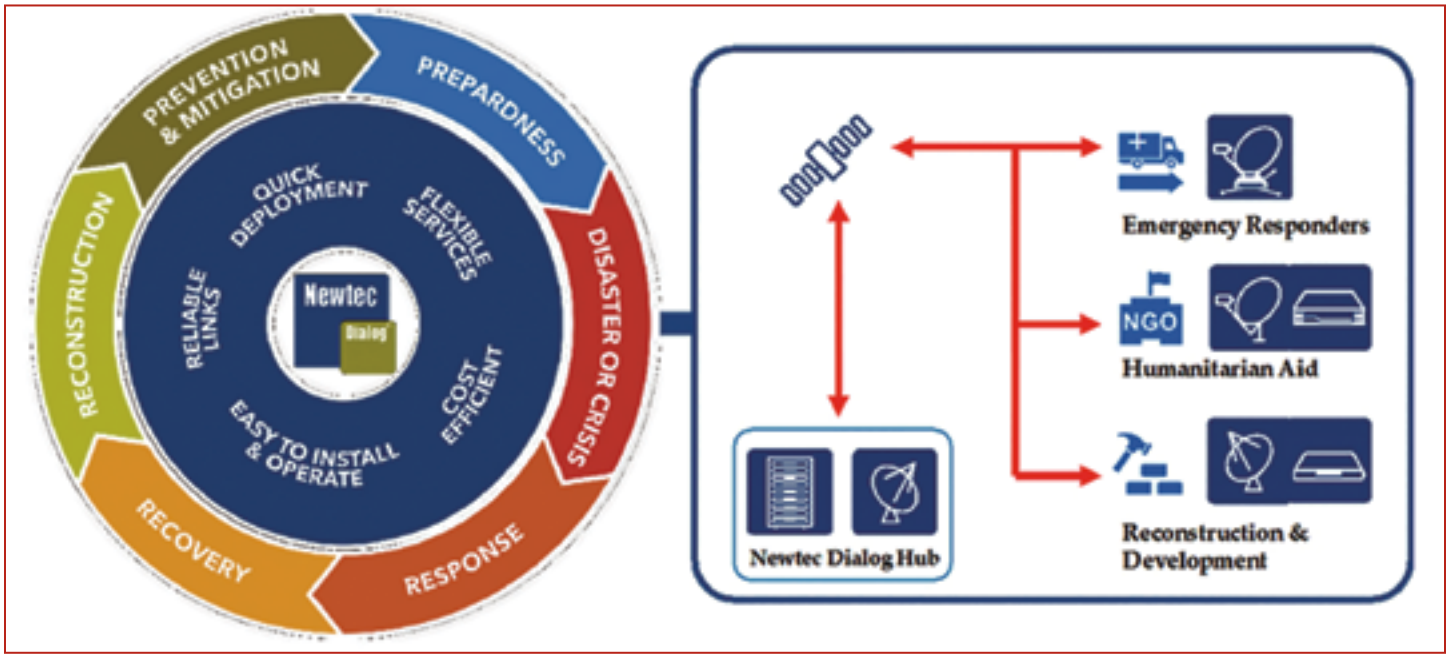


Figure 3: the Newtec Dialog VSAT platform can be deployed during all stages following a disaster.

The Newtec Dialog platform is a scalable and flexible multiservice satellite communications platform that allows operators and satellite service providers to build and adapt their networks easily as humanitarian operations change or grow. As such, Newtec Dialog gives them the power to offer a variety of services while making hassle-free decisions on which technology to use.

A set of key technologies (such as Newtec Mx-DMA®, DVB-S2X and FlexACM) bolster the high availability platform to offer highly reliable and secure services at unsurpassed efficiencies. This addresses the continued pressure on the ever-increasing need for more data throughput.

The Newtec Dialog VSAT system embraces the complexity of humanitarian operations and addresses multiple applications (logistics, medical, situational awareness, ERP, administration, internet access, video conferencing, VoIP, etc.) and services (video, voice, data) on a single platform. The platform can easily be adapted and operated during each stage of the humanitarian aid and development cycle when the mix of services and applications frequently change.

