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F: + 44 (0) 1376 533764

Teledyne Paradise Datacom LLC
328 Innovation Blvd.
State College, PA 16803, USA
T: +1 814.238.3450
F: +1 814.238.3829

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About the cover image...

Lockheed Martin Space Systems designed and built 21 IIR spacecraft for the Global Positioning Systems Wing, Space and Missile Systems Center, Los Angeles Air Force Base, California. The final eight spacecraft, designated Block IIR-M, were modernized to enhance operations and navigation signal performance. The current fleet of Block IIR and IIR-M satellites within the overall GPS constellation has reached over 100 cumulative operational years on-orbit.

An important milestone was just accomplished by the fifth Global Positioning System Block IIR (GPS IIR-5) satellite, designed and built by Lockheed Martin to provide critical navigation capabilities for military and civilian users worldwide — the satellite has reached 10 years of successful on-orbit operations.

The satellite was launched on July 16, 2000, and is one of 30 GPS spacecraft currently on-orbit delivering vital situational awareness and precision weapon guidance for the military, and supporting a wide range of civil, scientific and commercial functions. The GPS constellation is increasing productivity in areas as diverse as farming, mining, construction, surveying, package delivery and supply chain management, while also enhancing public safety by reducing response times for emergency services.

The U.S. Air Force's next-generation GPS spacecraft, known as GPS III, is being built by a Lockheed Martin-led team that includes industry partners ITT of Clifton, N.J. and General Dynamics of Gilbert, Arizona. The first GPS GPS IIIA satellite is projected to launch in 2014.

GPS III will improve position, navigation and timing services and provide advanced anti-jam capabilities yielding superior system security, accuracy and reliability. The next generation GPS IIIA satellites will deliver significant improvements over current GPS space vehicles, including a new international civil signal (L1C) and increased M-Code anti-jam power with full earth coverage for military users.

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Published by Satnews Publishers
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Invitation From GVF

For years, GVF has been asked by the international disaster-response community to identify a means by which satellite-enabled systems, services, and human resources can be cost-effectively pre-positioned worldwide. In a few weeks, GVF will provide an answer to that request, and we would like to invite your organization to coordinate with us now as we prepare to launch the GVF Disaster Preparedness Communications Registry.

Since the Haiti earthquake, GVF has held dozens of meetings with our partners at the United Nations, organizations in the humanitarian sector, the military, governmental groups, and with other first-responder groups. All of them support GVF's Registry plan, which will provide higher visibility for our industry, more rapid access to pre-positioned resources, less redundancy in resource provision, and improved commercialisation of the Membership's disaster-response and development capabilities.

At the same time, we have also been informed that many of our member companies who responded to calls for urgent assistance, gave very generously their equipment, services and the cost of employees who travelled to Haiti to conduct installations. While generous, some of these member companies have indicated that this approach is not sustainable.

The Challenge

A persistent problem that has severely inhibited first responders — as well as our industry's efforts — concerns the need for "pre-positioning" of satellite communications solutions that are local to the disaster zone and that can be quickly and cost effectively used to support a response effort. Further, how to link those same pre-positioned systems so that they can not only be used for disaster response, but also to be re-purposed after the relief effort to achieve medium and long-term development objectives has not been realized at a commercially viable level.

Indeed, major challenges have thwarted a comprehensive global program designed to provide a pre-positioned solution. Not least among those challenges is the difficulty for any organization to cost-justify investment in communications systems that are pre-positioned and which remain either unused or under-utilized until a disaster occurs, by which time they may even be obsolete.

This investment challenge is considerable in one region of a single country; it is overwhelming when considering a global pre-positioning solution.

Added to the cost-justification hurdle are other significant obstacles: Pre-positioned systems need to be maintained, which involves further expense. Often, licenses must be secured and kept current. Having locally trained technicians identified and available to deploy and/or operate the systems and services is essential and comes at a further cost. And for the most part, disaster-response stakeholders often do not have a communications approach that addresses the more robust on-the-ground collective solution that can also be transitioned into a medium and longer term infrastructure with scale capabilities — or that can eventually be transitioned into a permanent, locally-operated, commercial enterprise.

The following plan will be applied to address each of these challenges; the first phase will be implemented with nearly immediate effect. We would like to invite participation from your company.

The GVF Disaster Preparedness Communications Registry

The solution is our industry's current installed base and our rapidly-deployable fixed and mobile resources. Among GVF's approximately 230 Member

companies are all of the world's major satellite-bandwidth suppliers and satellite equipment manufacturers, as well as many local and international connectivity providers. Collectively, your companies and your customers supply, install, maintain and operate millions of fixed and mobile Earth stations throughout the world. Some of these resources can and should be considered as "pre-positioned" for use in supporting disaster-relief efforts, if they are ever needed.

These systems and services are already being maintained and operated with "sustainability", which is to say that their current use generates enough funds to keep the local operation running and, in most cases, to earn a profit. This profit enables further expansion of the networks to other locations throughout the world and strengthens development.

Many of these systems and services are already being used to support applications that are essential to development, including banking and financial services, agriculture, health, education, oil, gas & mining operations, mobile communications, fiber and other terrestrial last-mile extension, and much more. In addition to being already installed, these systems are already licensed for use in their respective countries. This solves another great challenge of the disaster response community when deploying communications systems.

Inherent in this existing value chain is a powerful solution to address the pre-positioning challenge. GVF will create an online ***Disaster Preparedness Communications Registry*** in which all GVF Members are invited to voluntarily identify systems, services, and other resources that:

» Are currently operational

» Can be quickly identified (as closely as possible) through a designated contact at your company

» May be re-purposed for use if necessary to support local disaster-relief efforts.

The idea for the GVF Disaster Response Communications Registry has been developed in coordination with not only our industry, but also with UN, humanitarian, military

and other governmental disaster-response interests. Before a disaster occurs, their awareness of the Disaster-Preparedness Communications Registry will inform decisions made regarding their strategic disaster-response plans. During a disaster, they will be able to quickly access the GVF Registry and use it to identify systems, services and/or personnel that are available to help support disaster-response efforts locally. After a disaster, they can explore use of the resources to support medium and long-term development objectives as the rebuilding efforts begin.

At each stage, the terms and conditions pertaining to the use of those resources are subject to agreement between the first responder, your company, and/or your customer. To be clear, the solutions may be provided either as in-kind donations, or under commercial terms.

The resources that can potentially be included in the GVF Registry include a vast array of not only fixed and mobile satellite-based solutions, but also include all terrestrial systems that are applied by GVF Member companies in tandem with satellite communications, *e.g.,* GSM, WiFi, WiMAX, LTE, digital microwave, fiber optic cable, pico and femtocells, and more.
Key among the Registry's advantages are:

» **Immediate Access to Global Infrastructure:** The systems, services and other resources are already in effect "pre-positioned" in hundreds of thousands of locations in every major world region,

» **Existing Linkage with Development:** The systems and services are, in many cases, already instrumental in promoting local development through the enterprise and social applications that they routinely support,

» **Local Participation:** The systems, services and other resources are, in many cases, maintained and operated by local companies, which could become involved in response efforts but which are often unknown to first responders... and many of these local companies are GVF Members or their customers,

» **Immediate Access to Qualified Technicians:** GVF already has a public database that will be linked to The Registry and which already includes nearly a thousand Certified VSAT Installers throughout the world, who can be contacted directly to support disaster-response SATCOM deployments (and who may secure business through The Registry),

» **Repurposing for Development:** Once applied, the Registry's resources can be more closely coordinated not only for preparedness and first-responder efforts, but also for medium- and long-term development. These options increasingly include "leave-behind" infrastructure for local partners, which can use the solutions to jump-start host-nation ICT infrastructure recovery and reconstruction and provide commercial opportunities to seed economic revitalization through ICT infrastructure development,

» **Rapid Online Implementation:** The online GVF Disaster-Preparedness Registry will begin to be made available globally next month, with the first phase consisting of a new search designation in the inter-active GVF Member Directory, entitled "GVF Disaster-Preparedness Communications Registry",

» **Coordination:** GVF already has partnerships with dozens of humanitarian organizations, all of the UN aid agencies, and other user groups that have confirmed the validity of the plan and their willingness to work with our industry to make The Registry a successful collaboration.

GVF is inviting your company to take advantage of this opportunity. To indicate your company's interest, please contact *Steve Birnbaum*, our newly-appointed lead for GVF's Humanitarian Assistance & Disaster Relief Task Force (steve.birnbaum@gvf.org). We look forward to working with you and your colleagues to transform the global disaster-relief challenge into a new financially sustainable paradigm.

David Hartshorn
Secretary General, GVF

Ensuring COB Speicher Is Connected To The World

Airmen are an integral part of Operation New Dawn and joint operations throughout Iraq. The communications site, or Task Force Palmetto, at Contingency Operating Base Speicher is no exception.

The 30 contractors and 34 service members, including 18 Airmen, assigned to the task force are responsible for installing, operating, maintaining and defending the communications network for COB Speicher.

"We take care of every aspect of the (U.S.) Central Command network here, from the satellite signal to the cables in the ground to the user's desktop computer," said 1st Lt. *Jesse A. Nelson*, the task force's officer in charge for the base. "If a problem comes up at any level, we fix it, and the entire team is doing an excellent job."

The joint team works on a network that supports more than 70 units, including U.S. Division-North.

"Our job isn't glorious, but it is critical," said Staff Sgt. *Ted Lee*, the service desk NCO in charge. "We provide strategic communication for the entire base."

It all starts with a satellite signal. The signals transfer to the technical-control facility and then gets distributed to the entire base via fiber-optic cables and other wires. Technicians continuously monitor the facility to mitigate network outages.

"Without the TCF, all the users on COB Speicher wouldn't have network access or the ability to communicate," said Staff Sgt. *Timothy Voliva*, the technical-control-facility NCO in charge. "If there is an outage, it affects our customers' ability to complete their mission, and it's important we fix it quickly." The network is available, but all devices must visit the automated-data-processing and equipment section to undergo a configuration process consisting of more than 30 steps before they can be plugged into the network.

Senior Airman Raymond Harmon reorganizes wires inside an area distribution node Jan. 20, 2011, on Contingency Operating Base Speicher, Iraq. Airman Harmon is a COB Speicher direct-support-signal-team network administrator. (U.S. Air Force photo/Senior Airman Andrew Lee)

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"We standardize every computer," said Staff Sgt. *Gissell Gilbert,* the NCO in charge of the ADPE section. "We ensure all systems have the proper software and drivers installed before they are hooked up to the network."

With more than 4,500 users accessing the network, the task force's service desk stays busy. The service desk handles 400 to 500 trouble tickets per week.

"Our main focus is tier-one troubleshooting," Sergeant *Lee* said. "We have never had a day when with no tickets. Computers are always breaking."

With the network being so important to mission success, maintaining the network's security is essential. Network and site administrators work to ensure that the network is always protected.

"We try and maintain as much network security as possible to ensure it doesn't get compromised by the enemy," said Senior Airman *Raymond Harmon*, a network administrator. "If the system goes down, COB Speicher loses its ability to communicate."

In addition to the job, Airmen have had to adjust to working with Soldiers.

"It's very beneficial for the Airmen to work side-by-side with the Army," Lieutenant *Nelson* said. "They see a new perspective on how to do their job, and it breaks down all the interservice stereotypes."

Although they wear different uniforms, the Soldiers and Airmen work well together to accomplish the mission, said Tech. Sgt. *Brian Bowles*, the NCO in charge of the base's direct-signal-support team. "It's as smooth as it can be," he said. "We are very successful as a team. It is definitely a joint effort."

Story by...
Staff Sgt. R. Michael Longoria
9th Air and Space Expeditionary Task Force-Iraq Public Affairs

Sometimes The Enemy Is A Storm Surge

Just ask Col. *Quill Ferguson*. "When you enter into a crisis situation, normally one of the first things to go is your communications," he said, as he is the G6 for U.S. Army North, which frequently responds to natural disasters. "Having a satellite-based network allows you to bridge some of that infrastructure damage that you normally get, whether it's an earthquake, a hurricane or another man-made or natural event."

In the years since Hurricane Katrina exposed dangerous information gaps between various government responders, the Army has developed high-tech capabilities that enable rapid, inter-agency communications during an emergency. One of those systems, the *Joint Incident Site Communications Capability*, or **JISCC**, has been deployed in response to wildfires in California, the earthquake in Haiti and other disaster areas, said *Joseph Cellini*, JISCC project lead for the Army's *Program Executive Office Command, Control and Communications - Tactical* (**PEO C3T)**.

In austere battlefield environments, network infrastructure can be nonexistent, leaving Soldiers to rely on imported satellite communications to transmit information by voice, data and video. Back in the U.S., a disaster that wipes out the communications infrastructure can have the same chilling effect. "The advanced, futuristic technologies that we live with go away, and you become very austere," *Cellini* said. "You have no electricity, satellite, bandwidth and communications. Think of all the things we do on a daily basis. Now take it all away. That's really what happens at an incident site such as 9/11 and such as Katrina."

Now, the Army is able to fill that void by bringing in its own communications pipelines. Army North relies on vehicles powered by a generator and equipped with a satellite connection, allowing Soldiers to connect with their higher headquarters on both classified and unclassified networks, said

Sgt. 1st Class *Alberto Hernandez*, who is assigned to Army North. "Once we have established communications through the satellite link, it's just like being back at the office. You have the same capabilities. We can be on the air in 10 minutes or better, and that means the difference in saving lives and coordinating with the first responders at every level - whether it's the local, state or federal level," he said. "The most crucial element of any crisis is information, and being able to disseminate that information, to share it with the right people, at the right time."

To track the movement of personnel, equipment and supplies to the area of distress, Army North responders also have access to the *Command Post of the Future* (**CPOF**), said *Matt Hopper*, a telecommunications specialist for **Army North G6**. The CPOF, a key command and control (C2) software system on the battlefield, can be used for domestic disaster response when it is fed with historical data and mapping software of the affected region, he said.

"It gives us a snap picture of what's going on during an event," Hopper said. "In theater, the Commander can see where his forces are, where they're moving. If we were moving logistics to provide food, water and shelter to citizens of the United States, we use it to track units that are going in to do search and rescue."

In addition to satellite feeds, both the Army North vehicles and the JISCC come equipped with handheld portable radios that can run on various bands and frequencies, permitting different agencies to talk to one another. That provides simultaneous situational awareness for first responders including police and fire departments, Emergency Medical Technicians, state and local governments, and relief organizations such as the Red Cross, Cellini said. "There are no longer these disparate communication nodes he said. "Everyone can talk by doing talk groups. It brings everyone on the same common page."

The JISCC is 11,000 pounds of communications and support equipment, all transported in an 18-foot trailer and can be set up and operational in less than an hour at an incident site, Cellini said. The *PEO C3T Special Projects Office* (**SPO**) supported the delivery of JISCC systems to all 54 U.S. states and territories supported by the **National Guard Bureau**.

In each state, the system is overseen by the adjutant general, the governor's military adviser, and the state is then responsible for training the local first responders. Because the JISCCs are identical and interoperable, states can rush to one another's aid, and have contractual agreements to do so, *Cellini* said.

"If a hurricane hits the entire Southeastern coastline, having an agreement between North Carolina and South Carolina does no service if they're both underwater," he said. "So South Carolina has (agreements) with its brothers on its borders, but also has an agreement with maybe Illinois or Wisconsin."

Mobile satellite communications also allow military responders to be prepared for the worst during big events such as the presidential inauguration, the Super Bowl and the Indianapolis 500, if the military is required.

Story by...
Claire Heininger, PEO C3T

Pfc. Paul Garland, left, and Pfc. Sean McCall, assigned to the Joint Forces Special Operation Component Command, check the set up of a AV/2011 SATCOM antenna for voice and data tactical communications in Haiti after the January 2010 earthquake. Photo courtesy of U.S. Army.

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A COMPLETE BGAN WAVEFORM DEVELOPED FOR SOFTWARE DEFINED RADIO

AUTHOR: CLAUS VESTERHOLD, TECHNICAL PROGRAM MANAGER, GATEHOUSE A/S

This article offers an introduction to the challenges, opportunities and advantages associated with *Software Defined Radio* (SDR), particularly within the field of satellite communication (satcom), and more specifically in relation to Inmarsat's currently most advanced IP-service, the *Broadband Global Area Network* (BGAN). SDR is no longer a vision but is an opportunity readily at hand for manufacturers of military terminals and radios, software developers and SATCOM service providers.

Software Defined Radio (**SDR**) as a term has been around for a long time. SDR has been the vision of a single wireless multi-purpose device that could seamlessly integrate multiple communication channels, including satellite communication (SATCOM).

This is no longer a vision!

Driven mainly by the military market and DoD/MoD's need for interoperability, flexibility in choice of communication means, reduced total cost of ownership as well as rapid functionality upgrades and repair, the SDR technology has experienced great advances and focus during the last decade.

With the increasing globalization on the military scene, *i.e.*, participation of various countries in international conflict resolution and peace keeping missions, the need for communication and interoperability in remote areas of the globe has increased significantly.

SATCOM is an attractive option when the communication distance increases and direct radio links become unavailable at the scene of an operation. SATCOM is used heavily by military entities and governments and operational needs can no longer be fulfilled by the military SATCOM (MILSATCOM) solutions only. In fact, 80 percent of all U.S. government and military traffic in 2008 was already carried over commercial satellites.

Thus, commercial SATCOM is an established supplement enabling easy, flexible and on-demand access to extra capacity.

Inmarsat BGAN is the leading global commercial broadband mobile SATCOM service available. Inmarsat is a well-established satellite communications provider and BGAN is easy to set-up and use and has already been proven in military field operations. Moreover, BGAN is currently an attractive option for achieving commercial SDR-based SATCOM.

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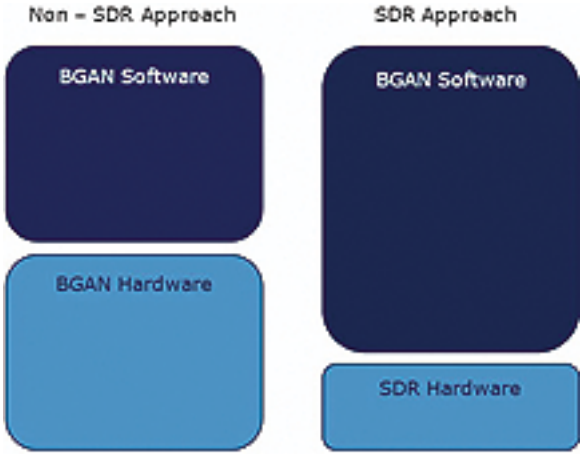

Figure 1: Using an SDR approach, the BGAN functionality is defined by software only, leaving the hardware platform generic. This is in contrast to the non-SDR approach where BGAN specific hardware is incorporated in the design.

