SATCOM for Net-Centric Warfare

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Artistic rendition of the BullDog satellite servicing solution. Image is courtesy of Altius Space Machines.

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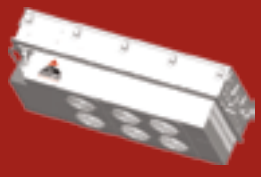

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DISPATCHES

iDirect Government improves troops' defense with new and faster 4.2 Evolution Software

iDirect Government (iDirectGov) has revealed their most powerful Major Defense-Based software release, Evolution 4.2 which releases the full capabilities of the 9-Series satellite routers, defense line cards and tactical hub while continuing to support existing 8-Series satellite routers and eMxDx line cards.

iDirect Government's Evolution 4.2 improvements are in performance, efficiency and security in support of the company's defense and government customers.

When used with the 9-Series, Evolution 4.2 boosts single carrier capacity to 29 mega-symbols per second (Msps) (previously 7.5 Msps in Evolution 2.3) as well as 10 times improvement — with achievements up to 64,000 packet-per-second (PPS) of simultaneous traffic.

These increased speeds and throughput are ideal for intelligence, surveillance and reconnaissance (ISR) content, larger volumes of simultaneous voice calls as well as other bandwidth-intensive applications for land, air or sea.

Significant advancements to the existing multi-frequency time-division multiple access (MF-TDMA) waveform greatly improves the availability of ultra-small disadvantaged terminals, thus improving reliability particularly for Communications-on-the Move (COTM) networks.These powerful waveform enhancements truly allow its new 9-Series airborne solution to take flight.

Building upon its existing two-way transmission security (TRANSEC) which is approved by the National Security Agency (NSA), Evolution 4.2 introduces an improved user interface and one-way TRANSEC.

This new TRANSEC capability comes with automatic over-the-air re-keying of one-way systems in support of the Global Broadcast Service (GBS). Evolution 4.2 also enables Multi-Protocol Encapsulation (MPE) ensuring backwards compatibility to existing GBS networks as well as Multicast Filtering to remove any duplicate channels.

Other enhancements made possible with iDirect's Evolution 4.2 and the 9-Series include:

- *Multi-channel demodulation (MCD) TRANSEC with 16 Channel Returns on the DLC-R for more in-route density*
- *Full Network Management System (NMS) support for the Tactical Hub*
- *Fan In/Fan Out in support of Wideband Global Satcom (WGS) constellations*
- *Security Content Automation Protocol (SCAP) service for Premium iSupport customers*
- *Federal Information Processing Standard Publication (FIPS) 140-2 Level 3 certification on the TRANSEC module as found on the 9-Series and DLCs, making its products more secure than ever before*

John Ratigan, President of iDirectGov said that Evolution 4.2 is the release their customers have been waiting for. It allows them to continue the use of their 8-Series installation base and expand with the full power and performance of the 9-Series.

He added that the SATCOM software energizes and elevates both the 8-Series and 9-Series Satellite Routers and line cards, enabling their customers to connect, command and coordinate their critical assets in the field better than ever before.

This will result in next-generation satellite communications deployment for airborne, maritime and land-based customers.

www.idirectgov.com/products/software/evolution42

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DISPATCHES

Harris delivers advanced nav paylods to Lockheed Martin for the U.S.A.F.'s GPS III satellites

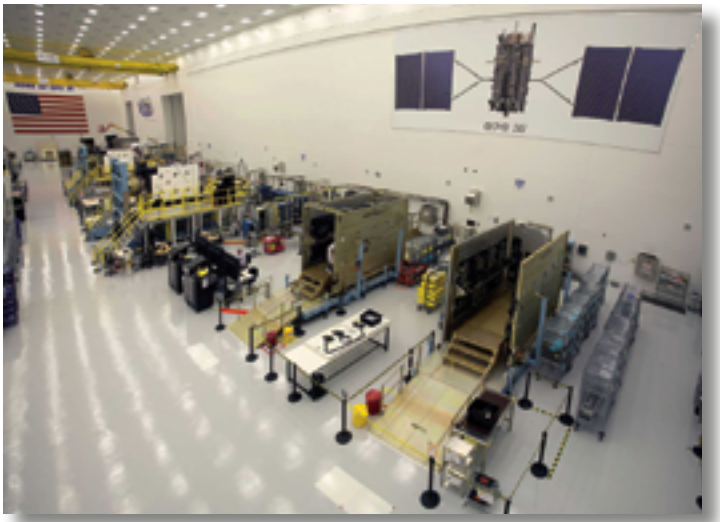


Photo of GPS III satellites in production flow at Lockheed Martin's GPS III Processing Facility near Denver. Harris navigational payloads have been delivered for the first five GPS III satellites. Photo is courtesy of Lockheed Martin.

Harris Corporation (NYSE: HRS) has provided Lockheed Martin (NYSE: LMT) with its fifth of 10 advanced navigation payloads contracted for the U.S. Air Force GPS III satellite program.

The GPS III navigation payload features a Mission Data Unit (MDU) with a unique 70 percent digital design that links atomic clocks, radiation-hardened computers and powerful transmitters — enabling signals three times more accurate than those on current GPS satellites.

The payload also boosts satellite signal power, increases jamming resistance by eight times and helps extend the satellite's lifespan.

Lockheed Martin successfully integrated the navigation payload into the fifth GPS III space vehicle (GPS III SV05). Harris is committed to delivering three more payloads by the first quarter of calendar year 2019 for GPS III SVs 06-08.

Four navigation payloads have already been fully integrated on GPS III SV01-SV04.

In September of 2017, the Air Force declared the first GPS III satellite Available for Launch, or "AFL," with launch expected later in 2018. In December 2017,

GPS III SV02 completed rigorous thermal vacuum testing and is anticipated to be declared AFL this summer. GPS III SV03 and SV04 are expected to undergo environmental testing this year.

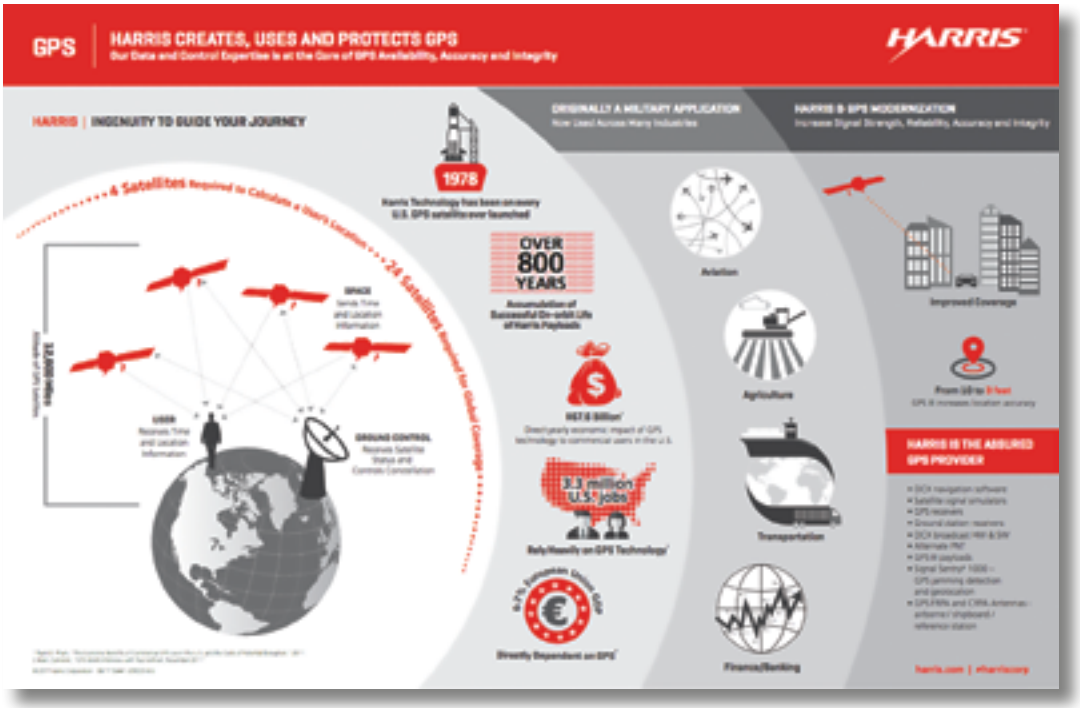
In November of 2017, Harris announced that it completed development of an even more-powerful, fully digital MDU for the Air Force's GPS III Follow On (GPS IIIF) program.

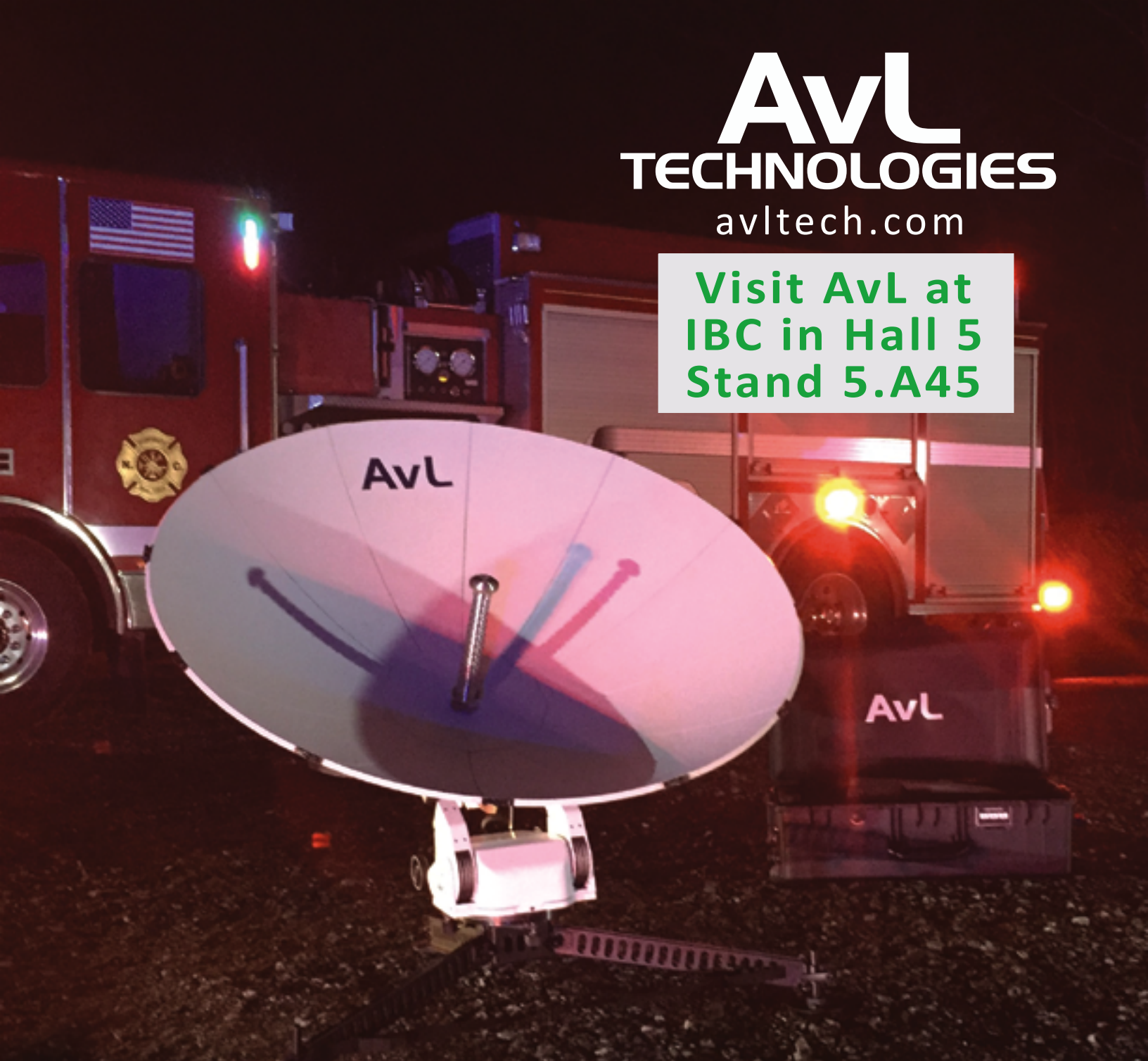
The new GPS IIIF payload design will further enhance the satellite's capabilities and performance for the U.S. Air Force.

Harris' expertise in creating and sending GPS signals extends back to the mid-1970s — providing navigation technology for every U.S. GPS satellite ever launched.

While the Air Force originally developed GPS for warfighters, millions of people around the world and billions of dollars of commerce now depend on the accurate, reliable signal created and sent by Harris navigation technology.

www.harris.com





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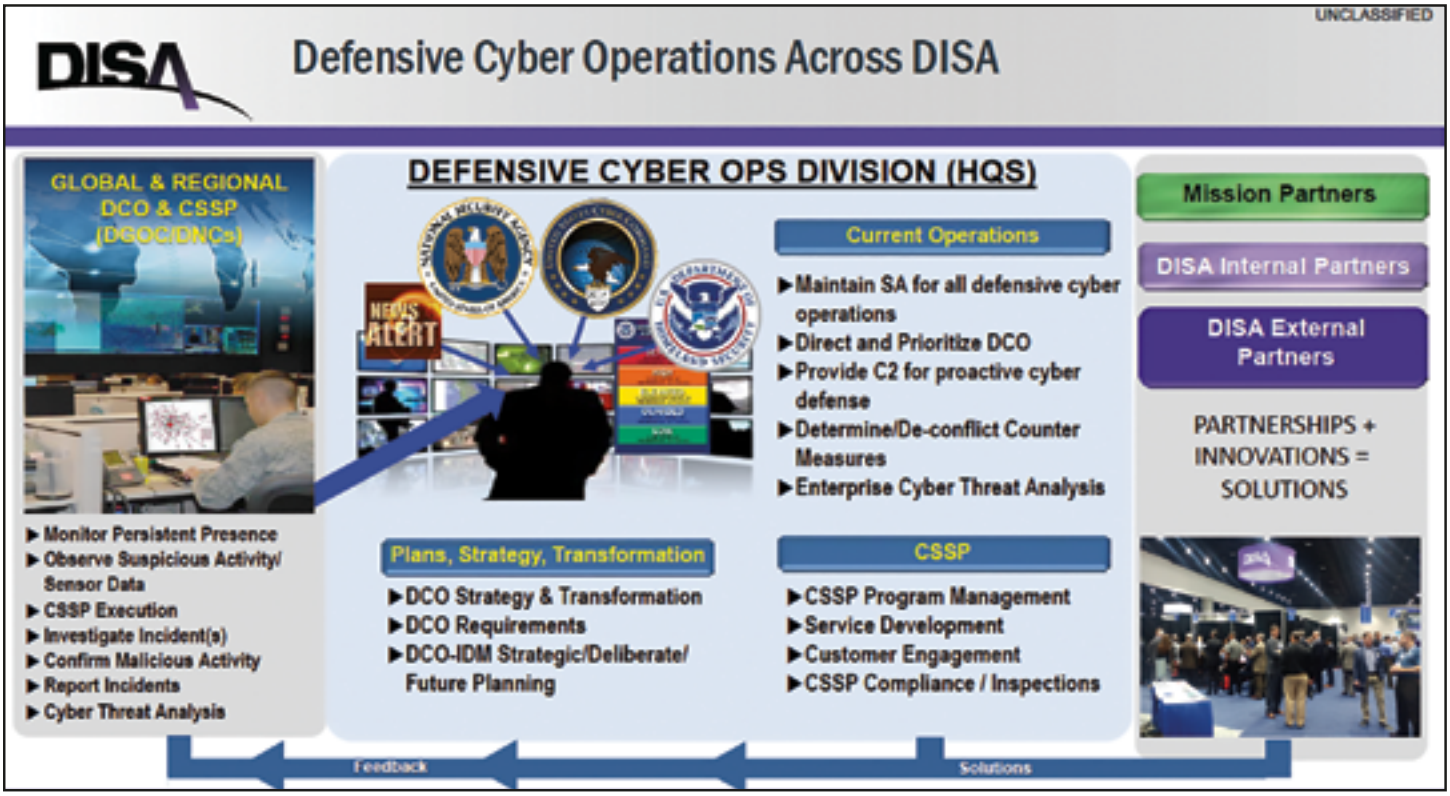
The cyber protection challenges wrought by cloud and mobile addressed by DISA



An abundance of data and expansion into the cloud and mobile environments present unique challenges for defensive cyber operations (DCO), said members of the Defense Information Systems Agency's (DISA) DCO Division during a panel discussion at the Armed Forces Communications and Electronics Association's Defensive Cyberspace Operations Symposium in Baltimore.

