MilsatMagazine

NROL-47
DELTA IV

MilsatMagazine

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DISPATCHES

ULA sends NROL-47 to orbital destination

The ULA launch of NROL-47 from Vandenberg AFB.

Photo is courtesy of United Launch Alliance.

A United Launch Alliance (ULA) Delta IV rocket carrying a payload for the National Reconnaissance Office (NRO) lifted off from Space Launch Complex-6 on January 12 at 2:11 p.m. PST — this launch was Designated NROL-47 and the mission is in support of national defense.

This mission was launched aboard a Delta IV Medium+ (5, 2) configuration Evolved Expendable Launch Vehicle (EELV) powered by one common booster core and two solid rocket motors that were built by Orbital ATK.

The common booster core was powered by an RS-68A liquid hydrogen/liquid oxygen engine. A single RL10B-2 liquid hydrogen/ liquid oxygen engine powered the second stage.

The booster and upper stage engines are both built by Aerojet Rocketdyne.

ULA constructed the Delta IV Medium+ (5,2) launch vehicle in Decatur, Alabama.

This is ULA's first launch of 2018 and the 124th successful launch since the company was formed in December 2006.

The launch was also the 36th flight of the Delta IV rocket since its inaugural launch in 2002.

The EELV program was established by the U.S. Air Force to provide assured access to space for Department of Defense and other government payloads.

The commercially developed EELV program supports the full range of government mission requirements, while delivering on schedule and providing significant cost savings over the legacy launch systems.

ULA's next launch is the Space Based Infrared System (SBIRS) GEO Flight 4 mission for the U.S. Air Force on an Atlas V rocket.

ULA's Delta IV launch vehicle in-flight with NROL-47 payload.

Photo is courtesy of ULA.

The launch is scheduled for January 18 from Space Launch Complex-41 at Cape Canaveral Air Force Station, Florida.

Will Crawford, ULA's NRO program manager, noted the company's thanks to the entire ULA team and all of the mission partners at the NRO and U.S. Air Force who made this, ULA's 27th NRO launch, possible.

In a statement from Colonel Greg Wood, who is the vice commander of the U.S.A.F.'s 30th Space Wing, as well as the launch commander, said he was delighted that every Team V member involved worked tirelessly to ensure this launch was safe and successful.

NROL-47 is a classified launch — the exact nature of the payload is unknown as of this writing.

www.ulalaunch.com

www.nro.gov

DISPATCHES

Orbital ATK signs a CRADA with the U.S.A.F.'s Space and Missile Systems Center (SMC)

Orbital ATK has signed a Cooperative Research and Development Agreement (CRADA) with the U.S. Air Force's Space and Missile Systems Center (SMC).

The CRADA provides the framework and plan for data exchanges needed to certify Orbital ATK's

Next Generation Launch (NGL) system to carry National Security Space missions.

The company is currently in early production of development hardware for NGL.

To date, the company has jointly invested with the Air Force more

than $200 million to develop the NGL rocket family.

In addition to launching the entire spectrum of national security payloads, the NGL family of vehicles will be capable of launching science and commercial satellites that are too large to be launched by Orbital ATK's current

Next Generation Launch System

Vehicle Configuration	500 Series	500XL Series
Payload Fairing	5 x 15m	5 x 15m or 5 x 20m
Payload Capacity	5,500 - 8,500 kg (GTO)	5,250 - 7,000 kg (GEO)
Stage 3	Cryogenic	Cryogenic
Stage 2	CASTOR® 300	CASTOR® 300
Stage 1	CASTOR 600	CASTOR 1200

Commonality Across Launch Systems

- Workforce
- Suppliers
- Facilities
- Avionics and Structures
- Propulsion Systems
- Launch Integration

Trident D5
First Launched
1990
Suborbital

GMD
First Launched
2003
Suborbital

Pegasus
First Launched
1990

Taurus
First Launched
1994

Minotaur
First Launched
2000

Antares
First Launched
2013

NGL
To Be Launched
2021

Ares I-X
First Launched
2009
Suborbital

SLS Boosters
To Be Launched
2019
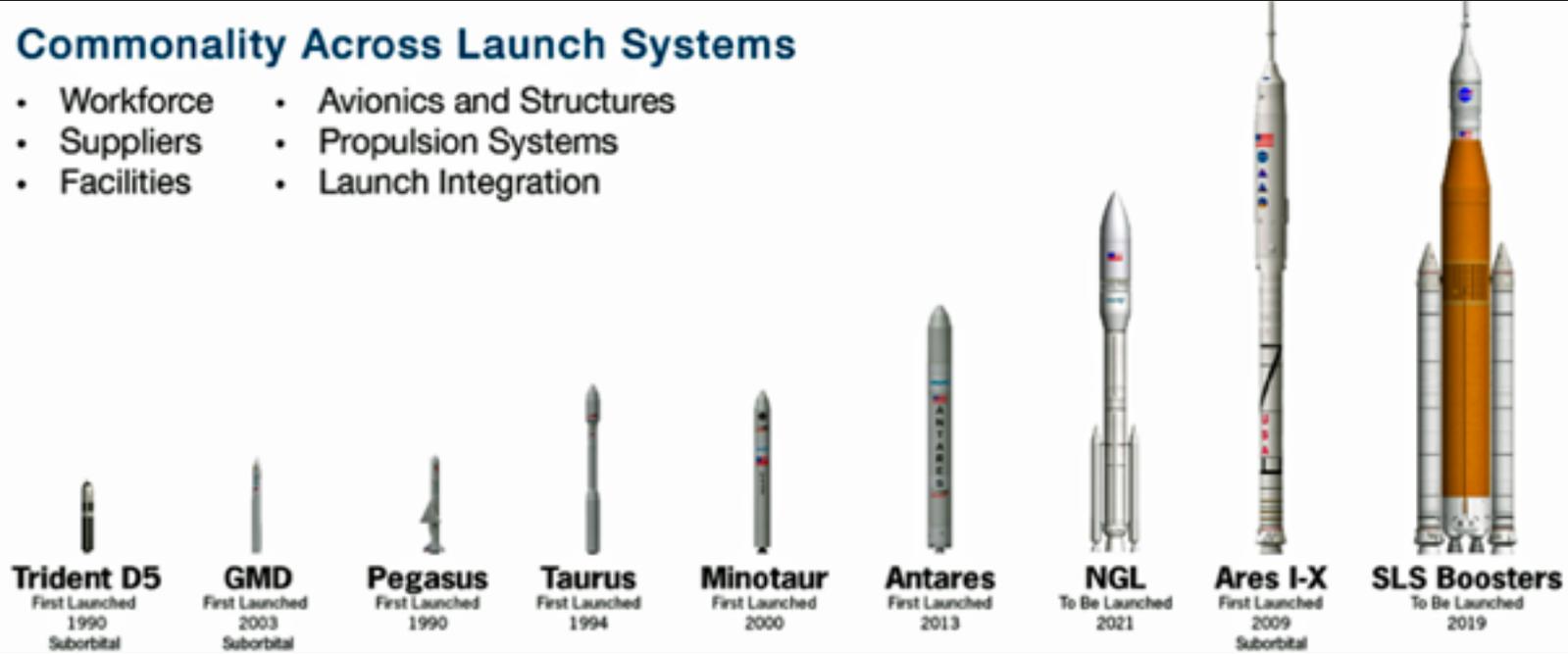
Pegasus®, Minotaur and Antares™ space launch vehicles.

The NGL vehicles will share common propulsion, structures and avionics systems with other company programs, including smaller space launch vehicles as well as missile defense interceptors, target vehicles and strategic missile systems.

The next phase of the NGL program is expected to begin when the Air Force awards Launch Services Agreements in mid-2018, which would entail full vehicle and launch site development.

The new launch system will be capable of launching 5,500 to 8,500 kg. Geosynchronous Transfer Orbit (GTO) and 5,250 to 7,000 kg. Geostationary Equatorial Orbit (GEO) payloads.

The 12-foot in diameter solid rocket motors draw on the firm's Space Shuttle and Space Launch System booster experience.

These vehicles will operate from both east and west coast launch facilities.

Current in-production programs provide skilled workforce, existing facilities, existing supplier relationships and available subsystems for the new launch system's development and production.

According to the company, high commonality with other programs benefits their customers by:

- *Reducing technical risk by using Orbital ATK flight-proven hardware*
- *Enabling Orbital ATK to maintain affordable costs, even in years of low market demand*
- *Providing synergies and cost savings on current and future government programs*

Milestones Orbital ATK has accomplished to date on their new launch system include:

- *Successful Critical Design Reviews of the first and second stages*
- *Complete refurbishment of the 66,000-square-foot case production facility*

- *Production and installation of tooling*
- *Manufacture of the first development rocket motor case*
- *Establishment of an agreement with NASA to use the launch facilities at KSC*

Scott Lehr, President of Orbital ATK's Flight Systems Group, noted that under this CRADA, Orbital ATK is better able to support SMC in being the guardians of assured access to space.

www.orbitalatk.com

Story by Silvano Payne, Executive Writer
Satnews Publishes

DISPATCHES

UN aids refugees with TAC-PAK systems

Horrible reports of abuse and murder in the Central African Republic has motivated the United Nations International Organization for Migration (IOM) agency to help change and assist the victims of this civil war.

The humanitarian crisis in the Central African Republic (CAR) has received plenty of media attention in recent years.

Since civil war broke out in CAR, 115,000 Chad refugees have been displaced in the remote region, countless people have been killed and many more have been the victims of rape and other forms of abuse.

The situation in Chad would be worse were it not for the peacekeeping work of the United Nations International Organization for Migration (IOM) agency that is providing basic facilities such as temporary shelters, water and sanitation facilities, health centers, schools, children-friendly spaces, as well as vouchers for their food subsistence.

Following the massive influx from CAR into Chad, the Humanitarian Coordinator (HC) on behalf of the Humanitarian Country Team decided to reactivate the Shelter/Camp Coordination Camp Management (CCCM) cluster that is led by UNHCR and co-led by IOM.

The aim is to provide technical support for the management of both transit and temporary sites as well as to advocate for durable solutions for the displaced persons in the sites in the long run.

The IOM recognized the need for more communications resources in the remote communications sterile refugee camps.

The IOM selected the 308 SYSTEMS TAC-PAK videoconferencing kits for deployment to multiple refugee sites.

These "mobile command in a box" systems, manufactured by 308 Systems in Fort Collins, Colorado, are custom-configured to meet specific IOM Chad mission field communication requirements.

Deploying the TAC-PAK mobile command systems, the United Nations has been able to create a satellite and cellular communications based continent-wide wireless network.

This network enables Shelter/CCCM cluster teams to coordinate, share information and request support.

The TAC-PAK's have created an invaluable and fast communications infrastructure where, previously, none existed.

The IOM's TAC-PAK videoconferencing flyaway kit deployment addressed the shortfall of voice and data infrastructure and equipment experienced by the IOM teams on a daily basis in the remote refugee camps.

www.308systems.com/

DISPATCHES

Elbit System's Mercury Radio System gains full operational status with the UK Army Cadet Force

Elbit Systems Ltd. announced that the UK MoD has declared that the Mercury Radio System achieved Full Operational Capability (FOC) and is now in service with the UK Army Cadet Force (ACF).

In conjunction with Drumgrange Ltd. ("Drumgrange"), Elbit Systems delivered over 3,000 PRC 710 VHF radios and amplifier sets and 150 PRC 720 HF man-pack radios along with battery charging and ancillary equipment to enable practical field-craft and signals training and a command and control capability.

The UK MoD was provided with extensive hardware and software enhancements to achieve best in class Radio performance.

At a formal customer presentation to mark the occasion, Brigadier Richard Spencer, Head of the Battlefield Tactical Communications and Information Systems (BATCIS) Delivery Team stated that the delivery of this capability to exacting time, cost and performance parameters is a real success story and he is delighted to see the radios now in the hands of both the Cadets and Instructors.

Elbit Systems Land & C4I Division manufactured and supplied the PRC 710 VHF Handheld Radio, including PRC 715 Amplifiers, and the PRC 720 MICOM Pathfinder HF Radios. Both VHF and HF models have been sold in large numbers worldwide.

Martin Fausset, CEO Elbit Systems UK, stated that the company is delighted to become a new radio supplier to the UK MoD providing a valuable capability for the UK Army Cadet Force and future users.

George Howe, Managing Director of Drumgrange, added that the company is gratified to be able to provide the ACF with a new and cutting-edge equipment and communications solution that will not only allow them to train effectively but also provide a key safety communications network for support on exercises and other activities.

elbitsystems.com/

Story by Jill Durfee, Associate Editor, Satnews Publishes

DISPATCHES

New Aitech Remote I/O unit available...

Aitech Defense Systems Inc. has developed a new method of providing high performance, application-specific remote I/O management through the use of expansion modules, or "slices," in the new rugged, space-qualified Ai-RIO.

Through the unit's modular, small form-factor (SFF) structure, the remote I/O interface unit (RIU) is a system-of-systems that provides a new level of scalable intelligence that meets specific user requirements and adapts to evolving application needs.

- *Scalable intelligence through highly integrated module 'slices' that add functionality as needed*
- *Dual-core P1020 Power PC and rad-tolerant FPGAs for powerful performance in space and defense applications*
- *Expandable with up to eight inter-networked units in compact form factor*
- *Different I/O configurations enable flexible design*
- *3.75 lbs with extremely low power dissipation of 12 W typical*

The Ai-RIO is an extremely high density, low power rugged sub-system that provides exceptional, user-specific functionality. This compact unit occupies very little space in a variety of aerospace, defense and military applications and is ideally suited for vehicle platform flight control, attitude and navigation controls, servo-valve and thrust vector control (TVC), robotic motor control, video and image processing and storage, data telemetry, platform stabilization, communications and telematics, high speed data recorders, booster and launch propulsion and thruster control, remote sensor and effector monitoring and much more.