This combination of BGAN SATCOM and SDR is enabled by **GateHouse** and is the company's most recent technological development. Currently, militaries operate with dedicated hardware/software for each communication mean, *e.g.*, one radio/terminal for SATCOM and one for VHF, UHF etc.

This is very space demanding and sets a limit as to the number of communication means the soldiers in the field can use. With an SDR platform, the number of communication means is only limited by the channels available on the terminal, as well as the requirements of the individual mission. This operational benefit is complemented by the cost benefits mentioned above.

SDR provides benefits for the end-users as well as for manufacturers of military radios/terminals. SDR provides each manufacturer with the opportunity of customizing their offering to changing customer demands with limited extra costs and extended time to market. With this technology, the manufacturers can produce the terminal hardware and then wait before equipping it with software waveforms until customer requirements are defined. This saves the manufacturer significant development and waveform porting costs. In other words, the manufacturers are empowered to deliver greater customer value at lower cost.

BGAN AT A GLANCE

Inmarsat is a recognized pioneer and market leader in the field of global ***Mobile Satellite Services*** (**MSS**), and the IP-based BGAN (short for *Broadband Global Area Network*) service is the most advanced of Inmarsat's current offerings. The system offers standard and streaming IP data services, as well as a voice and text service (source Inmarsat):

DATA

- *Standard IP (TCP)*
- *Variable bit rate service*
- *Up to 492kbps (send & receive)*

STREAMING

- *Guaranteed bit rate service*
- *Available on demand*
- *Up to 384 kbps (send & receive)*
- *UDP support*
- *ISDN support*

VOICE

- *4kbps circuit-switched service*
- *Voicemail*
- *Enhanced services: call waiting, forwarding, barring, holding*
- *Broadcast quality voice 3.1kHz*

TEXT

- *Send and receive text messages via a laptop*
- *160 characters SMS*

The service is provided globally via three satellites placed in geostationary Earth orbit.

System specifications provide for terminals operating from ground vehicles, ships and airplanes. While the Inmarsat BGAN system is a commercial system, it has been adopted by military forces for *Beyond-Line-Of-Sight* (**BLOS**)

communication, primarily because it is easy to set up and use and provides an on-demand 492 kbps data service on the surface of the Earth with exception of the Polar Regions.

The government sector is a major revenue generator for Inmarsat. The airtime is generated from an installed terminal base provided by manufacturers of commercial equipment for government aircrafts, ground vehicles, and ships. The shift to SDR based terminals is expected to enable BGAN on tactical radios, as it provides an opportunity for an instant BLOS capability, at limited extra cost.

SDR TECHNOLOGY

Over the past 30 years, radios have changed from purely hardware-based devices to containing more and more software. The term Software Defined Radio is used for a radio where the essential functions are implemented in software and which, as a consequence, can be reconfigured for different communication standards.

An SDR contains generic processing elements, namely *General Purpose Processors* (**GPP**), *Digital Processing Processors* (**DSP**) and *Field Programmable Gate Arrays* (**FPGA**). These processing elements are loaded and configured during startup of the modem to ensure the modem performs as required to implement a particular communication standard.

The term *Waveform* refers to the software loaded during the startup of the modem, which performs the communication functions. The development of SDR technology has been encouraged by the rapid development over recent years in integrated circuits, where size and power consumption have decreased and performance and flexibility have increased. Such enables very high performance generic platforms.

The U.S. DoD has invested in SDR through the ***Joint Tactical Radio System*** (**JTRS**) program. The JTRS program has produced a number of SDR

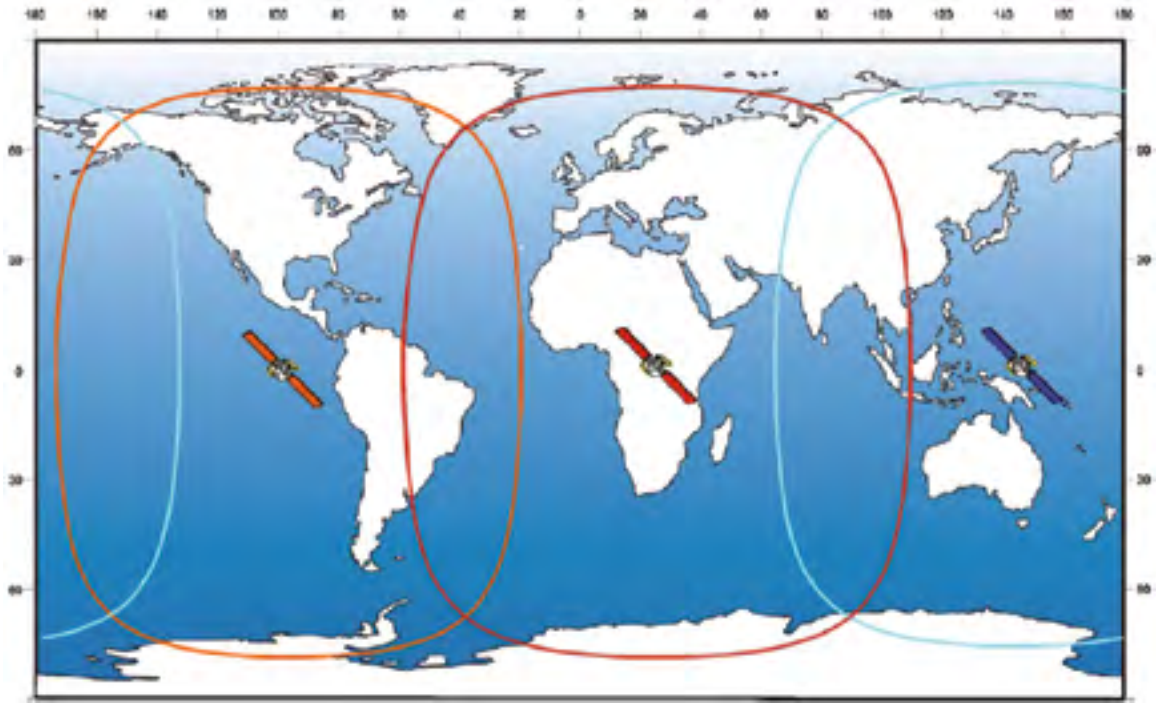

Figure 2: Inmarsat BGAN Coverage: The Earth is covered using three geostationary satellites (source Inmarsat).

radios and waveforms. It has also produced the **SCA** standard (short for *Software Communication Architecture*) which specifies how radio platform and waveforms must be designed and implemented to ensure interoperability, and in particular, that an SCA compliant waveform can run on different radio platforms as long as they are SCA compliant.

SOLUTIONS

The GateHouse BGAN waveform contains all the common functionality required to build a BGAN terminal with on-demand BLOS communication capability. The BGAN Waveform is developed for SDRs and is compliant with the SCA specification version 2.2.2, giving the waveform the ability to run on generic SDR hardware that are conformant to the SCA specification (the waveform can also run on non-SCA compliant hardware).

The BGAN waveform can run as the only waveform on the radio, or run as one of several waveforms on a multimode radio. Due to the SCA specification, the effort to port the waveform from one radio to another is considerably less than for a conventional radio design where the software typically interfaces custom designed hardware.

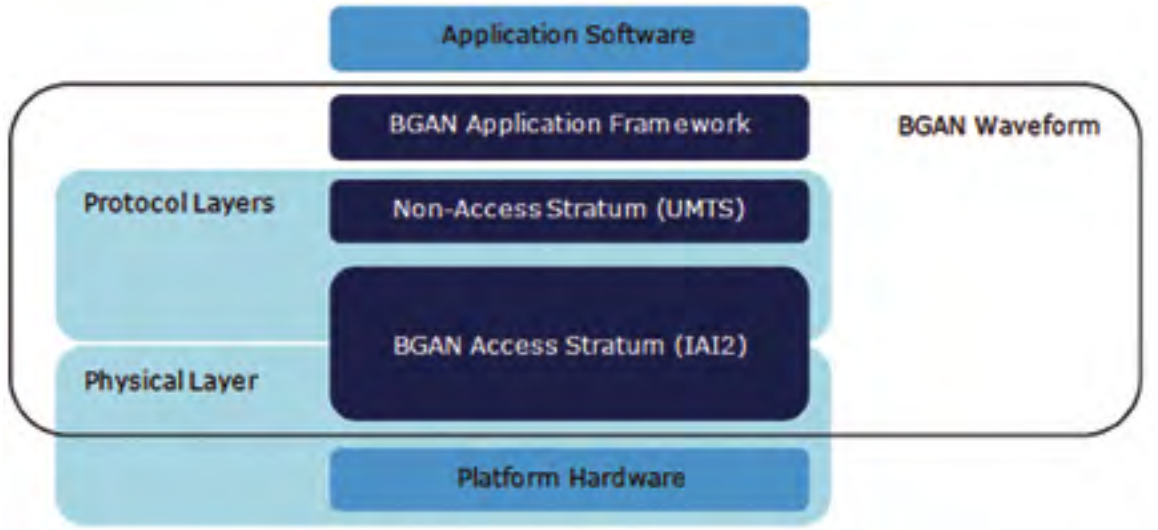

Figure 3: The BGAN Waveform is comprised of an Inmarsat proprietary access stratum (IAI-2), a 3GPP UMTS non-access stratum release 4 and an application framework.

The traditional approach has been to develop inflexible purpose-specific hardware to implement a BGAN terminal, whereas by using the SDR approach, the complete functionality (waveform) is implemented in software. This leaves the underlying hardware generic and fit for other purposes, as well (*see Figure 1*).

In addition to the advantage of reusing radio platforms and allowing for coexistence of waveforms on a single radio, the SDR approach also allows for easy upgrades of the BGAN terminals as the BGAN standard evolves (*e.g.*, support of higher data rates). The GateHouse BGAN waveform is structured internally according to the Inmarsat BGAN specifications and contains multiple layers of functionality as shown in *Figure 3*.

In a typical customer engagement process, the customer provides an SDR platform that is either already existing or a new development. In case of new terminal development, GateHouse is involved early on in the terminal design and implementation process to define software/hardware interfaces in cooperation with the customer and to ensure that the radio platform is capable of hosting the BGAN waveform.

When Gatehouse receives the radio platform, the BGAN waveform is then configured and built for the radio and loaded into the radio. A series of thorough tests is then conducted to ensure that the resulting terminal is compliant with the BGAN specifications. commercial system, it has been adopted by military forces for Beyond-Line-Of-Sight (BLOS) communication, primarily because it is easy to set up and use and provides an on-demand 492 kbps data service on the surface of the Earth with exception of the Polar Regions.

GateHouse offers a single point of contact and access to a rock-solid, field-proven IPR platform based on more than 100 man-years of accumulated expertise from more than 10 completed BGAN terminal development programs across many different hardware platform — for aeronautical, maritime and land mobile usage. There's also reduced development time (and, therefore, cost), as well. Offering an attractive alternative to in-house development, the Company will bring BGAN terminal projects through to **Inmarsat Final Type Approval** faster, with considerably fewer risks, and at a competitive and flexible pricing model.

GateHouse can be contracted to take charge of the entire BGAN implementation process based on a customer supplied hardware platform up to, and including, the mandatory approval testing.

About the author

Claus Vesterholt is the Technical Program Manager for the Satellite Communication activities in the Danish software company GateHouse A/S. He has a Master degree in Electrical Engineering from Aalborg University and has taken various positions in the wireless communication industry over the last 16 years. He has been leading a number of programs and projects on the development of communication software for wireless communication systems, mainly GSM/GPRS terminals and Inmarsat BGAN terminals. Claus has experience in developing and testing communication software for terrestrial systems and satellite systems. Currently, Claus is responsible for all technical activities in the satellite communication area of GateHouse and is leading the engineering team.

Additional GateHouse A/S information at...
http://www.gatehouse.dk/

ROBERT (TIP) OSTERTHALER
PRESIDENT + C.E.O., SES UGS

Mr. Robert Tipton (Tip) Osterthaler joined the SES family in December 2006 when he became the President and CEO of AMERICOM Government Services. Since then, the independent corporation and wholly-owned subsidiary of SES WORLD SKIES has grown and integrated with other USG business elements within SES to become SES WORLD SKIES, U.S. Government Solutions. During his tenure at SES, the U.S. Government business has transformed from a product oriented sales channel into an end-to-end satellite solutions company, and now to an entity that is directly aligned with the global assets and resources available on the SES fleet of 44 communications satellites.

From 1998 until 2006, Tip was a Senior Vice President at Science Applications International Corporation (SAIC), a large systems, solutions and technical services company serving the needs of the U.S. government. His last assignment at SAIC was Deputy General Manager of the Strategies, Simulation and Training Business Unit, a 2,300 person organization that provides government and commercial clients with advanced modeling, simulation and training solutions.

Prior to joining SAIC, Tip served in the U.S. Air Force for 28 years, retiring as a Brigadier General and Deputy Assistant Secretary of Defense for European and NATO Policy. Earlier assignments included Vice Commander of the Air Intelligence Agency, NATO Staff Officer, and numerous command and senior staff assignments. Mr. Osterthaler is a Command Pilot, having accumulated over 3,200 hours of flying time in fighter aircraft including multiple models of the F-4 Phantom II and the F-15 Eagle.

Tip holds a BS in Economics from the U.S. Air Force Academy and an MBA from Texas A&M University. He is also a graduate of Harvard University's Senior Executives in National Security Program as well as their National and International Security Management course, the Royal College of Defense Studies in the United Kingdom, the Air War College, and the Marine Corps Command and Staff College.

COMMAND CENTER

MILSATMAGAZINE (MSM)

Good day, Mr. Osterthaler. Your 28 years of service to our nation as a Brigadier General in the USAF was replete with numerous command responsibilities. Additionally, you served as the Deputy Assistant Secretary of Defense for European Policy. How did you manage the conversion from military and government leadership roles to becoming involved in the commercial environment? How do you apply your military and government experiences to leading the programs of SES UGS?

TIP OSTERTHALER

The differences between the two organizations are not as great as some may think. One of the things I discovered very early in my second career in business was that the same sort of leadership characteristics and traits work well in a civilian world as they do in the uniformed world.

I think there's a general assumption that the military's hierarchical structure is what drives leadership. What I've found is that formal authority is actually less influential as compared to your ability to articulate where you're trying to go, and encourage people to perform well as a team. This essentially becomes the most valuable leadership skill in any organization — private and military alike.

In terms of making the transition from military to the private sector, it certainly doesn't happen overnight. It took me several years to gain an understanding of the important differences that exist. While the way in which people operate in organizations can be very similar, the way

machinery works in the private sector is quite a bit different than it is in the government. When you're trying to create bottom-line results, techniques you employ are different. In most cases with the government, you are responsible for executing programs that are not necessarily bottom-line cost driven, and quite often, cost is a dependent variable. In the business world, cost is never a dependent variable. You have to produce bottom-line results or you don't stay in business. It takes time to figure out the metrics, the tools and the processes that are required in order to create these results.

MSM

What do you see as the most challenging aspect of running SES UGS?

TIP OSTERTHALER

The commercial satellite industry is an infrastructure business at its core and is not necessarily driven by the needs of the government. While the very charter of our company is based upon serving the needs of the U.S. Government, our parent company, as well as the other major commercial satellite operators share a predominantly commercial mission. They're driven by metrics of return on investment, which really is the obligation of the Board of Directors and senior leadership to the shareholders. With that in mind, any decision to create a capability or product that may be of interest to the U.S. Government is going to be driven primarily by the business case it presents to the parent company. That's where my group comes in as the advocate for the U.S. Government in the fleet development process.

MSM

What do you enjoy most about your role with the Company?

TIP OSTERTHALER

The qualities I enjoy most about my company, as well as the commercial satellite industry, is that it's technically challenging, fast-moving and exciting. The capabilities that we bring to our customers are of tremendous importance to them. In the case of our U.S. Government customers, we take great pride in knowing that the capability we provide enables connectivity in remote and disparate locations, communications between deployed service members and their families and mission-critical communications that are saving time, money and lives on a daily basis.

MSM

In recent months, FCSA or the Future Commercial SATCOM Acquisition has been a big topic within the SATCOM industry, specifically for those providing products and services to the U.S. Government. How did this program come about?

TIP OSTERTHALER

Over a period of about 10-years, the primary purchasing approach for the Department of Defense was through a series of contracts with three SATCOM reseller-integrators. That contract, referred to as DSTS-G, was in essence a way to organize the market and allow DoD to purchase capabilities on commercial satellites.

Over that 10-year period, there was a revolution in demand for commercial capacity as new systems were fielded, such as remotely piloted vehicles. With this increase in demand, the limitations of only using three companies and excluding other purchasing channels became clear, and the need to develop a process that worked in the best interest of the government was apparent.

Over time, the DISA and GSA collaborated on a new purchasing approach for the U.S. Government. This new approach, referred to as the Future Commercial SATCOM Acquisition

(FCSA), offers flexibility to the government in the way they're able to purchase SATCOM capability. With FCSA, the government can go directly to satellite operators, work through the integrators, or go through a managed service provider depending on the type of capability they are seeking to buy. This new program has opened the playing field for many more providers to bring their capabilities to the market, which in turn, provides the government with greater choices than they had previously.

MSM

What will FCSA mean for the industry in terms of the competitive landscape? Are you seeing an increase in entrants to the SATCOM market, or has the vehicle reduced the number of providers able to do business with the U.S. Government?

TIP OSTERTHALER

In the area of Transponded Services, we're seeing a tremendous increase in the number of players in the market. This is largely due to the fact that we have not only satellite owners and operators offering direct capacity options to the government, the integrators and resellers are bidding on opportunities to present capacity from the operators as well. In terms of new entrants to the market, where the previous DSTS-G vehicle was limited to three companies, FCSA has created opportunities for most of the owner-operators plus a large number of new reseller-integrators to participate. Though we're in the early stages of this new process, we have seen awards both to satellite operators as well as integrators.

MSM

As a global satellite operator offering service to the government for more than three decades,

what do you believe will change in the way you do business with the new FCSA?