Army Col. Darleen Straub, chief of DISA's DCO Division, led the Challenge of Cyberspace Defense and Cybersecurity Service Provider (CSSP) Services panel, which included Robert Mawhinney, chief of the DCO Current Operations Branch; Darrell Fountain, chief of the DISA CSSP Branch; and Paul Barbera, chief of the DCO Plans and Requirements Branch.

Straub said DISA stood up a consolidated DCO Division in the summer of 2017. The division plans, transforms, coordinates, synchronizes, and directs the security and defense of the agency's enterprise infrastructure and the delivery of DISA Cyber Security Services to the Department of Defense.

"*The DOD is in the middle of a cultural shift*," said Straub. "*That cultural shift is now saying that sometimes the protection of the network and what is in the network is more important than the availability of the network*."

One of the responsibilities of DCO is to monitor, track, and analyze suspicious activity within the Department of Defense Information Network (DODIN).

"*At the end of the day, that is what we are looking at,*" said Mawhinney. *"That is what we are trying to decipher … what is going on in the networks*."

A massive amount of data is trafficked through the DODIN. Ciphering through data, the cost of storage space, the additional volume of metadata and alerts, and the increase of cyber speed — the speed in which the networks are moving and operating — contributes to the continuously changing requirements for DCO.

Mawhinney emphasized the need to incorporate artificial intelligence (AI), advanced analytics, and machine learning as part of the cyberdefense environment to provide the initial blocking and tackling of malicious data.

"*Get that (initial protection) out of the analysts' hands and let them really start to focus on the cyber kill chain aspects of understanding where to go next*," said Mawhinney.

Barbera reiterated the importance of incorporating automated resources that process data and alert the defensive team where to look to find malicious activity.

"*How can we do things better, faster, stronger?*" asked Barbera. "*We need that machine learning; we need AI.*"

The transition to virtual environments — cloud and mobility — also changes the way operators perform DCO. The defensive framework that previously existed no longer aligns with the functionality of the cloud and mobility environments, and new frameworks must be developed.

"*We have been working (on a defensive framework for) cloud for four years*," said Mawhinney.

When data is hosted in the cloud, separate from the network, there is a disconnect between cyberdefense and direct access to the data. It is difficult to redirect the original data back into the DODIN to be analyzed and filtered for malicious activity, as required by cyber directives.

Fountain said his main concern is developing a global defense for the cloud environment. The CSSP established preliminary services to address the DOD's current cloud need, but further standards and capabilities are required to create an environment that provides the same protection as a traditional enclave scenario used in the DODIN defense.

He said, "*Our challenge is to keep the entire global team knitted together into one fabric that provides defense around the clock; 24 hours a day, seven days a week, 365 days a year.*"

Mobile device use within the DOD doubled over the last year, said Mawhinney, who addressed the challenge of monitoring mobile devices and the mobility environment, adding that mobility is going to be the endpoint solution in a few years.

Mawhinney said it is critical that DCO understands how to defend the mobility environment, how to redirect data back into an environment that the DODIN can analyze holistically, and evaluate what is normal or abnormal for data in this environment. Mawhinney also emphasized the importance of incorporating innovative ideas when addressing DCO for the cloud and mobility environments.

"*What DISA brings to the fight that few others can is end-to-end visibility*," said Fountain. "*We own the backbone. We own the internet access points. We have a fleet of sensors spread across the globe. And we have a global presence that allows us to capitalize on all that and bring defense to our mission partners.*"

www.disa.mil/

DISPATCHES

Viasat acquires Horsebridge Defence and Security to increase MILCOM expertise

Viasat Inc. (NASDAQ: VSAT) has acquired Horsebridge Defence and Security, a UK-based company focused on design, system integration and support of deployable secure networks.

Through this acquisition, the Viasat UK group gains deeper military communications integration expertise; enabling the Company to continue to grow its business in the UK defense market by delivering mission-critical ground-based communication networks and services.

From their UK-base in Cheltenham, Horsebridge Defence and Security have developed robust relationships with the UK Armed Forces, supporting a number of UK Ministry of Defence (MOD) programs.

The Horsebridge Defence and Security team will be integrated into Viasat's already established and growing Farnborough, UK-based organization They will have immediate access to Viasat's full communications portfolio from the Company's most advanced satellite communication (SATCOM) and Link 16 mobile networking solutions to its innovative cybersecurity and information assurance capabilities.

Horsebridge Defence and Security develops and integrates technologies under their Kestrel II-branded services portfolio. The Kestrel brand has a strong reputation with MOD through successful delivery of a high-capacity ground network for a specific operational mission.

The Kestrel II portfolio offers a range of complementary secure network products, solutions and services that are specifically targeted at today's UK Defence requirements and are continuously integrated and continuously developed (CI/CD) to stay at the forefront of technology.

Financial details of the transaction are not being disclosed. The transaction is not expected to materially affect Viasat non-GAAP (pro forma) earnings for fiscal year 2019. However, Viasat has not completed its valuation analysis and, accordingly, has not determined the impact to GAAP earnings.

Ken Peterman, the President of Government Systems at Viasat said that, by acquiring Horsebridge Defence and Security, the company hopes to accelerate the trajectory of the firm's ability to support UK defense operations. Viasat builds best-of-breed technology solutions that leverage commercial innovation; and by combining Viasat's strengths with the deep domain expertise of the Horsebridge Defence and Security team, the intention is to reliably extend commercial, military or emergency service networks to the tactical mobile edge.

Martin Flather, Director, Horsebridge Defence and Security, added that having access to Viasat's broad portfolio of technologies and capabilities will enable the company to create new secure communications and mobility platforms that leverage high-capacity mobile networks with assured availability — with accredited secure voice, video and messaging services — whenever and wherever military forces require it in the UK or overseas.

www.viasat.com/

www.horsebridgedefence.com/

DISPATCHES

Rohde & Schwarz enables comms among armed forces and countries

Rohde & Schwarz developed SVFuA, the joint radio system of the German armed forces that is installed in command vehicles as a communications hub.

This system is the first phase of digitalization of mobile tactical communications (MoTaKo) for the German armed forces.

The Rohde & Schwarz system architecture also provides smart routing, end-to-end encryption and system management.

The Rohde & Schwarz SDxR family has been implemented with strict separation between the device platform and the software, the waveforms, based on the internationally standardized Software Communications Architecture (SCA).

This makes it possible to port SCA-based waveforms from other manufacturers as well as existing waveforms, providing both security for future investments and backward compatibility with existing radio systems.

Customers can modify the waveforms as well as the integrated encryption, which enables them to establish interoperable secure communications channels between different branches of the armed forces and various countries.

National data is protected, and information in joint or combined deployment is assured.

Rohde & Schwarz has developed a family of network capable, high data rate waveforms for a variety of deployment requirements.

For every communications scenario, users can select the waveform and encryption that best match their requirements for range, data rate and interference immunity.

The R&S HDR waveforms and the latest generation of SDR technology are already used in the R&S SDTR for vehicle-based tactical communications and in the R&S SDHR handheld tactical radio.

The new R&S SDAR software defined airborne radio enhances the land-based communications system with airborne components.

Rohde & Schwarz recently presented their product portfolio for secure communications and cybersecurity at the Eurosatory Defense & Security International Exhibition in Paris at the Villepinte Exhibition Center.

www.rohde-schwarz.com/

DISPATCHES

AFRICOM, DISA plan for comms future in the African Theater

U.S. Africa Command's telecommunications requirements were the subject of discussion at the inaugural Africa Telecommunications Symposium, hosted by the Defense Information Systems Agency's Africa Command (DISA Africa) and the Defense Information Technology Contracting Office — Europe, in Stuttgart, Germany May 7 to 8.

Attendees representing DISA, U.S. Africa Command (AFRICOM) and their component organizations met with more than 24 telecommunications service vendors to discuss plans and requirements to foster innovation, build out the theater's network-based communications infrastructure, and enable assured service delivery in support of the AFRICOM Theater campaign plan.

Government representatives and commercial service providers presented information regarding telecommunications processes, capabilities, and services in open forum and during one-on-one engagements.

AFRICOM is working toward "setting the theater," a term for the activities associated with establishing the conditions for executing operations, in Africa.

AFRICOM J6 Communications Director Army Col. Christopher Eubank said the biggest challenge in setting the theater in Africa is the size of continent. "*There are 54 countries, 53 in AFRICOM's area of responsibility*," he said. "*Many of them are three to four times larger than the largest states in the U.S.*"

Eubank said although the vast and unique geographical and political landscape of Africa may present a challenge, AFRICOM's J6 Directorate is determined to ensure telecommunications infrastructure is in place and ready to support any operation.

Technology has evolved beyond traditional point-to-point solutions for building networks and AFRICOM wants to pursue new service offerings, specifically software-defined architectures. Benefits of software-defined networks include rapid provisioning, increased control and shaping of network traffic, and new ways to secure communication paths.

Eubank emphasized the importance of bringing new technologies to the theater by informing participants that two years ago, 90 percent of telecommunications service delivery in theater was via satellite links, noting that the organization should work toward fusing multiple technologies and enabling network-based communications. Telecommunications services are assured worldwide to support the Department of Defense Information Network (DODIN). However, the great distances, austere environments, and evolving requirements in Africa present unique obstacles.

AFRICOM seeks to meet concurrent, episodic mission requirements across the continent a priority. The J6 Directorate also faces a significant challenge to support the Command, Control, Communications, Computer and Intelligence (C4I) needs of the warfighter across the continent.

Limited infrastructure, combined with immature service provider capabilities, affect AFRICOM's ability to rapidly deploy survivable transport capabilities sized to meet the needs of its campaign plan objectives.

To address this, AFRICOM intends to work with DISA to leverage emerging technology, innovation, teamwork, and to develop international partnerships to protect critical infrastructure.

www.africom.mil/

www.disa.mil/About/Our-Organization-Structure/OD-Field-Office/AFRICA

DISPATCHES

U.S. Cyber Command steps up their recruiting efforts

A special authority called Cyber Excepted Service is helping the nation's newest unified combatant command to streamline and expedite its recruitment and hiring processes.

The CES gives U.S. Cyber Command hiring managers the discretion to hire people directly and make on-the-spot job offers through agile recruitment sourcing outside the traditional confines of the USAJobs platform, Cybercom officials said.

Authorized in the National Defense Authorization Act for fiscal year 2016, the CES granted the secretary of defense the authority to establish Title 10 civilian cyber workforce to carry out the responsibilities of Cybercom and other organizations within the Defense Department.

This initiative includes Cybercom, Joint Force Headquarters Department of Defense Information Network, the DoD chief information officer for cybersecurity, the Defense Information Systems Agency and the service cyber components. The CES maintains Title 5 provisions such as appeal rights, attained career status, protections, federal benefits, retirement and performance management, officials said.

Under the CES, Cybercom now brings on new hires under the excepted service, or GG, grades, instead of the competitive service, or GS grades. The CES places high value on experience, officials explained, which transcends the typical time-based approach in the competitive service. Promotions in the CES are qualification based with no time-in-grade requirements required for advancement, they added.

Cyber Command teamed up with the U.S. Air Force Personnel Center for the command's first-ever public hiring event May 8 in Silver Spring, Maryland. Co-hosted by Cybercom and AFPC's Air Force Civilian Service talent acquisitions team, the event featured on-site resume reviews and interviews, with multiple qualified individuals receiving job offers. More than 400 people attended the event, with 500 more candidates registering online, officials said.

Cybercom hiring managers screened more than 300 resumes, resulting in same-day interviews for 70 people and 18 on-the-spot job offers. Positions hired include those for cyber operations, acquisitions and support. Officials said they expect more offers to come as they review the remaining resumes.

The two organizations followed up at a community job fair here May 23. Cybercom recruiters talked to prospective candidates and collected more than 200 resumes to consider for current and future positions. JFHQ-DoDIN and DISA also recruited at the job fair.

"*These were an enormous success for the command and an important milestone as we just elevated to a combatant command on May 4*," said Air Force Col. Bill Norton, Cybercom's director of manpower and personnel. "*This is absolutely huge for the command, as the competition of cyber talent is hypercompetitive*."

Cybercom is far from finished with the CES hiring. Looking forward, the command will be recruiting at the San Antonio CyberTexas Job Fair on Aug. 14, again on Fort Meade on September 12, and in Baltimore at the Cyber Maryland Job Fair on October 9.