The Ai-RIO is easy expandable, with up to eight units networked together, for unprecedented functionality in a compact space. Added capabilities include I/O, power switching, mass/SD FLASH memory and other functionalities.

Offering one of the widest ranges of I/O available in a SFF platform, the remote I/O sub-system includes a Gb Ethernet port with precision time sync IEEE-1588 support, ten RS-422 ports (eight of which are RS-422/485), an additional eight LVDS or RS-422/485 UARTS as well as four SpaceWire ports with LVDS I/O, two CANbus ports and sixteen GPIO in two blocks of eight.

Using Aitech's RIO-NET client/ server software as well as additional memory and I/O arrays, the new unit can serve as a standalone command and data handling (C&DH) platform or networked remote command/ response I/O unit.

Meets High Performance Demands of Rugged Applications

The compact, rugged Ai-RIO features a powerful radiation-qualified, dual-core PowerPC processor with two rad-tolerant FPGAs. All internal electronics are conduction-cooled and mechanically fixed and housed within a sealed, EMI/EMC Faraday cage for maximum thermal transfer.

The housing is constructed of 6061/T6 flight grade aluminum and is based on a common 5.5" x 5.5" x 1.2" small form factor. The expansion modules can be single- or double width, incorporating one or two PWBs, respectively, measuring between 1" and 2", depending on connector width and type and module/"slice" board count.

External connectors can be either micro D-Subs for space applications or standard micro MIL-DTL-38999 circular military connectors for use in defense environments. The base unit configuration weight of an Ai-RIO is only 3.75 lbs with a power dissipation of less than 12 W.

Additional System Support

Each of the two e500 cores within the processor are monitored by its own watchdog timer that generates an internal CPU interrupt after the first expiration period or a hardware reset after a second timeout. A third external watchdog timer is located in the rad-tolerant FPGA that, when enabled, resets the entire subsystem after the first expiration period of the internal timers.

The Ai-RIO features onboard temperature sensors as well as A/D voltage and current monitoring with built-in test (BIT) for high reliability. The unit has been tested and characterized directly by Aitech for radiation effects over 25 krads (Si) TID at varied flux rates. The P1020 processor is immune to latch up, with other components meeting the heavy ion Linear Energy Transfer threshold (LETth) of at least 37 MeV-cm2/mg.

rugged.com/ai-rio-remote-io-subsystem

Story by Silvano Payne, Executive Writer
Satnews Publishes

DISPATCHES

Partnership for Search and Rescue finds Astrosat and DroneSAR Joining Forces

Astrosat, a leading business in Europe's space exploitation industry, has formed a partnership with Irish start-up DroneSAR-Search & Rescue, to incorporate drone software with Astrosat's Recovery and Protection in Disaster (RAPID) system.

The RAPID system is designed to provide intelligent situational awareness and support in the context of disaster scenarios to aid, inform and support decisions that are made in the operational theater.

DroneSAR recently won the Copernicus Master Service Challenge European Space Week in Tallin, Estonia.

DroneSAR was developed through Donegal Mountain Rescue, who were selected as one of four European pilot tests sites by DJI, a market leader in consumer drone technology, and EENA, the European Emergency Numbers Association. The software was refined based on the results of this project.

The company provides software that enables commercially available drones to maintain autonomous search patterns based on waypoint missions or user-defined search 'boxes,' reducing risk to search personnel, improving situational awareness and increasing the chance of finding people in distress, all at a fraction of the cost of a SAR helicopter.

The software has a Share Location function, which allows pilots to instantly share locations to all team members as the drone flies.

Oisin McGrath, the CEO and Co-Founder of DroneSAR, said that the software, a result of 18 months of development with input from Search and Rescue (SAR) teams across the country, fits perfectly with the

RAPID system.

Steve Lee, CEO of Astrosat, noted that DroneSAR's technology befits the firm's RAPID system. With RAPID's ability to provide up-to-date mapping images in less than three hours, and the ability to interlace footage from drones, Astrosat is giving first responders the most detailed picture

available. First responders receive a greater depth of overview, through the addition of drone footage to the interface.

Lee added that the company plans to integrate both platforms to give near-real-time satellite imagery to unmanned aerial vehicle (UAV) pilots and to Command & Control for better informed decision making.

www.astrosat.space

dronesarpilot.com
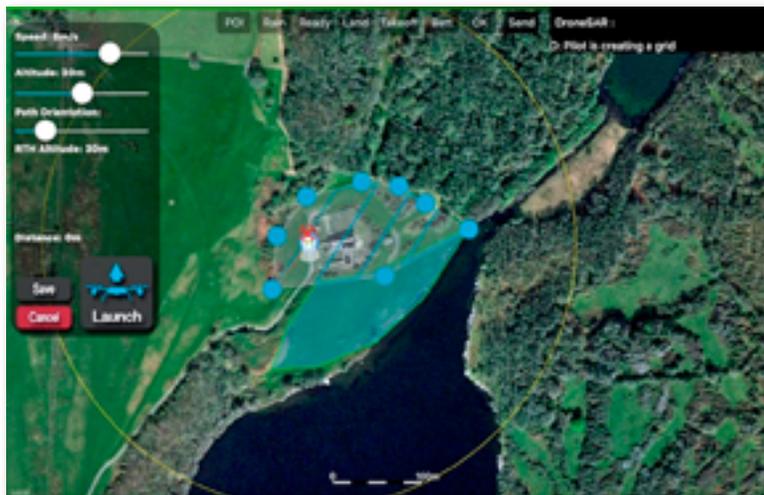
Story by Sean Payne, Industry Writer, Satnews Publishes

In-depth analysis of the UAS SATCOM and Imaging Markets Published by NSR

Recently released is NSR's UAS SATCOM and Imaging Markets, 4th Edition (UAS4) — this study provides the industry's most comprehensive outlook on the UAS market.

Building on more than a decade of data and analysis from NSR's popular Global Military Satellite Communications and Satellite-Based Earth Observation (EO) research coverage, UAS4 provides an exhaustive analysis of UAS markets and the associated revenue opportunities for stakeholders, from satellite operators to geospatial data analytics companies, over the next ten years.

The report covers SATCOM and Imaging applications for UAS markets:

• *The SATCOM portion forecasts retail revenues, capacity demand and revenues, and equipment sales the satellite industry can expect for both Defense and Intelligence (D & I) and Civilian Government market HALE and MALE UAS, by region and frequency band. The SATCOM portion also includes additional military scenarios (pivots and regional strengths) to build a holistic overview of how the UAS and SATCOM ecosystem will grow in the next ten years.*

• *The UAS Imaging portion of the report analyses and forecasts the*

global market for commercial sUAS services for imaging and analytics applications across five industry verticals and five regions. Forecasts are provided for two additional scenarios, projecting the revenue opportunity for UAS operators engaged in imaging and analytics applications.

The report answers critical questions regarding UAS SATCOM and Imaging:

• *How large is the SATCOM market for HALE and MALE UAS in the next 10 years?*

• *Which frequency bands will play a key role in supporting UAS SATCOM services, and what will be the impact of HTS?*

• *What is the SATCOM opportunity provided by Civilian UAS industry?*

• *How will various market verticals, investments and regulations impact the commercial sUAS industry?*

• *What is the market size of sUAS imaging and analytics, and how will it evolve in the next ten years?*

• *What are the market sizing scenarios to be considered, and the impact of commercial sUAS imaging industry compared to Satellite-Earth Observation, by vertical market?*

• *What are the UAS SATCOM equipment trends, and which emerging technologies could disrupt this market?*

www.nsr.com/

Story by Jill Durfee, Associate Editor, Satnews Publishers

Source: NSR
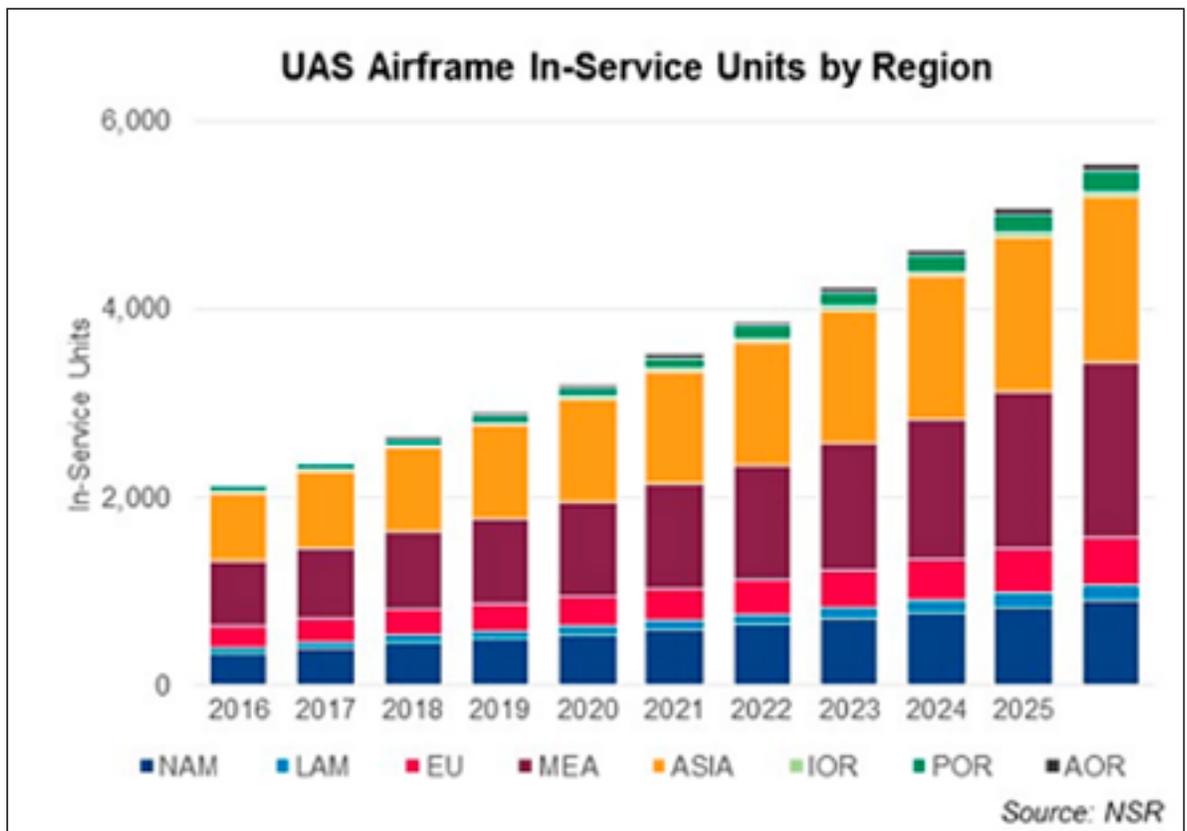
DISPATCHES

DARPA seeking revolutionary tools for U.S. military space ps

The growing complexity of space operations coupled with an increased need for timely decisions demands innovative approaches to battle management command and control (BMC2) technologies.

To help ensure future U.S. technological and strategic superiority, DARPA's Hallmark program seeks to develop revolutionary tools and technologies to plan, assess, and execute U.S. military operations in space. The program has completed initial research and awarded Phase 1 contracts to 11 organizations, which both augment existing commercial technologies and pursue entirely new capabilities. Hallmark has released a Broad Agency Announcement seeking additional technologies for potential inclusion.

DARPA's Hallmark program seeks to develop revolutionary tools and technologies to plan, assess, and execute U.S. military operations in space. In its pursuit of these breakthrough capabilities, the program has completed initial research demonstrations and awarded Phase 1 contracts to 11 organizations. Hallmark has also released a Broad Agency Announcement seeking additional technologies for potential inclusion.

The Hallmark Tools and Capabilities 2 (Hallmark-TC2) BAA aims to develop and validate additional technologies to complement and augment the Hallmark-TCEM tools and capabilities currently being integrated into the Hallmark software testbeds.

Hallmark's Phase 1 research seeks to develop a modular system that could quickly and easily add, remove, and exchange tools from multiple providers.

DARPA's Hallmark program seeks to develop revolutionary tools and technologies to plan, assess, and execute U.S. military operations in space. In its pursuit of these breakthrough capabilities, the program has completed initial research demonstrations and awarded Phase 1 contracts to 11 organizations. Hallmark has also released a Broad Agency Announcement seeking additional technologies for potential inclusion.

Hallmark Tools, Capabilities and Evaluation Methodology (Hallmark-TCEM) is developing the first set of tools and technologies, as well as providing one of the first instances of using cognitive evaluation to inform development of tools for U.S. military command and control.

Cognitive evaluation involves well-established research methods for assessing situational understanding and awareness, including qualitative (interviews) and quantitative (logging human-machine interaction) data collection during and after testing.

DARPA is using this discipline to more quickly discover which tool and task combinations most effectively convey information, contribute to operators' understanding of situations, and enhance real-time decision making.

Lt. Col. Jeremy Raley, program manager in DARPA's Tactical Technology Office (TTO), noted that 21st century space BMC2 must enable commanders to quickly understand and handle situations by optimizing delivery and presentation of crucial information

to make decisions, then provide flexible options for effective, timely response. Hallmark aims to more quickly, collaboratively, and cost-effectively develop unprecedented space BMC2 tools.