TIP OSTERTHALER

During the DSTS-G era, satellite owners and operators were essentially insulated from the end-user in a way that was not entirely in the best interest of the U.S. Government. Our business is a long-cycle business and the more we can find out about future government requirements, the types of applications they will employ that require our capacity, and such, the better chance we have to groom our fleet to better serve their needs.

When providing capacity exclusively through integrators and resellers, the direct relationship and conversation is inhibited. The ability of the satellite operators to sell directly to the U.S. Government creates an immediate day-to-day relationship. This direct conversation builds confidence on both sides and furthers the operators' ability to support investments in capacity and services specifically to meet the needs of the government.

MSM

SES created a proxy structure around its U.S. Government business. With FCSA, how important is this proxy to the government? Will operators without such a structure be able to offer bandwidth directly?

TIP OSTERTHALER

There's no requirement to have a proxy structure in order to sell through FCSA. The proxy arrangement is required for foreign owned companies to hold facility security clearances which in turn enable companies to host personal security clearances for employees so that they may engage in classified conversations with the government and perform classified work. To the extent that customers have classified requirements and they chose to satisfy them through FCSA, American-owned companies with security clearances will be able to bid. Likewise, foreign-owned companies who operate behind a proxy structure, or who are run by proxy boards, are essentially treated as American companies. The extent to which FCSA will require individuals to have security clearances is not yet clear. It's more likely to be a topic for consideration for the Custom Satellite Solutions, or CS2 portion of FCSA to be awarded later this year.

MSM

As the government will be able to contract directly with SES USG for capacity and services vs. going through another party, what are the benefits and costs to doing business more directly?

TIP OSTERTHALER

The benefit to the government is the direct relationship with their service providers within the satellite operating companies. We can gain a clear understanding of what their needs are, what works well with our existing infrastructure, and what they'd like us to improve upon or change as we plan for future satellite developments.

This direct conversation is tremendously important. It's the way you come to understand the customer's problem from the customer's perspective. When you're going through third parties, it's very difficult to achieve this level of understanding. It's important to keep in mind that in government contracting, it is common for the subcontractor to be precluded from direct conversations with the customer. In some cases, the requirement to go through the prime to investigate future needs of the end-user is often not productive. Many times both parties find the business interest of the prime are not identical to those of the subcontractor. The new FCSA creates the opportunity for open conversation between service providers and government end-users which will work to the benefit of both.

MSM

Has the direct FCSA channel to commercial operators such as SES posed a threat to the previous DSTS-G providers and integrators?

TIP OSTERTHALER

From my perspective, if it works to the best interest of the government, all participants in the commercial SATCOM market should acknowledge and appreciate that fact and seek to operate within a framework that better serves this important customer. Trying to protect market share and what often can be the narrow interest of one single company is not a good long term strategy.

We ultimately have to look at what the government needs; we must be willing to do what it takes to meet these needs. Additionally, it's critical that all of the players deliver what they promise. This is what will determine whether or not there is and will be a healthy government business for any of us who participate in this market.

MSM

SES USG was recently awarded SINS 54 and 55 with FCSA, enabling SES UGS to provide Transponded Capacity and Subscription Services directly to the government, while the third leg of the table, custom satellite solutions or CS2, has yet to be awarded. Is this an area where SES USG plans on providing service as well?

TIP OSTERTHALER

Yes. As CS2 is yet to be awarded, we don't know the exact kind of work that will come through this vehicle. In circumstances where a solution largely includes SES capacity, we plan to provide prime bids to the government. It's not our intention to grow our business as a reseller. It is our intention though to have a direct relationship with the customer wherever we can to provide them with the benefits of SES capacity through

CS2, or any other part of FCSA, and to use this relationship to gain a better understanding of the capacity they need in the future.

MSM

Do you envision the CS2 program encompassing large scale programs such as the Trojan network you currently support? Can you tell us about the Trojan network and how it will assist Military Intelligence?

TIP OSTERTHALER

As CS2 has not yet been awarded to industry, it is unclear as to whether it will include opportunities on the scale of Trojan. It's certainly conceivable that a large network such as the Trojan project could fit within the scope of work of a CS2 RFP; however it is too soon to tell at this point.

The customer for the Trojan network is the U.S. Army. Our company has been providing capabilities associated with this program for quite a few years. As the requirements of these users continue to evolve, it has become quite a substantial program. At USGS, we have a number of people that are dedicated to delivering this program and customer capability and we spend a lot of time ensuring that the services the Army depends on through the Trojan network are going to be up and running wherever and whenever they're needed.

MSM

Can you tell our readers a little about recent awards to SES USG via FCSA? How have you been using this program since receiving SINs 54 and 55?

TIP OSTERTHALER

We have been evaluating the opportunities that have been coming through FCSA, and in particular those associated with Transponded Services as that is the core of our business. We have bid capacity where we had it, in some cases directly to the government and in other cases, through third parties or integrators who have asked us for capacity. One of our very first awards through FCSA was with our long time industry partner, Artel, Inc. where we offered two C-band transponders to meet an Air Force mission in the U.S. Since the first of the year, we've seen a tremendous amount of activity on FCSA and our team has been hard at work designing solutions to meet the various government needs that have been identified.

MSM

A crying demand for capacity affects commercial and government segments — how do you see the role of hosted payloads progressing for the military aboard commercial satellites? What challenges need to be overcome in this regard?

COMMAND CENTER

TIP OSTERTHALER

In recent years, we've seen some innovative thinking on the use of commercial satellites to provide non-traditional capabilities to the U.S. Government. SES will host the a wide field-of-view infrared sensor on board its SES-2 spacecraft to launch later this year, in support of the U.S. Air Force's Commercially Hosted Infrared Payload (CHIRP) flight demonstration program. There can be a compelling economic argument for commercial owner operators providing the USG with timely and affordable access to space on commercial satellites.

As to how commercially hosted payloads could evolve in the future, I suppose time will tell. At this point, much of the conversation surrounding the topic of hosted payloads tends to be focused more on the traditional paradigm of what commercial satellites should do, and what government satellites should do. We need to further examine this dividing line and start a conversation not only about how to do things more efficiently, but how we can do different things. As an industry, we must examine the entire architecture and explore ways we can use the capabilities of commercial industry to provide more capabilities to the USG with less risk, and at less cost.

For example, in the case of EHF, is it actually the case that these special capability payloads can only be owned and operated by the government, or is that just the way we've always done business in the past? As we look at the fact that space is no longer an uncontested environment for the United States, shouldn't we be asking ourselves whether or not a distributed EHF architecture makes more sense than a highly concentrated one? I think there's scope for a lot of new thinking on hosted payloads and we're starting to enter into conversations with the government about doing things differently than we have in the past, examining the entire architecture and seeing if we can't use the capabilities of commercial industry in a new, innovative, and cost effective way.

MSM

One area of concern to many companies in this highly competitive industry is that of finding talented and educated professionals to continue to build product. How would you like to see the industry assist and encourage youngsters to pursue STEM courses? Is SES UGS involved in any such programs?

TIP OSTERTHALER

SES certainly has been involved in encouraging the development of a talent pool because in this industry, we have a demand for highly skilled engineers and people with very strong science backgrounds. Within our company, we have provided the most intensive development programs that I've ever seen in a private company where we build the skills of an individual over the course of a two year timeframe where they are provided with exposure to various aspects of the business. The commercial satellite industry is one of the more diverse industries when it comes to looking around the globe for technical skills that we need as an international company. We have people from different cultures and background with a unifying theme that they're all technically very well trained and highly skilled.

In terms of USGS investing in our talent pool, our internship program has been increasingly active in recent years and we're continuing to look at opportunities to encourage others within the private sector to participate in similar programs.

MSM

Where do you see MILSATCOM heading over the next year? How will this effect warfighters whose boots are on the ground or pilots with joysticks in the air?

TIP OSTERTHALER

There are several important MILSATCOM programs that are in the process of execution right now, such as WGS. We'll continue to see the deployment of this fleet, which will help reduce the pressure on the warfighter to get the bandwidth they need to support operational requirements. We're seeing the continued deployment of next generation government operated IR systems as well. We've seen challenges with this system, both in terms of cost and performance, however enhancements continue and the program is moving forward. The next generation UHF program for the government, referred to as MUOS, also continues to move forward. These programs, together with the AEHF, constitute the next generation of on-orbit capabilities owned and operated by the U.S. Government.

Many of these MILSATCOM systems have common characteristics that in addition to posing challenges to the government, they tend to be extremely expensive because they are very specific. With the exception of WGS, these systems have a demanding set of requirements and are built in small quantities which as a result, can be difficult to get on orbit, on cost, and on time.

In the years ahead, it's difficult to envision a lot of new resources being made available to support these kinds of programs; the current and near-future budget environment simply will not support many multi-billion dollar new starts. With the increased pressure on the USG, we're going to need to develop innovative ways to provide the capabilities our customers need. It's likely we're not going to see nearly as many government-owned and operated systems at least for the next several years.

When it comes to specialized capabilities however, such as those required for the support of our worldwide intelligence needs, I think we'll continue to see resources going to those, though it's certainly possible these programs will experience budget constraints as well, even if to a lesser degree. Operating within this budgetary environment presents industry with the opportunity to be creative and innovate solutions that are outside of our traditional way of doing business to ensure mission critical communications capabilities are available for our customer.

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VIBRATION TESTING OF SATELLITES

AUTHORS: JULIAN SIMPSON, KIM BOLDT, TREVOR HARRISON AND JENS BROCH OF BRÜEL & KJÆR

Ever-shortening design and development timeframes of modern space programs demand 'right-first-time' engineering. High quality, goal-focused, time- and cost-efficient vibration testing is critical to meeting program milestones.

Lift-off for the Space Shuttle Atlantis — the extent of the fumes indicate the violence of the operation.

Picture, if you will, a multi-million euro altar to the triumph of function over form, precisely oriented and silently gliding on its orbit around Earth in a smooth, graceful state of free fall. Satellites appear serene and fragile in their often ungainly forms, designed for a life in orbit, untroubled by the Earth-bound stresses of gravity and vibration. But they are not.

That same ungainly mass of technology, with its solar arrays not yet extended, must endure being stowed as the payload of a launch vehicle. The satellite must survive the noise and subsequent vibration of the ~145 dB interaction between the rocket engines and launch-pad environment, the jarring transonic climb phase, pyroshock as stages separate, turbulent boundary layer excitation, and the list goes on. These forces can induce fatigue in resilient metal structures, not to mention the sensitive electrical components of satellites.

The space industry probably has the most demanding requirements of vibration testing anywhere in the world. Given the huge stresses involved during launch, and the fact that you cannot easily repair a damaged satellite once it has been deployed, it's vital that the system has been thoroughly tested before the violent ride into orbit!

SHAKING + SHOCKING

Vibration testing, in brief, is shaking or shocking a component or assembly to model real-world conditions and seeing how it will stand up to them. Conducting these tests in the field or the laboratory involves the use of controllers, instruments, data analyzers, climatic chambers and vibration exciters.

Even though the development of vibration testing techniques quite naturally have been closely connected to aerospace and space, it might be worth mentioning that vibration testing, often supplemented by shock and bump testing, is also used today in many other fields. Typical examples are packaging (for example, for shipping flatscreen televisions that should arrive in your home flat and not buckled) and the automobile and agricultural machine industries.

The concept of vibration testing as we know it today is relatively new and has been intensively developed and continuously refined since its origin during World War II. The impetus for its development was the desire to test parts and equipment for use in aircraft before a first flight.

Even then, structural and mechanical failures due to vibrations were not the only problems. The use of complicated electronic and electro-mechanical equipment made control systems and communication instrumentation sensitive to the vibrations encountered during mobile operation.

Leveraging on the experience gained from aircraft work, the aerospace industry has taken on-board vibration testing as one of the main parameters of overall environmental testing. Environmental testing of satellites tries to ensure that the odds of Murphy's Law coming into play are significantly reduced. Vibration testing is concerned mainly with what is happening around the satellite during launch — one could say under the influence of Earth's gravity. Once in space, the effects of vacuum and extreme temperatures are in focus. For these tests, satellites are put into vacuum chambers cooled down to temperatures below –100°C, or exposed to artificial sunlight, typically at 1.4kW/m2 – the intensity normally experienced in orbit.

MILSATMAGAZINE — MARCH/APRIL 2011

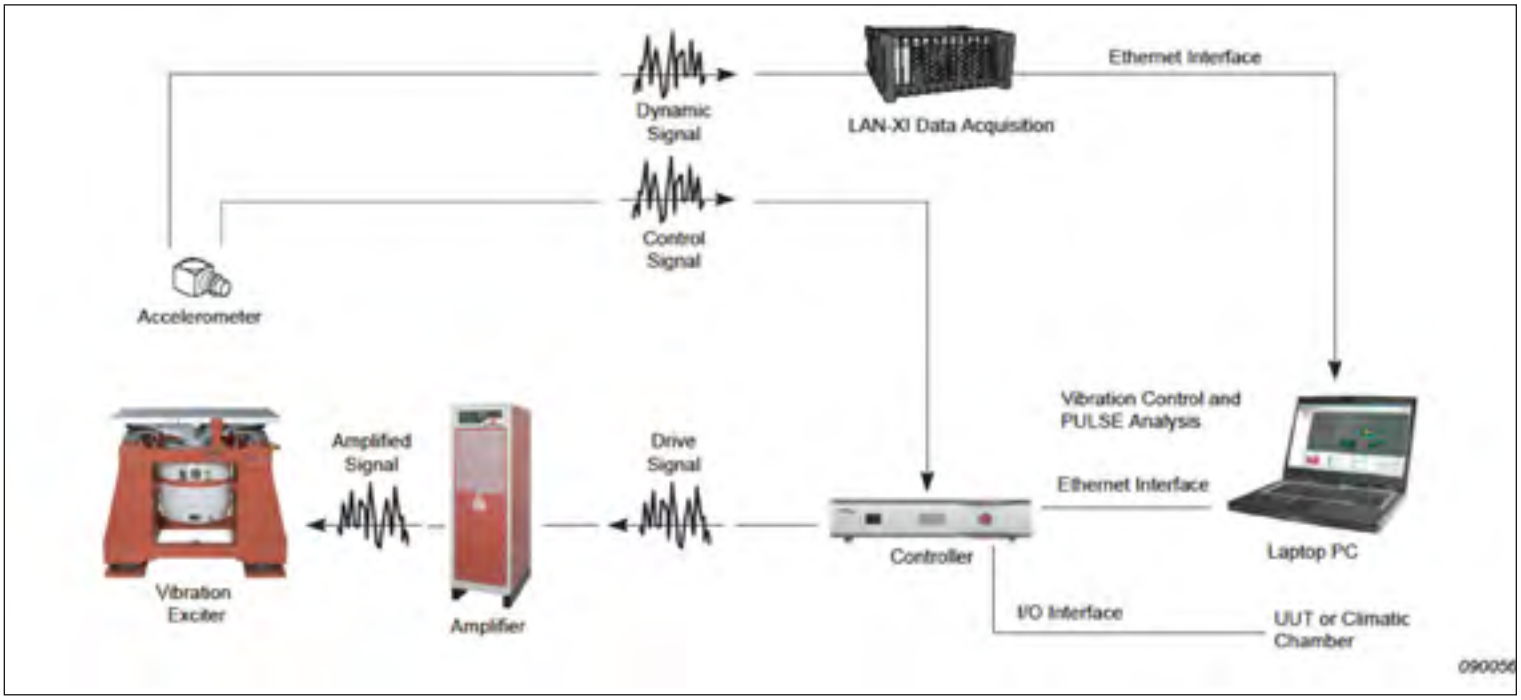
A Soyuz/ST Fregat rocket consists of 3 stages. The four side boosters (Stage 1) and the central structure (Stage 2) ignite at the same time, just before lift-off. About two minutes after launch, at an altitude of around 50 kilometres, the four side boosters are ejected while the second stage continues to burn.

TESTING REGIMES

The seriousness of malfunctions due to vibrations is, of course, greatest in manned vehicles where human life is at stake, but protecting the multi-million euro investment made in satellites is also high on the seriousness scale. Vibration testing is a prized tool for establishing the make-or-break robustness of components, subsystems and fully assembled craft. Depending on the stage of a project, different testing regimes are adopted.

Design qualification tests are usually carried out on the structural model during the development phase in order to demonstrate that the design enables the equipment to withstand the vibration level it will see during launch, plus a qualification margin. The tests also allow verification of the spacecraft mathematical model by measuring motion at "resonant frequencies", at which elements of the spacecraft structure are prone to self-vibrate once vibration is initiated.

Acceptance tests are carried out on the flight model in order to verify workmanship and ensure that the equipment does indeed operate satisfactorily in its final configuration, and will not degrade when subjected to the vibrations encountered during launch.



Typical Vibration Test System

TYPICAL VIBRATION TEST SYSTEM

» Shakers, Exciters + Systems

Shakers, or vibration exciters, come in a variety of sizes and operating configurations. The shaker might be small with a permanent magnet for the field, or large using an electromagnet for the field. Also, as more electrical power is used, more current flows and more wasted heat energy is produced, so small or medium shakers can be cooled using ambient air, while larger shakers require a water cooling system.

The LDS V900 series of water-cooled shakers has a long-established reputation in aerospace and space industries. Water-cooled shakers are able to deliver higher forces than equivalently powered air-cooled shakers. The water cooling is applied to the field coils and results in quieter operation and a cooler body temperature, minimising the temperature effects on the equipment under test. This makes water-cooled shakers ideal for applications requiring high forces, or large payloads tested for short durations.

The absence of air blowing around the shaker and test equipment makes water-cooled shakers particularly appealing in clean-room environments or when testing hazardous materials.

Accelerometers are used to measure the applied vibration levels in gravitational units. They can be used to control the test by sending feedback to the controller, or to measure acceleration and act as a monitor on the unit under test.

The controller interfaces with a computer to allow the operator to enter test parameters and observe channel information. The controller will provide a low voltage

The Brüel & Kjær LDS Quad V984LS shaker system is capable of delivering 640 kN of sine force.

drive output to the power amplifier by using a closed-loop control method. It constantly monitors and modulates the output drive signal to meet a programmed specification.

The power amplifier provides the current and voltage to the shaker. The provided current and voltage is proportional to the output from the signal source. For a medium-sized air-cooled shaker the field supply is also integrated within the power amplifier cabinet.

The operator is responsible for correctly attaching the unit under test to the shaker, attaching accelerometers, and general preparation of the setup. Finally, the operator programs the controller and observes the vibration test to completion.