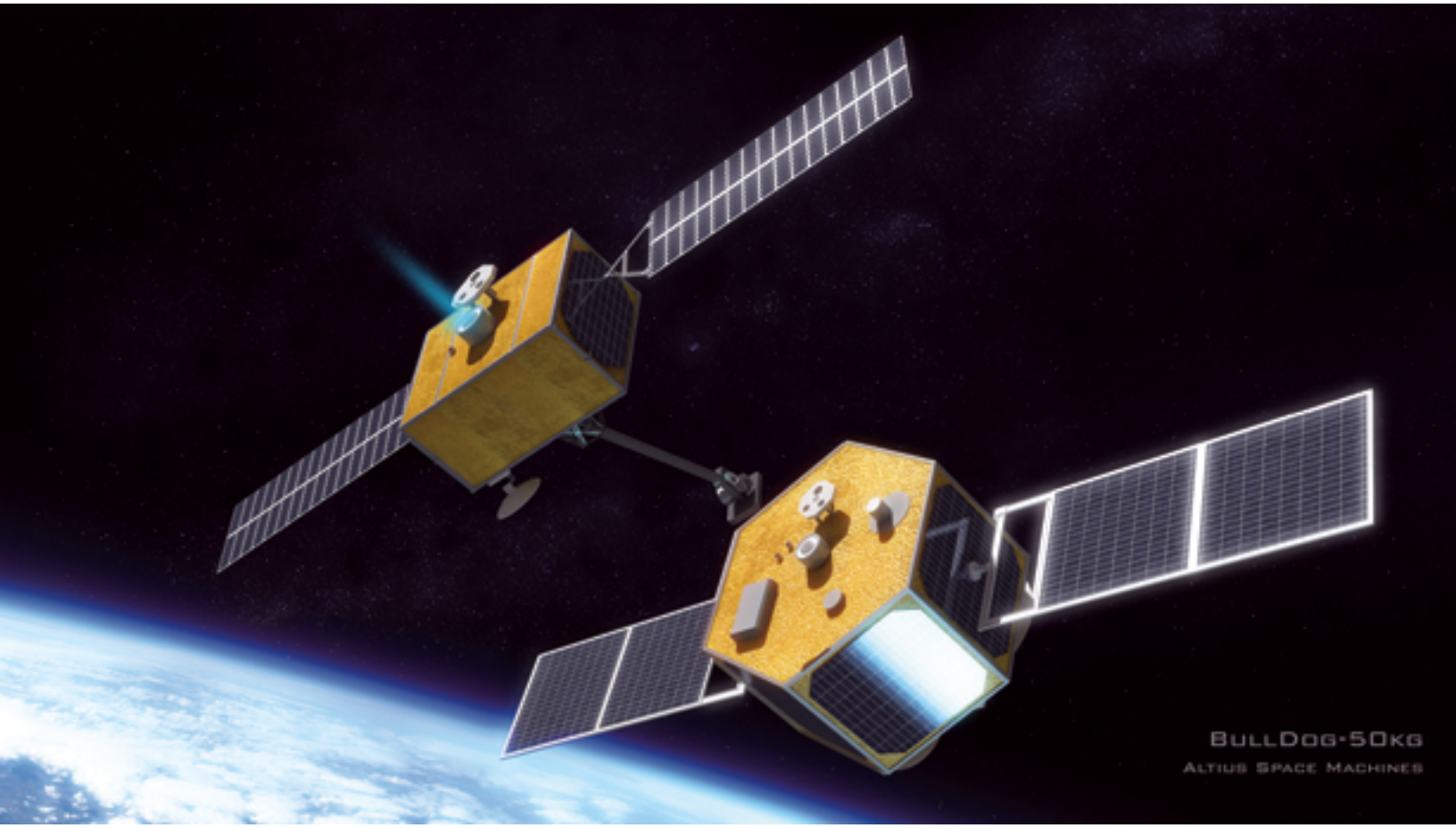
"*The cyber field is in demand and growing daily*," Norton said, noting that the CES offers a fast-tracked route to join Cybercom and jump into a "*dynamic operating environment with unique challenges*."

To register or learn more about hiring events, visit
www.afciviliancareers.com
or email your resume or questions to
cyber_recruiting@cybercom.mil.

SERVICING IN LEO

New possibilities

By Shawn Usman, Astrophysicist, Altius Space Machines



As the national security establishment's presence in space increases, the proliferation of space robotics will enable advanced missions in Low Earth Orbit (LEO) and beyond.

Civilian, military, and intelligence space capabilities all benefit from an increased presence of robotic satellite servicing technologies in space.

The United States Department of Defense (DoD) and the National Aeronautics and Space Administration (NASA) have made sizable investments in space robotics technologies, how the field is viewed is the key to maintaining the United States' place as a leader in space technology.

However, few robotic servicing investments are focused on serving the highly distributed reconnaissance and telecommunications smallsat constellation that is currently being assembled in LEO by the private NewSpace industry. Altius Space Machines is developing a low-cost LEO-centric satellite servicing architecture to fill this emerging technological gap.

This perspective article first describes the motivation for developing LEO smallsat constellations, provides a history of U.S. government satellite servicing investments to date, and finally provides a perspective on the role that Altius will play in providing affordable satellite maintenance capabilities.

The Promise...

The United States of America's national security establishment has begun to assemble a massively distributed LEO space infrastructure in an effort to avoid future space conflicts.

Mr. William Lee Shelton, former Commander of U.S. Space Command, publicly stated that "*Beyond the necessity of finding efficiencies and cost savings, we may very well find that disaggregated or dispersed constellations of satellites will yield greater survivability, robustness and resilience in light of environmental and adversarial threats.*[1]"

This simple, yet effective strategy, renders kinetic strikes and directed energy attacks significantly less effective by robbing such attacks of traditional "big juicy targets" as General Hyten, commander of U.S. Strategic Command recently said[2].

Such a strategy not only rewards the nation with the most distributed space infrastructure, but it also dissuades adversaries from launching preemptive attacks as the repercussions for such an infraction would far outweigh the benefit of disabling such a small part of the overall space infrastructure.

The United States Intelligence Community (IC) has recently taken concrete steps to realize Mr. Shelton's vision of replacing traditional space assets with disaggregated LEO smallsat constellations.

Originally described as "*Poor Man's National Technical Means (NTM)*", commercial satellite imagery now provides ubiquitous and high-resolution imagery access to anyone with an internet connection[3].

Mr. Robert Cardillo, Director of the National Geospatial-Intelligence Agency (NGA), has tasked his agency to "*embrace emergent commercial capabilities with the same dynamism that we embraced NTM decades ago*[4]."

Following suit on his promise, the NGA awarded a $20M contract to Planet Labs, followed by a $14M contract in 2017 for "*persistence and global coverage capabilities that could most effectively support the NGA mission*[5]."

In addition to the NGA, the National Reconnaissance Office (NRO) has a publicly declared cubesat program[6] with the Director of the NRO, Ms. Betsy Sapp, stating "*Cubesats, smaller sats, combined with affordable launch, are a huge enabler for us*[7]."

Aside from imagery, the smallsat revolution is also beginning to target non-imagery markets. Several emerging smallsat companies seek to provide commercial signals intelligence apparatus with the detection of radio frequency (RF)-emitters, low bandwidth Internet-of-Things (IoT) networking capabilities, and an infrastructure to enable machine-to-machine (M2M) interactions.

Lastly, Big LEO constellations from OneWeb, SpaceX, and others promise high bandwidth, low latency communication to government and commercial customers worldwide.

The recently announced Defense Advanced Research Projects Agency (DARPA) Blackjack program seeks to leverage these Big LEO telecom constellations to serve as a mesh-network backbone, thereby enabling DOD LEO smallsats capabilities to support missile defense, tactical communications, and signals intelligence.

Despite this progress, there is currently not a plan aimed at enabling robotic servicing of these LEO satellites that will be in orbit in 2020 and beyond.

The DOD and NASA have only made investments in robotics technologies whose high costs limit their use to very high-value military assets and large GEO telecom satellites.

As such, there is a technological gap to provide low-cost satellite servicing capability to spacecraft in LEO.

USG Satellite Servicing Investments

As mentioned previously, satellite servicing has long been a topic of intense interest to the DoD and NASA.

This interest has largely been spearheaded by DARPA, which began its interest in space robotics with the ***Spacecraft for the Universal Modification of Orbits*** (SUMO) program in 2002, followed by the ***Front-end Robotics Enabling Near-term Demonstration*** (FREND) program in 2005, with an eventual on orbit demonstration of satellite servicing in 2007 with their ***Orbital Express*** program.

Following these three successful satellite-servicing programs, DARPA launched the ***F6*** program in 2009 to demonstrate a distributed satellite hardware architecture.

The F6 program was inherently linked to the DARPA ***Phoenix*** program, which aimed to construct a satellite in-orbit with the parts of decommissioned satellites "cannibalized" by the Phoenix spacecraft.

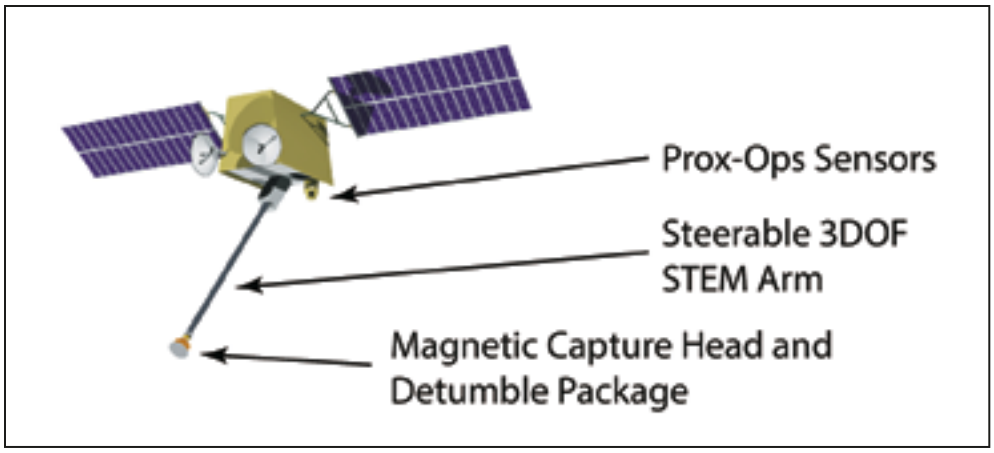
After investments of US$200M, the F6 program was canceled in 2013 and the Phoenix program restructured in 2015, due to the U.S. Air Force's dissatisfaction with the program.

The new focus of the Phoenix program was to focus on working on an operational satellite for commercial and military applications, as such an approach could improve resiliency in space.

This simple, yet effective strategy, renders kinetic strikes and directed energy attacks significantly less effective by robbing such attacks of traditional "big juicy targets," as General Hyten, commander of U.S. Strategic Command recently said[2].

Finally, in 2016, DARPA launched the ***Robotic Servicing of Geosynchronous Satellites*** (RSGS) program.

The program was a partnership between commercial and government entities, essentially combining all the technologies from SUMO, FREND, and Phoenix with a commercial bus provider to demonstrate on orbit demonstration of a geosynchronous satellite by 2021.



Unfortunately, this program was marred in controversy from the start, with Orbital ATK filing a lawsuit against DARPA for the government competing with a commercial capability.

The suit was eventually dismissed, and DARPA announced it was partnering with Space Systems Loral to develop the geosynchronous satellite-servicing vehicle.

Meanwhile, Orbital ATK recently signed two contracts with Intelsat to provide satellite-servicing capabilities at geostationary orbit.

The end result of nearly 30 years of DoD and NASA investment has resulted in three planned U.S. satellite servicing missions upcoming in the next three years:

- *Orbital ATK's commercial Mission Extension Vehicle 1 (MEV-1) which will provide life-extension services for commercial GEO communications satellites*
- *NASA's Restore-L mission which plans to refuel the Landsat-7 Earth science spacecraft*
- *DARPA/SSL's RSGS mission, which targets more sophisticated servicing of commercial and government spacecraft in GEO.*

While the hope is that these missions will open the door to widespread satellite servicing in GEO, two challenges may make it difficult to leverage these systems for servicing LEO satellite constellations.

First, LEO constellations tend to have much lower per satellite costs than their GEO counterparts. To be worthwhile, satellite servicing has to have a transaction price that is significantly lower than the replacement cost of the spacecraft.

Second, LEO constellations involve significantly more spacecraft than GEO, and these spacecraft are usually distributed across a large number of different orbital planes, adding significantly more time and/or propellant to transfer between those planes.

The larger number of spacecraft, and the mass-produced nature of these spacecraft will require much higher satellite servicing frequency. Due to these issues, a new low-cost architecture is needed to specifically address the smallsat LEO constellation.

Altius LEO Satellite Servicing

Altius is initially focusing on providing backup end-of-life disposal services for high-altitude LEO assets that are unable to complete their own post-mission disposal maneuvers (e.g., failed spacecraft from the proposed Big LEO constellations) and eventually extending this to more sophisticated servicing including propellant transfer and the installation of plug-and-play modules to repair or upgrade spacecraft.

The autonomous servicing of these assets is essential to providing the flexibility, resilience, and persistence needed by government and commercial customers. Such servicing solutions provide satellite maintenance to enable a new generation of capabilities in space.

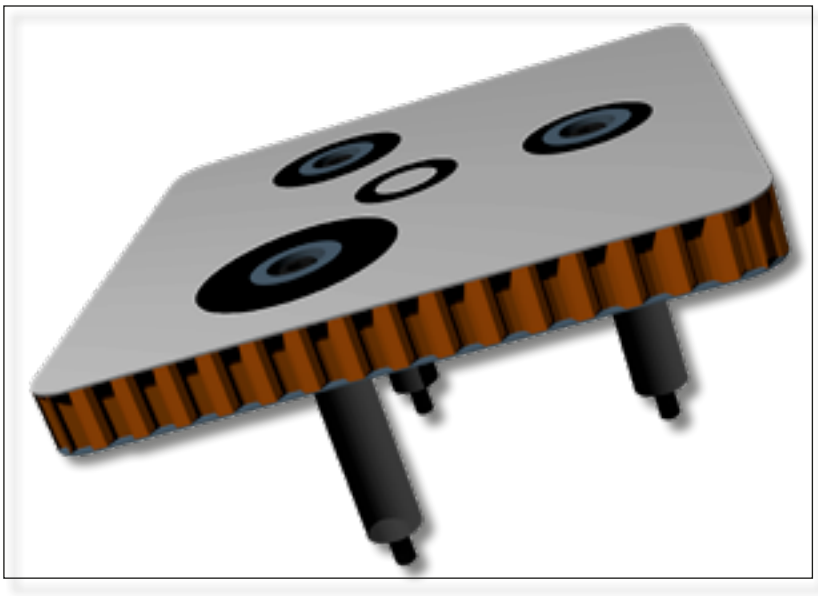
Altius' BullDog servicing solution is based on two key technologies: Altius' patented Sticky Boom™ robotic capture system, which is incorporated into the BullDog servicing vehicles, and the Altius' DogTag™ grapple fixtures, which will be mounted pre-launch as a cooperative servicing aid on the customer vehicles.