TTO Director Fred Kennedy added that everyone says they can build 'better' human-to-machine interfaces, but how is 'better' being measured? Normally, subjective interpretations from operators at consoles are relied upon — Hallmark's unique insight is that quantitative methods should be able to be used to accurately and reliably measure cognitive performance. That's a big step forward.

www.darpa.mil

Story by Sean Payne, Industry Writer, Satnews Publishes

DISPATCHES

China's Ambitious 2018 Launch Agenda

Asianewsphoto

China could almost double its record for space launches in a year in 2018, with the main space program contractor aiming for 35 launches and additional missions planned by emerging commercial actors.

The ambitious schedule reflects multiple expanding space programs, a growing commercial space sector and a backlog from 2017.

The China Aerospace Science and Technology Corporation (CASC), announced at a conference on January 2 that the nation's 2018 work model includes 35 launches, underlining the return to flight of the heavy-lift Long March 5 rocket, the Chang'e-4 lunar far side mission and launches of Beidou navigation satellites as the major activities.

In addition CASIC, a defence contractor, missile maker and sister company of CASC, will carry out a number of missions through its subsidiary EXPACE, including launching four Kuaizhou-1A rockets within one week and the maiden flight of the larger Kuaizhou-11.

Landspace Technology, a Beijing-based private aerospace company, is also expected to debut its LandSpace-1 solid propellant rocket this year.

China aimed for around 30 launches in 2017, but two launch issues — notably the failure of the second Long March 5 rocket — halted activities for 89 days.

China closed the year with 18 launches — including 16 from CASC — down from a national record 22 in 2016.

In 2017 the United States topped the launch tables with 29 (all successful), with Russia second with 20 (19 successful) and China third (1 partial failure, 1 failure).

The Chang'e-4 mission will be the first attempt to soft-land on the far side of the Moon and involves first sending a relay orbiter to a Lagrange point beyond the Moon, set to launch in May or June 2018.

The Chang'e-4 lander and rover, which was manufactured at the same time as the Chang'e-3 mission which put the Yutu (Jade Rabbit) rover on the Moon, is scheduled to

launch around half a year later, in November or December.

As well as the gains in international prestige, the mission promises serious scientific returns, landing within the South Pole–Aitken basin, a huge crater that may include lunar mantle excavated by the impact that formed it and thus offer unique insights into the interior of the Moon, what is made of, and how it formed.

The mission also includes a biology experiment involving a mini-ecosystem containing silkworm eggs and potato seeds, pioneering astronomy tests, and involvement from Sweden, the Netherlands, Germany and Saudi Arabia.

The Long March 5, which successfully debuted in November 2016, is by far China's largest and most powerful launch vehicle, and is capable of launching interplanetary missions, lifting huge satellites, with a variant being developed to launch modules of the future Chinese Space Station to low Earth orbit.

However, the second flight of the Long March 5 on July 2 failed due to an apparent first stage propulsion issue, delaying the Chang'e-5 lunar sample return mission, which was scheduled for November 2017.

No details of the launch failure investigation nor the return to flight mission were revealed, but there are indications that it will involve the large Dongfanghong-5 (DFH-5) satellite bus, the first of which, Shijian-18, was lost with the failed July launch.

While a launch of Chang'e-5 late in the year was not explicitly ruled out, the omission of information on the mission suggests it will take place in 2019.

There was also no mention of debut of the Long March 5B for low Earth orbit missions, which remains a possibility for either 2018 or 2019.

Expected 2018 missions

China's space activities are typically opaque, with missions sometimes becoming apparent only days before launch, and with no prior official announcement.

Expected launches for 2018 include more than 10 Beidou GNSS satellites — China's answer to GPS of the U.S. — including a number of dual satellite launches to MEO.

China had aimed for 6 to 8 such satellites to be launched in 2017, but a partial failure of the Long March 3B rocket in June dented these plans.

A number of satellites for the Haiyang (ocean observation), Fengyun (weather), Yaogan (remote sensing and/or reconnaissance), Gaofen and Ziyuan (Earth observation) and Zhongxing (telecommunications) satellite series will be launched, as well as satellites for Egypt, Saudi Arabia, Pakistan and Sri Lanka, and commercial companies GomSpace, Satellogic, Changguang (Jilin), SpaceTY, Kepler Communications,

SuperView (Gaojing) and others. Preparations for the November 2017 launch of the Beidou-3 M1 and M2 satellites via Long March 3B from Xichang, Sichuan Province. *beidou.gov.cn*

Science missions Zhangheng-1, also known as China Seismo-Electromagnetic Satellite (CSES) with Italian involvement, and the China-France Oceanography Satellite (CFOSAT) are expected to launch in February and the second half of the year respectively.

All four of China's launch sites — Jiuquan, Taiyuan, Xichang and the new Wenchang coastal complex — will be in action, with the latter to see Long March 5 and Long March 7 launches.

In addition, CASC will attempt its first sea launch in 2018, using a Long March 11 solid rocket and a modified freighter.

*News story by
Andrew Jones,
GB Times — gbtimes.com/*

An SES Networks Perspective

Empowering Global Defense and Security Missions

By Nicole Robinson, Senior Vice President of Global Government at SES Networks and Managing Director of Techcom Services

During 2017, the security environment around the globe changed dramatically — terrorism, cyber warfare, border management and natural disasters are examples of the challenges that are increasing the complexity of today's world.

Add in the threats resultant of the changes in the geo-political environment, where some nation-states actively contribute to the creation of instability across the globe. Preventing these threats requires constant access to information and there is no better counter for such incursions than resilient, flexible and secure satellite-enabled solutions.

Escalating demands for GovSATCOM capabilities can be resolved though close collaboration between governments and the private sector. Simultaneously, shrinking governmental budgets mean offered solutions must be cost-efficient, effective and innovative to acquire military/agency/government (MAG) interest.

SES Networks, a data-centric division of SES, has achieved success in this area in 2017 through innovative and close collaboration with governments and institutions.

Also leveraged is the company's unique, multi-orbit, multi-frequency satellite fleet. In fact, the combination of Geostationary and low latency Medium-Earth Orbit satellites is a technological leap that supports innovative solutions for governments.

The company's satellite fleet is a force multiplier for various missions and provides flexible, scalable and resilient services in all parts of the world. Today, SES Networks is providing solutions to defense and security stakeholders and fully supports 70 government entities across the world.

In the ISR domain, for example, innovation is aimed at leveraging high throughput, low latency capability to bring UAS platforms that today have the capability of generating 5 to 10 Mbps of data capability to the needed delivery of greater than 50 Mbps during the execution of their missions. This promotes surveillance and reconnaissance missions to an entirely new level of competence.
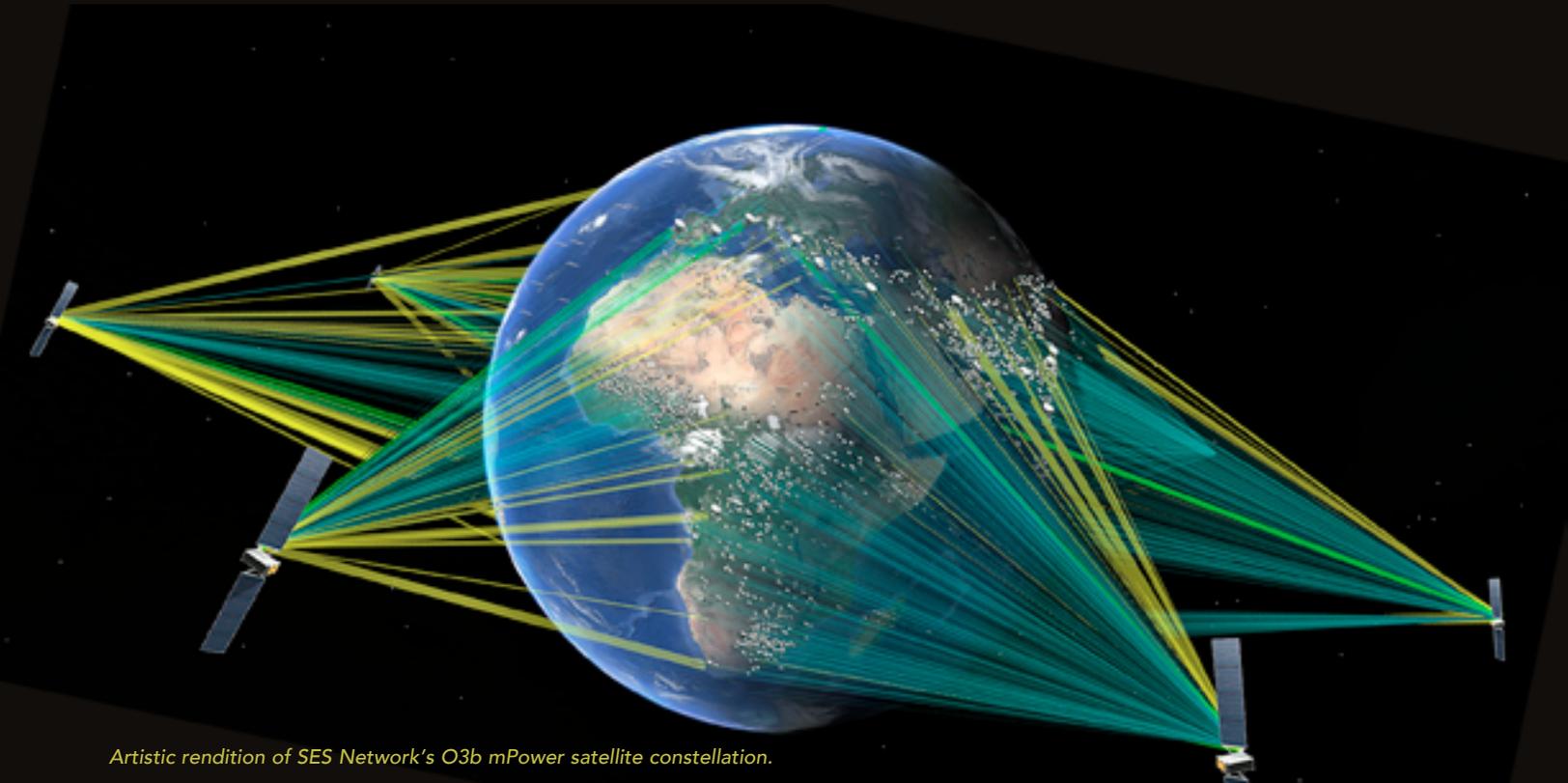
Artistic rendition of SES Network's O3b mPower satellite constellation.

An example of partnership that drives innovation in GovSATCOM is the recent agreement between SES and the European Space Agency (ESA) that was announced in November. This is an important step for the European space industry in supporting the EU's GovSATCOM initiative and leveraging governmental and commercial satellite services.

The SES led project aims to bring together a consortium of European partners to deliver secure pooling and sharing of commercial and Government SATCOM in support of cross-EU SATCOM needs.

Pacis-1 will demonstrate in-field usage of the system for civil protection, border control, humanitarian missions, maritime surveillance, among other applications. The mission will pave the way for governments to obtain flexible access to secure SATCOM in a cost-efficient manner. The members of the consortium will be providing specific technological contributions, including engineering, satellite capacity, commercial, project management and other services.

Powering Government Missions
SES's satellite systems offer security required for government missions, leveraging its multi-band capabilities.

In the ISR arena, the company has a track record in providing services to support UAS platforms for a number of governments and institutions across the world, including in the U.S. Furthermore, GovSat, a public-private partnership between SES and the Government of Luxembourg, delivers services for the Alliance Ground Surveillance (AGS) program for NATO. GovSat is already providing secure SATCOM capability to deployed military users in advance of the company's first satellite launch, GovSat-1, this year.

The missions supported by SES's capabilities include sophisticated scenarios, whether airborne, maritime or terrestrial. In 2017, SES's fully-owned subsidiary, SES Government Solutions (SES GS), won several key contracts to provide critically important managed network services to the U.S. Government. Through the leverage of SES's MEO satellite network capabilities, SES GS delivers nearly 4 Gigabits per second of managed services in support of 13 global sites and will serve customers that range from the Department of Defense (DoD) to the National Oceanic and Atmospheric Administration (NOAA).

In 2017, SES also expanded services for maritime missions for various governments, such as serving Navy missions for an ASEAN nation as one such example.

Reliable Connectivity
Beyond traditional defense and security requirements, institutions and international organizations leverage SES's solutions for such applications as supporting exploration, e-inclusion initiatives and disaster relief.

As a case in point, SES Networks is involved in supporting connectivity service for several hundred expeditioners in the Antarctic. Recently, SES also deployed high speed connectivity solutions for peacekeeping troops who are engaged in some of the most challenging regions in Africa.

Throughout 2017, SES's capabilities have been driving the important mission of bridging the digital divide by providing hundreds of Mbps of connectivity in Africa. One such example is Burkina Faso, where SES Networks has been providing the full end-to-end connectivity solution to connect more than 880 sites for e-government, e-education and e-health. Supported by the Luxembourg Development Cooperation project and the Government of Burkina Faso, the initiative is changing the connectivity landscape throughout an entire county.

Governments and international organizations also leverage SES's capabilities to support disaster relief efforts. Following

the devastating Hurricanes Irma and Maria in the Caribbean, emergency.lu — a public-private partnership with the Government of Luxembourg — provided connectivity to humanitarian responders in collaboration with the World Food Program and the Emergency Telecommunications Cluster. The portable emergency.lu terminals accessed dedicated SES capabilities to re-establish vital communications at the airport in Saint Martin and coordination centers in Dominica.

SES Networks also collaborated with Project Loon to restore 4G connectivity in Puerto Rico, where satellite-enabled solutions are playing an important role in the island's restoration efforts — in close collaboration with local and international partners.