» TestingTypes

There are three characteristic modes of vibration testing that are usually done in satellite testing. Sine testing involves subjecting the test item to a progressive sweep of frequencies and amplitudes, random testing randomises this progression, and shock testing induces a sudden severe excitation, simulating the shocks felt during stage separations and engine firings.

One form of sine test is a resonance search. This is a low amplitude sine sweep run from a low frequency to a higher frequency, usually at a constant logarithmic rate, to search for any natural resonances within the unit under test. Typically, a transmissibility or transfer function plot is produced to show the ratio of response to the controlled input.

Another form of sine test is an endurance test. This is applied to the unit under test by sweeping up and down over a frequency range for a specified number of sweeps or a test time, typically hours. This test does not simulate a real-life environment, but does test for material fatigue.

For a more realistic simulation of a real-life environment, broadband random vibration is used. The random vibration excites a defined band of frequencies. The resonant frequencies of the unit under test are excited regularly together to cause and show interaction.

For a shock test, a rapid pulse of short duration and high energy is imparted to the unit under test by the shaker system. The damage potential of shock pulses can be readily simulated using a classic shaker setup and have the advantage of being very repeatable.

» Quad Shakers

The **Brüel & Kjær LDS Quad V984LS** shaker system is capable of delivering 640 kN of sine force For larger components, the quad shaker system combines individual shakers, in this case **LDS V984LS** shakers, delivering forces up to a staggering 640 kN of sine force (each shaker is capable of delivering a maximum sine force of 160 kN/36000 lbf). The four shakers are mounted on a seismic block and connected to a head expander level with the floor. This is used to test satellite solar arrays, large satellite communications antennas and complete satellites, from 400 kg up to 10,000 kg.

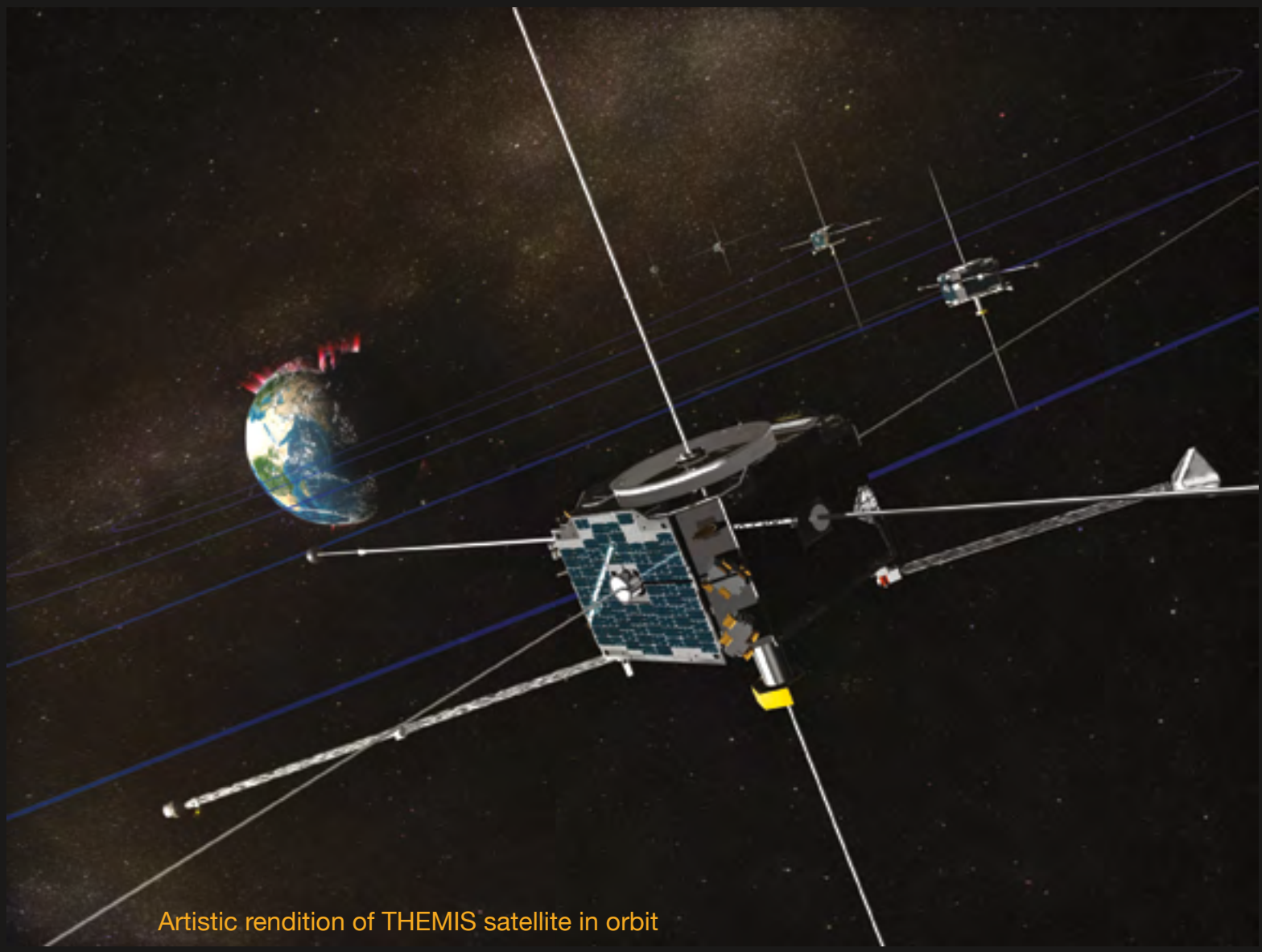
Quad vibration systems are used for a variety of tests. They can be used for large, light specimens doing sine and random tests at levels up to 20 g, or for complete satellites that are submitted to sine sweep testing at acceleration levels around 1 g, and quasistatic tests up to 12 g.

Environmental testing has long been known to provide a repeatable and controlled way of introducing a satellite to a testing regime that simulates real life, or to stress a satellite in a controlled manner. Vibration and shock can be measured in the real world and then reproduced using electrodynamic shaker systems under laboratory conditions. Testing combinations of temperature, pressure and mechanical stress can make or break a satellite prior to launch. This, of course, increases the cost of development in the short term, but more than pays for itself in the long term as the cost of fixing a problem prior to launch is much preferable than the alternative.

About the author
Julian Simpson is the Marketing Group at Brüel & Kjær

TOM WILSON
V.P.+ G.M., ATK, SPACECRAFT SYSTEMS & SERVICES

As Vice President and General Manager of ATK Spacecraft Systems and Services (SSS), Tom is responsible for leading all aspects of the business with a team of more than 560 employees in California, Maryland and Virginia. Previously, Tom served as the Vice President of Strategy, Business Development and Advanced Systems for ATK Space Systems Group. He was responsible for managing and coordinating all activities at ATK Space Systems involving corporate business and acquisition strategy, business development, and aligning ATK's capabilities/synergies to customer requirements.



Artistic rendition of THEMIS satellite in orbit

COMMAND CENTER

Prior to the acquisition of Swales Aerospace by ATK in June 2007, Tom held management positions at Swales that included Vice President, Corporate Development, and Vice President, Space Systems Programs. At Swales, he was responsible for establishing a sustaining national security market based business and growing revenues that grew from nothing to more than $75M/yr. Tom also led the development of program management and business enterprise processes at Swales.

Before he entered the Aerospace Industry in 2001, Tom had a distinguished 13 year career as a Government civilian in the DoD, including Staff Director of the Congressional Commission to Assess United States National Security Space Management and Organization, chaired by the Honorable Donald Rumsfeld and Special Assistant, Space Systems Directorate, Office of the Assistant Secretary of Defense for Command, Control, Communications, and Intelligence; Head, Technology and Flight Demonstrations, Naval Space Science and Technology Program Office, Office of Naval Research; and Special Assistant, Office of the Deputy Under Secretary of Defense for Space.

Tom entered Government service in 1989 at the Naval Research Laboratory (NRL) Naval Center for Space Technology (NCST). While at NRL, Tom held positions as the Deputy Head of the NCST Program Coordination and Liaison Office and was Program Manager of several leading edge technology programs including the Naval Earth Map Observer (NEMO) Program, the Advanced Fiber Optic Sensing (AFOS) Program, the Joint Navy/NRO Breakout Information Age Technology (BIATech) Program, and the Basic Launch Understanding Effort (BLUE).

MILSATMAGAZINE (MSM)

You have certainly enjoyed a prolific career in both the government and private company segments of our industry. Would you please tell us how you decided to enter the space technology environment in the first place?

TOM WILSON

My father Tom Wilson, Sr., graduated from the University of Maryland with an Aerospace Engineering degree in 1970. From college, he went into the space business and in 1978 co-founded Swales Aerospace. So I grew up around the space business and in particular NASA. When I graduated, also with an Aerospace Engineering degree, I went into the National Security Space Sector to try something different than the space business I understood—that is how I ended up at the Naval Research Laboratory.

MSM

The Naval Center for Space Technology (NCST) was heavily involved in space technology research and the application of those technologies. Could you tell us something about the programs you were involved with at that time, and how Navy involvement in space issues came into being?

TOM WILSON

The Navy's involvement in space began back in 1946 when the Naval Research Laboratory (NRL) developed the Viking sounding rocket. The Navy space program continued during 1955-1959 when NRL conducted the first American satellite program called Vanguard. So the Navy has been involved in the American space program from its inception. My career at NRL's

Naval Center for Space Technology began in 1989 as a cooperative education student and continued through 2001. During that time period I worked with a remarkable team of engineers and technicians developing leading edge space technology in the areas of sea based launch systems and advanced hyperspectral remote sensing technology satellites.

MSM

How has your background prepared you for your position at ATK?

TacSat-3 artistic rendition

TOM WILSON

I have spent more than 20 years as a senior executive in the defense and aerospace industry and as a civil servant in the Department of Defense. I held several high level positions in national security space programs during my 13 years of government service. I then worked for Swales Aerospace before it was acquired by ATK in executive positions including Vice President, Corporate Development and Vice President, Space Systems Programs. At the group level, I served as the Vice President of Strategy, Business Development and Advanced Systems for ATK Space Systems. In every one of these positions I have been blessed to have had a world class senior mentor and been challenged by opportunities that continuously stretch my capabilities.

MSM

Please describe the variety of programs worked on at SSS.

TOM WILSON

Spacecraft Systems and Services provides a broad portfolio of products and services that include integrated satellite bus systems, world-class multidisciplinary engineering services and market leading integrated thermal control systems for defense, civil, commercial, and international markets. We are an industry leader in small satellite bus technology. We also developed the platform for the Earth Observing-1 which just marked its 10-year anniversary; THEMIS, recently redirected by NASA for a new lunar mission; and TacSat-3, which the Air Force transitioned from experimental to operational status. We are the global leader in developing two-phase thermal solutions for spaceflight applications and recently secured our first contract in a near space defense market. SSS also provides high-quality engineering support services and enabling technologies to NASA and military customers in execution of its missions.

COMMAND CENTER

MSM

How do you see your business lane progressing in the future?

TOM WILSON

Our future is filled with growth opportunities and the potential to expand into new and adjacent markets. One example of a ground breaking program is a new company we just launched with U.S. Space called "ViviSat." The program offers on-orbit services aimed at extending the life of existing satellites and positions ATK as a leader in an emerging market. The Integrated Thermal Systems unit is thriving with a historically robust backlog of orders and plans to optimize future growth as a "factory of the future." Engineering Services remains an integral part of the ATK portfolio. We just hired a new Vice President to lead Engineering Services on its expanded mission. Kenneth Reightler, a former NASA astronaut and a highly experienced aerospace executive joined us on February first. Our investments, achievements and forward vision position Spacecraft Systems & Services well for the future.

MSM

Tell us more about ViviSat and why this on-orbit servicing venture is a game changer in the industry.

TOM WILSON

We are offering commercial and government satellite operators a game-changing advance in the operation of geosynchronous satellites. ViviSat is the first U.S. based company to offer this kind of service. ViviSat is backed by ATK and U.S. Space — both creative and customer-oriented companies. U. S. Space brings to ViviSat its experienced and deeply respected management team, and ATK brings its extraordinary record of performance. Unlike other versions of this service, we don't interfere with anything the satellite is doing. Our solution is simple, low risk and unique. We are offering commercial and government satellite operators a game-changing advance in the operation of geosynchronous satellites.

ViviSat's Mission Extension Vehicle (MEV) is designed to dock with the orbiting satellite, securely latch on to it, and serve as a back-up propulsion system. This enables a mission extension for satellites which have run out of maneuvering fuel yet still have plenty of electrical power to operate their payloads. ViviSat services include rendezvous and docking without interruption of satellite operation, long-term station-keeping and attitude control, relocation to different orbits or orbital slots, de-orbiting, and rescue and re-orbiting of satellites stranded in incorrect orbital slots. We have done a first round of meetings with satellite operators around the world and there is substantial interest. We are now starting our second round of meetings.

Our target customers not only see this product as extending the life of their satellites — this service will offer more life and more profitability for their space assets. They'll see more performance, return and cash flow from existing assets.

MSM

Is there a market for this service?

TOM WILSON

Our model opens the door to the satellite servicing market. Right now, the market doesn't exist. The ViviSat product will change that. Our tool is simple, affordable and brings new life to space assets. In today's economy — where satellite operators are trying to manage costs — our service fits their needs. We created the ViviSat service to meet a market need. We had many conversations with satellite operators, and potential U.S. and coalition governments. We heard in great detail about their opportunities, goals and challenges, and built ViviSat as a solution to their needs. The interest in ViviSat's ability to improve the customer's performance, cash flow and return from existing space assets is substantial.

MSM

What can we expect to see from ATK over the next few months to a year? Will there be an ongoing emphasis in working with the government for payload delivery, such as hosted payloads due to capacity crunch?

TOM WILSON

You should expect to see strong ATK presence in planned GSFC satellite servicing demonstrations, both manned and unmanned, building on our award winning Hubble Space Telescope repair mission work. We are watching the evolution of hosted payloads, but our business focus is on satellite buses and components, not the payloads.
In that regard, one of our strengths is payload to bus thermal/mechanical interfaces and deployment mechanisms which could be an important part of hosted payloads and where we might team with the mission prime contractor. In general we believe small satellites offer benefits of autonomy without the constraints of being locked with the host at competitive costs. In addition to ViviSat, in the coming year you might look to ATK for new, innovative commercial business contracting (fee for service) approaches for satellite capability to NASA and other US Government agencies.

MSM

The space/satellite industry continues to develop new systems and programs, one reason for the continuing global vitality. This also means more direct competition for U.S.-based firms from overseas with lower financial requirements for clients. How does ATK compete against such financial incentives? Could there be affiliations between ATK and other global delivery system companies?

TOM WILSON

We are confident of our ability to compete internationally, especially if the USG reduces the ITAR and other export regulations as stated in the new National Space Policy and the National Security Space Strategy. It is no doubt more difficult to compete with overseas firms that have financial incentives from their governments, but the quality of our work and high tech products,

Artistic rendition of the Mission Extension Vehicle (MEV) to be created by the new company, ViviSat, which has been formed by U.S. Space and ATK.

and our efficient facilities in the US often give us an edge. Our Integrated Thermal Systems — loop heat pipes and radiator panels — already have some presence in foreign markets, as well as precision structures, propulsion tanks, and solar array systems offered by our sister ATK components division.

Also, we partner very well with other space companies to address global markets. For example, ATK Launch Division is partnering with EADS-Astrium on the newly announced Liberty launch vehicle. We are discussing other partnerships as well.

MSM

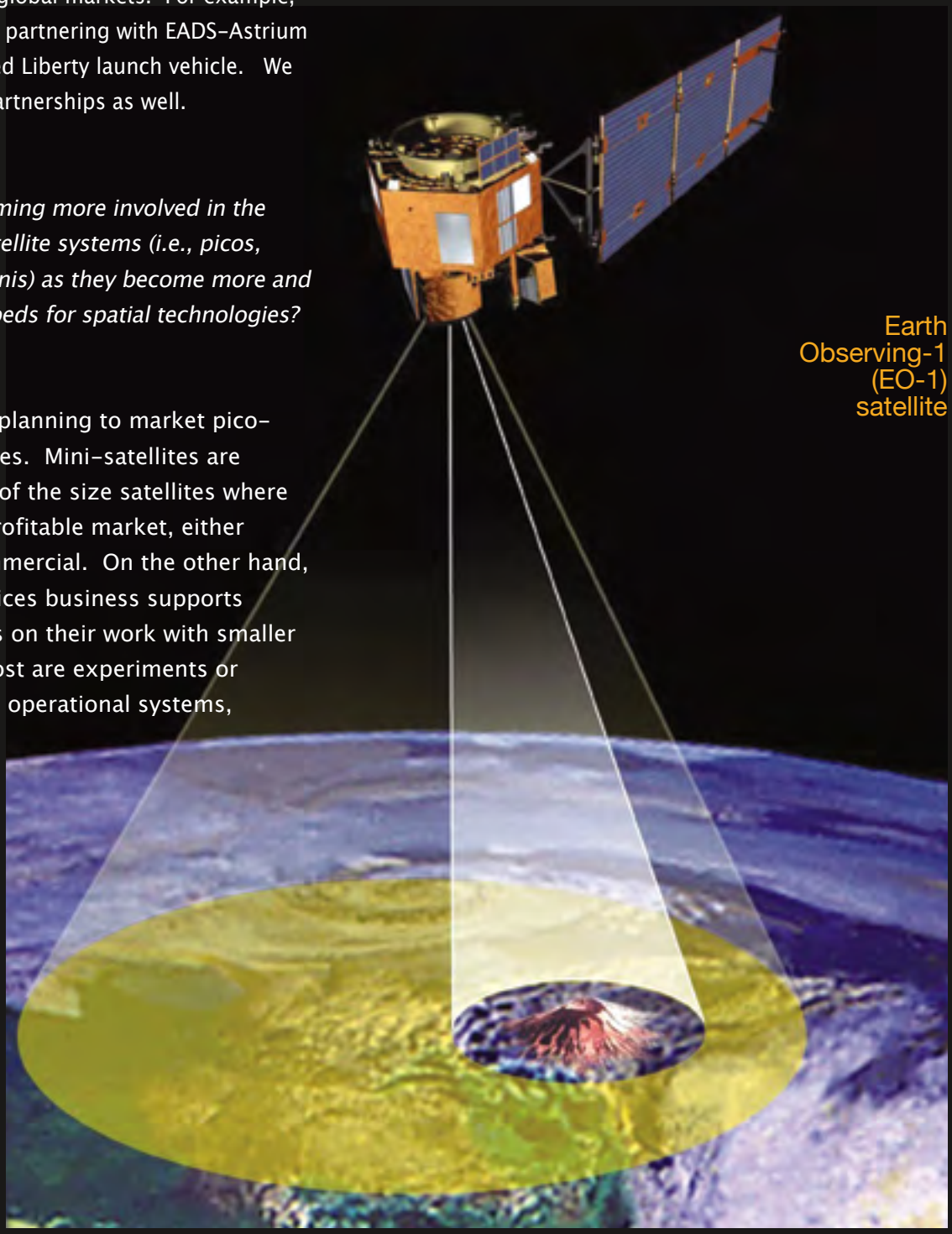
Will we see ATK becoming more involved in the delivery of smaller satellite systems (i.e., picos, nanos, micros and minis) as they become more and more popular as testbeds for spatial technologies?