The Altius' BullDog servicing solution will transition rendezvous-proximity-operations from a complicated and expensive endeavor, to one that is routine and low-cost.

Sticky Boom uses a 6 degree-of-freedom steerable, long-reach (2 to 5 meters), extendable/retractable composite arm with an electro-permanent magnetic (EPM) capture head to magnetically attach to the target vehicle's DogTag.

The EPM gripper is a solid-state switchable magnet that only requires power to switch on or off, allowing the gripper to remain magnetized indefinitely without requiring continuous power.

The Sticky Boom allows capture of even tumbling targets without requiring a highly-maneuverable, expensive spacecraft bus, by offloading most of the complexity to the Sticky Boom and EPM capture head.



DogTags are a lightweight, low-cost cooperative capture interface (~250g and ~US$1,000 for the Big LEO constellation version) installed on a satellite before launch that makes a target spacecraft much easier to capture by combining a sheet of magnetically-grippable ferrous material with optical fiducial markings on its surface. This technology, therefore, provides an easy machine vision target for simple rendezvous sensors.

The ferrous material in the DogTags provides a strong magnetic target for the EPM gripper head, without retaining significant residual magnetic fields when the gripper is removed, thereby minimizing magnetic interference with the target spacecraft.

The fiducial markings enable the BullDog sensor to precisely estimate relative position and movement of the capture target prior to connection without the need for complex and expensive LIDAR systems.

By using these pre-installed DogTag cooperative capture interfaces and the Sticky Boom capture system, Altius can provide affordable LEO satellite servicing using a low-cost, smallsat-scale Bulldog servicing vehicle.

The IC/DOD's highly disaggregated future space architecture will likely maintain the United States' space dominance for decades to come.

By providing low-cost, efficient satellite servicing capabilities to the future disaggregated space architecture; Altius aims to play a critical role in continuing an era of U.S. space superiority.

www.altius-space.com/

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Mr. Usman has more than a decade of federal service with the United States Intelligence Community where he led teams in the development of next-generation reconnaissance systems.

A NEWTEC DIALOG

Efficiency and reliability for On-The-Move Comms

By Koen Willems, Market Director, Government and Defense, Newtec

Different market reports and dedicated media predict a big increase in On-The-Move (OTM) and On-The-Pause (OTP) applications over satellite, mainly due to the change in operations by government and defense agencies to cope with the new geopolitical events, environmental challenges and conflicts.

The large military deployments observed in the past in Iraq and Afghanistan are now being replaced by a scattering of smaller deployments and theaters around the world.

Peacekeeping and first responder operations are shorter and more agile. In addition to flexibility, there is the need to communicate anytime and anywhere to provide near real-time situational awareness and have information superiority over any adversaries.

First responders need to set up communications as quickly as possible in disaster areas to activate logistical support, sending out first reports and starting their emergency activities.

The multitude of sensors and multimedia services (video, data, voice) on board these OTM and OTP platforms have increased the need to support growing volumes of throughput over reliable satellite links.

Traditional narrow-band and legacy VSAT solutions find difficulties in coping with these new requirements. Disruptive VSAT technologies are taking over this market at a quick pace.

In regard to traditional Fixed Satellite Services (FSS) satellite capacity, the market research company Northern Sky Research (NSR) reports a growth rate of between 7 and 12 percent in the amount of shipments of Satellite Communication (SATCOM) systems for OTM and OTP applications.

The main market growth however can be seen in High Throughput Satellites (HTS), increasing from 25 to 53 percent over the coming years.

Although the new HTS constellations solve the throughput requirements, they increase the complexity of OTM and OTP applications as the satellite beams become smaller and traveling between the different beams requires sophisticated beam switching solutions.

Furthermore, satellite capacity planning becomes a headache when using legacy VSAT platforms and MF-TDMA waveforms on HTS satellites.

Current VSAT Technologies Are Not Always Adapted for OTM and OTP Applications

The increase in OTM and OTP communications over satellite presents a set of technical challenges that need to be addressed.

To develop an efficient OTM and OTP VSAT network requires a deep understanding of end-user government and defense operations, innovative technologies, new satellite constellations and a need to overcome various technical challenges.

In this article, seven technology challenges will be presented and then they will be matched with the disruptive and innovative technology on board the Newtec Dialog® VSAT platform in order to provide seamless, efficient and multiservice communications over satellite.

The Seven Technology Challenges

- *Small antennas*
- *Increased throughput to cater for bandwidth hungry applications*
- *New constellations using GEO, LEO and MEO HTS satellites*
- *Moving platforms*
- *Seamless operations*
- *SWAP-C*
- *Future technologies (IoT, 5G, connected vehicles)*

Challenge 1 — Small Antennas

OTM SATCOM terminals use very small antennas mounted on airborne, land and naval platforms. These are often restricted in form factor. OTP SATCOM terminals need to be small to increase transportability and facilitate easy installation. Antennas of this dimension greatly limit the achievable link budgets of a satellite network. In addition, the pointing error and focus of such antennas often requires using efficient modulation and power spectral density reduction technology to mitigate Adjacent Satellite Interference (ASI).

The new-generation OTM antennas sit flat on top of the platform and use phased array antenna technology. Although these low-profile antennas provide better aerodynamics, they can cause scan angle issues, resulting in low performance and ASI again. The scan angle depends on the elevation angle of the satellite and the orientation of the OTM platform and its antenna vis à vis the satellite and the geostationary arc.

Challenge 2 — Increased Throughput

In government and defense operations, such as Intelligence Surveillance and Reconnaissance (ISR), near real-time situational awareness and detailed information is required to make correct decisions.

Different video and sensor technologies consume significant capacity on the satellite transponder. Raw HD video imaging and sensor technologies such as hyper– and multispectral imaging, infrared etc., already account for a few hundred Megabits to a couple of Gigabits worth of content. Part of the data can be pre-processed on board or analyzed after the mission. However, for real-time operations, a maximum throughput is required. In naval applications, extra capacity is needed to support welfare and e-medicine services, as well as tactical and video conference communications.

During an operation, the throughput needs to be shared over multiple OTM and OTP remote terminals on the same satellite network without creating congestion. As such, the VSAT platform needs to be bandwidth-efficient and flexible at the same time.

Challenge 3 — New Satellite Constellations

Although traditional FSS wide beam satellites are still dominating the government, defense and disaster recovery satcom market, they are gradually being replaced by upcoming HTS constellations.

The new HTS satellites bring several advantages. A key one being the increased throughput and the reduced costs per bit compared to traditional widebeam systems. Newer generation HTS systems allow bandwidth to be moved, or reallocated, in real-time, enabling optimal resource allocation based on changing operational requirements. The high gain spot beams of HTS satellites support the usage of smaller user terminals for OTM and OTP applications.

On the other hand, HTS satellite constellations increase the complexity of the network and the ground infrastructure. An efficient handover needs to be considered when terminals move across spot beams. When operating in higher frequencies such as Ka-band, the OTM and OTP links become more susceptible to atmospheric conditions which could affect the availability of the SATCOM service. Adding Low Earth Orbit (LEO) and Medium Earth Orbit (MEO) to the equation will reduce the delay time over satellite but, at the same time, require more sophisticated (tracking) antenna technologies.

Challenge 4 — Moving Platforms

The government and defense platforms and vehicles requiring connectivity could either be moving around (OTM) or be temporarily stationary (OTP) during the transmission over satellite. This movement has an impact on satellite communications and the required technology to compensate it.

Naval vessels, for example, are moving slowly but are being rocked sideways, up-and-down and front-to-end by the waves. ISR aircrafts are flying at a higher speed and make roll, pitch and yaw movements to fly specific ISR patterns during operations. During these movements, the antenna could face shadowing effects because the tail and wings of the aircraft partly block the line-of-sight between the antenna and the satellite. Skew angle issues, as discussed earlier in the article, also come into play.

Land vehicles are the most difficult to deal with for OTM satellite communications, as shadowing and blockage effects are a continuous concern as a result of driving under bridges, through forests, mountainous regions and cities. All of these vehicles

are expected to operate in rugged terrain, advancing at various speeds and taking sudden corners.

Technologies to quickly recover the link after an outage and compensate for the movements are required to maintain service availability and avoid ASI.

Challenge 5— Seamless Operations

A key requirement for peacekeeping and first responder operations is the service availability and link reliability. Losing the satellite signal could have serious consequences such as endangering human lives, compromising the operation or losing important data which could hamper the decision-making process.

Legacy VSAT equipment with basic adaptive modulation and mobility features still have to deal with minutes of outage due to rain fade, interference, shadowing effects, or sudden link outages. Additionally, in a global network with HTS spot beams, technology to efficiently manage the switching between different beams and different satellites needs to be in place.

A scalable network should be able to handle multiple operations, platforms and services without compromising on availability, reliability or efficiency.

Challenge 6 — SWAP-C

With the continued proliferation of OTM and OTP platforms for peacekeeping and first responder operations on top of ever-increasing budget constraints, the requirement for small Size, Weight and Power (SWAP) has increased significantly. At the same time, cost (C) needs to be limited. With the reduced SWAP designs, the satellite terminals become easier to transport, carry and set up for OTP applications, as well as being as easy to mount on naval and airborne platforms as on land vehicles.

Smaller, lighter terminals require less power consumption, a lighter battery and are less demanding on the generator, as well as offering a wider operational span. The longer ISR aircrafts such as Remotely Piloted Aircraft Systems (RPAS) can be kept in the air, the more effective and efficient the operation.

Challenge 7 — Future Technology

The Internet of Things (IoT), 5G and autonomous and connected vehicles are among the most heavily researched technologies in regard to communication systems.

As the technology has evolved over the past decade, the requirement to keep people, devices and machines connected is on the rise. When translating the connected and automated vehicle for the government and defense market a lot of applications become apparent.

The lack of availability of network services in remote terrains, deserts, oceans, and mountains has produced a growing need to adopt satellite-enabled IoT applications in the defense sector. These connected devices include GPS and tracking systems, health and personnel monitoring devices, along with just-in-time equipment maintenance to support tactical reconnaissance.

Armed forces across the globe have been dependent on satellite-enabled connectivity to support their bases and personnel. Along with this, the technology aids in the predictive maintenance of aircraft or other equipment that uses real-time IoT data to schedule repairs before breakage occurs.
The connected and autonomous cars, for example, give government and defense agencies the ability to send out convoys of connected trucks to carry supplies to difficult, dangerous or hard-to-reach areas without endangering the lives of their deployed logistical staff.

Efficiency and Reliability On-the-Move

Now that the challenges of setting up a network for OTM and OTP platforms are understood, focus can be concentrated on the solutions Newtec can provide through the Newtec Dialog multiservice VSAT platform.

Only disruptive innovations in the SATCOM and MILSATCOM context will be able to respond fully to today's and tomorrow's requirements for government and defense networks.

The Newtec Dialog VSAT Platform

The Newtec Dialog platform is a scalable, efficient and flexible multi-service satellite communications platform that allows network operators and satellite service providers to build and adapt their networks easily as peacekeeping, conflict and first responder operations evolve. As such,

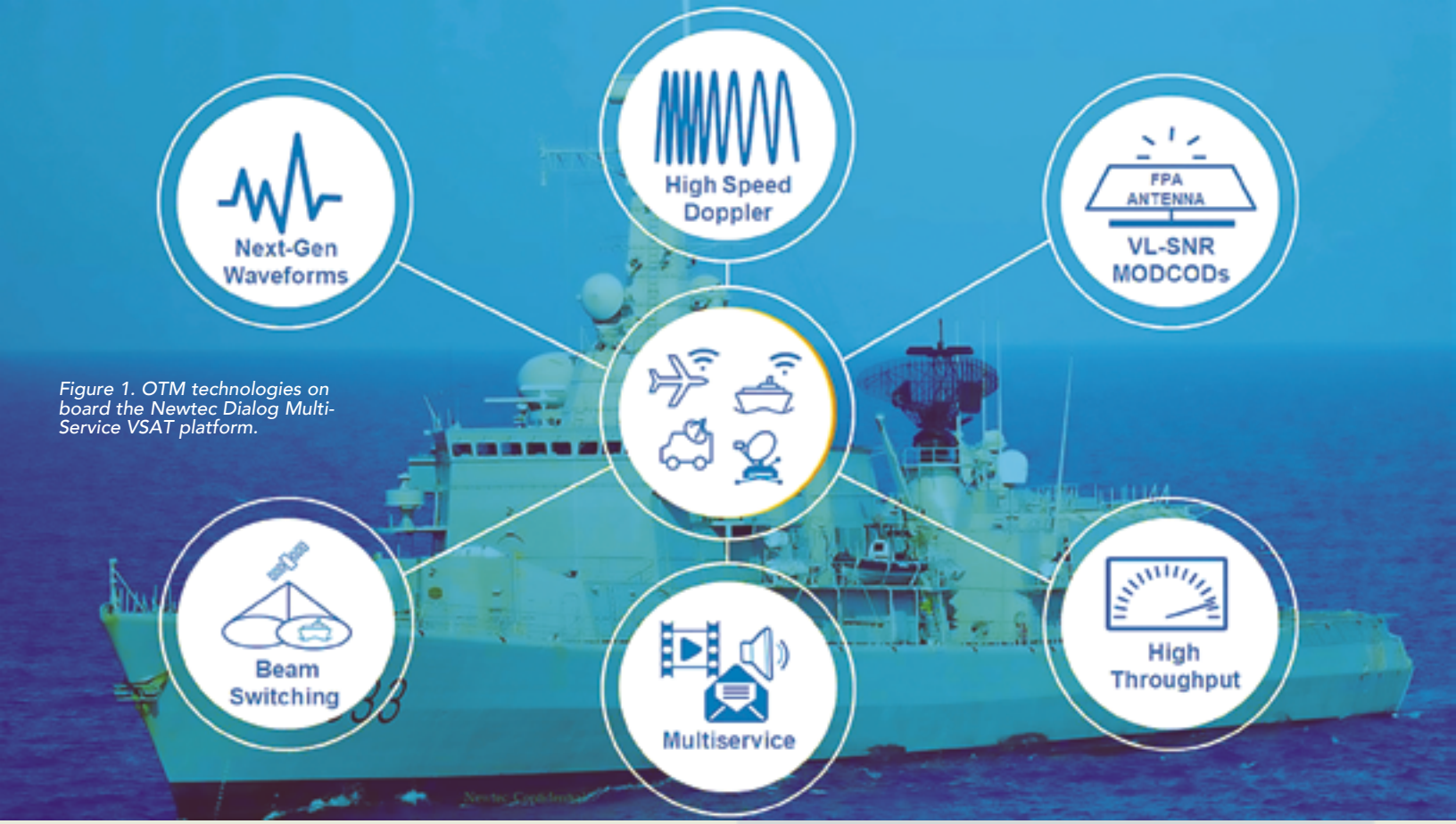


Figure 1. OTM technologies on board the Newtec Dialog Multi-Service VSAT platform.