The Newtec Dialog VSAT platform is equipped with a set of tools and technologies to facilitate the easy installation of hubs and remote VSAT modems, as well as ease the planning, monitoring and management of a humanitarian network over satellite.

Successful Deployments in Humanitarian Networks

The Newtec Dialog VSAT platform is a very good fit with humanitarian satellite networks.

The platform has a track record of installations and deployments worldwide in first responders, humanitarian aid, development, educational, bridging the digital divide and disaster recovery networks, and has built a firm reputation on efficiency, reliability and innovation in the satellite market.

Newtec Dialog has been installed in each stage of the humanitarian aid and development cycle in networks supported by humanitarian organizations, NGOs and government agencies.

In the first phase when interventions are planned and situational awareness imagery is exchanged, Newtec technology is the engine behind the distribution of weather maps, climate models and earth observation imagery in Europe and U.S.

During the response stage (phase 2) Newtec Dialog has been deployed by first responders in the US for emergency services after several different hurricanes hit Puerto Rico and continental U.S.

During the Ebola crisis in Africa, Newtec Dialog supported health organizations to provide the first medical aid to victims and prevent a global pandemic outbreak. Peacekeeping agencies and humanitarian organizations dealing with refugee shelter and relief use the Newtec Dialog VSAT system to provide their different missions with a mix of services during the recovery stage (phase 3).

Development banks play an important role in financing and initiating development programs during the reconstruction stage (phase 4). Newtec Dialog connects their offices and operations throughout Africa and Asia.

In the Democratic Republic of Congo, 300 hospitals and health centers in remote communities have a Newtec VSAT terminal in place to access the internet and exchange medical information. A lot of today's focus has shifted towards prevention and mitigation programs (phase 5).

The Newtec Dialog platform connects 4,000 schools in Morocco as education is a key driver for sustainable development, economic growth and prevention. In Indonesia, the Newtec Dialog VSAT system is part of the government initiative to bridge the digital divide, connecting remote communities for internet access, data and voice services.

Thanks to Newtec's vast experience in trunking networks and high-speed modem technology, Newtec modems have been installed in disaster recovery networks (phase 6) that serve as back-up solutions over satellite when terrestrial communication networks fail due to natural or man-made disasters.

When a disaster strikes, a timely reaction and intervention is of utmost importance in order to save lives, bring stability to the region and restore the affected elements of the key infrastructure. Satellite communication is the only reliable method to exchange critical logistic, medical and situational awareness information with mission headquarters after a man-made or natural disaster.

Newtec SATCOM technology supports the emergency response and humanitarian missions by providing a VSAT platform that can be deployed from the early stages after a disaster to the restoration of the affected area.

The five key requirements to support efficient humanitarian operations have been implemented inside the Newtec Dialog VSAT platform. These requirements originate directly from the operational reality in which humanitarian organizations set up their relief and development programs. Newtec Dialog is a very good fit with humanitarian networks thanks to its ability to support quick deployments and easy installation of terminals, as well as its ability to provide flexible VSAT services worldwide.

With the Newtec Dialog platform network, operators can set up reliable satellite links at all times in a flexible, scalable and efficient way. Furthermore, double throughput can be achieved at maximum service availability.

Finally, the OpEx and CapEx savings achieved through Newtec's cost-efficient SATCOM technology can be reinvested by humanitarian organizations in relief, development and disaster recovery programs.

www.newtec.eu

Koen Willems, Market Director for Government and Defense at Newtec, and a Senior Contributor for MilsatMagazine, presented "Satellite Communications for Humanitarian Networks" at AID & International Development Forum.

GLOBAL MILSATCOM

A crucial dispersement of information for satellite defense communications

The landscape of defence satellite communications is changing rapidly, on both sides of the Atlantic, with the announcement of a new Air Force Space Command and conclusion of the Wideband AoA, the addition of new enduring capability for Skynet 6 and a new era of LEO mega-constellations set to provide new COMSATCOM bandwidth for military partners.

It is in this context that SMi Group will be hosting the 20th annual **Global MilSatCom** conference and exhibition in London from the 6th to the 8th of November, 2018, at the **QEII Conference Centre**. With more than 500 attendees, this is a key calendar date for satellite professionals across the alliance.

Scheduled into four dedicated days of content, the meeting will cover mission critical updates from national programs from the U.S., Europe as well as the wider international community.