TOM WILSON

We are not currently planning to market pico- or nano-satellite buses. Mini-satellites are really at the low end of the size satellites where we think there is a profitable market, either government and commercial. On the other hand, our Engineering Services business supports several NASA Centers on their work with smaller satellite systems. Most are experiments or science testbeds, not operational systems, and often require unique engineering problem solving support. We are a charter and major sponsor of the annual AIAA/Utah State University Conference on Small Satellites Conference in Utah because of the interest in small satellites it generates in academia, government and industry.

MSM

With the absolutely crucial requirement for a trained workforce pool from which companies such as ATK



Earth Observing-1 (EO-1) satellite

ViviSat's MEV

can hire competent professionals, what should the industry be doing to encourage students to engage more readily in STEM coursework? Is ATK involved in any such programs?

TOM WILSON

The industry has been and should continue to be a partner with education and the community to help today's students see the value in being scientifically and technologically literate. Among the greater needs are to mentor and develop our nation's teachers who have the greatest impact in our classrooms across the country. We have the opportunity to help shape formal and informal learning opportunities, to make teaching relevant to the real world, and we should do that.

ATK's partnership with education has spanned decades and has encompassed local, regional and national initiatives focused primarily at the intermediate, high school and higher education levels of academic learning. Partnerships have been as simple as spending time with students in the classroom or mentoring them at their science fair to staging conferences and sponsoring national competitions to encourage students to explore their career interests and test their skills.

We have a passion for what we do, and we have an educational outreach program in place to share that passion.

A notable example is NASA's University Student Launch Initiative that ATK began sponsoring in 2007. Our sponsorship has since expanded to include both the high school and university components of a nationwide competition. The contest challenges students during the course of a school year, to design, build, test and fly their own recoverable rocket capable of launching a payload to an altitude of one mile. Participation is growing each year, and an additional challenge of a water recovery has been added to this year's competition. This competition demonstrates that students become engaged and are willing to work hard to conquer these challenges. As an industry, we need to continue to create these opportunities.

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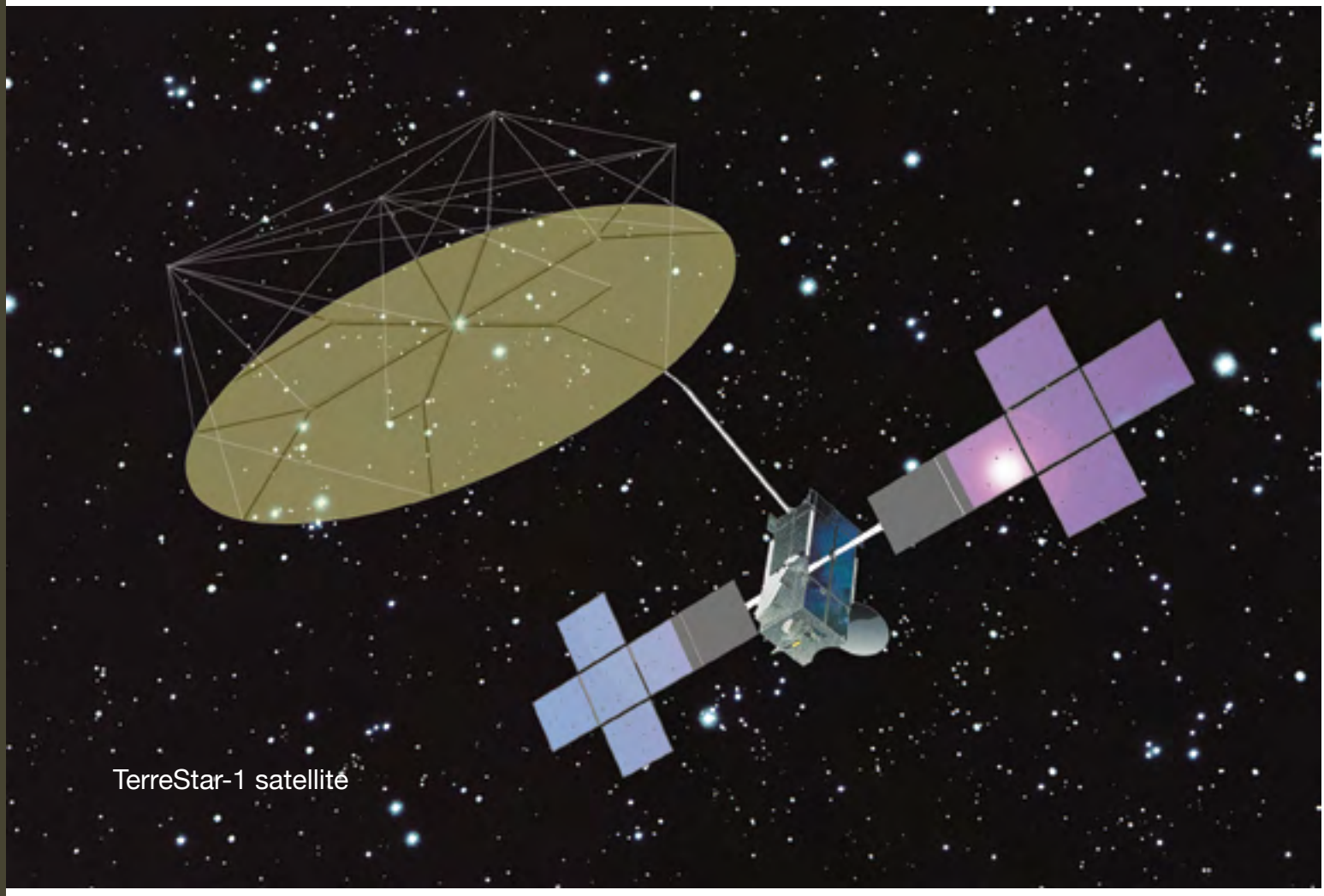
THE ESSENTIAL DEVICE FOR YOUR EMERGENCY RESPONSE + DISASTER RECOVERY TOOLKIT

AUTHOR: DENNIS MATHESON, CHIEF TECHNOLOGY OFFICER, TERRESTAR

Following years of increased hurricane activity, the blizzards of winter 2010, and the foiled terrorist threat in Times Square, concerns over an overburdened or failed terrestrial communications network resurfaced, and in some cases, these fears became a reality. The potential and actual lack of operable terrestrial communications resulting from these situations could severely impede disaster relief and recovery efforts of first responders and government officials. With these threats looming, satellite communications has increasingly become part of the response plan to fill the communications gap.



TerreStar-1 satellite

THE SATELLITE INDUSTRY RESPONDS

Success in emergency relief and disaster recovery is measured by quick response times and the ability to establish real-time connectivity. With ubiquitous coverage, satellite communications networks can provide the backbone for rescue and support initiatives during times of crisis and offer first response, medical and emergency teams with full communications capabilities.

When cellular communications networks are compromised, satellite communication is often the only available communications option. In fact, in many of the affected areas following a natural or manmade disaster such as areas impacted by hurricane Katrina in 2005, satellites proved to be the only source of communications in the days and weeks following, and provided the basic operability that terrestrial networks could not.

Satellites are the most reliable platform for communications in disaster situations as they are unaffected by land-based issues, where damage to ground equipment can be widespread following a catastrophe. Satellites provide redundancy and communications path diversity while ensuring that first responders and disaster recovery teams are able to coordinate in any emergency situation. As a result of this reliability, satellites allow public safety officials to communicate their needs and provide information to families, communities, governments, and the general public.

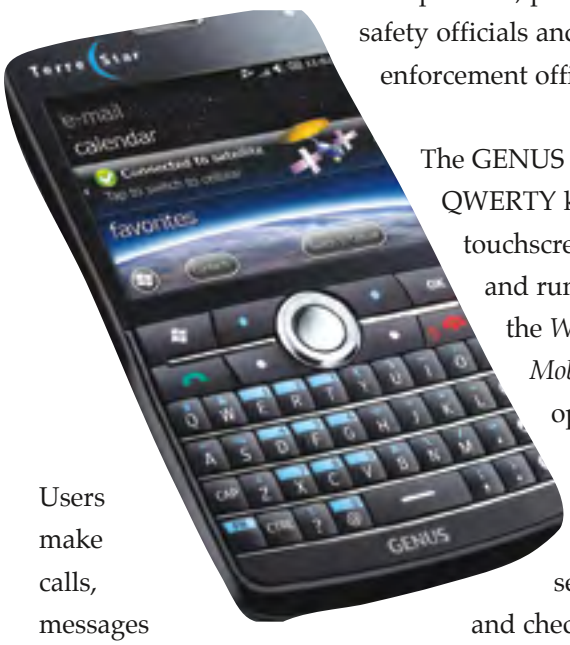
It is, therefore, critical that first responders have the instant communications infrastructure and ubiquitous coverage that only satellites provide. What's more, first responders cannot rely solely on satellite voice communications when relaying information

to and from the field and command center, but must also have access to data communications to provide vital information that can save lives.

A SINGLE DEVICE

TerreStar Networks recently launched the world's first mobile device that integrates both traditional cellular features (provided by **AT&T**'s cellular network) as well as a non-terrestrial based communications platform. The ***TerreStar***™ ***GENUS***™ is a unique and important tool for public safety officials and first responders that augments terrestrial infrastructures, which themselves are susceptible to all types of natural and manmade catastrophes.

Designed to be used as an everyday device, the GENUS is a dual-mode satellite-cellular smartphone. With just one number for voice, data, and messaging, the GENUS provides 3G cellular wireless connectivity integrated with an all-IP satellite network offering coverage throughout the United States, Canada, Puerto Rico, U.S. Virgin Islands and in territorial waters up to 200 miles offshore. It is the first and only device operable on both terrestrial and satellite networks that delivers "always on" communications for first responders, public safety officials and law enforcement officers.



The GENUS offers a QWERTY keyboard, touchscreen and runs on the *Windows Mobile 6.5* operating system. Users can make voice calls, send text messages and check email on one device with one phone number for both satellite and cellular service. Offering one phone number with one contact list alleviates the need to search for numbers and contacts, which is especially important when in disaster mode. The GENUS includes other standard smartphone features that can be critical to emergency response and disaster recovery teams, including a 2.0 megapixel camera, MicroSD slot, WiFi, Bluetooth and GPS.

THE ESSENTIAL TOOL

Finally, TerreStar's revolutionary spot beam technology, coupled with Ground Based Beam Forming (GBBF), allows TerreStar to allocate power and spectrum to situation-specific incidents ensuring capacity when and where it is needed. With the integrated cellular/satellite communications solution enabled by the TerreStar GENUS, emergency and disaster response personnel no longer have to reach for the clunky traditional satellite phone in storage when disaster strikes. Instead, they can gain access to ubiquitous wireless coverage through a robust and flexible communications platform with the ease and full functionality of a state-of-the-art smartphone that they carry on a daily basis.

About the author

Mr. Matheson is responsible for TerreStar's corporate planning and drives the technical direction and delivery for development of the satellite and network systems and handset technologies for TerreStar Networks. Prior to joining TerreStar, Mr. Matheson was the Senior Vice President and Chief Technical Officer for Motient, providing the technical direction for all services. His responsibilities included the ground station development and satellite operations for the L-band spectrum. Mr. Matheson previously was the Senior Manager of Systems Architecture for Bell Northern Research, a subsidiary of Northern Telecom and a leading provider of telecommunications equipment for both wireless and wireline applications.

"Well done for a great conference!"
Senior Representative, SES ASTRA, Military Space 2010

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JOHN RATIGAN
PRESIDENT, IDIRECT GOVERNMENT TECHNOLOGIES

John Ratigan is the President of iDirect Government Technologies (iGT), a satellite-based IP communications company that transforms the way the Department of Defense (DoD) and civilian government agencies get and stay connected. He started the Federal group for iDirect Technologies in 2003 which resulted in establishing iGT as a wholly owned subsidiary in 2007. Under his leadership, the group has enjoyed tremendous growth and has deployed thousands of terminals in support of military operations throughout South West Asia, as well as well as many civilian networks.

John brings more than 20 years of experience in the satellite communications arena to the Company. Prior to joining iGT, he ran the east coast operations for Fairchild Data, and EF DATA, and eventually partnered in his own company that helped EF DATA grow from $20 million to $120 million in revenue and 700 employees between 1992 and 2000. EFDATA became the preeminent leader in SCPC satellite technology in the late 1990s and provided John the baseline knowledge and expertise that would later benefit him in his role with iGT and the migration of technology into TDMA. In addition to starting his own company, he held the position of Senior Vice president of North and South American sales for the start-up, Broadlogic, just as companies started to run IP directly over satellite.

Ratigan started his career in the U.S. Senate working for Senator Bill Armstrong (R-Colorado) and eventually moved into the sales field with the Xerox Corporation as a member of the legal sales team. He holds a Bachelor of Science degree in Marketing from the University of Maryland.

MILSATMAGAZINE (MSM)

John, you have more than 20 years of experience in SATCOM related environments... how did you decide upon this field for your career?

JOHN RATIGAN

I don't know if I chose SATCOM or it chose me, but we've had a great time together for a long time. I started my career in the political environment and quickly migrated into sales at Xerox but one thing that was always clear to me was that I always enjoyed being around and working interactively with people. Sales was a natural path for me, and my aggressive nature led me to take risks with many start-up companies. One of the first start-ups I worked for after leaving Xerox was a satellite-based company called Multicomm where I truly enjoyed the risk and workload of a fledgling company and the impact that one person could have combined with some really innovative technology.

This early experience and success led me to other satellite-based companies including Fairchild Data and the formation of EF DATA with Bob Fitting and Steve Eyemann. Before I knew it, I'd spent more than 20 years in the industry and haven't regretted a single day. VT iDirect and subsequently iDirect Government Technologies (iGT) have been two highlights in my career as we started from nothing and were able to grow these two great companies into powerhouses with some spectacular people.

MSM

Given the constant changes in our industry, what have you seen or experienced as one of the most pivotal technological advances that moved the industry into the mainstream of communications?

JOHN RATIGAN

When I was interviewing at iDirect in 2002, I was amazed at what they were telling me was capable in a single box solution. I'd spent years in the SCPC part of the industry, and iDirect was doing what was clearly innovative. Technology had allowed circuit boards and chip sets to dramatically shrink in size, so the only thing that was left was to keep adding additional capabilities to the modems. iDirect figured out a way to build a satellite modem, an IP router, an accelerator, an encryption device and a complete network QOS system into one box. It was the dawn of the FPGA (Field Programmable Gate Array).

Satellite modems and other SATCOM products were moving from strictly hardware devices to dynamically programmable software devices that could be altered, not by adding new hardware, but by just a new load of downloadable software. The majority of the engineers now being hired are software engineers, and the greater amount of time is now spent in testing software and not hardware. I see this trend continuing. The chip guys will keep making the chips smaller, and the engineers will keep finding ways to improve performance, add features and capabilities, and improve the user experience.

MSM

Given the demands of MILSATCOM, how have your prior positions established your credentials within this tightly knit community?

JOHN RATIGAN

There are two contributors to this. The first is the extensive experience and history that I have not only within SATCOM but within the MILSATCOM arena. Having a deep knowledge of both the strengths and weakness of SATCOM and how this pertains to the military environment and specifically to the soldiers that have to use this is critical. This understanding has given me the foresight to hire a tremendously talented group of SATCOM, IP and military professionals who make up a highly motivated team of people. This team thinks of nothing else but how we can help the soldier on the ground and those involved in network and command operations.

We have built our entire company around making sure our soldiers have all the best technology and assistance required to successfully complete their missions, and we take our role in the success or failure of these missions very personally. We consider ourselves partners with the U.S. military not just vendors or contractors.

The second factor is one that you can't buy, and that is trust. Our end customers know that our entire team will not fail in our mission to support our military. The foundation of trust can only be built over a long period of time and with the successful completion of many tasks together. This is really an area where actions speak much louder than words. I hope we have shown that, over these many years, they (our customers) can trust us to deliver a high-quality product, move with a great sense of urgency in a crisis, and come through with quality solutions.

MSM

The warfighter has to counter enemies, seen and unseen, on today's battlefield. What advances in MILSATCOM will assist them in the ongoing fight, both in command operations and for those whose boots are on the ground?

JOHN RATIGAN

All of us in the MILSATCOM industry continue to strive for more and more ways to assist the warfighter. One of the undeniable migrations of technology is that there continues to be a proliferation of data being generated by any number of conceivable devices. This data is used to prosecute the war and that data must be moved to a location for analysis or compiled into an easy to understand report or projection. The transport of information has always been critical, but there are two important changes that are being implemented.

The first is the ability to transport larger amounts of data out of ever-shrinking devices closer to the battlefield. Broadband communications in a Man-Pack or Man-Portable device allows for the application and implementation of technologies previously unavailable to the soldier on the ground. These devices will allow both the transmission and receipt of high-speed communications into areas and devices that have never been available before. These devices and the corresponding technology also allow for more efficient and higher data speeds in the airborne environment for both ISR and normal voice, video and data application.

Second is the ability of software to quickly and efficiently process the information that is being received and give commanders a better situational view of what is transpiring, in real-time, and with interfaces that make it easier to quickly understand the data.

MSM

How did you become involved in moving from COTH, COTM to airborne communications?

JOHN RATIGAN

Like many great products, they were born from specific needs. COTH came into play with the logistics group under CSS SATCOM when they needed the logistics capability to have a terminal that could provide broadband communications capability but be quickly disassembled and quickly reassembled as they moved with the troops. We worked very closely with both the end-user and our integrator terminal partners to deliver the right modem product inside a high-quality terminal that was dependable in the harsh desert environment. COTM was the next logical migration as vehicular, seaborne and airborne platforms all had the requirements for broadband communications.