Acceleration of Capabilities

SES has been spearheading the deployment of High Throughput Satellite (HTS) capabilities to better serve commercial and government applications fueling the need for data.

To continue enabling a wide array of innovative applications across the world, SES will be launching eight additional MEO satellites throughout 2018 and 2019, as well as GEO HTS. Early 2018 will note the launch of GovSat-1, a military frequency satellite with encrypted command and control as well as anti-jamming capabilities. The satellite will offer X- and military Ka-band capacity over Europe, Africa, the Middle East, as well as the Atlantic and Indian Oceans.

In September of 2017, SES announced the firm's revolutionary O3b mPOWER satellite system. Flexible and shapeable according to changing needs, the new system will offer a dramatic increase in throughput, being capable of delivering multiple terabits of throughput globally to power any mission imaginable, anywhere. A constellation of seven satellites for O3b mPOWER system is scheduled for launch in 2021.

During 2018, SES will continue to increase the focus on tailored end-to-end GovSATCOM solutions to deliver resilient, diverse and robust communications systems. The company will work closely with governments and institutions to customize connectivity for applications such as border control, ISR, specifically devised connectivity platforms for rapid response, and more.

www.ses.com/networks/government/

Nicole Robinson serves as the Senior Vice President of Global Government for SES Networks and the Managing Director of 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 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. She was the recipient of the 2012 Future Leaders Award by the Society of Satellite Professionals.

International and is a member of "The FEW," an invitation-only assembly of senior executive women.

Artistic rendition of the SES GovSat-1 satellite.

A GLOBLSTAR PERSPECTIVE

Security and more... multi-tasking with satellites

By Gavan Murphy, Director of Marketing EMEA at Globalstar

Today's satellite technologies are helping organizations enhance security through reliable tracking of assets and people. However, these systems simultaneously deliver many operational benefits. Gavan Murphy explores how flexibility, functionality and reliability all come together with satellite solutions for security.

Security seems to be at the top of everyone's mind today. Government agencies, first responders and NGOs are all placing more emphasis on safeguarding staff and assets as these essential workers travel to ever more remote locations and play vital roles in hazardous environments.

In part, this is because regulators are increasingly mandating that organizations demonstrate a commitment to upholding the welfare of personnel. Commercial and non-commercial entities have a duty of care to safeguard staff who work alone, or in isolated regions, and those who face hazards on the job.

At Globalstar, the company sees satellite solutions for such environments used in ever more diverse security situations, including tracking and securing fixed and movable assets as well as people. Users of such crucial services span emergency services, military and defence organizations, non-governmental first responders as well as other authorities that are responsible for delivering public services and managing resources.

Importantly, the technologies in these deployments are fulfilling additional roles for users, including enhancing operations, maximizing the value and lifespan of their key assets as well as cutting costs. When that money is public money, such as in the case of emergency services, it is in everyone's interest that the funds are well invested.

Geo-fencing security

One of the most valuable security features of satellite enabled asset tracking is the ability to create a geo-fence.

A geo-fence is a virtual, invisible enclosure that determines where an asset, such as an item of heavy machinery, can move. The system can be established so that, if the item moves outside of this virtual fence, an alert will be issued. For instance, such a message could be sent via SMS to alert the user that something is wrong and can help forestall attempted thefts.

Wildfires burning in the Castilla-La Mancha area of southeaster Spain.

These systems are highly flexible and configurable. Satellite trackers can check in on an asset just once a day, or more frequently, should the user so wish. For instance, a drill for excavation equipped with a small tracking device will ping at pre-determined intervals to verify location or will provide notifications if the asset has moved.

The user can be made aware when equipment has been stolen or used in an unauthorized manner. Plus, the motion sensors can expand the security possibilities to include monitoring of doors being opened or closed, and so on, and can be adjusted to the required sensitivity.

A firefighter using his SPOT Gen3 tracking and safety device.

Protecting EU peacekeeping personnel

Kosovo and Georgia are striving to build a better future for their citizens. EU peacekeeping organizations European Union Monitoring Mission in Georgia (EUMM) and EU Rule of Law Mission (EULEX) are charged with maintaining law and order in the region, as well as with carrying out judiciary, policing duties and border patrol.

Officials were committed to finding a technology that would reliably track and safeguard their staff, even when in locations beyond the reach of radio and GSM.

In early 2017, they deployed SafeFleet Telematics, which uses Globalstar satellite communications and chipset technology, and installed discreet tracking devices in their vehicles. Radio, GSM and SIM-based solutions had all been considered, but only SafeFleet Telematics was deemed able to deliver the required reach and reliability. The platform, developed by Globalstar VAR, ETA Automatizari Industriale SRL, based in Romania, is a bespoke solution.

The system ensures security teams know the exact whereabouts of peacekeeping staff as they travel across the region. However, SafeFleet Telematics does far more

EU peacekeeping organizations in Kosovo and Georgia have deployed SafeFleet that incorporates Globalstar's SmartOne technology.

in providing solutions. The technology also monitors driver behavior, with sensors measuring any erratic movement such as an engine over-revving, or sudden braking, and compares such actions against GPS positioning to help identify irregularities.

The technology allows these EU organizations to monitor fuel consumption and other engine metrics to optimize vehicle performance and better manage fleet maintenance schedules. This helps the vehicles to stay in serviceable life for longer, and helps reduce maintenance costs and vehicle downtime.

Motion sensors and GPS gather and transmit asset status information over Globalstar's satellite network such as movement and location reports, stop/start messaging and theft recovery alerts via email or text message. The system also transmits data on battery status, input alarm status and diagnostic information.

In addition to satellite communications, this deployment uses RFID-based identification to ensure the driver of the vehicle has the correct authorization and is in possession of the required licenses. Also, as an additional safety measure, a one-touch panic button on the dashboard enables the driver to alert security teams and to summon help in case of an emergency.

Furthermore, this intelligent system uses GSM when is available and, when it is not, automatically switches to satellite. This smart network swapping capability maximizes cost effectiveness, while ensuring uninterrupted connectivity.

Security in the SPOTlight

Although originally being developed as a tracking and safety device for adventurers and outdoors enthusiasts — the first generation of SPOT was launched in 2007—- now in its third generation, SPOT Gen3 is more popular than ever with consumers as well as increasingly being used to enhance the safety of lone and remote workers. SPOT has helped in 5,500 rescues worldwide to date.

SPOT uses satellite communications to share the user's location via Google Maps. If someone is faced with an emergency, with just a single press of the SOS button, the user's GPS coordinates will be instantly transmitted to the GEOS International Emergency Response Center where rescue notifications to search and rescue authorities will be initiated and managed.
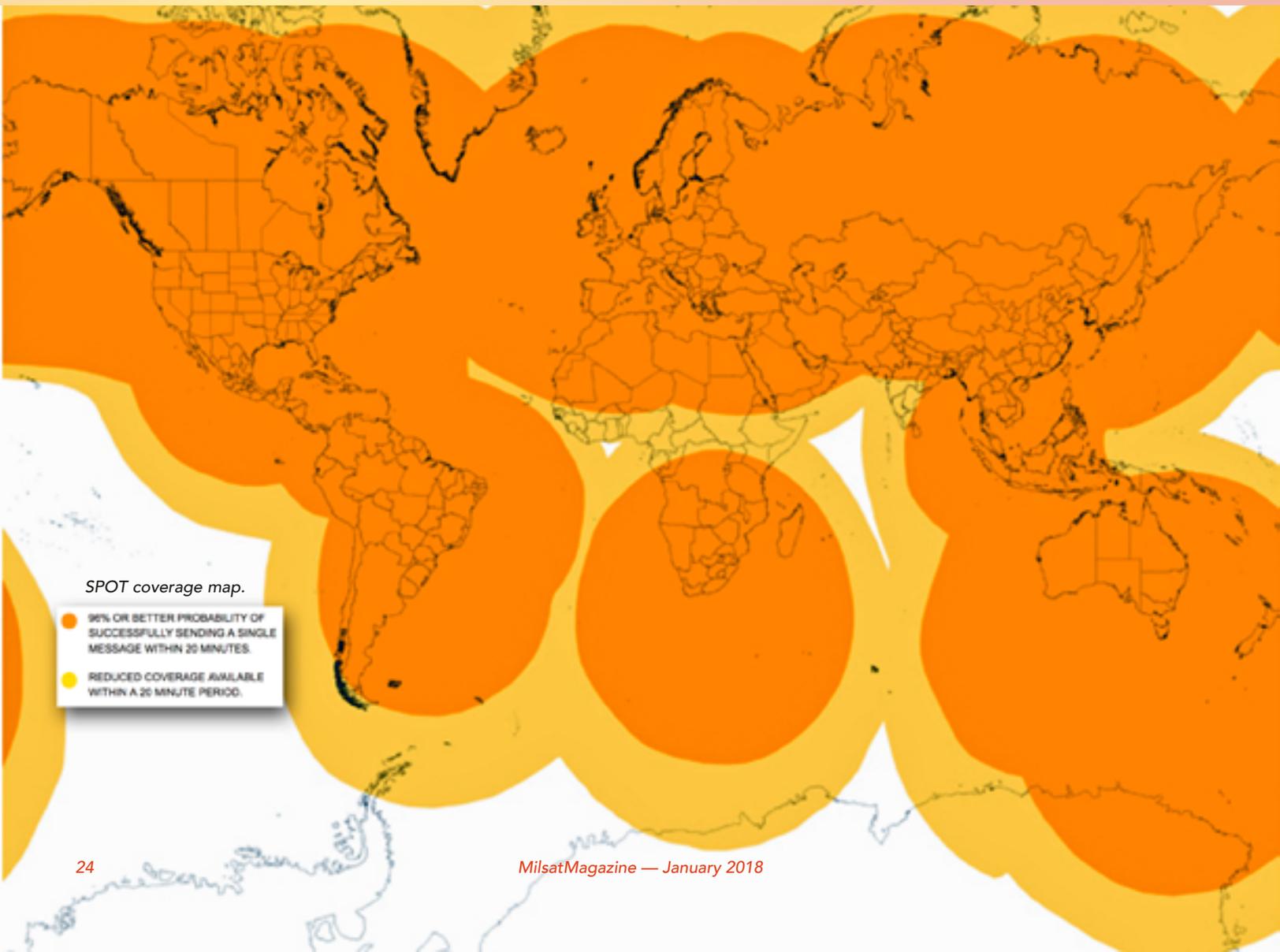
SPOT coverage map.

96% OR BETTER PROBABILITY OF SUCCESSFULLY SENDING A SINGLE MESSAGE WITHIN 20 MINUTES.

REDUCED COVERAGE AVAILABLE WITHIN A 20 MINUTE PERIOD.

Safeguarding First Responders

First responders are among these professional groups who have embraced SPOT.

As fire authorities strive to improve operational efficiency, and to better safeguard crew, they are increasingly turning to satellite technology.

Castilla La Mancha is a vast region in central Spain where forest blazes and wildfires are a fact of life. Junta de Castilla La Mancha, the administrative authority whose responsibilities include forest fire and wild fire management, employs some 2,000 response personnel who are always on standby to help keep forest and wildfire at bay. The administration recognized a need to enhance safety for crews in the extremely dangerous situations they routinely face.

Junta officials talked to wildfire solutions specialist Technosylva, provider of fire behavior analysis and management software. Joaquin Ramirez Cisneros, Principal Consultant at Technosylva, explains why Globalstar's SPOT Gen3 was chosen to meet the Junta's requirements as an integral part of his company's Wildfire Management System, fiResponse.

"*To keep firefighters safe, it is critical to know where exactly they are at all times,*" he explained. "*The positions of the crew members need to be known in relation to the engine and equipment resources being used, and it is particularly important to know how far away they are from the heart of the fire. Providing these professional teams with the communications support they need in the extremely dangerous situation of wildfire is an absolute must.*"

However, this satellite technology is doing more than helping keep firefighters safe — it is helping them manage fires more effectively.

Juan Bautista Garcia, Wild Fire Coordinator at GEACAM (Public Agency of Castilla La Mancha), said, "*Tracking our crews with SPOT fundamentally changes the way we can face operations. Not only is safety dramatically improved, providing situational awareness in real time to all of the organisation, it also helps to improve our response and tactics. The integration of the SPOT Gen3 within fiResponse is helping us to provide a better service accomplishing the highest standards of safety in the most efficient way.*"

The authorities also installed SPOT Trace satellite tracking devices on pumps, helicopters and aerial fire apparatus, allowing operations coordinators to know precisely where their resources are, where they need to be, and how much time it will take for them to get there.

Security support for NGOs

During the many unfortunate natural and man-made humanitarian crises across the globe, first responders and NGOs offer a vital lifeline to stricken communities.

The dangerous nature of many of today's humanitarian aid efforts makes it essential for these individuals, many of whom are volunteers, to consider their own safety before they can help others who are in dire need. Specifically, a number of crucial communications-based security measures need to be in place. The Lebanese Red Cross, for one, uses SPOT Gen3 to track the location of its volunteers and search and rescue teams as they respond to critical emergencies.

Rodney Eid, Assistant Director for Crisis Management at Red Cross Lebanon, said, "*Our volunteers and staff operate in some of the most difficult environments across the country. With SPOT Gen3 we have the reassurance that our hard working team is safe and, if they are in life-threatening situations, they can press a single button and we can quickly respond.*"

These devices facilitate the delivery of first aid and other support to those in need while helping NGOs better manage their organizations and coordinate operations. They also help improve inter-NGO coordination.

Disaster Tech Lab (DTL), for instance, is a non-profit organization that provides communication technology to support humanitarian relief in the world's disaster zones. Since 2015, DTL teams have been assisting with the refugee crisis that is affecting Europe and the Middle East.