In addition, introduced by popular demand, the '*Small Satellites and Disruptive Technology Focus Day,*' will be held at the **Taj St James Court** on November 5th. This event offers registrants an opportunity to explore how the growing race to launch smallsats into orbit and their impact is driving the provisioning of '*data connectivity for the many*' and what this means for the defence sector.

St James Court, Taj Hotel and QEII Conference Centre].

The focus day will feature in-depth presentations from leading industry innovators, such as **Clyde Space** and **Surrey Satellite**, as well as the expertise from those individuals and companies that are driving innovation in government procurement. These presentations will feature

Sponsors and Exhibitors at this year's MilSatCom conference in London.

BOOK BY **JUNE 29TH** TO **SAVE £300** • BOOK BY **SEPTEMBER 28TH** TO **SAVE £200** • BOOK BY **OCTOBER 31ST** TO **SAVE £100**

SMi Group Proudly Presents the 2nd Annual...

MARITIME INFORMATION WARFARE

SMi
LINKING BUSINESS *with* INFORMATION

26TH AND 27TH NOV 2018

Optimising Naval Information Exploitation Through New Technologies, Systems and Enhanced Data Management

Copthorne Tara Hotel, London, United Kingdom

BENEFITS OF ATTENDING:

- The only event that approaches the concept of 'information warfare' in the maritime domain, and the need to **embrace information to enhance naval operational effectiveness.**
- Hear comprehensive technical briefings from the Royal Navy and other leading maritime experts on **Artificial Intelligence, big data analysis, open source intelligence gathering and C4i combat information systems.**
- Detailed focus on naval cyber warfare and how major European naval forces are approaching **cyber defence of maritime assets and networks.**
- Meet **cutting edge technology providers** at the forefront of delivering artificial intelligence, information technology, and cyber defence solutions.

CONFERENCE CHAIRMAN:

Rear Admiral (Ret'd) Anthony Rix, Former Flag Officer Sea Training, **Royal Navy**

EXPERT MILITARY AND TECHNICAL SPEAKERS INCLUDE:

Vice Admiral Hervé Bléjean, Deputy Commander, **NATO MARCOM**

Senior Representative, Royal Navy Information Warfare Staff

Commander Jeffrey Loder, Section Head Communications and Information Systems Requirements, **Royal Canadian Navy**

Captain Antonio Gonzalez Garcia, F110 Frigate Programme Manager, **Spanish Ministry of Defence**

Commander Thomas Smith, Lead, Joint ISR and Targeting, **NATO**

Commander Verner Dam, Head of N6 Information and Command Technology, **Danish Defence Command, Naval Staff**

Dr Matthew Howard, Director Artificial Intelligence Technology, **Deloitte**

Half-Day Post Conference Workshop, 28th November 2018 | Copthorne Tara Hotel, London, United Kingdom

Cyber Warfare in the Maritime Domain

Hosted by Colonel (Ret'd) Ralph Thiele, Director, **StratByrd Consulting**
9.00am-12.30pm

www.maritimeinfowarfare.com/satnews

Register online or fax your registration to +44 (0) 870 9090 712 or call +44 (0) 870 9090 711
SPECIAL RATES AVAILABLE FOR MILITARY AND GOVERNMENT REPRESENTATIVES

CPD CERTIFIED

@smigroupdefence
#MaritimeInfoWarfare

Networking at last year's MilSatCom Conference.

a special guest presenter — Dr. ***Fred Kennedy***, Director, Tactical Technology Officer, **DARPA**.

With all military communications of the future set to exploit smallsat networks in some capacity, this technically-focused meeting is certain to provide insight into future technologies.

Critical coverage of the UK's SATCOM program is certainly another key reason for attendance at ***Global MilSatCom***.

Day one of the conference is set to outline the host nation's vision for future MILSATCOM capability with presentations at all levels; from Mr. *Stuart Andrew* MP, **Minister for Defence Procurement,** to key space stakeholders such as Mr. *Mike Rudd*, Head of Telecommunication Strategy, **UK Space Agency**.

At the center of this morning of British content is the future of ***Skynet 6***, which is set to provide the backbone of UK military capability to 2040 and beyond. With updates from a range of portfolio managers, Day One will provide a holistic message on future UK space capability for those in attendance.