Newtec Dialog gives them the power to offer a variety of OTM, OTP and fixed services while making hassle-free decisions on which technology to use.

A set of key technologies bolsters the high availability platform to offer highly reliable services at unsurpassed efficiencies. This addresses the continued pressure on the ever-increasing need for more data throughput.

The VSAT platform consists of a variety of hub and modem flavors adapted to the type of network (wideband or HTS) and applications (OTM, OTP, Fixed VSAT). The open Application Programming Interfaces (APIs) on board the Newtec Dialog platform facilitate interfacing with higher layer Network Management Systems and external Mobility Managers to a high degree.

As such, the Newtec Dialog VSAT system can be easily plugged into global satellite networks or **Pool** and **Sharing** initiatives.

The Seven Newtec Dialog Solutions

- *Efficient next-generation waveforms including VLSNR MODCODs*
- *Easy antenna interfaces*
- *High speed Doppler compensation*
- *Seamless beam switching*
- *High speed throughput in shared capacity*
- *Efficient management of a multiservice VSAT network*
- *Future technologies (HTS, beam hopping, 5G)*

Solution 1

Efficient Next-Gen Waveforms

The Newtec Dialog platform supports DVB-S2 and DVB-S2X waveforms in the forward link and three return access technologies from a single hub, including MF-TDMA, SCPC and Newtec's patented Mx-DMA® (Cross-Dimensional Multiple Access). In this section, we will dig deeper into DVB-S2X and Newtec Mx-DMA next-generation waveforms, including:

A. DVB-S2X

Since its release in 2014, the DVB-S2X standard has provided the industry with vastly increased efficiency, service availability and profitability. Having been key to its development, our Newtec team has had a pioneering role in the application of the standard, utilizing its modems and modulators as first modem manufacturer ever since. In a nutshell, the successor to the DVB-S2 standard is a combination of innovative technologies that improve overall efficiency over satellite links by up to 51 percent. The technologies involved in DVB-S2X are:

- *A combination of smaller roll-offs (5, 10, 15 percent) and advanced filtering technologies to allow*

optimal carrier spacing. Compared to DVB-S2, the combination brings efficiency gains of up to 15 percent.

- *The DVB-S2X standard increases the granularity in the MODulation and CODing (MODCOD) schemes and Forward Error Correction (FEC) choices. The amount of MODCODs has grown from 28 in DVB-S2 up to 116 in DVB-S2X, bringing efficiency as close to the theoretical Shannon limit as possible.*

- *Adding higher modulation schemes such as 64, 128 and 256APSK dramatically increases efficiency in high speed applications with improved link budgets provided by bigger antennas and more powerful HTS satellites.*

- *DVB has added nine extra Very-Low Signal-to-Noise (VLSNR) spreading MODCODs to the DVB-S2X standard in the QPSK and BPSK range to mitigate heavy atmospheric fading and to enable the usage of smaller antennas for applications OTM (land, sea, air).*

- *The DVB-S2X standard supports new wideband transponders that are becoming available today. The introduction of the wideband technology also adds an extra 20 percent efficiency gain for legacy 72 Mbaud transponders. Current Newtec Dialog modems support 500 Mbaud wideband transponders today.*

- *Other DVB-S2X implementations are providing different classes for linear and non-linear MODCODs, Channel Bonding and additional scrambling sequences. More information can be found in the* ***Newtec white paper on DVB-S2X*** *on the Newtec website.*

B. NEWTEC MX-DMA

Newtec Mx-DMA is the next-generation dynamic bandwidth allocation return waveform featured on the innovative Newtec Dialog platform and provides high-quality, efficient and reliable links for government, defense and first responder network operators to ensure smooth and seamless operations.

The satellite waveform is fully adaptive to changing traffic, environmental and operational conditions. Newtec Mx-DMA allows network operators to deploy anything between dedicated to low-to-medium overbooked services at any given time and at minimum space capacity cost. In technical terms, this translates into the fact that Newtec Mx-DMA cross-correlates and assigns in real-time.

Return frequency plan, symbol rate, modulation, coding and power-based on return traffic demand, QoS management and channel conditions are all adapted simultaneously for each terminal in the network every single second. As such, a secure and efficient government grade frequency hopping plan can be achieved.

With each carrier assigned to just one terminal, highest return SCPC-like efficiencies are obtained while maintaining the flexibility of MF-TDMA.

Next to industry-leading efficiencies, the Newtec Mx-DMA waveform incorporates several benefits to connect OTM, OTP and fixed Beyond Line of Sight (BLoS) operations over satellite.

- *Implementing Newtec Mx-DMA for peacekeeping and first responder management operations immediately results in important efficiency gains*

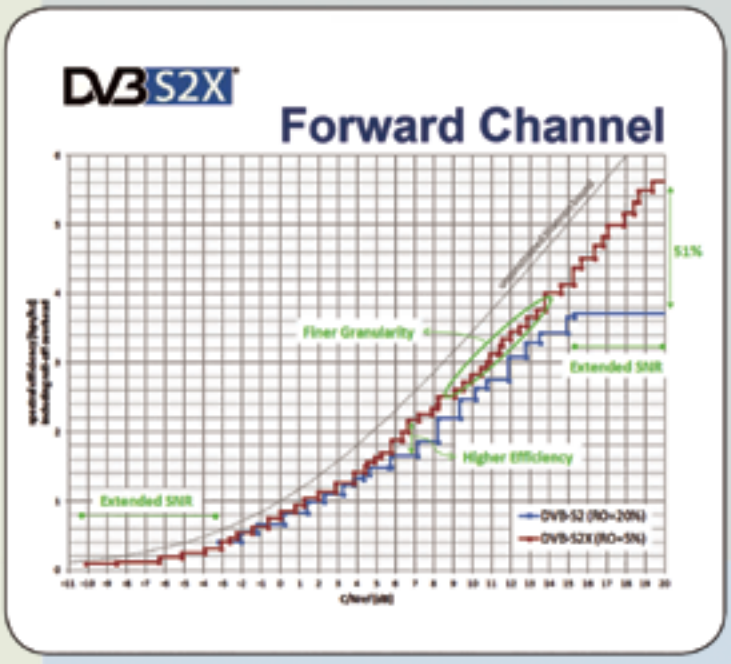


Figure 2.
DVB-S2X waveform in the forward link of Newtec Dialog platform.

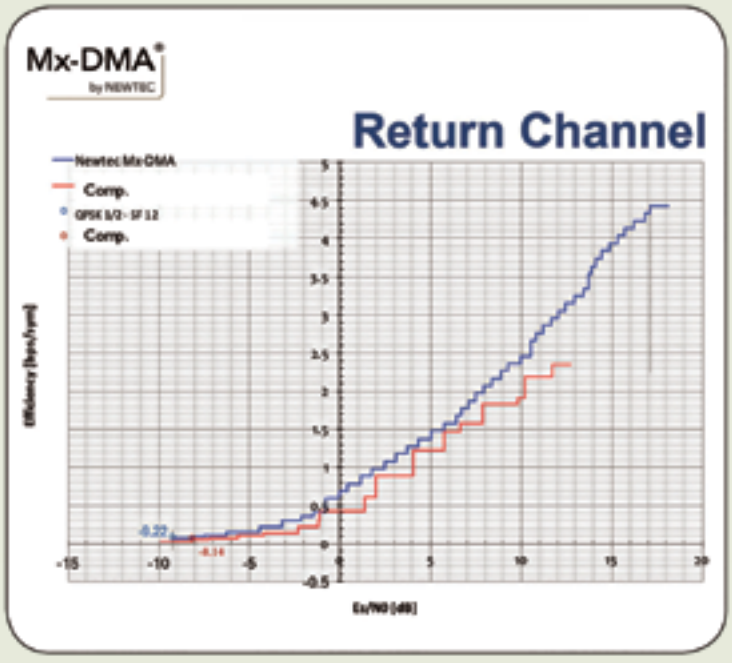


Figure 3.
Newtec Mx-DMA waveform in the return link of Newtec Dialog platform.

(30 to 50 percent) in satellite bandwidth, which can be exploited for different purposes from providing double throughput in the same bandwidth to increasing service availability, cutting costs or a combination of these scenarios.

- *Unlike other return technologies on the market, Newtec's patented Newtec Mx-DMA carrier resizing based on incoming traffic is seamless with zero packet loss and almost no jitter. The Newtec Mx-DMA does not need a buffer to tear down and pull up a carrier with every change in traffic. The seamless changes provide the government and defense end-user with full and continuous situational awareness.*

- *Keeping the satellite link alive and maintaining maximum service availability for mission critical communications is imperative for peacekeeping and first responder operations. The availability of such a service is defined by the capabilities of the technology to handle a certain amount of fading effects such as rain, interference and shadowing. Here, Mx-DMA works with Newtec technology implementations such as FlexACM, statistical multiplexing and deep fading compensation at the lowest margin to optimize bandwidth usage and service availability.*

- *The Newtec Mx-DMA waveform incorporates a set of Very Low Signal-to-Noise (VLSNR) spreading MODCODs as part of the full Newtec Mx-DMA MODCOD range. These VLSNR MODCODs facilitate the use of small and phased array antennas, counter deep fading effects and secure communications when the carriers are hidden in the noise. At the same time these Mx-DMA VLSNRs are 100 percent more efficient compared to legacy spread spectrum implementations. In the next chapter these VLSNR MOD-CODs will be discussed in more detail.*

- *Newtec modems running Mx-DMA provide a significant step forward for SWAP-C requirements. With the efficiency gains, smaller terminals can be used to reach the same throughput demands. At the same time smaller terminals also require less power, are lighter and less costly. On top of that, Newtec Mx-DMA implements automatic uplink power and regrowth control for the Newtec terminals reducing the need for a more powerful or expensive Block Upconverter (BUC) while still achieving higher throughputs.*

- *Instead of engaging in a manual and time-consuming capacity management and carrier planning workflow as in SCPC and MF-TDMA networks — where for every change in the carrier plan a human interaction is required — Newtec Mx-DMA automates the process. The start frequency and stop frequency are defined at the initial carrier planning phase. Within that bandwidth envelope, the different carriers for each terminal will be dynamically assigned by the Newtec Dialog Hub. Newtec Mx-DMA takes over from that point on. Every change in incoming traffic or link conditions will be automatically managed. No human intervention is required anymore at the Network Operations Center (NOC), except for monitoring and control.*

- *More information on Newtec Mx-DMA can be found in the Newtec articles: 'Five Steps towards Efficient Peacekeeping Operations' and 'A Tale of 3 Return Technologies' on the* ***Newtec website****.*

C. Efficient and Secure OTM Operations

OTM applications increasingly demand the installation of extremely small, equivalent, aperture antennas. These antennas limit the link budgets of the network. In addition, the high pointing error and wide beam-width of such antennas often require the use of inefficient power spectral density reduction technologies like spread spectrum to mitigate ASI.

The **Very Low Signal-to-Noise (VLSNR) MODCOD**s inside the Newtec Dialog Mx-DMA waveform compensate for these effects by dynamically spreading power over a higher symbol rate when needed. Newtec Mx-DMA has 10 VLSNR MODCODs which spread power per terminal and per frame rather than spreading per carrier.

The huge advantage of the Newtec Dialog Mx-DMA VLSNR MODCODs is that they are an integral part of the overall Mx-DMA MODCOD range. Compared to legacy MF-TDMA-based VSAT systems, there is no need to provision extra satellite bandwidth to cater for the spreading MODCODs.

Additionally, there is no buffering or switching required

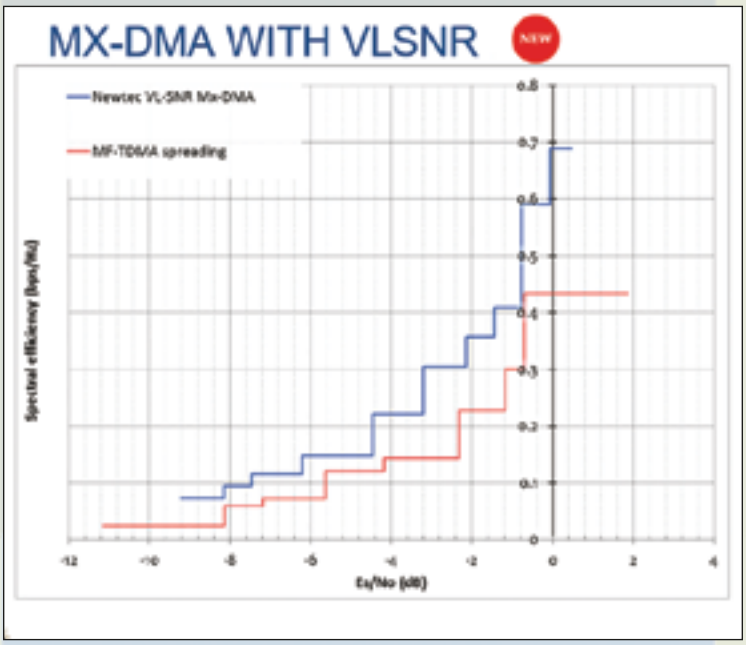


Figure 4: Newtec Mx-DMA VL-SNR MODCODs in the return link of Newtec Dialog platform

which could lead to packet loss. In conjunction with Newtec's adaptive modulation technology, FlexACM, the modulation can change from 8PSK to a VLSNR MODCOD, with a spreading factor of 12, in a matter of a second in case of a sudden deep fading effect without impacting neighboring carriers in the bandwidth envelope. Implementing the **Newtec Mx-DMA VLSNR MODCODS** in a satellite network with OTM and OTP platforms increases overall performance by 100 percent when compared to legacy VSAT networks.

The extra benefit from implementing the VL-SNR MODCODs for government, defense and first responder networks is that they provide extra security and resilience alongside the Newtec Mx-DMA government-grade frequency hopping on board the Newtec Dialog platform and typical encryption standards.

When going into stealth mode, the OTM or OTP platforms can hide the carrier under the noise floor. At the same time, it is possible to combine VL-SNR carriers under the noise, and normal carriers alongside, in the same bandwidth envelope to avoid consuming extra bandwidth.

During an operation, if the OTP or OTM terminal suddenly needs to go into stealth mode, the modem settings can be entered through the GUI and the system will automatically adapt itself in a second without the need for time-consuming frequency planning.