Evert Bopp, DTL founder and CEO, said, "*We are using SPOT Gen3 trackers to remotely keep track of our teams. The devices allow us to have an instant overview of our teams' locations and enable improved response times and efficiency. Overall, having this technology on hand has greatly improved our organization's efficiency and coordination.*"

VARs show their creative flair

The success of these deployments owes much to the creative engineering from Globalstar's value added reseller network. While security is the primary driver for many customers, quite evident is that satellite solutions offer many additional features that yield a broad range of operational and resource management benefits. As NGOs, first responders and other providers of essential public services maximize the value of their investments in satellite technology, they also find they are getting better return on investment in key assets.

www.globalstar.com/

Based in Globalstar's European HQ in Dublin, Gavan is responsible for the development and implementation of Globalstar's marketing strategy across the European, Middle Eastern and African regions. He spearheads the marketing of Globalstar's consumer products, including the SPOT tracking solutions portfolio, as well as the B2B marketing of voice & data solutions for a range of vertical sectors including maritime, energy, safety & security, commercial fishing and shipping, construction and heavy industry as well as the burgeoning M2M/IoT sector.

AN AVWATCH FOCUS

Restoring hope... WiFi in storm-ravaged Puerto Rico

Their destination was a stricken community in Puerto Rico, but for how long they were unsure — the extent of the damage was unknown, as the Category 4 storm had wiped out all communications.

This is why the Massachusetts-based team of four set off for the devastated island with nearly 1,000 pounds of mobile network gear, cases of water, and enough dried food to last them several weeks.

The Avwatch team, a nationally-recognized leader in disaster response and mobile tactical networks, was on a humanitarian mission to establish Mobile Ad hoc Networks (MANET) in areas where critical communications had gone dark after Hurricane Maria struck and devastated the island.

From left, members of the Avwatch team, Ryan Kowalske and Marcus Tooker, deploy specialized gear to re-establish Internet connectivity in Puerto Rico in the wake of Hurricane Maria.
Photo is courtesy of Avwatch.

We didn't know what we were walking into," said Marcus Tooker, Avwatch VP of operations. He said a private foundation director contacted the team, recognizing them for their proven emergency response and network expertise in past disasters, and requested their assistance in Puerto Rico.

The director gave them a contact on the island — Christine Enid Nieves Rodriguez — who runs a community center in Mariana. The center, which feeds more than 300 people a day, had been without power, connectivity, and logistical support for weeks following the hurricane. With food and water in short supply and no means of communication, many more desperate people were showing up at the door.

With widespread devastation, and time running out several weeks after the storm, Nieves would help the Avwatch team prioritize once on the ground, the director said.

The AVwatch team landed on the eastern side of the island in the city of Humacao. With only a specialized hand-held radio, battery, and solar panel, they quickly found and patched into an existing WiFi signal and pointed that signal toward the mountains. With the main hub established in Humacao, the team then deployed relay gear in the mountains and created a wireless network of nodes, extending connectivity to outlying and otherwise cut-off communities.

Among the first was Mariana.

The team established a hot spot at the community center, and at the advice of Nieves, they established additional nodes in nearby towns, one at a local church about 20 miles away which was served as a high-capacity community center, as well as three hospitals. For the first time in weeks, people were connected with their loved ones. Some were without internet or cell service for nearly a month and didn't know if family members were alive.

"*Many people on the island don't have cars,*" Tooker said. "*And if they did, there was so much damage it was difficult to get around.*" He said that while many people were without cars, nearly everyone he encountered had a cell phone. "*But without a signal, the phones did them little good.*"

Tooker said because they were without power for so long, most of the phones were dead. This meant that the team also had to set up generators in some areas, and solar charging stations in others. In a short period of time, with connection reestablished and batteries back to full power, Tooker said he witnessed hope being restored for many residents.

"*Just as an example, we had these three guys who hadn't been able to contact their families in like a month,*" he said. "*In less than ten minutes, we had them charged, connected, and in touch with their loved ones.*"

He watched the three men celebrating and exchanging high-fives as they each learned their aunts, uncles, and other extended family and friends were alive and well.

Similar cheers continued and multiplied throughout the community center as more and more people charged their phones, connected to the ad-hoc hot spot, and contacted friends and family on the island and elsewhere around the world for the first time in weeks.

The Avwatch team used lightweight antennas, handheld radios, and solar panels to re-establish internet connectivity in Puerto Rico in the wake of Hurricane Maria
Photo is courtesy of Avwatch.

"*As an emergency response company, that's a big part of why we do this,*" said Chris Kluckhuhn, Avwatch CEO and retired U.S. Coast Guard Cmdr. He said the other part of the operation is to connect managers like Nieves to vital resources after disasters. "*We've spent a decade perfecting our ability to rapidly provide wide-range communications to the most critical areas and link responders with resources,*" he added. "*And we do it with minimal infrastructure and personnel.*"

He said with a small ground support team placing lightweight but powerful nodes and solar panels on mountaintops, the team could effectively create a semi-permanent internet network across Puerto Rico's entire 3,500 square miles.

In the days and weeks that followed, Nieves used the Avwatch network to continue managing the center, coordinating logistics, food, and medical deliveries, and soliciting volunteer support and donations via social media.

While no one can predict the weather, looking ahead, the Avwatch team anticipates more hurricane responses in the future. Like any emergency response team, Tooker said they hope for the best, but are prepared for the worst.

"*If next year is anything like this year, we'll be front and center, and ready to help again,*" he said.

avwatch.us/

The Avwatch team consists of nationally-recognized homeland security experts, each well-versed in military, federal, state, and local disaster response planning and protocols. Avwatch technology has been used during security efforts at Super Bowl 50, the Boston Marathon, and emergency responses including Hurricanes Sandy, Irene, Irma, Maria, and the 2010 Deepwater Horizon oil spill response.
The company provides training for U.S. Air Force and Marine forces prior to overseas deployment and offers a wide range of aerial platforms in support of advancing UAS technology.

DEMYSTIFYING THE CNSSP-12, WITH ANDREW D'UVA OF PROVIDENCE ACESS COMPANY

By Ryan Schradin, Executive Editor, Government Satellite Report, and Senior Contributor

The United States military has long enjoyed a tactical advantage from space — SATCOM, GPS and other satellite services and capabilities have given our warfighters an edge on the battlefield. But this hasn't gone unnoticed by our adversaries.

One of the military's largest concerns today involves the space domain. Space is increasingly congested and our adversaries are becoming increasingly capable of compromising and attacking our satellites. With many military IT capabilities, applications and services traveling over satellites, cybersecurity is becoming increasingly essential.

One of the policies that the government has put in place to ensure the security of the satellites the military is using in-theater is *Committee on National Security Systems Policy 12* (**CNSSP-12**).

That policy is currently being reevaluated and refreshed, and new standards and requirements are scheduled to be released shortly.

To learn more about CNSSP-12, its history and its impact on the satellite industry, a discussion was conducted with *Andrew D'Uva*, the President of **Providence Access Co.** and the U.S. Industry Liaison on the *Commercial Space Infosec Working Group* (CSIWG), which is giving the satellite industry a voice in the CNSSP-12 refresh process.

During the first part of a two-part interview with Andrew, CNSSP-12 is defined, how the policy has evolved over time and how it helps the Commercial Satellite Communication, or COMSATCOM industry, serve the federal government.

Government Satellite Report (GSR)
What is the CNSSP-12? Why is a review and update currently being done? What is the status of the CNSSP-12 review/update right now?

Andrew D'Uva (AD)
The CNSSP-12 is effectively the CNSS policy number twelve. It's a formal policy of the CNSS, which is the Committee on National Security Systems — a U.S. government interagency committee comprised of the DoD, National Security Agency (NSA), Central Intelligence Agency (CIA), Defense Intelligence Agency (DIA), FBI, the branches of the military, and other national security-focused government agencies and entities.

The CNSS puts out policies and implementation guidance on a variety of information security issues by developing operating policies, procedures, guidelines, directives, instructions and standards. Issues can range from the use of cryptography, secure modes of communications and other security challenges facing the nation.

CNSS Policy 12 is the evolution of an earlier set of policies designed to apply to the cybersecurity of space systems used to support national security missions. This policy isn't new, although it periodically gets updated. In the past, it applied to the U.S. government at large.

However, about ten years ago, it was updated to clarify that its requirements would apply to foreign and commercial systems used to support national security missions. That was the first time that the government said, "Here is a set of government requirements that apply to COMSATCOM operators and solution providers serving national security missions."

In the past, COMSATCOM providers wouldn't have to worry about a policy like this – they would just provide a commercial solution to the government. But the new, updated policy implied a number of cyber security requirements needed to be added to these systems due to their critical role in national security missions.

The policy was updated as part of a normal review process that is supposed to occur every few years. That review process is occurring again right now, with a new update anticipated to be released in early 2018. These updates and reviews are necessary because threats change, and the government's approach to vulnerabilities has to change and evolve with them.

GSR
You mentioned that CNSSP-12 has been updated and changed over time. What has changed and what new requirements have been added?

AD
CNSSP-12 levied a requirement in the past stating COMSATCOM systems that served national security missions would have to use what is called NSA-approved cryptography and cryptosystems to protect the satellite command uplink between the ground and satellite.

That meant that satellite operators had to design, equip, and operate their satellites using a system that had been reviewed and approved by the NSA on their spacecraft that would apply an approved cryptographic system implementation to secure the commands between the ground and the satellites.

NSA-approved solutions protect the confidentiality and integrity of the commands, preventing third parties from seeing or altering commands in transit to the satellite. This was a requirement that applied to government systems in the past, but the CNSSP-12 policy effectively extended it to commercial systems.

As a result, almost all communications satellite companies that want to do business with the military have worked this into their satellites. It costs them more money and there's more security involved, but it's been largely accepted by industry. It has largely been a policy success for the government.

The policy change and update in 2012 involved a new requirement for securing the telemetry — the information traveling from the satellite to the ground regarding its health, safety and monitoring.

The update called for similar NSA-approved systems to be used to protect that information in the downlink direction.
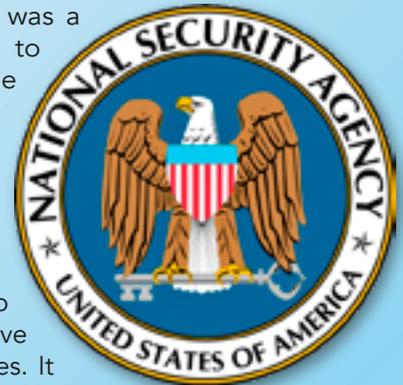
That has been slower to be adopted by industry because of a lack of available systems. However, we're starting to see that get worked into COMSATCOM systems that are used for national security missions.

GSR
How does the CNSSP-12 enable commercial operators to better serve government needs?

AD
Ultimately, all of these policies and policy changes are all about reliability and robustness. The government wants to use COMSATCOM and commercial imagery, but they want to be sure that those solutions are of high quality and available when needed. CNSSP-12 improved that resilience posture and made them more robust.

A satellite with these solutions — in contrast to one without them — is less vulnerable to being impacted by adversaries. With space becoming an increasingly contested environment, and with our adversaries recognizing the advantage that the U.S. military gains from its satellite infrastructure, this is an increasingly realistic concern for today and into the future.

GSR
How are the commercial operators participating in the CNSSP-12 refresh effort? How has this matured over time?

Andrew D'Uva
Up until this last refresh cycle, the government was the sole driver of the refresh activities. However, in the last refresh cycle, the government — specifically the NSA and DISA — established a working group called the Commercial Space Infosec Working Group (CSIWG), which was open to U.S. industry and designed to look at information security issues, including policy issues.

I serve as the U.S. Industry Liaison, and I lead the CSIWG with two other leaders from the NSA and DISA, respectively, along with a steering committee of industry executives.

The CSIWG meets a couple of times a year at various sites, and – through the efforts of the NSA — they work to inform industry about the policy review process and get industry comments.

Through the CSIWG, industry leaders have authored a series of inputs and comments for the government. These comments specifically addressed the current policy, the role of commercial providers, the applicability of CNSSP-12 to commercial systems, as well as some technical issues with downlink telemetry and transmission security and how it is applied. The NSA then took these comments and inputs into the process for consideration.

The government hasn't shared this revised CNSSP-12 yet with industry, but there are indications that some of that input was taken into account and worked into this guidance.

www.providence-access.com/

Editor's note: Ryan's Q&A with Andrew D'Uva will continue in part two of this interview in a future issue of MilsatMagazine. Andrew will share his predictions for what will change in the refreshed CNSSP-12, discusses how it will impact space policy for the military and discusses the impact CNSSP-12 will have on the SATCOM industry.

This article is republished, courtesy of The Government Satellite Report (GSR) and Executive Editor Ryan Schradin. He is a communications expert and journalist with more than a decade of experience and has edited and contributed to multiple, popular, online trade publications that are focused on government technology, satellite, unified communications and network infrastructure. His work includes editing and writing for the GovSat Report, The Modern Network, Public Sector View, and Cloud Sprawl.
His work for the Government Satellite Report includes editing content, establishing editorial direction, contributing articles about satellite news and trends, and conducting written and podcast interviews. Ryan also contributes to the publication's industry events and conference coverage, providing in-depth reporting from leading satellite shows.

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AN IRG FOCUS

Satellite innovations for solving interference

By Martin Coleman, Executive Director, Satellite Interference Reduction Group

Interference won't go away unless the industry supports a fix for the problem — interference effects the delivery and issuance of mission data for militaries and governments as well as revenue generation for commercial entities. Users expect efficiency and reliability from satellite — ignoring the problem only compounds the problem further and damages the reputation of the industry.