The U.S. is currently in a critical time regarding the nation's future MILSATCOM capabilities. With ***WGS 11*** and ***12*** set for launch as well as the continued development of ***AEHF6,*** what comes after the initial concept pilot and pathfinders are set to be center stage on Day 2 — a focus on the American environments.

Featuring keynote presentations from the **Space and Missile Systems Center** (SMC) that include Mr. *Thomas Beckt*, MILSATCOM Executive Director and Ms. *Deanna Ryals*, Chief International Partnerships Division, the bandwidth set to be launched moving forward will be covered in depth.

Similarly, how space systems interact with ground terminals, such as ***FAB-T*** (using AEHF satellite bandwidth) and the resilience of these networks will be of particular importance in the era of hybrid warfare and is certain to be analyzed in depth by presenters such as Dr. ***Brian Teeple***, Chief Information Officer, **U.S. Department of Defense** (DoD).

Of course, networking remains a key function of the forum and brings together those who are establishing the requirements — procurement officers and end users in an unparalleled four days of interaction that include seven hours of onsite lunch and coffee breaks, three receptions and two evening dinners.

Arguably even more vital is the space the conference provides attendees to engage with leading industry players, providing system integrators and government stakeholders the ability to network with the array of exhibitors at the conference. Exhibitors including key industry leading companies and subject-matter experts from **Airbus**, **SES Networks**, **Comsat**, **GovSat**, **Hughes**, **Intelsat**, **Kratos**, **Laser Communication Coalition**, **Lockheed Martin**, **Newtec**, **Open Cosmos**, **Raytheon**, **SES GS**, **Thales**, **Viasat**, **Advantech Wireless**, **Comtech**, **Datapath**, **Exoanalytic**, **Inster**, **Integrasys**, **Planewave**, **Satcube**, **Scisys**, **Teledyne** and **Xtar**, all of whom are set to host exhibition stands at the meeting.

Finally, rounding out the conference on Day 3 will be updates from the wider international community, with key APAC nations such as **Australia** (Lieutenant Colonel *Michael Hose*, Deputy Director, **Australian SATCOM Systems Branch**), **New Zealand** (Wing Commander *Paul Drysdale*, **JSO1 Joint CIS Division**), **Republic of Korea** (Colonel *Jae Soong Lee*, Chief, **Defence Communication Command**) and **Japan** (Colonel *Schinichiro Tsui*, Counselor, **National Space Policy Secretariat**), all providing comprehensive briefings from the region.

Emerging space faring nations developing their own capability will also be offering their information. Major General *Emmanuel Whyte*, Chief, **Nigerian Defence Space Administration** among them. Attendees will be able to see how these new states will operate in the fourth domain, essential information for established space operators.

These international briefings are set against an even more vital backdrop as partnerships across nations are expanding — such as the anticipated ascension of Australia to the AEHF program — and other opportunity areas that will present innovative and disruptive technologies for future MILSATCOM bandwidth optimization.

Anyone involved in the diverse array of MILSATCOM should consider attending this important conference, which continues to set this event at center stage as the event celebrates its 20th birthday.

For important information and to register for this event, please visit:
www.globalmilsatcom.com/feature

AvL TECHNOLOGIES

avltech.com

ENABLING COMMUNICATIONS IN ANY SITUATION

AvL'S FAMILY OF INTEGRATED TERMINALS (FIT)

- Ultra lightweight - meets IATA requirements for carry-on or checked baggage
- One person set-up in less than 10 minutes
- Carbon fiber reflectors - sizes range from 45cm to 1.35M
- All-in-one positioner system & switchable manual or motorized operation
- Quick change tri-band feed and RF kits
- AvL AAQ computer-assisted pointing and acquisition
- Beacon receiver, ODU/modem integration and BUC/LNB integration
- Watch the video at avltech.com/media

SPACE MISSION SOLUTIONS

IDEAS IN ORBIT

Outside the box. Above the Earth. Beyond our wildest dreams. Our engineers are turning science fiction into reality that's shaping tomorrow's world.

Raytheon.com/space
@Raytheon
Raytheon
@raytheoncompany
Raytheon

Raytheon