The more complicated part of COTM was the antennas that had to track the satellite from ever faster moving platforms, under and around obstacles, and in all types of weather conditions causing degradation in the satellite signal. iDirect has spent vast amounts of internal R&D funding in the creation of technology that accommodates for Doppler shifts and a system to rejoin the network quickly after encountering an obstacle. We've been involved in maritime operations for many years and now have several groups using us in the vehicular environment. This month, we go operational with our first airborne platforms.

MSM

Given your expertise with TDMA, are there new security safeguards being implemented to negate unwarranted access by unauthorized parties?

JOHN RATIGAN

I was surprised when I first arrived at iDirect in 2003 that it already had encryption built into its devices. It seemed logical, but iDirect was the first to implement it. We've really become experts at protecting the payload and overhead structure and preventing unauthorized access. Since 2003 we've migrated from 3DES encryption to our current AES (advanced encryption standard), which is the strongest commercial encryption you can buy without going to a government-controlled type I encryption device. Additionally, iDirect has implemented a bevy of controls to prevent incursion and to protect our customers.

The first is to have our equipment certified through FIPS 140-2. This is a NIST qualification that ensures that the implementation of your encryption algorithm is done correctly and would default and shut down if it has been shown to have been tampered with. Secondly is our TRANSEC development. This is additional encryption that hides all of the overhead of a data packet, which denies the adversary from identifying anything about the sender, the receiver, the data, the location or any other data point that could provide an advantage. Additionally, many other software and hardware gates are in place to safeguard the security of our end customer.

Security is a huge issue for our customers and subsequently a huge focus for iGT. To negate unwarranted access from the IP side of the network, iGT has developed a software engine designed to quickly implement the latest STIG security recommendations. The STIG engine removes the pain previously felt by network operators when implementing the latest Information Assurance recommendations.

MSM

What recent advances has iGT made in the airborne communications segment?

JOHN RATIGAN

iGT and our parent VT iDirect have diligently worked to improve the performance of our product in the military and first responder environment. We've worked closely with our partners to seamlessly integrate into an airborne platform so that the modem, antenna and aircraft are all working in concert. This has enabled our collective solution to substantially increase the data rates available, anticipate the transit between satellite footprints, accommodate the rapid Doppler shifts that occur during flight, aand allow the antenna to react more quickly to aircraft movement and integrate into many of the ISR systems that are in use today. Additionally, we've designed our solution to accommodate hundreds of aircraft in one network and track their movements dynamically if required.

MSM

Are there any immediate benefits to using airborne communications in the ISR arena as opposed to ground COTM?

JOHN RATIGAN

The ISR arena requires that a system be able to transmit large amounts of data back to either an analyst or directly to soldiers on the ground.

iGT brings the ability to work in either the ISR or ground COTM arena and to provide a platform that allows for tremendously efficient satellite communications. Bandwidth is a very valuable and limited commodity, and the iGT system allows for our end customers to use bandwidth for multiple tasks without any degradation in performance or throughput.

MSM

What real-world implementations of airborne satellite and video have transpired recently, and were they successful?

JOHN RATIGAN

Most recently, we were able to work with the Coast Guard in helping to monitor the oil spill in the Gulf of Mexico. iGT worked with our contractor partners to provide the SATCOM network component on an airborne platform. Our work enabled airborne SATCOM to send video images of the extent of the Deepwater Horizon oil spill and track where the oil was spreading in the Gulf of Mexico. The images were transmitted to the U.S. Coast Guard and cleanup workers over a secure satellite communications backbone developed by iGT. It felt great to be a part of this effort.

MSM

What is the outlook for airborne SATCOM in 2011?

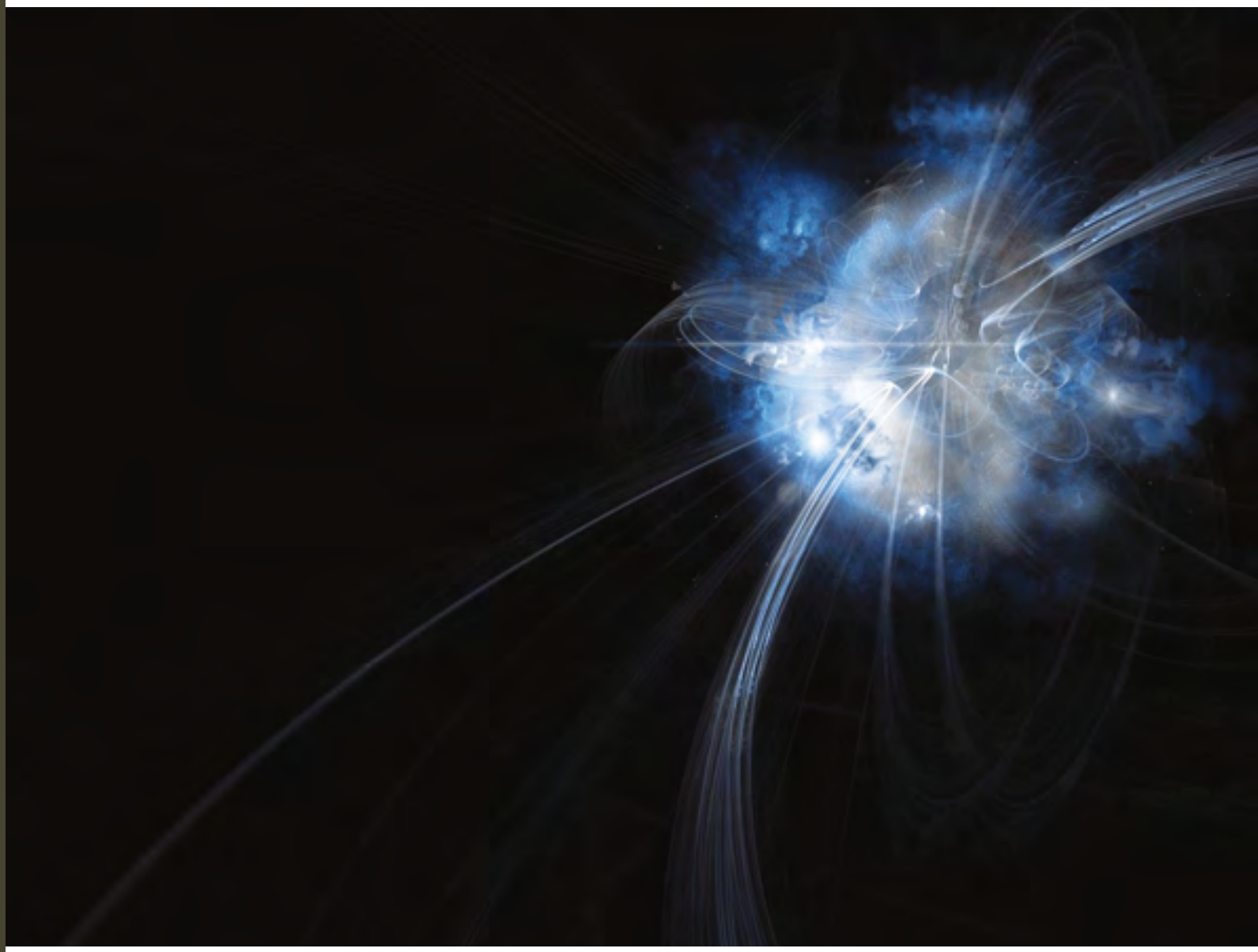
JOHN RATIGAN

I expect many good things to happen in 2011 as both vehicular and airborne COTM networks seem to have some funding and motivation behind them.

CONTROLLING SATELLITE COMMUNICATION COSTS

AUTHOR: SANDY JOHNSON, COO, SATCOM GLOBAL

For armed forces operating in remote parts of the globe, the ability to communicate with colleagues, friends, and family has, until now, been restricted on the grounds of affordability and lack of communication channels. However, there is nothing less than a revolution currently occurring in the world of satellite communications. As a result, it is now possible for users who spend long periods of times in these distant locations, whether on land or at sea, to benefit from the kind of high quality voice and data communications they have become increasingly used to using at home.



The key to this change is compression. The latest data compression technologies provide two major benefits which now makes the provision of advanced communications channels a viable proposition for command staff and individual military personnel.

First, the adoption of an advanced, flexible codec delivers a new level of high quality, two-way voice and data communications in an easy-to-use and secure environment. At a fraction of the cost of existing satellite communications, this makes it affordable to all.

In addition, the technology is designed from the ground up to support ultra-efficient satellite communications delivery via pre-paid and post-paid options, providing military and civil organizations alike with the flexibility and transparency to retain control of their telecoms costs.

KEEPING IN TOUCH

The difficulty of staying in touch with family, friends and colleagues has long been a challenge for those working in tough and out-of-the-way land-based or maritime environments. This has been especially problematic for military personnel operating in war zones in inhospitable terrains thousands of miles from home.

In the case of individuals, often away for extended tours of duty and perhaps keen to save as much as they can in order to send money home and support their families, the options have historically been limited. Until recently, in most cases they have not been able to communicate from their operational base. They have had to wait until they reached the nearest city or next port in order to use a local, expensive, pay-as-you-go phone.

In the past few years, matters have improved with the development of satellite communications, as it has become more common for the local command to provide some form of calling facility — for example, offering vouchers which allow military personnel to call home from their base, and at a time that suits their duty schedules.

The ability to take advantage of this capability has continued to be restricted by the high cost of calls, typically $1 per minute or more. In response, with the greater use of Voice over IP (VoIP) solutions, technology is now playing its part in making such communication much less expensive.

The issue extends significantly beyond a simple requirement to be able to call home using a pre-paid voucher. At home, and on-shore more broadly, military personnel are increasingly able to take advantage of a wide variety of sophisticated voice and data communications options — from instant messaging to sending and receiving emails to searching the Internet — all in a secure, controlled environment and achieving much better value for their hard-earned money as a result of today's compression technologies.

With the greater availability of IP in the home environment, when in outlying geographies individuals similarly want to send and receive emails and photograph attachments — the modern day equivalent of the traditional long awaited letter (to and from) home.

At the same time, they may also want to be able to fill some of their leisure time surfing the net. This has also been beneficial for senior staff who are keen to send and receive business-critical information via voicemail, for example, with colleagues at the command centre or other remote locations.

In enabling this enhanced two-way communication capability, for the first time in a pre-paid environment family or friends have the ability to leave a voicemail message so that the call can be returned at a convenient time, something which once again has long been taken for granted in the world of terrestrial landline and mobile communications.

'ONE WORLD, ONE NETWORK'

Another key beneficiary is the bill payer or owner of the communications device. Those with responsibility for remote land bases or fleets are typically reliant on satellite communications for all communications between the command centre and outlying operating units, with telecoms an important element of the budget in managing each site.

The availability of new satellite-based solutions using compression technology represents a revolution in enabling truly global land-based and maritime communications, both in terms of cost and range of facilities, significantly narrowing the gap with what is available in well-developed terrestrial environments.

The cost of communicating is dramatically reduced by using VoIP end-to-end by installing a ***Horizon*** Multi-VoIP unit in each remote location and another in the operational centre.

Previously, the center, or hub, would have to use a landline phone and call each location via a PSTN line, an expensive option costing perhaps $3-4 per minute. Now it is possible to call any outlying base or vessel direct through the local user extension number and make a VoIP-to-VoIP call, using the background IP channel, therefore by-passing the PSTN operator.

The concept of email data compression in remote terrestrial or maritime environments is not new, although recent developments have taken performance and cost reduction to a new level. However, until now, access on such broadband products has been limited to a one-voice channel, resulting in long queues to make a call.

With the introduction of a flexible new proprietary codec for the first time, it is possible to have multiple connections, with as many as eight handsets on one Horizon Multi-VoIP unit. Not only does this allow eight people to make calls simultaneously, data can also be passed across the background IP channel at the same time. Users can also maximize savings by selecting from several call settings for optimum cost/quality voice delivery.

This is a radically different form of communication and is highly intuitive and easy to install. Equally, the savings to be made here are huge, as this cuts the cost of such calls to just cents per minute.

Operationally, the availability of instant messaging is another valuable new facility. Historically, sending data across a satellite communications network in this way has been highly bandwidth intensive — up to 25 kbps — and, therefore, once again, very costly. With the advent of instant messaging and peer-to-peer VoIP, the satellite system is optimized, using less than 2 kbps and provides an ideal low-cost two-way conversation option.

This offers a number of other advantages. The instant messaging text facility enables correspondence to be put into print, which can be valuable in ensuring clarity of communication. For the local commander, for example, such also provides a way to communicate rapidly with the command center in the event of an immediate requirement for equipment, engineering, or other specialist support.

In a tough economic climate, this clearly offers a notable benefit to the armed forces overall in the ability to operate effectively within tight budgets. However, it offers the additional plus of boosting the operator's ability to recruit and retain individuals with specialist skills — and in effect become an 'employer of choice', by including superior, low cost voice and data communications facilities as part of a more competitive remuneration package.

SHRINKING THE WORLD

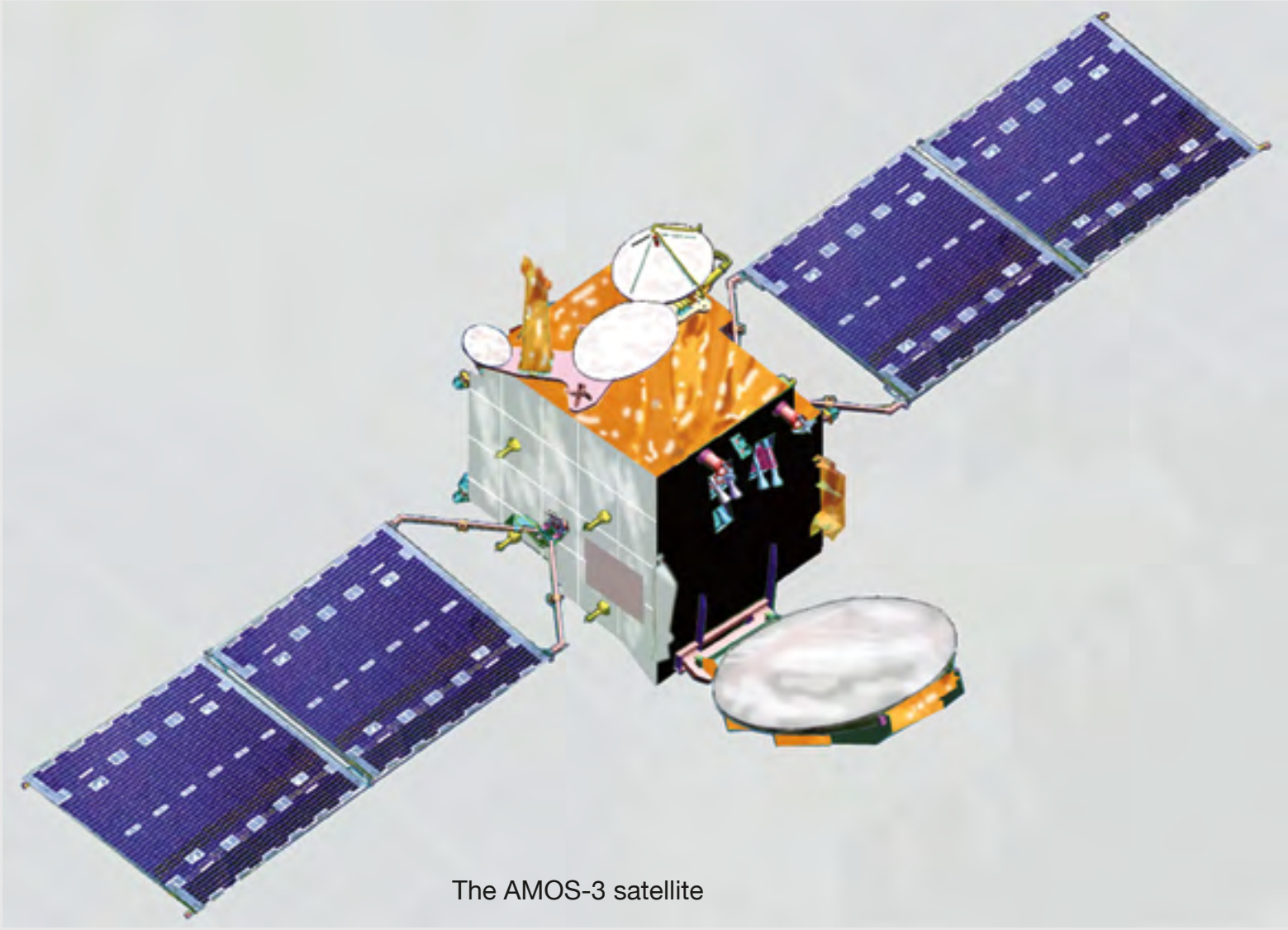
For military personnel operating in dangerous war zones or dealing with civil emergencies such as natural disasters, the ability to access the Internet and stay in contact with home on a regular basis in this way — by phone, email and text — will make the world a much smaller place.

For the administration, the visibility and control of communications costs that such tools provide means that they can offer these benefits without the fear of expenditure spiralling out of control as they look to attract and retain the best recruits.

GOVERNMENT CALLS FOR COMMERCIAL SUPPORT

AUTHOR: ORI ONN, SR. VP MARKETING & SALES, SPACECOM

U.S. Government agencies continue to be large consumers of adaptable commercial satellite services to establish and maintain communications for their operations. In fact, according to one recent industry analyst report, commercial satellite operators provide more than 80 percent of the bandwidth the U.S. government and military uses.



The AMOS-3 satellite

As an example, the U.S. Department of Defense (DoD) is leveraging the satellite capacity of Spacecom, operator of the **AMOS** satellite fleet, through a relationship with a major U.S. systems integrator in order to secure, reliable satellite communications in Europe and the Middle East, and soon in Africa.

A supplier of continual, secure communications customized for the unique needs of defense personnel, **Spacecom** is currently providing the DoD with secure video, email and other satellite communications services in Europe and the Middle East.

SATCOM FOR CRITICAL MISSIONS

Delivering end-to-end, secure communications and services to government requires that satellite providers be equipped to handle a variety of communication needs. For remote government facilities and deployed personnel spread out across rural areas, on land, sea, or in the air, maintaining open lines of communication with the home base and ensuring secure and reliable transfer of information is crucial.