Solution 2

Easy Antenna Interfaces

To easily interface with a variety of OTM and OTP antennas, the Newtec remote modems and OEM cards comply with the OpenAMIP standard. This IP-based protocol basically facilitates the exchange of information between the antenna controller unit and the Newtec modem. The modem will inform the antenna which satellite to point to, enabling the use of Automatic Beam Switching (see later chapter) when moving across multiple satellite beams. Furthermore, the modem will instruct the antenna to mute the signal in no-transmit zones to meet with government regulations.

The Newtec Dialog platform will also compensate for skew and scan angle issues. Depending on the location and positioning of the OTM platform vis-à-vis the horizontal equatorial arc, the system will adapt power and modulation. In certain use cases the power and modulation can even be clamped at a certain level to meet the satellite operator instructions. These instructions can either be fed through the open API available on the Newtec modems or can be triggered via presets on the Newtec modem itself. The interaction with the Newtec Dialog technologies on board the Newtec modems will ensure a maximum throughput without causing ASI when considering small, phased array or flat panel antennas for the network.

Solution 3

High Speed Doppler Compensation

The Doppler effect gets introduced when objects move. The Doppler effect is the apparent change in frequency in a wave caused by relative motion between the source of the wave and the observer. The Doppler effect impacts the effectiveness of OTM antennas and could degrade the performance of demodulators inside the VSAT hubs and cause link outages. The Newtec Dialog platform has more efficient Doppler compensation technology integrated in the Newtec Mx-DMA return waveform compared to legacy VSAT systems which need extra margin to counter the Doppler effects.

Through the dynamic Doppler compensation technology, the frequency of the Newtec Mx-DMA signal is dynamically offset during the transmission, ensuring the hub receives a constant frequency signal. As such the satellite link performance can be maintained regardless of the OTM terminal's position, location or movement.

Solution 4

Seamless Beam Switching

Beam switching technology typically comes into the picture when government, defense and first responder operators deploy their networks on a global scale and consider using HTS spot beam satellites. This technology will allow the OTM platform to move across satellite beams from the same or different satellite constellations.

As these OTM networks become larger and more complex, there is an accelerated need for more sophisticated beam switching systems. Two key aspects need to be considered when selecting a VSAT platform for beam switching technology. Firstly, does it provide seamless operations and reduce time outage and secondly, does it avoid distribution of GPS coordinates that might reveal the location of the platform?

The Newtec Dialog platform includes an advanced central beam switching engine called the Newtec Dialog Mobility Manager. The beam switching decision making can be easily customized to adhere to specific and sophisticated switching rules. While the Newtec Dialog Mobility Manager is a turn-key solution, customers also have the option to implement their own mobility managers, giving them unprecedented control over beam switching logic.

As such, the network operators can effectively manage issues like network load balancing, regulatory compliance, and most efficient routing switching towards non-congested, lowest-cost satellite beams. Switching times are literally reduced to a couple of seconds or near-seamless handovers depending on the OTM network implementation (one or two antennas, make before break, etc.). This gives the end-user virtually uninterrupted situational awareness and mission critical communications without packet loss. When OTM terminals are offline due to full shadow blocking effect or if the OTP terminal is being shipped between theaters, a local Automatic Initial Beam Selection (AIBS) process runs on the Newtec Dialog modem to help it join the network, anywhere in the world.

In this process, there is no need for GPS exchange to identify all eligible beams available in a given area. AIBS then uses an arbitrary "cost" variable (e.g. least congestion) and satellite elevation angle (higher elevations are preferred) to sort the available beams.

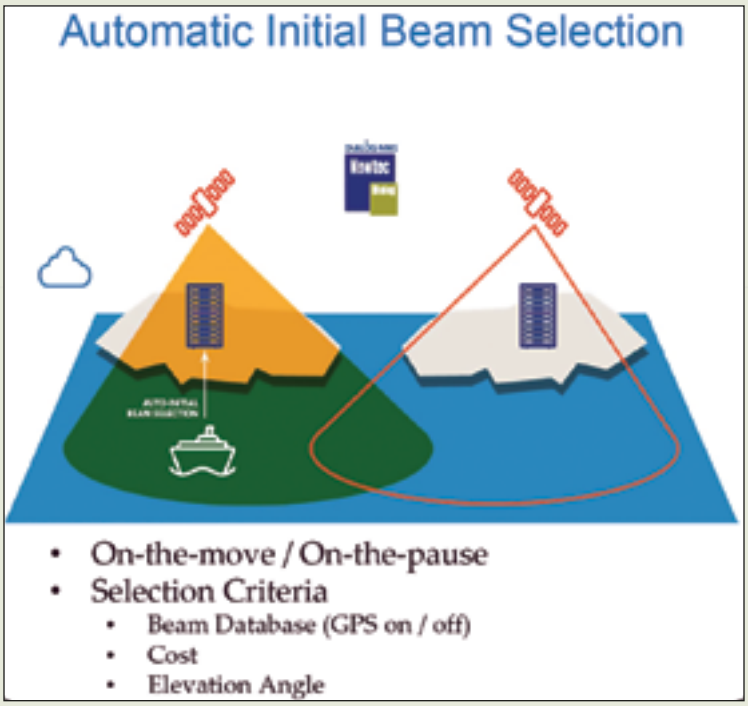


Figure 5.

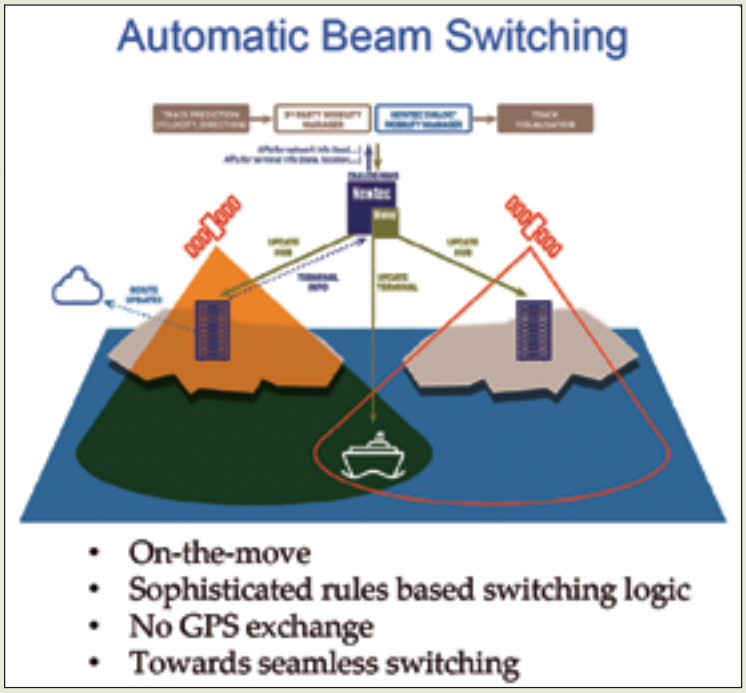


Figure 6.

Exclusion zones can be defined on each beam to enforce regulatory restrictions. Beams are tried one at a time in the order determined by AIBS, while respecting any exclusion zones. Once a terminal successfully joins the network, all subsequent beam switches are managed by the Newtec Dialog Mobility Manager.

Solution 5

High Throughput in Shared Capacity

OTM and OTP platforms are increasingly confronted with the need to transmit big amounts of throughput (sensor data, HD video, ISR data) over satellite to provide ISR, situational awareness, tactical, welfare and other mission critical services. Legacy satellite systems will typically tackle this demand by deploying dedicated point-to-point SCPC modems and satellite links if the VSAT system cannot handle the requested data rates.

With the Newtec Dialog platform the network operator can connect fixed, OTM and OTP terminals on a single VSAT hub or system and share the high throughput forward and return links in the same dedicated bandwidth pool. There are multiple benefits in working with such a configuration. Obviously, it will save CAPEX and OPEX investments because of less equipment at the hub and the gained bandwidth efficiency. On the other hand, the management of the operations becomes easier and more efficient.

For example, during a humanitarian operation with multiple OTM terminals (e.g. Navy vessels in Mediterranean Sea) which is using one shared satellite bandwidth envelope on Newtec Dialog, if one of the vessels picks up a high value target (e.g. human traffickers), the Newtec Dialog platform will sense the increased throughput demand and automatically allocate extra capacity to that vessel to get as much granularity and details out of the sensor imagery as possible.

This automated allocation will be based on the activation of the sensors and increased incoming traffic demand, as well as Quality of Service and Priority rules presets. During that time the other vessels' throughput will dynamically be reduced unless the satellite network operator decides to extend the bandwidth.

Solution 6

Efficient Management and Planning of a Mult-Service Network

The final step for the peacekeeping, or first responder, satellite network operator is to deploy the Newtec Dialog VSAT platform in an operational context. Planning

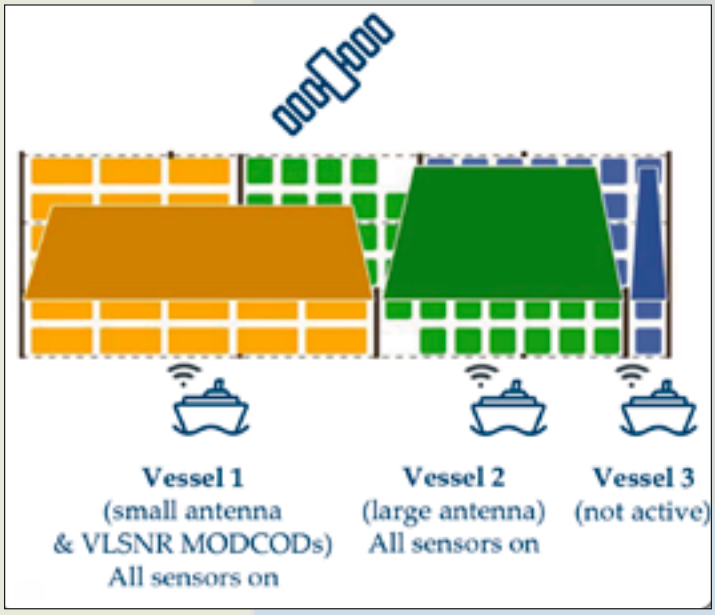


Figure 7. Humanitarian naval use case with two vessels following a human trafficker at sea.

and managing a VSAT network that covers multiple operations and theaters with a diversity of OTM, OTP and fixed remote platforms is not an easy exercise for network operators because a lot of elements need to be taken into consideration.

Adding a Pooling and Sharing concept to the equation may even increase the complexity. The type of VSAT selected for the job is key to managing the complexity. 1 (small antenna and VLSNR MODCODs) All sensors on Vessel 2 (large antenna) All sensors on Vessel 3 (not active).

The network operator will need to determine the amount of operations and theaters that they want to service from the VSAT network, whether these operations are on a regional or a global scale and what coverage they have to plan. As a result, there might be a need to address multiple satellites, different satellite beams and frequency plans.

To add to the complexity, the operations could consist of different platforms (OTM, OTP, nomadic and fixed) and have a variety of services (video, data, voice) running over the satellite links. Each platform demands a dedicated Service Level Agreement (SLA) type with individual throughput, availability and performance requirements.

When the platform is OTM (naval, airborne or land vehicles), seamless operations have to be assured, switching between different satellite beams and taking into account small antennas and Doppler effects.

The Newtec Dialog VSAT platform embraces the complexity of these kind of peacekeeping and first responder networks over satellite. The combination of innovative technologies on board the Newtec Dialog VSAT solution provide the network operator with a flexible, scalable and efficient tool to manage all the different elements on a single platform without compromising on resilience, security or affordability.

A key element in the Newtec Dialog toolbox is the Network Management System (NMS) that helps to manage the complex global network over satellite, including OTM and OTP platforms moving across different beams, satellites and satellite constellations. The Newtec Dialog NMS provides a single, scalable, unified interface for all configuration, monitoring and troubleshooting of the platform. Whether a small, dedicated private hub or a large HTS network with teleports at different geographical locations, the Newtec Dialog platform can handle all operations whatever their size. This means network operators can manage their entire globally distributed Newtec Dialog platform from the same NOC. Additionally, the Newtec Dialog Satnet Calculator will help the network planner to set-up and manage the different operations and satellite capacity requirements across the world.

Solution 7

Upcoming COTM/COTP Technologies

Newtec is already preparing the Newtec Dialog platform for future and upcoming satellite architectures. There is no question that HTS technology (GEO, MEO and LEO) is transforming the satellite industry.

This evolution in the payload is driving the market to look for new opportunities to exploit the increased performance it can offer. However, for HTS to succeed, this innovation in space must be matched on the ground.

This key dependency drives Newtec to ensure the Newtec Dialog terminal and hub technologies are ready to maximize the benefits of HTS, and are never the weakest link in the value chain. A key expertise provided by Newtec will be how to handle future OTM and OTP platforms moving across these new HTS satellites using beam hopping and beam shaping technologies.

The need for data to be delivered everywhere will see 'Communications On The Move' become an increasingly key Newtec Dialog application. Newtec is already making great strides here, with hundreds of Newtec-designed modems on commercial flights with Panasonic Avionics and integrated into multiple airborne ISR platforms.

Figure 8. Efficient management of the SATCOM network covering multiple operations using the Newtec Dialog VSAT platform.

Beyond this, Newtec is actively working to expand its solutions for upcoming 5G networks. Newtec is working closely in this area with other industry partners such as the European Space Agency (ESA), that includes defining solutions and investigating opportunities for satellite to support 5G across expanded vertical industries. The transformation towards connected vehicles and the IoT will surely define the feature set and design of upcoming Newtec Dialog VSAT releases.

Conclusions

VSAT technology needs to embrace the complexity of peacekeeping and first responder networks over satellite.

The efficiency of these operations is directly linked to the efficiency of the VSAT platform.

Firstly, a multiservice VSAT solution such as the Newtec Dialog platform is needed to allow operators and satellite service providers to build, adapt and manage their networks easily as peacekeeping and first responder operations change or grow.

Furthermore, technology to provide flexible and efficient services towards remote fixed locations and platforms that are OTM (land, sea and air) or OTP is required.

The Newtec Dialog platform gives the current and future users of the system all the elements to provide efficient services towards OTM and OTP platforms. The combination of existing technology and disruptive innovation seeks to maximize throughput at maximum service availability for mission critical communications over satellite.

To cater for OTM and OTP platforms over satellite, the Newtec Dialog platform incorporates the latest and most efficient waveforms DVB-S2X and Mx-DMA, bringing the latest mobility features to the table such as Doppler compensation, advanced beam switching without the need to exchange GPS coordinates, and VLSNR MODCODs that ensure reliability of the link and provide extra security.