There are some who might claim incidences of interference happen so rarely that such does not warrant industry attention. This is not the case and points to the challenging work of satellite operators who usually move transmissions to another space to immediately restore the service to the user. In the short term, this does ensure continuity but only results in vast amounts of unusable spectrum.

Fortunately, and on the back of various initiatives, there are many new technology solutions that look promising in terms of solving, or at least lessening, the problem of interference.

Carrier ID — The Hoped-For Solution?
The creation of Carrier ID (CID) was the result of the satellite industry attempting to uncover a solution for broadcasters who were struggling with disruption-causing interference. In fact, the IRG was in league with the manufacturers that successfully lobbied the DVB to create a specification and allow CID capabilities to be implemented in all new modems and modulators as standard.

At present, the IRG has also encouraged operators to integrate CID detection across networks — there remains much work to do to encourage users to replace legacy equipment and witch Carrier ID on. Although CID enabled, most equipment is shipped with the setting turned to 'off.' As an embedded code containing contact information, CID enables satellite operators to rapidly and easily identify the source of an interfering carrier.

IRG is now working on a Carrier ID alternative, a "dongle" that will simply connect externally to any modulator and will cater to all types of services, including those less than 128 Kbits — that should appeal to the military and broadcasters alike. In addition, the IRG aims to work with manufacturers to default CID to 'on' at shipment.

Carrier ID has been the hoped-for solution but the take-up of the technology is rather slow. On one hand, in regular cases of interference caused by human error or equipment failure, CID is a quick way of resolving interference. Do not forget that most cases of interference are caused by those mentioned reasons. In an instance where interference is affecting a transmission, a simple call is all it usually takes to alert a user to a problematic carrier and to resolve the issue.

The real by-product of CID is that the technology and methods to detect CID have led to more products being developed to mitigate interference directly, from cancellation to automatic avoidance. The technology has also led engineers to develop ways to resolve burst-mode VSAT transmission issues quickly as we shall see next.

Have New Tools Produced the Desired Effect?
The inception of burst-mode networks using Very Small Aperture Terminals (VSATs) was a double-edged sword for broadcasters. The terminals presented unique opportunities for Satellite News Gathering (SNG), but at the same time, the VSATs themselves have also contributed to higher occurrences of satellite interference than any other system. Many of IRG's members over the years have reported endless cases of interference when mobile VSATs are in the area.

Mobile VSATs are prevalent in all sectors of the industry, especially given the growth and size of the provided networks. This now includes Outside Broadcast (OB) trucks which present a significant problem, mainly because the terminal is constantly on the move.

Most cases of VSAT interference stems from misaligned terminals, where the margin for error during setup is small, resulting from human error or manufacturing standards being reduced to keep costs low. Whether for military or broadcast professionals who only possess minimal training, this combination of underlying issues is problematic. With the ever-increasing reliance on VSAT by the military, agencies, governments and commercial sectors, the reliance on mobile VSAT looks set to dramatically increase.

Thankfully, IRG members have been pioneering methods and products designed to limit the extent of VSAT interference, and in some cases to solve this challenge altogether.

Different methods and tactical choices can be implemented in order to limit VSAT interference. One such tactic is to move to circular, polarized higher frequency bands. This means users have no need to manually adjust polarization and that reduces one element of interference caused by human error. Unfortunately, rarely is a solution perfect, and the result of high frequencies is poorer cross-polarization performance. A multi-faceted problem needs a multi-solution approach

and this is where the innovative products are delivered by IRG members.

One such product comes from Kratos and is called SatGuard. This interference monitoring system was developed due to the work the company has done with CID. As a result, SatGuard is one of the first mitigation tools that can effectively and quickly resolve VSAT interference for the broadcaster, and other users.

Another product is Satmotion Pocket from Integrasys and has proven to be highly successful at preventing the problem of human-induced VSAT interference before such even occurs. Satmotion Pocket does so by assisting non-satellite professionals during the setup procedure to correctly install equipment to prevent any errors during operation. Uniquely, as a downloadable app, Satmotion Pocket feeds back measurements and error alerts to any mobile device via an easily-navigated interface, acting as an effective monitoring tool as well.

Geolocation — Getting Smarter?
Currently, identifying the origin of an interfering carrier could take days, weeks or even months. These investigations also occupy manpower and resources from other revenue-generating activities.

One would hope, in most cases, that users have Carrier ID switched on, but this is not always the case, particularly in the case of a jammer. As a result, many of the mitigation tools conceptualized recently only work to either locate sources of interference or lessen the effects of interference when it occurs. Geolocation is one of the former.

In the past, Geolocation was an expensive tool, but has come a long way in a short space of time. IRG member Siemens Convergence Creators has now developed a Satellite Geolocation Service that now covers practically all of Earth's inhabited land masses. By providing and operating the service, Siemens ensures operators no longer have to invest money into infrastructure and training personnel to take advantage of this effective solution. The service also boasts localization success rates of more than 60 percent compared to that of previous localization systems at a hit-rate of around 30 to 40 percent. Collecting accurate and reliable ephemeris data, geolocation at sub-kilometer accuracy could be obtained if investment in the technologies continue unabated.

Another organization working to improve Geolocation is the Space Data Association (SDA) whose Space Data Center (SDC) 2.0 is currently in development and will include geolocation solution sets. This will mean that when an operator needs to perform a geolocation, the system will be able to identify the best match for a neighboring satellite to enable geolocation to be performed. As most operators are unlikely to always have a second satellite nearby, this will drastically reduce the time to identification and resolution.

Big Data and Machine Learning — Where Will They Take Us?
Big Data is a 'big' concept, no pun intended. Essentially, for IRG, this involves making effective use of the organization's own data as well as referencing the world's vast quantity of data, and then asking the correct questions to help to more efficiently predict and resolve occurrences of interference. Machine learning goes hand-in-hand with this as a method of analyzing data using algorithms to find hidden patterns or solutions.

Data is, quite literally, everywhere. The analyst firm, IDC, predicts that by 2020 the amount of data around the globe will equal 40 zettabytes. Consider for a moment that Mark Liberman calculated the storage requirements for all human speech ever spoken at 42 zettabytes if digitized as audio.

If every statistical piece of information within our satellite industry is retained, Machine Learning can be applied to help predict future incidences and, ultimately, solve them in the first place. With the growing complexity of networks and particularly for those experiencing intentional jamming due to hostile and/or political reasons, analyzing data from across the globe to predict potential incidences of interference would certainly benefit militaries and governments as well as broadcasters.

The satellite industry has long been considered a forerunner of new technologies — IRG has definitively recognized the benefits of Machine Learning as the base of future tools using Big Data to improve satellite communications themselves as well as to ensure SATCOM's reliability by solving interference and ensuring reliability.

Win the Battles to Win the War
The satellite industry plays an essential role in many operations within numerous sectors and must "keep up" to remain relevant. As innovation continues to ensure satellite communications are consistently seen as the reliable and efficient choice for users, military and commercial, the same must be done in terms of corresponding mitigation technologies. If the problem is ignored, perhaps users such as military comms specialists and broadcasters will look elsewhere for less expensive, better quality and more reliable options.

By continuing to develop solutions, interference could well become a problem of the past. In the meantime, the small victories should be celebrated, all the while ensuring current solutions do not stagnate but continue to advance for the benefit of all.

satirg.org/

Martin Coleman is Executive Director, IRG, and spearheads significant initiatives and introduces new technology and processes to mitigate all types of satellite interference: VSAT TDMA Systems, BIG Data; a reference guide to Interference; sorting out difficult cases, including new standards and processes within the Geolocation industry; he also assists the ITU in dealing with Harmful Interference and implementing Carrier ID (CID).

AN XTAR FOCUS

Combating interference

Team Leader: "*Mission Control, this is Team Leader. In position. Waiting video feed. Over.*"

Mission Control: "*Mission Control. Wait. Out.*"

Team Leader: "*Team Leader. We are in position. Is mission on? Window is small, and all elements in position. Just need that drone video. Over.*"

Mission Control: "*Mission Control. Wait. Video corrupt. Attempting to correct. Over.*"

Team Leader: "*Team Leader. What do you mean video corrupt? Is the drone up there? I need that video before final insertion!*"

Mission Control: "*Mission Control. I think we have some interference going on. Seems to be messing up the video feed. Over.*"

Team Leader: "*Team Leader. Window closing. Targets moving out. I must have that video now, if we are to continue the mission. Over.*"

Mission Control: "*Mission Control. Something's definitely interfering with the video. There's nothing I can do. Advise mission abort. Over.*"

Team Leader: "*Team Leader. Mission abort!? Are you crazy? We've been planning this for weeks. We'll have to go in without the intel. Over.*"

Mission Control: "*Mission Control. Team Leader, video is definitely being interfered with. Mission is compromised. Abort. Move to extract point and return to base. Out.*"

Much focus has been devoted to satellite interference recently, as well it should be. Interference is a serious issue for satellite operators and the problem will likely worsen.

The increase in number of satellites orbiting, the rise of High Throughput Satellites (HTS) employing multi-spot beams and the reduction in antenna size all mean that the potential for interference will only increase.

When discussing satellite interference, the tendency is to categorize it into two main types that users typically encounter; adjacent satellite interference and accidental interference.

When government or military users experience either form of interference, their mission is delayed and in some cases endangered. Time is lost and, in many instances, additional funds must be spent to remedy the problem.

To decrease the chance of any type of satellite interference, government and military users should rely on those frequencies dedicated solely to their use, such as Mil-Ka-band and X-band.

These frequencies have natural advantages that automatically translate into a lower chance of interference and therefore a greater chance to complete the mission.

When a user experiences interference, they are often assigned a new frequency, but it's not always possible to do so if there is no other frequency available.

Finding the source of the interference can often be difficult, and in many cases, is never discovered. Regardless of the type of interference or its cause, it can be a nuisance in the best-case scenario and a disaster in the worst.

Adjacent Satellite Interference (ASI) often occurs when using small terminals, typically sub-1.0 meter, a common size for Comms-On-the-Move (COTM) or Comms-On-the-Pause (COTP) situations.

Artistic rendition of XTAR-EUR X-band services satellite. Image is courtesy of XTAR.

4° spacing at X

2° spacing at Ku

X-Band provides less chance of Adjacent Satellite Interference
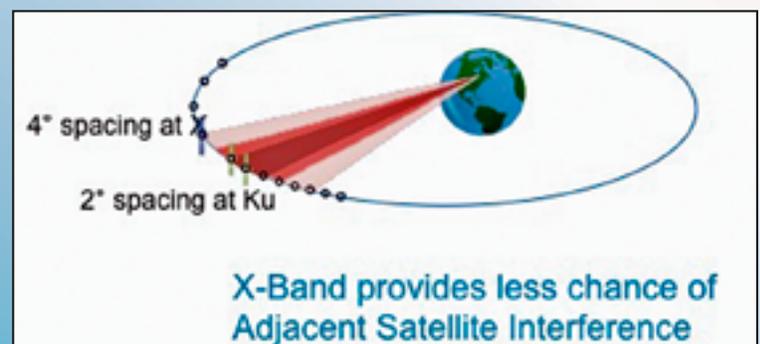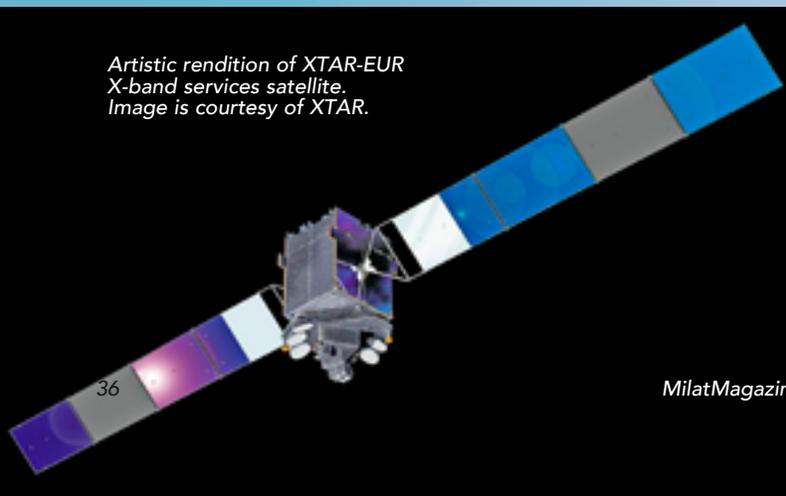
This is due to beam size; the smaller the terminal the wider the beamwidth. Therefore, small terminals are more prone to transmitting and receiving ASI.

Commercial band satellites, such as Ku- and Ka-band, are typically spaced apart at two degrees (sometimes even closer). This spacing makes users with small terminals vulnerable to ASI, as their beamwidths are larger than two degrees. In example, a parabolic Ku-band antenna smaller than about 0.8 meters would have a 3 dB beamwidth larger than two degrees in the transmit direction.

To avoid transmitting ASI, the EIRP spectral density (a measure of radiated power per unit bandwidth) is strictly limited in Ku- and commercial Ka- frequency bands. To stay within these limits, users must often use a technique called spread spectrum.

Spread spectrum allows a user to transmit the higher EIRP often needed by a small terminal to close a link by spreading the power over a larger bandwidth. However, doing so increases cost.

The result of spreading the signal can double, triple or quadruple the amount of bandwidth required. With this significant increase in bandwidth, the user may experience a cost higher than what might have been expected.