However, moving content is only one of the many challenges facing the DoD. Given the nature of much of that content, the agency must also be ever vigilant about the security and integrity of communications. Challenged to meet stringent *Defense Information Systems Agency* (**DISA**)-mandated security requirements, the DoD needs to ensure defense against unlawful interference.

The Company supplies secure, congestion-free delivery of video, voice and data applications, including videoconference, telephony and fax transmissions, to remote locations through interconnecting LANs between DoD offices and remote branches abroad. Spacecom also provides dependable emergency backup infrastructure on co-located satellites — AMOS-2 and AMOS-3 — at 4 degrees West to minimize the chance of disruption in case of malfunction.

COST-SAVINGS FOR COMPLETE CONNECTIVITY

Designing, launching, and operating a military communications satellite is an expensive and time-consuming effort. Amid shrinking budgets and a government-wide emphasis on efficiency, capital and operating expenditures needed for satellites are in short supply. What's more, Defense Secretary R*obert Gates*' proposal to eliminate $78 billion in defense spending has prompted the military to home in on cost-effective solutions that demand the DoD do more with less — without short changing mission success.

Rather than commit to creating an entire satellite constellation, the DoD is leaving development to defense contractors and system integrators, which then partner with providers such as Spacecom to provide satellite services, in order for the agency to better reallocate resources for strategic development and logistical support.

Of course, the DoD isn't the only government agency, either in the U.S. or abroad, that has noticed the cost advantages of piggybacking on existing satellite networks. Government agencies worldwide can't deny the business case for third party provisioning of satellite services, which creates a potential supply and demand challenge: everyone wants a piece of the pie, but there isn't enough for everyone.

FIGHTING FOR A LIMITED COMMODITY

The truth is that demand for satellite bandwidth will eventually outstrip supply — a possibility that threatens assured access to satellite communications capacity.

It should come as no surprise, then, that government agencies, particularly the DoD, have made securing reliable satellite bandwidth a major priority. National security is dependent on the DoD's ability to secure enough of this resource to support U.S. military and foreign policy efforts around the globe. The DoD, warfighters and the *intelligence community* (**IC**) need access to the correct amount of bandwidth to accomplish mission critical activities.

Fortunately, satellite providers continue to expand service and capacity in high growth, under served regions of the world that even just a decade ago would have garnered little attention.

REACHING FOR AFRICA AND BEYOND

Ongoing conflicts on two fronts and new security challenges in Africa — ranging from piracy to failed states harboring terrorists — have strained the DoD's communications resources.

With political turmoil in North and West Africa and piracy in East Africa, the DoD's geographic command, the *U.S. Africa Command* (**AFRICOM**), is working to achieve cooperative relationships with nations on the African continent. Through AFRICOM and in conjunction with other international partners, the DoD relies on secure communication for military operations that promote U.S. foreign policy in Africa.

With the anticipated addition of the ***AMOS-5*** satellite scheduled to launch in July 2011, the DoD will soon be able to access comprehensive satellite services that support military personnel deployed across the African continent.

At a new orbital slot over Africa at **17 degrees East**, the AMOS-5 satellite will provide flexible, dependable pan-African connectivity solutions for government. After all, government needs a far-reaching satellite constellation to secure end-to-end communications in even the most remote locations all around the world.

About the author
Ori Onn leads Spacecom Marketing, Sales to Europe and North America, and Broadcast systems offerings worldwide. Throughout his 25-year career, Mr. Onn has held senior positions within the communications and satellite sectors. Prior to joining Spacecom in 2004, Mr. Onn was Managing Director at Comverse Technologies where he established and managed its European subsidiaries. He holds an honorary M.Sc. in Mathematics & Computer Science.

Scheduled to start service in Q3 2011 at 17 degrees East — a new orbital slot over Africa — the *AMOS-5* satellite will position Spacecom at the forefront of Africa's emerging satellite services market. Once in orbit, the *AMOS-5* satellite will feature a fixed high-power pan-African C-band beam and three regional Ku-band beams — all covering Africa with connectivity to Europe and the Middle East and supporting multiple transponders in both C-and Ku-band.

Additionally, Spacecom's *AMOS-2*, *AMOS-3* and *AMOS-5* satellites offer defense agencies coverage over the Middle East, Central and Eastern Europe, and Africa.

The AMOS satellite constellation provides flexible and dependable connectivity solutions for government and international organizations with a regional or global presence that facilitates access and connectivity between hundreds of crucial locations.

SCOTT SCHEIMREIF
VICE PRESIDENT, GOVERNMENT DIVISION, IRIDIUM

Scott Scheimreif brings more than 10 years of experience to the satellite communications industry as well as more than 17 years in the telecom industry working closely with the U.S. Government and particularly the Department of Defense. As vice president for Iridium Satellite's Government Division, he is responsible for business development and growth of the company's U.S. Department of Defense (DoD) business sector. Scheimreif manages Iridium's relationship with DISA's EMSS (Enhanced Mobile Satellite Services) program, which provides Iridium based services to more than 30,000 war fighters and other U.S. Government users.

During his tenure at Iridium, the EMSS program has increased the number of users subscribing this mission critical service by more than 173 percent. Scheimreif has also been one of the key drivers expanding Iridium's core capabilities into the U.S. Department of Defense by offering a multicast, push-to-talk voice and data service. This service, known as *Netted Iridium*, is envisioned by many to help satisfy the growing demand for tactical, communications-on-the-move (COTM) requirements for a variety of vertical markets, specifically the military.

EDITOR'S NOTE

An article on the *Distributed Tactical Communications System* (DTCS) — also known as "Netted Iridium" — in the September, 2009, edition of *MilsatMagazine*. At that time, the DTCS products were just completing field tests in Afghanistan. We asked *Scott Scheimreif*, vice president of government programs for Iridium Communications Inc., to bring us up to date on this interesting and innovative technology.

MILSATMAGAZINE (MSM)

First, Scott, can you tell us about yourself and your career?

SCOTT SCHEIMREIF

In my role at Iridium, I am responsible for business development and growth of the company's U.S. Department of Defense (DoD) business sector. I manage Iridium's relationship with the Defense Information Systems Agency's (DISA) Enhanced Mobile Satellite Services (EMSS) program which provides Iridium based services to over 44,000 war fighters and other U.S. Government users.

I've worked closely with the U.S. Government, and particularly the DoD, in the telecom industry for more than 17 years. I hold a bachelor's degree in science from Salisbury University and I'm an active member of the *Armed Forces Communications Electronics Association* (AFCEA) and *The Satellite Industry Association*.

MSM

Can you give us a concise description of the DTCS program and its benefits to warfighters?

SCOTT SCHEIMREIF

DTCS uses Iridium's constellation of 66 low-Earth-orbiting (LEO) satellites to provide push-to-talk (PTT) communication nets for dismounted warfighters on the move. The cross-linked Iridium satellites provide near real-time over-the-horizon (OTH) voice and data links in places such as the mountains of Afghanistan where geostationary satellites or line-of-sight (LOS) communication systems cannot be used reliably.

MSM

When and how did the DTCS program originate? Why was it developed?

SCOTT SCHEIMREIF

The system had its origins in 2006 under a *Cooperative Research and Development Agreement* (CRADA), to meet requirements for better and more reliable squad and platoon level communications for troops operating in Afghanistan's mountainous environment. Troops operating in deep valleys, for instance, were often unable to communicate over geo-satellites or use standard LOS radios due to terrain blockage. It was believed that Iridium's LEO satellites could provide a solution. The *Naval Surface Warfare Center* (NSWC) in Dahlgren,

Virginia, which functions as the research and development lab for the war fighting community led the effort. NSWC's Harsh Environment Lab produced the first prototype handsets, which were basically commercial-off-the-shelf Iridium handheld satellite transceivers modified to permit one-to-many PTT communications to multiple users over the narrowband Iridium channels. NSWC conducted demonstration trials and field tests in 2008. At the end of 2009, there were roughly 100 DTCS radios being used in Afghanistan.

MSM

Please describe the DTCS handset.

SCOTT SCHEIMREIF

The radio weighs about one pound. It has a simplified operator interface with one knob for volume, one knob to select channels and a PTT button. It operates much like a trunked radio, in which a pool of users share a range of frequencies that which can be organized into separate nets for command and control, medevac, fire support or other operational requirements. Users in each net are assigned a channel number, and the radio scans for traffic on nets to which the user has access. The caller only needs to select a channel and press the talk button.

The satellite network automatically assigns a channel and alerts all other users on the net. Once the linkup is made, they work just like any other PTT radio net.

The handsets also contain an embedded GPS providing a position tag for all users on the net when communicating, so the one-pound radios can provide force tracking at the hand held levels as well as these tracks integrate into other C2 programs of record like FBCB2 and GCCS. They use standard CR123 lithium batteries, which are readily available in the field to minimize combat load and impact on logistics.

MSM

What is the current status of the DTCS program?

SCOTT SCHEIMREIF

In 2009, the *U.S. Central Command* (CENTCOM) sent a request to the *Office of the Secretary of Defense* (OSD) for rapid deployment of DTCS radios in the region through the *Joint Urgent Operational Need* process. OSD approved the request and transferred program management responsibilities from NWSC to DISA's EMSS office.

Under the management of the EMSS program office, contracts were awarded for initial production of the DTCS satellite radios, and CENTCOM received the first deliveries in April — just five months after the request was received at OSD. By year end, more than 5,300 Netted Iridium satellite radios had been deployed in Afghanistan.

MSM

What's next for the program?

SCOTT SCHEIMREIF

DTCS Phase 2 will start rolling out in the next few months. Phase 2 will provide expanded net footprints out to 250 miles and will increase the number of available nets to 16,000. We are also working on additional architecture enhancements that will improve scalability and decrease latency, and we are working closely with our industry partners to develop a new command and control handset, which will provide situational awareness at the handheld level, allow for netted text, chat and continue to integrate into other C2 programs of record.

MSM

What else is on the horizon for the Netted Iridium program?

SCOTT SCHEIMREIF

With a successful program in place, the future holds many opportunities for the Netted Iridium program. For example, we have been discussing creating new segments with commercial netted services. Definitely stay tuned for more to come.

Civilian contractor Douglas Kummings, who was deployed to train and support *Distributed Tactical Communications System* users in Afghanistan, demonstrated the DTCS "radio only" handset and accessories. Kummings, a DTCS program field service representative, was also a Gunnery Sergeant in the U.S. Marine Corps Reserve and was one of several NSWC Dahlgren Division civilian engineers — government employees and contractors — who worked with warfighters in Afghanistan to evaluate and field the *Netted Iridium* radios since September 2008.

Editor's Note:
The following article was originally posted in
WAR ON TERROR NEWS @
http://waronterrornews.typepad.com/

AFG Task Force Thunder's Netted Iridium Radio Program

359th Signal Brigade Story

by Capt. *Michelle Lunato*

There is a fine line between mission success and failure, where success can depend on the reliability of a single one-pound radio.

Back in the Civil War, citizen-soldiers communicated with their commanders on the battlefield with signal flags during the day and lanterns by nights. As messaging moved from flags to satellites over the last century, so have the demands of the service members fighting for peace. The war fighters' needs for communication have become almost instantaneous, and without it, the results can be devastating, said Army Staff Sgt. *Tommy L. Andrews*, Microwave Line of Site non-commissioned officer, *Joint Network Communication Center-A, 359th Theater Tactical Signal Brigade*. "You can have the greatest Army in the world, but without good communications, you will fail."

With new things developing every day, "it is hard to keep up with technology," said Andrews. In its efforts to deploy new technology, the Army has been fielding *Netted Iridium Radios* to the warfighters in Iraq and Afghanistan under the *Distributed Tactical Communications Systems* program.

The radios are a combination of "walkie talkies," cell phones, and tactical phones, said *Andrews*. The encrypted channels are similar to the security features of the heavy tactical phones, but keep a continuous "call" like cell phones.

However, the radios function like a "walkie talkie," where each user within a secure talk group can hear all the other members of that group. Only one user can talk at a time by pushing a button. "It is like the new CB [Citizen Band radio] of the Army," said *Andrews*.

These radios have layers of security and are lightweight, said *Aaron Chudosky*, a representative of Solutions Development Corporation, who works with *JNCC-A, C4* section on distributing and training Soldiers on the radios in Afghanistan. "Being a former Marine, I like that this is secure and I can take it with me everywhere."

The one-pound, 6-inch antenna radios, use the 66 Iridium, low-orbiting satellite system to create a nearly seamless transfer of coverage, said *Chudosky*. "The satellites are always moving, so if you can't reach one satellite, it is only a matter of a few minutes before you can get another one."

The time to reach a satellite footprint is significantly less than when geosynchronous satellites were used, said *Chudosky*. "The advantage of the DTCS system is that unlike geosynchronous satellites, the Iridium satellites come to you."

When time is of essence, this fact can be critical in the combat environment of Afghanistan, said *Chudosky*. "In a firefight, you don't have time to figure out where the satellites are. With the Iridium System, they come to you."

This ability to get a signal faster is just one of the benefits though, said *Chudosky*. The radios are compatible with other military equipment and can be mounted in tactical vehicles, taken on patrols, set up in a Tactical Operations Center, and be used as a data modem for location tracking. "It's tactical, it's mobile, it's lightweight, it's secure, and it's multipurpose."

Aaron Chudosky, a representative of Solutions Development Corporation, and Staff Sgt. Tommy Andrews, Microwave Line of Site non-commissioned officer, who both work for the Joint Network Communications Center — Afghanistan, train a Cavalry Soldier in Kandahar on how to set up secure channels on the Netted Iridium Radio. Photo by Capt. Michelle Lunato

When this article was written, radio teams were under the direction of CW2 *David Mauriello*, JNCC-A Chief, HHC, 359th TTSB, with distribution of hundreds of these tactical radios to a variety of units throughout Afghanistan. As of June 15, 2010, more than 800 radios had been issued in Afghanistan as part of *Phase 2* of the DTCS program, said Army Lt. Col. *John H. Phillips*, JNCC-A director, HHC, 359th TTSB. From Army security forces to Marine units to coalition forces, there has been a lot of positive feedback, said *Andrews*.

"With these radios, I can actually have a conversation, not just bits of one," said an Army platoon sergeant with a security forces unit that is in the radio-fielding program. "Having voice communications with my TOC is invaluable," said the platoon sergeant.

The capabilities of the fielded radios should take away some of the Taliban's advantages in the mountainous area of Afghanistan, say a number of military leaders involved in the DTCS program.

Taking away any enemy advantages can only help a unit that is outside the wire, and that is the purpose of the program, said *Chudosky*. "We are supplying a means of reliable communications to the war fighters in the harshest of terrains, and that can only help save lives."

WHY ALL THE INTEREST IN DVB-RCS FOR SATCOM NETWORKS?

AUTHOR: RICHARD R. FORBERG, VICE PRESIDENT, MARKETING & STRATEGY, STM GROUP INC.

Most people have probably never heard of DVB-RCS or assume it is just another military acronym. DVB-RCS is actually a commercial standard of increasing importance to military SATCOM network operators. It stands for Digital Video Broadcast with Return Channel via Satellite.

U.S. Army's ME, photo courtesy of Harris

Particular interest in **DVB-RCS** this year comes with the imminent final approval the Second Generation (2G) of the DVB-RCS standard. This is a major advance in performance and capabilities that has been in development and testing for several years under the informal name, "Next Generation DVB-RCS". It offers the latest satellite waveform technologies for modulation and coding, plus many other useful features.

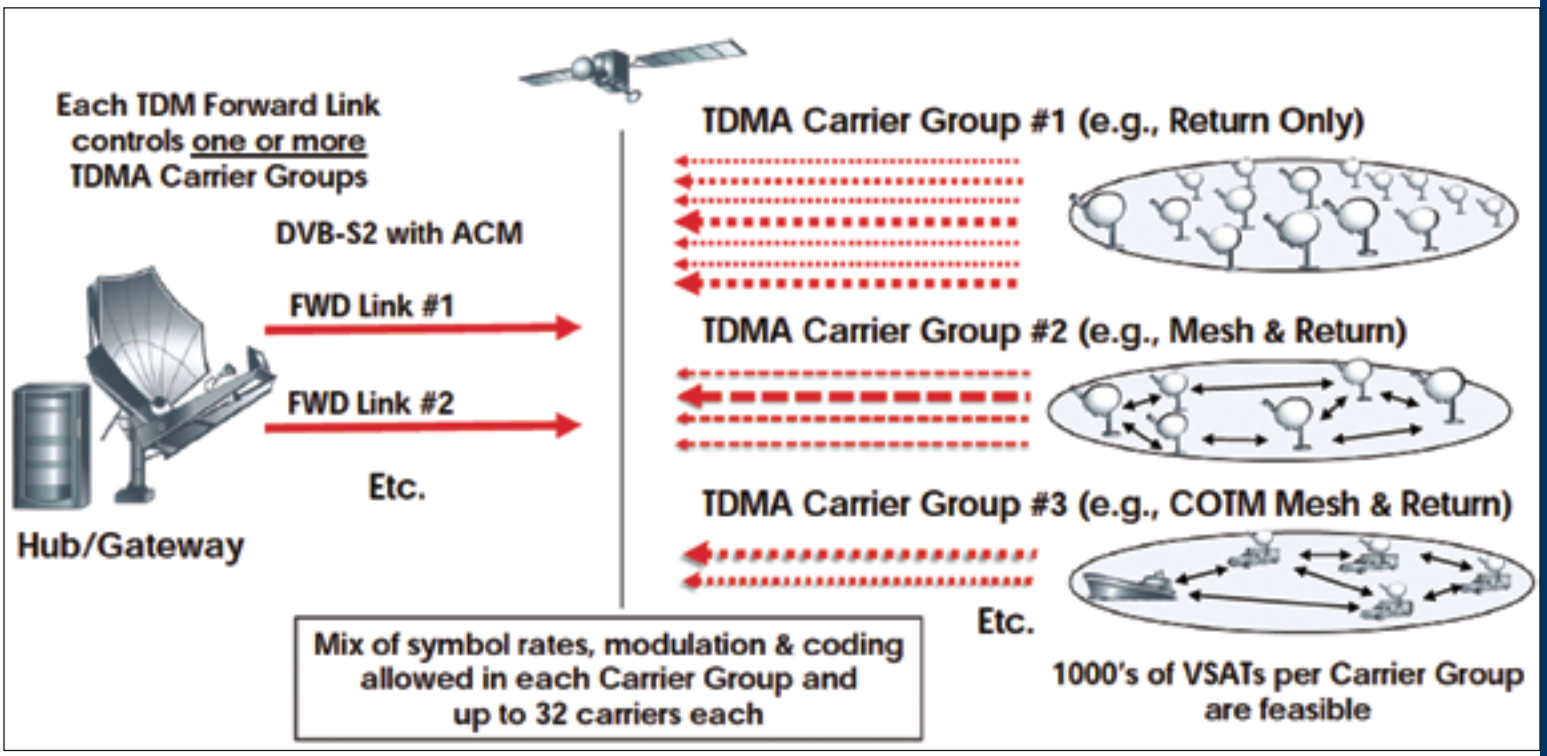
WHAT'S IT ALL ABOUT?