The Newtec Dialog VSAT platform is ready for high data demands in the return channel which are typical for ISR and situational awareness applications and can offer these kind of services over shared bandwidth.

In short, make your move towards Newtec Dialog and ride the wave of efficient, innovative and reliable communications for peacekeeping and first responder networks.

Author Koen Willems started his career in 1998 with Lernout & Hauspie as a project manager in the Consulting and Services division. More recently, he joined Toshiba as a Product Marketing Manager for the Benelux and, later, for the European market. In a total of six years, Koen contributed to all of the major Toshiba Retail IT product releases.

Mr. Willems is currently the Market Director for Government and Defense for Newtec, a Belgium-based specialist in satellite communications.

Koen holds a degree in Germanic Languages (University Ghent, Belgium, 1997) and completed a Masters degree in Marketing Management program at the Vlekho Business School in Brussels (1998). He acquired a Six Sigma Black Belt for product development and process improvement in 2006.

The Seven Newtec Dialog Platform Benefits for Government and Defense Satellite Networks

EFFICIENT
Double throughput at the highest availability

FLEXIBLE AND EASY-TO-USE
Ready to deploy anytime anywhere

SCALABLE
Scale your network to your operational needs

ON-THE-MOVE
Seamlessly connected on sea, air and land

GLOBAL
From regional to global connectivity

MULTISERVICE
Video, voice and data on a single platform

SECURE
Robust and resilient links at highest efficiency

SPACE: A CHALLENGING DOMAIN FOR THE DOD

By Ryan Schradin, Senior Contributor and Executive Editor of SES-GS' Government Satellite Report

In May of this year, the Government Satellite Report editorial staff had the opportunity to attend a breakfast event sponsored by the Air Force Association.

This meeting, held at the Capitol Hill Club in the heart of the nation's capitol, was part of the Mitchell Space Breakfast Series and featured an engaging address by Deputy Assistant Secretary of Defense for Space Policy, Mr. ***Stephen Kitay***.

In his position with the Department of Defense (DoD), Mr. Kitay is responsible for establishing policy and guidance for the assurance of space capabilities for both our nation and our allies. He also helps guide DoD strategy for addressing space-related issues, and leads DoD activities in international space cooperation.

Needless to say, Mr. Kitay is well positioned with his finger on the pulse of the nation's current and future space architecture, policy development and implementation and the associated national space and security implications.

The theme of Mr. Kitay's address was, "***A Strategy for Protecting and Advancing our Vital Interests in Space***," a theme that has been repeated frequently at many of the space conferences that we've attended in the past few years. However, before breaking into the familiar messaging about the need to defend our nation's space capabilities, Mr. Kitay discussed why today is an exciting time for satellites and space.

Government Gives Space its Due

According to Mr. Kitay, the space and satellite field has, "*an energy and excitement that is nothing short of remarkable.*" As for the reasons why there is so much energy around space and satellites, Mr. Kitay chalked that up to two separate factors: technology advancements and attention from the top of the government.

"*We could spend an entire day talking about all of the technology changes that are happening directly within the space sector or outside of the space sector that are being applied to it,*" Mr. Kitay explained. "*Space is getting a lot of attention these days. Our most senior levels of government – from our President to Congress to the recently-instated National Space Council – are all focused on U.S. leadership in space across all sectors – National Security, Civil and Commercial.*"

Mr. Kitay went on to explain that the attention being paid to space and satellites from the brass of the military and federal government wasn't just talk, but had the added validity of additional investment and budget dollars.

As Mr. Kitay explained, "*From a DoD space perspective, the President's budget included an additional $1B in this year's budget request and an additional $8B over a five year planning period for space.*"

But that attention, energy and interest in space and satellites isn't just because there are new technologies being brought to bear in the industry. It has a lot to do with the changing space environment and the increased threats to our space infrastructure. This brings us to a very familiar topic in the industry.

Adversaries in Space

Mr. Kitay did an excellent job of laying out the current challenge facing the DoD in space when he said, "*While there are a multitude of friendly international activities and partnerships in space, there is also – unfortunately – a very serious scope and growing maturity of foreign counter-space capabilities. Hands-down, this is the most significant change in space from a DoD perspective. Because of these threats, space is not a sanctuary and we have now recognized space as a warfighting domain. As a result, we need to be prepared to treat it as such.*"

This isn't a new topic. Rather, it's a topic that has dominated the military space and satellite conversation for what seems like years. However, there is a good reason for the military to be taking this seriously, as warfighters have grown increasingly reliant on satellite services and IT tools that satellites enable. U.S. adversaries have grown increasingly capable of denying satellite capabilities to these warfighters.

Mr. Kitay laid out multiple different ways in which the DoD is looking to improve assurance, including, "*through resilience, defensive operations, reconstitution and…even…satellite servicing.*" But he made it clear that attaining assurance was both essential and complex when he said, "*We must assure our space capabilities so that we're prepared to prevail in any environment and against any threat. Let me underscore that there is not a one-size-fits-all solution to space mission assurance. Just as there are a variety of threats and a variety of missions to perform, we are going to need a variety of capabilities, tactics and techniques to achieve our mission.*"

However, there is one way that mission assurance can be improved and, according to Mr. Kitay, this gave for the increased excitement around satellites and space — new technology.

Commercial Blazes a Path to Assurance

Taking advantage of innovation from the satellite industry is one way that the military can improve mission assurance quickly and effectively. Using Medium Earth Orbit (MEO) and Geostationary (GEO) HTS satellite constellations from commercial satellite providers that incorporate the latest in satellite technologies can mitigate the potential for adversaries to deny the military satellite capabilities in a number of ways.

First, these satellites are — by their nature — more difficult to jam, and jamming remains one of the easiest and most effective ways for adversaries to deny satellite capabilities.

As Doug Loverro, Mr. Kitay's predecessor as Deputy Assistant Secretary of Defense for Space Policy, recently said, "*Cyber attack against a variety of communications networks is a difficult challenge. But the far simpler thing that Russia can do. That North Korea can do. That Iran can do. That Botswana can do. That some guy in the middle of a field with a TV truck can do…is jamming. Jamming is very hard to protect against, unless you have the right equipment.*"

But there is more to commercial services than simply protecting against jamming. They also provide other benefits by simply distributing and disaggregating military communications across multiple satellite constellations and providers — making it harder for adversaries to specifically target satellites carrying military signals, and even harder to deny them by compromising a single satellite.

As Mr. Kitay made abundantly clear, the threat of adversaries impacting the nation's satellites remains the largest and most essential challenge for the DoD to overcome. Thankfully, new satellite technologies, led by the commercial industry, are doing more than drumming up excitement for space – they're providing the DoD with a clear and capable set of solutions able to effectively improve our National Security Space architecture.

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.

EQUIPPING THE ROMANIAN ARMY

An ETL Systems case in point

By Dominic Overton, Component Sales Manager, ETL Systems

Founded in 2001, Solhard Technology AKH is a service and equipment provider within the Romanian IT and Telecommunications market.

The company mainly covers the design and integration of communications and information systems. Solhard also provides industrial and defence equipment and is a systems integrator for the defence market.

VSAT Terminals

With a great deal of knowledge and understanding of communications systems as well as the unique pressures and challenges of the defence industry, Solhard was recently awarded a contract with the Romanian Ministry of Defence.

The project involved delivery of multiple VSAT terminals and a framework agreement that spans a period of three years.

With the requirement to provide 60, 1.2 meter transportable satellite communications terminals, Solhard needed a range of products to solve several distinctive challenges.

The project needed to be rolled out in a timely manner and the terminals had to be ready to be easily used upon delivery and installation.

Uncovering Challenges

As with any project of this size, Solhard had to integrate equipment from various providers. As the work started, the company uncovered a variety of challenging issues.

There were a number of elements required for the project that included...

- *The distribution of RF signals from the antenna terminals to the modems*
- *Insertion of an external 10MHz reference signal on to the transmission line with the ability to attenuate the power level to avoid any damage to the equipment*
- *To provide power on to the receive chain*

Solhard initially contacted ETL Systems to provide splitters and combiners to handle the satellite feeds. However, having quickly realized the vast range of the company's RF distribution solutions, Solhard presented their issues to ETL's components team to determine how many of these challenges could be resolved through the use of ETL's products.

Catalin Bordei, CTO, Solhard, commented, "*I contacted ETL Systems as I was aware of the company and its reputation for high quality RF products. I knew they could provide the splitters and combiners. However, I was delighted to realize that they could help with more than just the one issue.*"

Overcoming Challenges

The RF components team at ETL Systems was able to quickly suggest solutions that would resolve all of the previously mentioned issues with the goal of improving RF signal distribution within the VSAT system.

As well as combiners and splitters, ETL Systems provided multiplexers to take the external 10 MHz reference signal on a separate port and multiplex that signal to the L-band RF port, with attenuators integrated to enable Solhard to lower the power level when needed.

Power supply units were implemented to provide DC power to the amplifiers and modems, as well as bias tees, which allow the user to inject DC on the RF line using those power supplies.

Solhard is now able to monitor the network effectively using a 20dB coupler from ETL, providing a lower power sample of the signal on a designated coupled port.

ETL Systems' Model SRY-TR-L1-931 is an IP65 rated, outdoor, VSAT Fiber StingRay chassis.

Finally, ETL Systems also supplied Solhard with terminators to ensure that the performance of the system would not be adversely affected, for example, by signal reflections and unwanted harmonics.

Once the solutions were selected, they were quickly and easily installed and integrated into the VSAT terminals, providing peace of mind to the Romanian Army through the support of ETL's reliable solutions and continual service.

Catalin Bordei, CTO, Solhard, added, "***I was thoroughly impressed by ETL Systems. It was extremely valuable for us to find one provider that could solve all our issues. The customized nature of the service and products was even more impressive, giving me the impression that the equipment was tailor-made, just for me and the technical support was on hand whenever I needed it. ETL is not just providing RF products, but also delivering new capabilities.***"

Dominic Overton, Components Sales Manager, ETL Systems, added, "*Solhard has undertaken a massive project for the Romanian Army. Combining different solutions is never easy, especially when the end result has to be nothing short of perfect. We were of course pleased to be able to help and we were thoroughly impressed with its dedication and attention to detail.*"

www.etlsystems.com/

www.solhard.ro/

The author is Dominic Overton, the Component Sales Manager at ETL Systems

WHEN DISASTER STRIKES...

by Gwenael Loheac, Managing Director, IEC Telecom Europe, and Scott Scheimreif, Executive Vice President, Government Programs, Iridium

Satellite broadband connectivity nowadays is heavily used by organizations, companies and people operating in remote areas where there are no terrestrial communication means, or where it is compromised due to natural disasters, political problems or wars.

This niche of the satellite communications market, as well as the voice and data requirements of militaries and public safety sectors, have changed dramatically over the past few years.

Rapid technology development and the need of more and more bandwidth, has inspired providers all over the world to create satellite solutions that are ready to meet all needs, regardless of location and conditions; solutions that are highly mobile, reliable, easy to carry, to deploy and use.

Gwenael Loheac, IEC Telecom Group

Scott Scheimreif, Iridium Communications

What affected these industry changes and what the future could bring to this market were commented on by top managers and experts from two global satellite market leaders, ***Gwenael Loheac***, Chief Operating Officer at IEC Telecom Group, and ***Scott Scheimreif***, Executive Vice President of Government Programs at Iridium Communications.

Companies, organizations or individuals need extra bandwidth because they want to connect in the field as easily as they are able to do at the office or at home, mentioned Gwenael Loheac. Even in remote areas, such as in the middle of the ocean, individuals use more and more social networks and apps with their personal devices and want to have reliable access to TV channels, movies, or sports events anywhere in the world.

When discussing humanitarian missions and public safety, connectivity is about well-being as well as efficiently reacting to save people's lives. Regarding this, Scott Scheimreif anticipates that there will be an increased desire among clients for small-form-factor antennas, with agile and robust broadband connectivity capabilities that can support fast-paced mobile communications in any kind of environment, regardless of location.

However, providing the military and humanitarian sector with basic communications needs, such as effective voice calls and data transfers, is not enough today — Loheac and Scheimreif both agree. Contemporary satellite connectivity can play a crucial role in taking communications infrastructure to the next level with internet-like functionality and streaming capabilities.

Satellite technologies enable staff members based in remote locations to offer the crucial services that are usual for civil areas, such as e-health, e-learning, and centralized logistics. In addition, satellite communication can enhance operational efficiencies by enabling efficient data exchange, online reporting and monitoring.

Providers actively cooperate with each other as well as with governments to make sure that connectivity is provided when and where it is needed. In this field, IEC Telecom and Iridium have a long history of a successful partnerships.

Iridium's network is comprised of 66 LEO interconnected polar orbiting satellites that cover the entire globe and is the largest commercial constellation in operation today, according to Scheimreif. Due to the constellations unique architecture, it is the only network that delivers complete global coverage, including the Polar regions, making it the ideal network for customers in need of mobile and global connectivity. Thanks to cooperation between providers, these advantages can be experienced by a greater number of customers all over the world.

Mr. Loheac from IEC Telecom noted that Iridium was used by IEC Telecom's humanitarian customers in September of 2017 in the Caribbean during the Hurricanes Harvey and Irma. He further noted that, in case of emergency, first responders can take their flight to the areas under distress with a mobile satellite modem in their suitcase or a mini VSAT system in one or two flight cases that can be loaded onto the aircraft with the additional luggage.