Orbital slots for satellites using military frequencies (X-band and Mil-Ka) are typically spaced four degrees apart (twice the spacing as their commercial counterparts). This wider spacing allows the coordinated EIRP density limits to be significantly higher than those at Ku-band and commercial Ka-band. The higher EIRP density limits allow even smaller sub-meter terminals to transmit, in most cases, without the need to use spread spectrum.

The second type of interference is accidental. The most common types of accidental interference occur when a user accidentally transmits at the incorrect frequency or transmits on the incorrect polarization.

Through the company's experience providing X-band, noted is that there is a significantly smaller base of users, as the frequency is reserved for military and other government users. While a smaller base of users creates a smaller chance of causing accidental interference, it is also true that when interference does occur, there is a smaller base of users to contact to correct the issue.

Cross-pol interference is a specific type of accidental interference and occurs when a terminal transmits at the correct frequency, but on the opposite polarization from that assigned. It is here that military frequency bands have a distinct advantage.

Ku-band and some commercial Ka-band operates with linear polarization and, to avoid interference, users must ensure their feed is properly aligned, either vertically or horizontally. This alignment of the feed on the terminal can be affected by wind or snow from a strong storm.

From the misalignment, that user's signal can begin to bleed into the cross-pol transponder and into another user's signal. In contrast, X-band and Military Ka-band both use circular polarization which does not require alignment. Therefore, users do not have to be concerned about the accidental misalignment of the antenna feed.

A discussion on interference would not be complete without mentioning jamming. Jamming is, of course, purposeful interference. With frequencies that are reserved for government and military use, we see a smaller chance of interference due to jamming.

Commercial Ku- and Ka-band equipment that can be used for jamming is readily available. In contrast, terminals operating at the military frequency bands are less available to those seeking to do harm and are mostly under the control of the military.

This means there is less likelihood that rogue militants would be able to jam communications on a satellite using military frequencies.

As more and more technologies arise, unfortunately the chance for interference also rises. Much discussion and effort have been devoted to mitigating interference. Nowhere is this more important than for the military user.

By using those frequencies specifically dedicated to the military and government user, the chances for interference are naturally reduced.

www.xtar.com

Founded in 2001, XTAR, LLC is the first commercial satellite operator to provide services in the X-band frequency. XTAR is a privately owned company backed by majority shareholder Loral Space & Communications of New York. XTAR also enjoys investment and support from minority shareholder Hisdesat Strategic Services SA.

XTAR launched its fleet without government funding, employing its own technical and financial resources for a system that is reserved exclusively for the benefit of the government user. Countries around the world trust XTAR to support critical services such as border security and information gathering.

AN LGS INNOVATIONS FOCUS

Optical Lasercom brings capacity and security to SATCOM links

By Tom Wood, Senior Director, Optical Communications and Networking, LGS Innovations

MILSATCOM networks face many challenges.

The demands on these networks include:

- *Carry more and more traffic, with constrained procurement budgets*

- *Give up dedicated RF SATCOM frequency allocations*

- *Make comm more secure and difficult to jam*

- *Operate on smaller, lighter, cheaper platforms that are robust against anti-satellite threats*

While traditional RF-based comm systems struggle to meet these demands, an emerging technology, free-space optical lasercom, can address all these areas. *Figure 1* shows the concept, with cubesat lasercom terminals.

A relatively modern RF SATCOM link operates in the Ka-band, at an RF carrier frequency of about 30 GHz. A free-space optical lasercom link uses light, instead of RF energy, to carry data.

A typical lasercom link operates at a carrier wavelength of 1.5 microns, or a carrier frequency of about 193 THz — that's 6,400 times higher than the RF link. For a given aperture size and link range, the lasercom beam spreads 6,400 times less than the RF link, meaning that a much higher fraction of the transmitted power is received.

The transmit light is literally laser-focused on the receiver. In practice, this means that lasercom links operate with much lower transmit powers, with much smaller apertures, and at much higher data rates, than RF links.

There are other advantages of operating at higher frequencies. For one, the bandwidth available for transmission is much greater. A Ka-band link might have 1 GHz of bandwidth allocated, but the bandwidth available for lasercom, largely determined by the bandwidth where good amplifiers can be made, is almost 8000 GHz. The need for bandwidth-efficient modulation is greatly reduced, leading to lower requirements for signal-to-noise. Furthermore, free space lasercom technology leverages the very large technology base of commercial optical fiber communication systems, where, for example, coherent modems handling 100 Gigabits/s/carrier are readily available for about $25K.

Because beam spreading is reduced, the problem of different users interfering with each other is greatly reduced. This leads to another advantage of lasercom: all this optical spectrum

Figure 1. Artistic rendition of a Lasercom smallsat constellation in space. Image is courtesy of LGS Innovations

Figure 2. LGS Innovations engineers prepare a High Power Optical Amplifier for thermal vacuum testing. Image is courtgesy of LGS Innovations.

is unlicensed and available at no charge. As demands for government users to migrate RF spectrum to civilian users grows, many missions dependent on SATCOM need to be looking to migrate to lasercom.

Security and anti-jamming is one more critical advantage of lasercom. An eavesdropper can't detect a signal unless he's inside the beam. Similarly, a jammer can't effectively jam a receiver unless he's inside the field-of-view of the receiver. Both the transmitted beam spot size and the receiver field-of-view are reduced over RF systems by the roughly 6400x ratio of the carrier frequencies. For example, even if an RF aperture can be 10 times larger diameter than an optical aperture, the footprint of the optical beam on earth is 600 times smaller.

Of course, lasercom has its limitations and challenges. Space/ground applications are limited by the need to operate in the absence of clouds. This can be met by a diversity of ground sites, or by an airborne relay operating above the weather.

Space and space applications of lasercom are not impacted by clouds. Even though transmit power is much lower in optical than RF systems, High Power Optical Amplifiers (HPOAs) that can generate the 10 to 20 W needed for high-end lasercom systems have, until recently, been considered risky. Plus, with few lasercom-in-space systems fielded, the technical risk for lasercom is perceived to be higher than for RF.

Much progress has been made reducing these perceived risks. An example of an enabling component for lasercom is shown in *Figure 2* — engineers from LGS Innovations ready an HPOA for successful thermal-vac testing.

These amplifiers are constructed with optical and opto-electronic components that have been extensively tested for long-duration space missions. In a test, one unit ran open-loop at full power for 5-½ years with no signs of degradation. The units are at TRL 6 for space. To support flexibility in terminal design, both Polarization-Indefinite (PI) and Polarization-Maintaining (PM) units have been demonstrated, with excellent efficiency[1].

In another proof of the maturity of this technology, LGS delivered a Master Oscillator/Power Amplifier transmitter to the Jet Propulsion Lab in California. This unit, which generated a Pulse-Position Modulation (PPM) amplified signal, performed flawlessly when tested by JPL for 5,000 hours[2].

Confidence in lasercom for space applications has been boosted by successful demonstrations from the U.S., Europe, Japan, and China. For example, NASA recently returned 622 Mb/s from lunar orbit to the Earth in the Lunar Laser Communications Demonstration (LLCD)[3]. NASA is planning a ground/GEO/ground lasercom demo (Laser Communications Relay Demo, LCRD), with launch scheduled for 2019[4], as well as lasercom demos from LEO to GEO and from deep space.

While most lasercom terminals to date have been relatively heavy and designed to go on large vehicles, an emerging application for lasercom is on smallsats. For example, LGS Innovations is working on a DARPA program to build LEO-to-LEO lasercom terminals with a gimbal for independence from satellite body-pointing. This program has design targets of <2 lbs. total weight and orbit-averaged bus power draw of <3 W. Global, low-latency communication networks can be constructed with a LEO constellation using many of these relatively low-cost links. Terminals like this can also be adapted for high-speed LEO-to-ground links.

To deliver high-bandwidth comm to the warfighter, while keeping costs in check and providing higher security and anti-jam protection, it's clear that lasercom will become a part of future MILSATCOM networks.

References

[1]P. Wysocki et al., "High Reliability 49 dB Gain, 13W PM Fiber Amplifier at 1550 nm with 30 dB PER and Record Efficiency," 2006 Optical Fiber Communication Conference and the National Fiber Optic Engineers Conference, 2006, pp. 1-3; doi: 10.1109/OFC.2006.216053

[2]Malcolm W. Wright, Alfonso B. Piccirilli, Andrew R. Grant, "Preliminary results of testing a space-grade laser transmitter for optical communications", Proc. SPIE 8246, Free-Space Laser Communication Technologies XXIV, 82460L (23 February 2012); doi: 10.1117/12.913635

[3]D. M. Boroson, et al., "The Lunar Laser Communications Demonstration (LLCD)," 2009 Third IEEE International Conference on Space Mission Challenges for Information Technology, Pasadena, CA, 2009, pp. 23-28. doi: 10.1109/SMC-IT.2009.57

[4]www.nasa.gov/mission_pages/tdm/lcrd/index.html

COMMAND CENTER: SKOT BUTLER

President, Intelsat General Corporation (IGC)

Skot Butler is the President of Intelsat General Corporation, a wholly owned subsidiary of Intelsat S.A., the world's first Globalized Network operator, delivering high-quality, cost-effective video and broadband services anywhere in the world.

In this capacity, Mr. Butler oversees Intelsat General's strategic direction, operational plans and execution of the overall mission to provide a range of sustainable, cost-effective and secure communications solutions to government and commercial customers.

Mr. Butler most recently served as Vice President of Satellite Networks and Space Services at Intelsat General, and prior to that held positions in strategy and business development since joining the company in 2006. During his tenure he has led a number of initiatives to provide innovative, mission-critical solutions ranging from hosted payloads to global satellite networks for government and commercial customers worldwide.

Prior to joining Intelsat, Mr. Butler worked at DRS Spacelink as Director of Business Development, leading strategy and solutions for the company's satellite services business line. He began his career in the satellite industry in 1999 with Verestar where he held sales and business development roles and launched the company's government services unit.

Mr. Butler is a graduate of the University of Phoenix and has a Masters of Business Administration from the University of Maryland, College Park.

He stays active in the industry and has served as the President of the Mid-Atlantic Chapter of SSPI, on the Board of the Washington Space Business Roundtable and represents IGC on the Commercial Space INFOSEC Working Group (CSIWG) and on other assignments.

Artistic rendition of an Intelsat Epic[NG] satellite on orbit. Image is courtesy of Intelsat General.

Mr. Butler, thanks for taking the time to "chat" with the readers of MilsatMagazine. How did you initially become interested in the SATCOM and MILSATCOM market segments?

Skot Butler (SB)
In the late 1990s, I was looking to make a career change; I had friends in the COMSATCOM business who made some introductions for me. I had a background in sales and business development and the industry seemed like an exciting place to be, though I knew nothing about space, satellites, or even telecommunications at that time.

I was lucky that this was before the dot com bust and the need for internet trunking over satellite to places like Africa and Latin America was booming. Everyone wanted access to the U.S. backbone, which was where something like 80 percent of the internet content was cached at the time. After the terrorist attacks on September 11, 2001, I saw an opportunity to participate in a small way by providing critical SATCOM solutions to the warfighter.

Since that time, I have come to better appreciate the important role that our industry plays in delivering critical, timely information to decision makers from the battlefield to the Pentagon.

In March of 2016, you were promoted from the position of Vice President of Satellite Networks and Space Services to the role of President of Intelsat General. Now, nearly two years

later, has your transition been as you expected? What areas of the business have been somewhat of a surprise to you?

SB
I don't think anything has been a particular surprise to me. I will say that I have gained a much greater appreciation for the role that each individual in my organization plays to the overall success of the mission. It's easy to say that we simply meet a market demand with a commercial product, but the dedication of our people to the customer mission that I see in the office every day is inspiring.

We have a good mix of former members of the armed services and industry veterans, which means we both understand the users and have the technical expertise to rapidly deliver what they need, while also providing the critical on-going support to help ensure they achieve their objectives.

Given your breadth of experience in this industry, when you look back upon your career, what projects or missions truly bring a smile of satisfaction to you?

SB
The greatest satisfaction comes from enabling our customers to do something they could not do previously — to help them close a capability gap. Whether it is helping them to reach a location with connectivity, achieve a new milestone in data speeds, or enable the use of a new piece of hardware that provides a step function in capability—this

Intelsat Epic^NG Coverage
Overlay to Intelsat Global Network

IS-33e
IS-32e
IS-35e
IS-35e
IS-29e
*H-3e
*IS-37e
*H-3e

Intelsat Epic^NG satellites coverage map, courtesy of Intelsat.