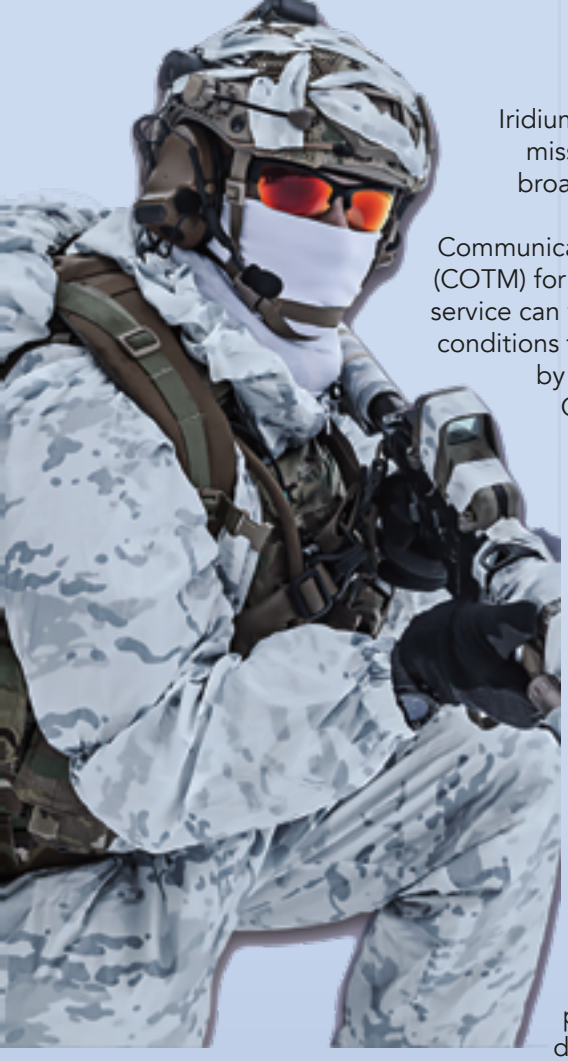
On the other hand, global satellite solution providers such as IEC Telecom specialize in dealing with issues such as control of the airtime usage, sharing heavy data online, and so on. IEC Telecom's solutions enable clients to monitor consumption, apply customized filtering, interconnect remote sites with headquarters or enables compression of up to 99 percent of an image attached to an email without quality loss and even with advantages, according to Loheac. The company's sales team, skilled project managers and engineers join forces to offer the most technically adapted solution that could combine high bandwidth advantages and mobility at the best price.

Another section of this triangle is the collaboration that is possible with the government, international organizations and regional distributors. For instance, Iridium works with the U.S. Department of Defense (DoD) and, during Hurricane Maria, Scheimreif revealed that Iridium's Push-to-Talk (PTT) service (also known as the Distributed Tactical Communication System [DTCS]) was used to support critical group communications across multiple relief organizations, helping to coordinate resources and life-saving rescues.

Photo of Hurricane Maria damage.

Iridium PTT is an ideal solution for emergency response efforts, as proven during Hurricane Maria. The service helps streamline the entire communications process through organized, group communications with a simple handheld satellite terminal. For instance, during Hurricane Maria, Iridium PTT allowed individuals across multiple groups to collaborate on solving many of the crises that were simultaneously hitting the region. During that historic 2017 hurricane season, a significant increase in activity over the Iridium network was recorded. In fact, during Hurricane Maria alone, the network experienced a 3,900 percent increase in usage in Puerto Rico, Mr. Scheimreif said.

With Iridium's Certus, Iridium's next-generation satellite broadband solution enabled by Iridium NEXT, government and humanitarian customers of IEC Telecom and Iridium will gain even more connection capabilities. Both of these top-managers concur that this service will deliver new capabilities to the industry.



Iridium Certus will deliver mission-critical satellite broadband connectivity to support secure Communications-on-the-Move (COTM) for the warfighter. The service can withstand the harsh conditions that are brought on by inclement weather. Certus is robust and durable enough to support mobile communications in high-risk combat zones, connecting end-users when they need it most, explained Scott Scheimreif.

Through this service, United States government's users will be able to securely connect remote assets, mobile platforms, as well as dismounted soldiers, anywhere in the world, including polar regions, he continued.

Whether it's a member of the military operating in a remote combat zone, or an emergency responder tending to a hurricane victim, Iridium's network will be there. Moreover, the coverage is highly reliable, due to the unique architecture of the network and its close proximity to the Earth in LEO, and Iridium's unique L-band spectrum is resilient to poor weather conditions.

With Iridium Certus , IEC Telecom will be able to deliver enhanced capabilities that meet military and public safety needs. These capabilities include, but are not limited to, real-time usage statistics, telematics data, voice calling, personnel tracking applications, and real-time environmental assessments, added IEC Telecom's Mr. Loheac.

The Iridium Certus service will offer dramatic improvements to current L-band services offered by other satellite companies. The service terminals are smaller and capable of maintaining broadband connectivity in fast-paced, unpredictable environments on land, at sea, a in the air.

Additionally, Gwenael Loheac continued, Iridium Certus will eventually deliver the highest L-band broadband speeds on the market, eventually reaching speeds of approximately 1.4 Mbps. With commercial availability scheduled for later in 2018, the service will debut at speeds of 352 Kbps with terminals upgradable to 704 Kbps through a future firmware update, making the service a cost-effective, high-quality, well-rounded and competitive option for all verticals in the satellite space.

As IEC Telecom Europe's Managing Director predicted, more and more bandwidth will be offered to customers, and equipment will become more and more lightweight and easy to use in the future. New projects by Google, Facebook, SpaceX and Thales should bring in the coming years a technology revolution based on low orbit mini-satellites or drones, he suggested.

These new networks should be able to reach 50 Mbit/s with a very low latency and airtime prices should strongly decrease. Even now satellite phones and modems, Loheac said, are becoming more advanced every year — some are already close to matching smartphone capabilities and offer to remote locations the same level of connectivity as GSM or 4G devices. Loheac's colleague from Iridium, Scott Scheimreif, agreed and believes that in the near and long-term, there will be an increase in the availability of smaller terminals with a lower cost-per bit due to more High Throughput Satellites (HTS) in operation.

Outside of the Ka-/Ku-bands of the spectrum, Iridium's new L-band broadband solution, Iridium Certus, will address the needs of this industry for reliable mission-critical communications, that can withstand inclement weather-induced problems like rain fade.

The advantages of the Iridium network's LEO architecture, enabling small-form-factor antennas and terminals, make Iridium Certus an ideal solution for customers operating "on-the-move", offering a robust communications platform that works anywhere in world.

www.iec-telecom.com/

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CYBERSECURITY: PROTECTING SAP SYSTEMS

Governments and municipalities need to consider three key areas

By Thomas Kastner, Managing Director and Chief Technology Officer, Virtual Force GmbH

Technology and, just as importantly, data, were critical even before the full emergence of the internet.

For example, government agencies rely on technology to run more efficiently and must be able to leverage data to better understand their constituents.

When the internet exploded and subsequently morphed into mobile shopping via tablets and smartphones, government agencies of all sizes started to leverage technology such as SAP to run highly complex operations that joined physical and online processes, such as driver's licenses, deeds and permits, business documentations and other pertinent forms.

Because of SAP's vast amount of code and data, this also means agencies have constantly been weary of cybersecurity threats — from internal and external audiences. In fact, there are roughly 320 million lines of code in SAP's Business Suite alone. What's more, they've also struggled to remain in compliance with changing regulatory expectations.

The challenging part governments and municipalities face is that, even if they're large enough to have a dedicated internal IT department, their focus remains on tying operations to the IT function.

The notion that most IT staff are cybersecurity experts is a widespread misconception, leaving thousands of agencies and their millions of constituents exposed to everyday cybersecurity threats.

Such vulnerabilities can be costly — the CISO of a Fortune-500 company once said, "If our company's SAP system is breached, it will cost us $22 million per minute."

There are three key areas government agencies and their IT staff must be aware of to help keep their SAP data secure: **SAP Systems, Custom Code** and **Transports**.

SAP Systems

A large proportion of all SAP security vulnerabilities are a result of improper configurations to the broader SAP System.

This area is difficult for IT staff to comprehend simply because there are so many settings in a typical SAP landscape. Interfaces are difficult to identify and manage and patch management is not as easy as you might find with a Windows applications, for example.

IT personnel frequently consult with reliable SAP security experts who provide a comprehensive overview of all SAP interfaces; complete transparency of data streams; continuous protection of interfaces; and a proactive approach to ongoing and automated monitoring of the entire system landscape.

Custom Code

One of the great benefits of SAP for agencies is the ability to customize the system for the benefit of a specific organization's unique mission.

As an example, a local government entity will have slightly different IT needs as compared to a Federal bureau. As such, the SAP system running both organizations and their functions will each be customized for their specific needs.

In this case, custom code must be developed and implemented for the agency to realize the benefits of SAP. The challenge here is that there are millions of lines of custom code developed for SAP and it is virtually impossible to manually scan this code for security vulnerabilities. What's worse, developers typically do not have the proper knowledge needed to fully vet code for cybersecurity vulnerabilities.

To combat this challenge, developers and organizations are now using cutting edge technologies that automate the scanning process of custom code implementations. These solutions are similar to a spell-checker system and are able to quickly scan lines of custom code with the click of a button to help protect against any vulnerabilities.

Transports

As mentioned earlier, organizations that use SAP software add in their own customizations and developments.

This means that functions and settings are often modified and enhanced, which can lead to changes made to hundreds of objects every day, along with manipulation of data.

These changes are reviewed and adjusted in development and test environments before getting deployed to the live production system. Unfortunately, these transport files can't be checked before the import takes place to production, leaving systems vulnerable to stability issues when the data is transported.

Any slight modification during development and test environments can change critical settings of the data, leaving important applications unable to operate or even result in a complete system failure. What's worse, there can be possible intrusion situations that involve transporting a user and password or other critical data without drawing attention.

In response, advanced SAP system solutions today leverage technologies designed to ensure the integrity of transports, as well as configuration and application data that are critical for running error-free operations.

Today's government landscape is beyond complex, and the global economy has digitally connected businesses, vendors, governments and constituents in a way that helps move information, services and goods at lightning speed.

This velocity of commerce and information as well as vast networks of interconnectivity also means organizations are vulnerable to malicious entrants they may not be aware of for weeks — or even months. On average, it takes an organization 80 days to realize their SAP system has been penetrated; and another 50 days until the vulnerability is fixed.

By leveraging new SAP security solutions and technologies, agencies of all sizes realize they will be defended in a more efficient way, keeping them in compliance with the latest regulations and ensuring their data and that of their constituents remain safe.

www.VirtualForge.com

Thomas Kastner is the Managing Director and Chief Technology Officer at Virtual Forge GmbH, the leading provider of Cyber Security solutions for SAP® systems and applications. He is responsible for the product management and development, consulting services and IT Infrastructure.

TALKING SPACE TECHNOLOGY WITH STUART DAUGHTRIDGE, KRATOS

SatCom Frontier

A SatCom Frontier Conversation

Earlier this year, the SatCom Frontier editorial teams engaged Stuart Daughtridge, the Vice President for Advanced Technology of Kratos Defense and Security Solutions, to discuss the technologies that are driving this industry. One example are the developments being made currently in satellite modem technology that can mitigate satellite interference.

Stuart, please tell us about your company.

Stuart Daughtridge (SD)
For more than 30 years, Kratos has been at the heart of the space community's mission assurance.

Our broad suite of integrated products includes satellite command and control, interference detection and mitigation, payload and signal control, and network monitoring & control for defense, intelligence, government and commercial satellite, and aerospace applications.

EPOCH IPS is the most widely used C2 system and 90 percent of U.S.-based space missions use Kratos products, solutions, and services.

Artistic rendition of the Intelsat-35e Epic^{NG} satellite.

Would you please describe Continuous Wave (CW) interference — what are the problems this causes?

SD
Certainly — CW interference is an unwanted unmodulated signal in the same time and frequency space as the desired signal and is one of the more common forms of interference that threatens mission success. Other sources of interference include modulated satellite signals, GSM, and radar. CW interference is typically caused by equipment failures, as well as being the most common form of intentional interference because it is so easy and inexpensive to generate.

CW interference, like all forms of interference, causes the desired signal to be degraded, often to the point of being unusable. For example, on a satellite video transmission, CW interference can cause everything from periodic pixelation of the video to a total loss of the transmission.

How does the new class of Kratos modems address these problems?

SD
Traditionally, CW interference has been difficult to deal with, especially when generated intentionally. An exciting industry innovation is the development of signal cancellation capabilities originally introduced to help increase capacity in duplex circuits. New signal cancellation technology products from companies like Kratos are now allowing the CW signals to be canceled at the receive sites, such that the desired signals can still be processed even in the presence of intentional CW interference.

How does interference monitoring change for HTS systems?

SD
There are various thoughts on how HTS will affect interference — one is that the small beams of HTS are more difficult to jam, which will reduce intentional interference.

The nature of HTS and the user's application of VSAT technology will inadvertently generate the majority of interference seen on HTS. Placing so many high-powered beams close together, targeting mobile VSATs with smaller antennas that require dynamic pointing, increases the likelihood of interference from misconfigurations and miss-aligned antennas.

How signals are monitored today for satellites with a handful of beams can't cost effectively be scaled up for monitoring HTS' 70+ separate beams. The scale of HTS requires the deployment of much lower cost sensors designed to monitor multiple smaller beams from a signal site. Additionally, to provide the operator with the information needed to quickly identify, characterize and rectify problems when they occur, advanced visualization and management tools are required to manage all the sensors and convert all the sensor data into an actionable status and information on the beams.

With respect to interference and RF quality of service monitoring, Kratos has developed lower cost sensors for use with HTS satellites. For Kratos, we leveraged our Monics carrier monitoring technology to develop Monics 200. Designed for spot beam monitoring, Monics 200 provides operators with economical, yet highly versatile DSP-based RF sensors which automatically determine signal modulation type, symbol rate, measured Eb/No, and other parameters as well as providing detection and analysis of interfering signals. This is important because it gives the operator all of the capability of a full Monics sensor.

Another innovative technology we see is Digital IF, which allows you to digitize an RF signal and transport it over an IP network. This technology can enhance the operational efficiency of the multiple gateway systems required of HTS/spot beam satellites. Kratos' SpectralNet™ digitizes RF signals, transports them over IP networks with no degradation or loss, and recreates the RF signal at its destination. This technology allows the gateways' locations to be driven by operational efficiency, rather than by proximity to antenna/RF systems.

How do you see the satellite market changing in the next 18 months?

SD
According to Euroconsult, more than 100 new HTS payloads and satellites are expected to launch over the next decade.

Over the next three to five years, if not sooner, everything about our industry will change. HTS will massively increase the amount of capacity, the flexibility to respond to market changes, and the price of that capacity will dramatically decrease. Additionally, the types of services provided will grow into a wide range of new applications. How operators will sell, deploy, and manage these new services will also change.

A great example of this is Intelsat's Epic satellites. They will enable incredible new data services to both fixed and mobile platforms supporting higher data rates at lower costs than traditional, shaped beam satellites. Intelsat's Epic satellites also provide impressive onboard routing flexibility to allow Intelsat to offer both fully managed services as well as selling capacity to third party managed service providers. This type of on orbit flexibility will open up new applications and services to the SATCOM industry.

The needs of customers are rapidly evolving, requiring new ground system technologies and capabilities. New ground architectures and services, such as Digital IF, for site diversity, are needed to centralize operations, extend network hubs to antennas at remote teleports, and antenna combining to maximize clear-sky performance are becoming available to improve mission assurance. As stated previously, this is going to be a most exciting time for our industry.

www.intelsatgeneral.com/
www.kratosdefense.com/

The preceding article is courtesy of Intelsat General's SatCom Frontier infosite and their editorial team.

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