Illustrative Only
* Specific beams not yet determined
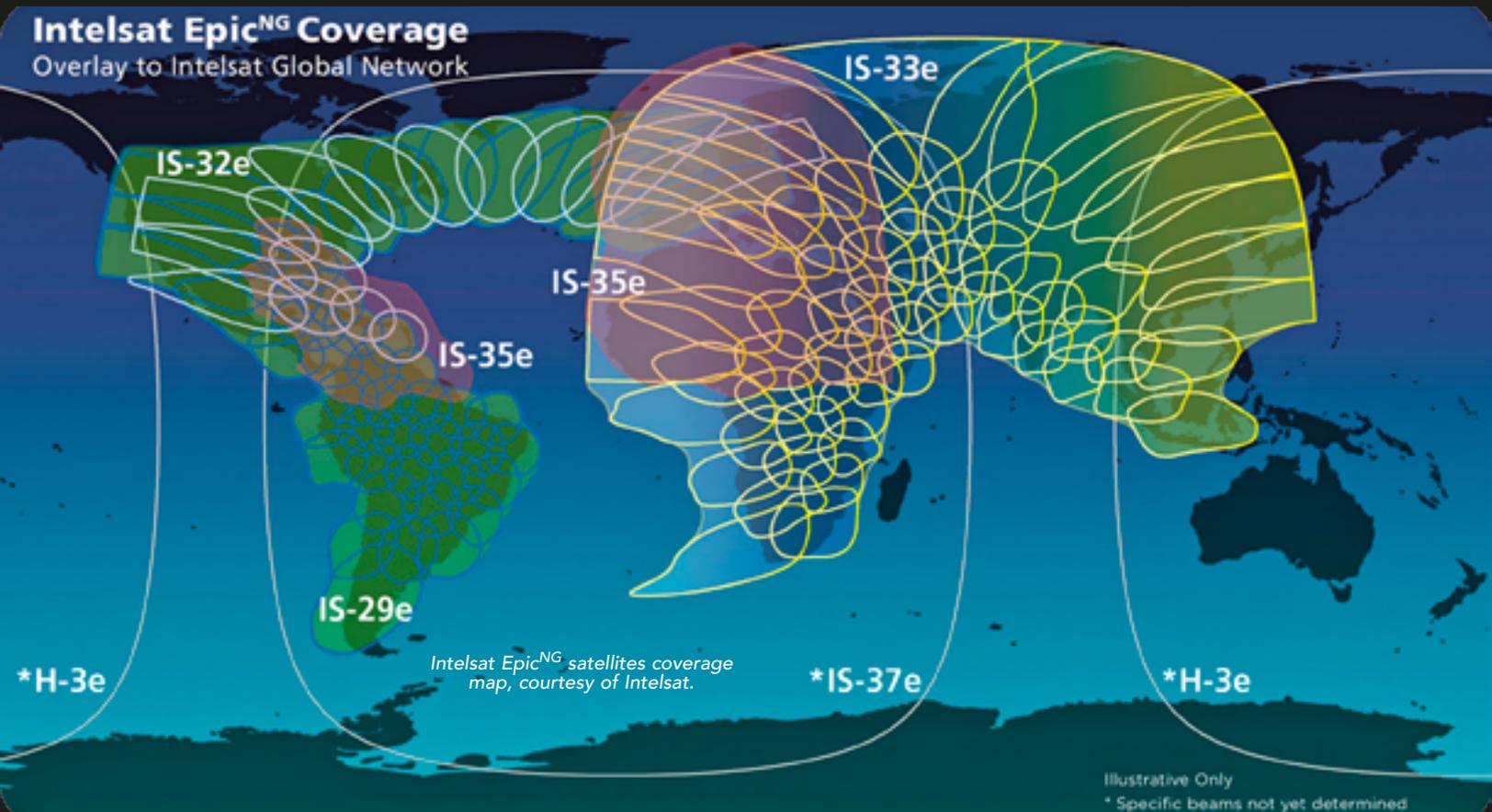
is an experience I have the privilege to encounter regularly. There is nothing more frustrating than not being able to meet a customer need, and nothing more satisfying than exceeding their expectations.

High-throughput satellites (HTS) have gained quite a bit of momentum over the last few years. Please explain Intelsat General's goals for deploying HTS, especially for the government user.

SB
Intelsat General offers government customers increased satellite performance in our new constellation of Epic^{NG} high-throughput satellites. These new spacecraft mark the progressive evolution of our global network, incorporating new C-, Ku- and Ka- spot beams into our fleet to create differentiated solutions for a range of commercial and government applications. Higher throughput offers government users more value for each bit of data they receive, with an efficiency improvement of nearly 300 percent over conventional wide-beam satellites.

The Epic^{NG} spot-beam technology is ideal for mobile applications, offering commercial and government users high-speed connectivity wherever they go. For land, sea and air missions, the platforms used by warfighters need smaller antennas to receive and send vital voice, data and video.

The Intelsat Epic^{NG} HTS satellites deliver high power to small satellite beams that support smaller terminals, as small as 20 cm in diameter. For aeronautical applications, we are leveraging technology that is already deployed on commercial airliners — high-speed internet access and content services at 35,000 feet. The improvements in antenna technology over the past few years are just now coming to market, and our military and government customers are able to take advantage of the new antennas in a range of mobile applications.

Now that Intelsat General has four Intelsat Epic^{NG} satellites deployed, what capabilities are gaining most interest from potential government users?

SB
One of the top requirements among all government customers is the need for more resilient broadband via satellite, which our Epic^{NG} satellites can deliver. Broadband connectivity can support many missions, but the area gaining the most interest is for critical intelligence, surveillance and reconnaissance (ISR) missions.

In the last month, Congress discussed this constantly growing requirement and how to address it effectively for ongoing military superiority. Congressional committee members looked at recent data that shows ISR requirements grew by more than 800 percent in the last 10 years, yet still not all of those requirements were met. Commercial satellite

capacity is available to help meet this demand. HTS has the coverage, the volume of bandwidth, and the security to enable ISR.

As you may know, commercial satellites have supported this huge need over the last decade by providing bandwidth to remotely piloted aircraft (RPAs) delivering much needed situational awareness. More RPAs continue to be deployed and new, smaller RPAs, in the Class III category, are looking to commercial SATCOM for beyond-line-of-sight communications that have not previously been possible.

These aircraft can now include this capability because small antennas can fit on the limited space of these platforms, enabling both military and non-military applications. IGC follows these RPA trends each day and does not foresee interest slowing any time soon.

Can you please explain the advantages that Epic^{NG} satellites bring to DoD users, specifically?

SB
Intelsat's Globalized Network has a proven track record of reliability, security and performance for the most demanding government communications. In addition, the Intelsat fleet of more than 50 satellites provides the flexibility and resiliency to keep pace with the military's changing geographic and mission requirements across the globe.

The new Intelsat Epic^{NG} satellites enable throughput in the range of 25 to 60 Gbps per satellite, nearly 10 times that of traditional wide-beam satellites, including the U.S. government's WGS satellites. This Epic^{NG} throughput delivers both technical and economic benefits that are extremely valuable to DoD users.

These advanced satellites deliver more efficiency for the bandwidth used, provide very high throughput to a concentrated area using the spot-beam technology, and offer backward compatibility because they use the Ku-band frequency already deployed across the DoD.

You have completed several tests on the Intelsat Epic^{NG} platform over the last two years — please provide an overview of the tests and the information that you gained from these tests.

SB
Our most recent tests proved two important elements: smooth data transmissions during long-distance RPA missions and much improved interference mitigation. Intelsat's Epic^{NG} platform uses multiple spot beams, each covering approximately a 700-mile radius. This multiple-spot-beam design is found in most HTS spacecraft, which as I said earlier allows for the use of much smaller ground antennas.

Intelsat General joined up with General Atomics Aeronautical Systems Inc. (GA-ASI) to test the spot-beam technology. The tests proved smooth switching capabilities for the company's Block 5 Predator B/MQ-9 while communicating with the Intelsat 29e satellite over very long distances that require switching over multiple spot beams.

This test also represented the first time the MQ-9 transmitted over a high-throughput satellite. Since this unmanned platform is so widely used by the DoD and allied governments, we believe this test will prove very significant to future RPA operations.

For the interference mitigation testing, IGC proved that the Epic^{NG} spot beams could limit jamming or interference from any source, including adversaries, so that the user could have uninterrupted communications. Older satellites use one broad beam that can cover the entire continent, for example. This increases the likelihood of satellite communications being interrupted either accidentally or purposefully.

The 700-mile radius for each Epic^{NG} beam means that a jammer must be in that spot beam for the jamming to occur. If they do jam the signal, IGC has now proven that it can disconnect the uplink signal from the downlink signal, find a new frequency for the RPA and reestablish a link, essentially neutralizing the jammer.

In 2016, we also demonstrated the unprecedented performance of Epic^{NG} with very small satellite terminals. A series of tests were performed using Gilat's BlackRay 71 airborne terminal, with its mechanically steered 6" by 6" flat panel array. Data was sent from the small antenna to the Intelsat 29e satellite at a rate of 3.9 Mbps with an efficiency of 0.26 bits/Hz. This compares to an uplink rate of about 1.8 Mbps and efficiency of 0.09 bits/Hz achieved with a conventional Ku-band wide-beam satellite.

This link was effectively two times the rate and almost three times more efficient than traditional wide-beam satellites. These tests represented another milestone—effective use of HTS with small aero terminals that the U.S. Department of Defense and allied military forces urgently need.

The DoD needs to become more resilient in its satellite capabilities. Please tell us how IGC is addressing this issue and how HTS specifically addresses resilience issues.
SB
Agility and resiliency have become critical to national security space and will contribute to overall mission assurance. Hundreds of commercial satellites orbit the globe today and thousands more are planned for the near future. Operators launch satellites several times each year, providing the opportunity to deploy innovation regularly and deliver resilient technology that supports military space operations.

To maintain optimal agility throughout the DoD, commercial SATCOM capabilities must be designed into the space architecture so these satellites will have a role in ensuring resilience. When commercial capacity and capabilities become part of the long-term military space fabric, commercial will accelerate investment in yet more advanced technology specific to the needs of the DoD.

Does the working interface between Intelsat General and Intelsat S.A. provide clarity regarding mission development and internal/external resources? Please explain how your subsidiary works directly with Intelsat S.A.

SB
IGC leverages the global infrastructure investments that Intelsat makes for our government customers, both in space and on the ground. In addition, IGC influences those investments and satellite designs to better serve the unique requirements that the U.S. DoD and global militaries expect in order to maximize our satellite capabilities and meet those requirements.

As an example, Intelsat has long built our satellites with the ability to transmit encrypted commands to our satellites using NSA-approved equipment in order to meet U.S. DoD expectations. More recently, Intelsat began designing our satellites with ability to employ NSA-approved encryption on telemetry from the satellite to the earth as well. We continue to invest on behalf of our government users.

What are your thoughts regarding the enthusiasm surrounding the development of small satellites and the attendant constellations? Is Intelsat General considering such technologies for use within the military community? If so, what can you tell us regarding this.

SB
As new satellite technology continues to evolve, we will watch carefully to see how it can be leveraged for our customers. For the near future, we are focused on smaller Low Earth Orbit (LEO) satellites from OneWeb. This innovative technology partner will help to meet the growing demands for Big Data, with high-throughout and low-latency services.

OneWeb will enable IGC to bring ubiquitous high-throughput connectivity to government users by incorporating OneWeb's new capability into our global satellite network. We believe that no one solution will fulfill all requirements. Working with OneWeb will expand this capability.

Are Hosted Payloads of continuing interest to Intelsat General and is there any progress on that front?

SB

IGC continues to see great value in hosted payloads for government applications. We have seen a bit of progress in government use of hosted payloads and encourage the government to expand their investment in this area and design HPs into their future architecture.

Are your partnerships with other firms proving fruitful? Everyone knows about the OneWeb acquisition/ partnership withdrawal… what may the industry expect from IGC with new partnerships, such as Kymeta?

SB

IGC has developed relationships with several innovative technology partners. As you mention, Kymeta is one of these partners. IGC is working with the company to address the need referenced above—smaller and lighter antennas for mobility applications. Kymeta is designing and beginning to deliver low-profile, flat-panel antennas. Flat-panel antennas are scalable and also have no aerodynamic issues so they can easily fit onto a ship, a car, or comparable military platforms.

Military users look forward to having a new antenna technology that provides access to high-speed connectivity with lower size, weight and power. Our partnership with OneWeb will bring another advantage to our government customers. This LEO constellation will help IGC provide high-throughput access anywhere on the globe, including the Polar Regions, especially for users who are mobile and need connectivity to a small terminal.

Just like people expect to have connectivity on their mobile phones and other devices, we will have this service with much higher speeds and integrate it into our Intelsat Epic^{NG} network so that we can deliver the most appropriate service to each user.

What new technologies do you see as important inclusions during 2018 for industry consideration and implementation?

SB

As a commercial technology provider, IGC is always looking at new ways to provide innovation to our customers.
For government users, they need cutting edge technology that is available quickly to support requirements around the globe. In 2018, we believe that our customers will begin to see the value in our managed services, like IntelsatOne Flex.

With these services, we will provide bandwidth and all related technology and service as one solution. By delivering a service and not just providing bandwidth, IGC can layer in new technology as it is available and applicable to each user so they can focus on their mission and not the connectivity technology.

In addition, we can look for efficiencies wherever possible. For example, we can work with users to determine when and where they need specific connectivity service. If they do not need to continue the service, they do not need to pay for it. We will offer this Flex service to support surges or new locations without significant changes in cost.

I believe that new users can understand this model if they think of it in the same way they use their mobile phones. People do not buy bandwidth in each area where they may be, or go to several different providers because they move around. Intelsat Flex will follow this type of structure in a comprehensive service.

An area that remains of concern is a perceived lack of technical talent available for filling important positions within the SATCOM and MILSATCOM industries. How can companies such as yours assist in STEM training for young students at the junior high, high school and college levels to develop an interest in learning the skills necessary for a fulfilling career within the industry's various market segments?

SB

Those in the space industry want to stimulate growth and development that will help transform today's students into tomorrow's space leaders. Space has provided the commercial world with many great new technologies that we now depend on daily, GPS being just one. IGC wants to ensure that young people are motivated to join the space industry to continue this evolution of technology, and maybe even get us to Mars and beyond.

With government clients increasingly looking to commercial providers for a range of space and satellite technology and services, our participation in STEM education is critical for maintaining our country's technological edge in space. IGC has invested in an active internship program and works with groups such as the Future Space Leaders Foundation (FSLF) and SSPI, organizations dedicated to the career development of young space and satellite industry professionals in this exciting and growing field.

Our staff goes to colleges across the country to recruit new talent and help teach students about the amazing technology that space is creating today. I am passionate about STEM and space and hope that IGC can inspire a new generation of space technology innovators.

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