Despite its unusual name, DVB-RCS is actually all about implementing fast, efficient, and reliable Internet Protocol (IP) networks using Very Small Aperture Terminals (VSATs) — or larger ones, if necessary. It also provides excellent support for VSAT mobility. High-throughput *Communications-On-The-Move* (**COTM**) is delivered with roaming across beams and countermeasures against interference for ships, off-road vehicles, and aircraft. DVB-RCS works with any type of electronic array or stabilized antenna system, in any satellite band or beam configuration.

DVB-RCS specifies use of the popular **DVB-S2** standard for the *Time Division Multiplexed* (**TDM**) carriers in continuous mode, which can be broadcasted to hundreds or thousands of remote VSATs from a central hub, gateway, or master station. It also specifies the advanced TDMA control logic, precise burst synchronization (down to 37 nanoseconds), modulation and coding, plus fast frequency-hopping used on TDMA carriers. Time slots may be allocated to a given VSAT statically and/or dynamically (*i.e.*, as bandwidth-on-demand) in any mixture determined by policies set by network operators for different applications or traffic types.

Missions requiring any combination of VoIP, video conferencing, video feeds and/or video multicasting, plus any type of data application, can be served with a single VSAT. Each capacity request from the VSAT for bandwidth-on-demand may distinguish the QoS treatment required for the service.

DVB-RCS is ideal for remote field or combat operations that need huge transmit bandwidths rapidly but unpredictably. A TDMA "carrier group" can have dozens of carriers creating a massive



DVB-RCS Network Example

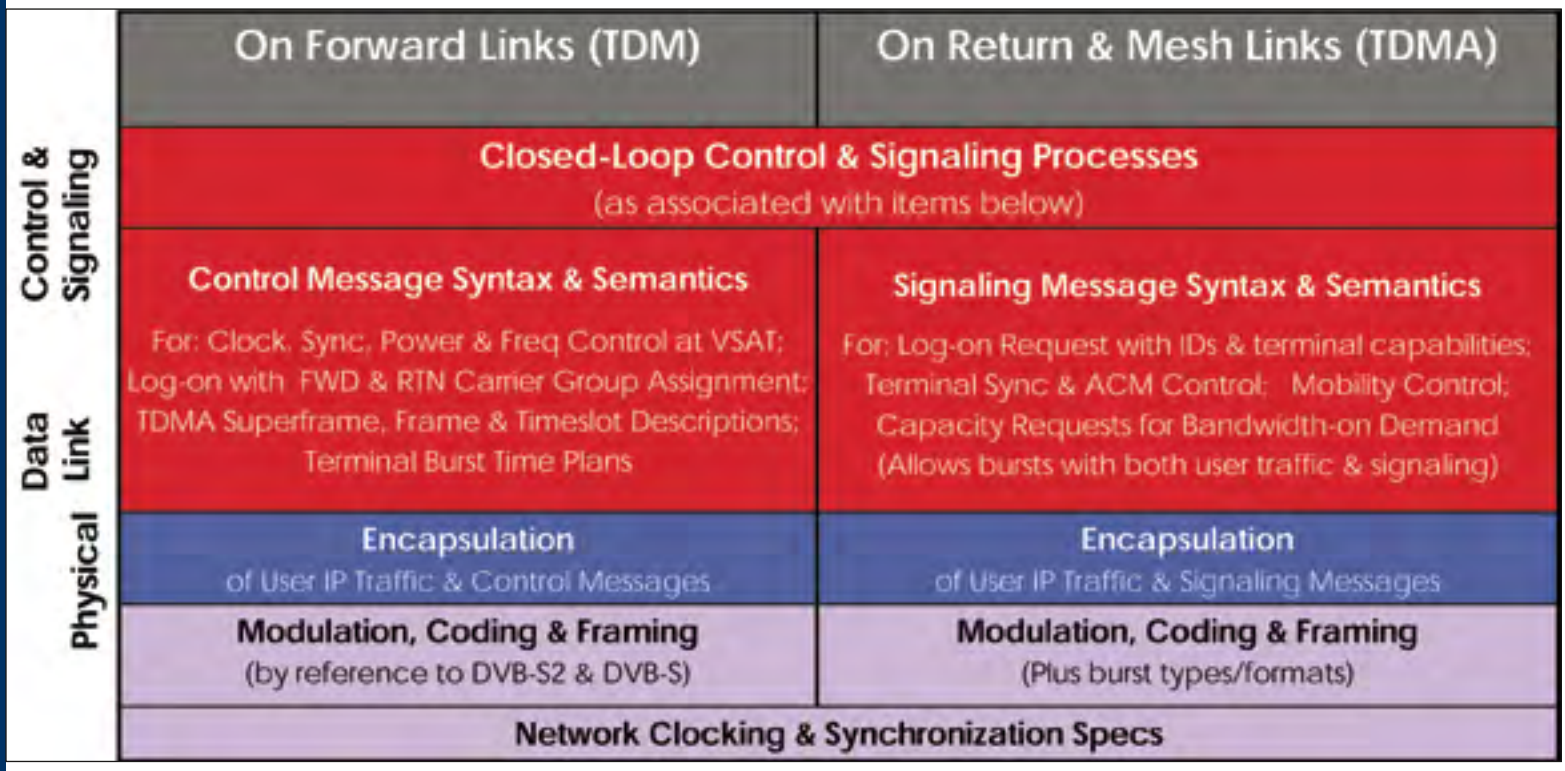
pool of shared bandwidth for return and mesh link communications. Up to 80 MHz (or ~70 Msps) of shared TDMA capacity is feasible in commercial implementations that use wide-band, multi-carrier burst demodulators. This is in contrast to most proprietary TDMA systems which are limited to < 8 MHz of shared bandwidth for TDMA access.

In the latest commercial *Return Link System* (**RLS**) burst demodulators, all 80 MHz can be digitized and processed for up to 32 concurrent bursts in a 1U rack-mounted unit for reception at the hub or a number of gateway stations. This also enables high-capacity, high-performance hub/gateway systems, easily transported to the theater of operation.

Mesh networking capabilities — also available in commercial implementations today — over these same TDMA carrier groups enable single-hop communications between small remote VSATs with capacity for demodulating four (4) concurrent bursts. Mesh also supports bandwidth-on-demand with statically assigned capacity, if desired.

In recent years, *Adaptive Coding and Modulation* (**ACM**) on DVB-S2 carriers operating at information rates well over 100 Mbps in TDM mode has proven to be a key advantage in many networks using DVB-S2 today, often doubling the TDM carrier capacity and greatly improving TDM link availability. It is DVB-RCS, however, that specifies how ACM is implemented with rapid closed-loop control using the same signaling messages that handle closed-loop synchronization and capacity requests for TDMA time slots.

In DVB-RCS, the modulation, coding, and symbol rates on TDMA bursts are also handled adaptively, in real-time, using intelligent carrier selection in the TDMA controller at the hub. This completes increased link availabilities and average information rates obtainable for two way communications, and delivers better gains than today's proprietary adaptive methods, because of the larger dynamic ranges supported. This allows VSATs to perform fast frequency hopping across a wide range of TDMA carriers, operating, say, from 500 ksps up to 8 Msps in a highly reliable manner.



Layers Covered by the DVB-RCS Standard

Other features in the leading commercial DVB-RCS implementations at higher layers include: built-in TCP and HTTP acceleration, *Network Address Translation* (**NAT**), and header compression of IP stack protocols. These are not yet covered under the DVB-RCS standard, but they are essential for high-performance, flexible networking. Many aspects of such features are now gradually being standardized by efforts in the DVB *Higher Layers for Satellite* (**HLS**) working group, in close coordination with the RCS working group.

Transmit capacities over 12 Mbps of IP content from a low-cost VSAT are feasible in today's low-cost commercial implementations of DVB-RCS; and the receive capacities for total IP content over DVB-S2 to a single VSAT can easily exceed 50 Mbps. Of course, throughput always depends on signal-to-noise ratios (SNR), which depend on antennas, amplifiers, and many other factors including satellite characteristics and atmospheric fading, especially in higher frequency bands.

This is where the Second Generation of DVB-RCS becomes especially important.

2G DVB-RCS

This major advance in DVB-RCS specification offers 8PSK and 16QAM modulation options, as well as the usual QPSK. It also uses a new, powerful 16-state Turbocode FEC algorithm in TDMA bursts, giving about 2 dB more gain. Selected alternative modem specifications (*e.g.*, for non-linear modulation, or for spread spectrum operation) are also allowed but yield lower efficiency. VSAT log-on signaling now handles an even wider-range of diverse terminal capabilities via auto-discovery, promoting simplicity of operation in networks with diverse terminal types.

Particularly important is that ACM is now also implemented on the TDMA carriers for each time-slot (*i.e.*, "per burst"). This is done in combination with the dynamic adaptive carrier selection already in use today.

TDMA carriers, therefore, have no defined modulation and coding until a time slot is assigned on them to a given VSAT. Even the symbol rates and the number of carriers in the TDMA carrier group may be dynamically adjusted, given the flexible superframe and frame formats in the new standard. All this gives an additional dramatic improvement in average network capacity and link availability over TDMA carriers in high-frequency networks (*e.g.*, Ka-band), without increasing antenna sizes.

With these advances, the transmit capacities from a low-cost VSAT will reach 24 Mbps of IP content in the near term, with more in the years to come.

Complementing the use of exclusive, scheduled time slot access on TDMA carriers for high-throughput, stream-oriented user traffic, the new specifications also allow random access for very short user messages, as may be used for remote monitoring & control applications and transaction-oriented services.

Another benefit comes from new methods for encapsulating IP packets into TDMA bursts and on DVB-S2 carriers, which reduce layer 2 overheads to the bare minimum and eliminate MPEG overheads, while retaining flexibility for diverse Layer 3 protocols, such **IPv6** and **IPv4** running concurrently over the same carriers.

JOINT IP MODEM (JIPM) AND DVB-RCS INTEROPERABILITY

The ***JIPM*** program, which started several years ago under **DISA**, specifies the use of the DVB-RCS standard in combination with various other standards and features, such as **TRANSEC** to meet DoD IP transmission policies. This has given added importance and reason for the adoption of DVB-RCS in military SATCOM networks.

Example RLS at Hub
(One Rack Unit with Multi-Carrier Burst Demodulator

A key goal of the JIPM program is to improve interoperability among the diverse SATCOM systems in the defense community. DVB-RCS is the ideal platform to meet that goal. There are already several suppliers of Commercial-Off-The-Shelf DVB-RCS systems today. Furthermore, interoperability among different implementations of DVB-RCS, from different commercial suppliers, has been demonstrated for many years.

An independent body, **SatLabs** (www.satlabs.org), was created specifically to promote interoperability for DVB-RCS, and tests terminal products for conformance to the standard, issuing certifications for conformance to one or more "profiles" in the standard. Hub/gateway systems can support many profiles within the standard concurrently to further the goal of interoperability with diverse terminals in single network.

But, of course, interoperability among commercial implementations does not extend necessarily to some of the enhanced features and options outside the specifications of the DVB-RCS standard, making complete interoperability still a challenge at this time.

A further consideration is that JIPM, specified over the last few years, does not yet reference the Second Generation DVB-RCS standard. However, this is not a problem, as most COTS implementations will continue to offer the current generation of the standard for years to come and will likely apply all major improvements of the new standard as options for defense related deployments. Furthermore, both generations of the standard can coexist in the same network and interoperate with the same hub/gateway systems. Therefore, as the JIPM program progresses, commercial suppliers will have available COTS solutions that offer good interoperability with the modem features, IP encapsulation and TDM/TDMA control systems of the JIPM program. This bodes well for increased competitiveness and cost-containment in military SATCOM procurements, as well as increased interoperability among the major SATCOM systems in the defense community.

THE YEAR OF TRANSITION

The year 2011 will be remembered the start of a major transition in both commercial and military SATCOM networks. DVB-RCS has the power to embrace and harmonize the use of diverse modem types, features, and modes of network operation within a single network. The robust "future-proof" architecture of DVB-RCS is rapidly gaining appreciation from many market sectors, while it also delivers ever increasing performance and efficiency for networks and applications of all types.

About the author

Mr. Forberg is VP of Marketing and Strategy at STM Group, Inc. in Irvine, California (www.stmi.com). STM Group is the leading supplier of commercial DVB-RCS network systems and teleport services, as well as a major contributor to DVB-RCS standards over the last 12 years and a key contributor to the forthcoming Second Generation DVB-RCS standard, in close cooperation with other equipment suppliers and research institutions.

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- Brigadier General "Jay" Raymond, Vice Commander, 5th Air Force, and Deputy Commander, 13th Air Force, Yokota Air Base, Japan, United States Air Force
- Group Captain Praphon Vibisukh, Director of Space Affairs, Department of Defence Technology and Space, Ministry of Defence Thailand
- Commander Andy Rayner, S01 Core Networks, Cap CC&II, Ministry of Defence, UK
- Atsuo Suzuki, Director Defence Policy Planning, Head of Space Policy, Ministry of Defence, Japan
- Lieutenant Colonel James Dryburgh, JS01 CIS (J6), New Zealand Defence Force
- Captain Michael Rothwell, Director Satellite Communications Capability, HMAS HARMAN DNOC-1C-12 CIOG, Department of Defence, Australia
- Senior Representative, Pakistan Space Agency
- Professor Chau Van Minh, President, Vietnam Academy of Science and Technology
- Dr Mohammed N Mubarek Alahbabi, Information Communication Technology (ICT) Advisor, United Arab Emirates Armed Forces
- Bhaskar Burman, Additional Director, O/O/Scientific Advisor to Chief of Naval Staff, Defence Research and Development Organisation, India
- Jonathan Hung, President, Singapore Space and Technology Association (SSTA)

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AARON BROSNAN
DIRECTOR, BUSINESS DEVELOPMENT, ARMY PROGRAMS
THALES COMMUNICATIONS

Mr. Brosnan is responsible for supporting U.S. Army requirements in the areas of tactical radio communications and other C4ISR systems capabilities within air, mounted and dismounted domains. He enlisted in the U.S. Navy in 1983 and was subsequently commissioned as a Naval Flight Officer from the U.S. Naval Academy in 1990 with a bachelor of science degree in ocean engineering, graduating with honors. Mr. Brosnan went on to receive a masters of engineering management from The George Washington University in 1998.He made several tours aboard USS CONSTELLATION (CV-64) and USS NIMITZ (CVN-68), deploying in support of Operation Southern Watch in the Arabian Gulf. Prior to joining Thales, Mr. Brosnan worked on the Royal Navy Type-45 Future Destroyer program in the United Kingdom.

Joining Thales in 2003 to create a new Naval communications business, Mr. Brosnan has been successful in capturing Naval and maritime communications programs and broadening the company's product portfolio to include automated, integrated shipboard High Frequency (HF) communication systems. In 2008, Mr. Brosnan assumed the role of Director, Land and Joint Systems Division US. In this role, Mr. Brosnan was responsible for overseeing Thales' US business in the areas of Command, Control, Communications, Computers, Intelligence, Surveillance, and Reconnaissance (C4ISR) products and systems. Mr. Brosnan assumed the role of Director, Business Development for Army Programs in 2010. Mr. Brosnan's awards include the Navy Commendation Medal, Navy Achievement Medal, National Defense Service Medal, and Armed Forces Expeditionary Medal. He is also a member of the Navy League of the United States, the Association for Communications, Electronics, Intelligence and Information Systems Professionals, the Association of the United States Army (AUSA), the Surface Navy Association (SNA), and the National Defense Industrial Association (NDIA).

MILSATMAGAZINE (MSM)

Mr. Brosnan, what is SATCOM IW and why is it needed?

AARON BROSNAN

The ***SATCOM Integrated Waveform***, or ***SATCOM IW***, addresses the need to allow more users space and time on channels while improving both voice and data quality. The replacement to *Demand Assigned Multiple Access*, or **DAMA**, SATCOM, it is the enhanced method of multiplexing radios on the same channel.

As U.S. Department of Defense services continue to increase usage of tactical satellite, or ***TACSAT***, terminals, there are insufficient channels to support user requests. While aging satellites continue to degrade, a gap-filler is necessary to support requests until the ***Mobile User Objective System***, or MUOS, becomes available.

MSM

How does SATCOM IW work?

AARON BROSNAN

It uses carrier phase modulation to allow for more access on the same channel. CPM was implemented in radios to provide higher data throughput on the UHF dedicated satellite channels in line-of-sight mode. One channel is assigned as the master and contains the system forward orderwire. All other channels fall under the master channel and can be either 25-kHz or 5-kHz. Each channel has its own format that is changeable upon user demand. Time slots for ranging and other communications can be arranged based on these same requirements. Updates are also obtainable from preplanned update forward orderwires transmitted on other channels.

MSM

How does SATCOM IW benefit the warfighter?

AARON BROSNAN

The benefits of SATCOM IW for the warfighter will be many. The waveform structure allows communication accesses to be tailored based upon operational need. There is greater access on each channel with flexibility of services on each channel to provide the most bandwidth to each military service. It doubles the capacity for communications services and increases data throughput capacity over legacy DAMA. Voice communications quality is improved through inclusion of Mixed Excitation Linear Prediction voice encoding, and overall usability is improved through a more intuitive human-machine interface.

This new waveform capability will be transparent to the warfighter and has a minimum impact to fielded radios. There is minimal operator intervention in that the waveform sends sufficient information to set up radio services itself. As users continually face challenges such as mountainous terrain and urban environments, the increased availability of SATCOM channels will greatly improve safety and situational awareness across the battlefield.

MSM

What is Thales Communications doing to field this new waveform?

AARON BROSNAN

Thales' ***AN/PRC-148 Joint Tactical Radio System*** Enhanced Multiband Inter/Intra Team Radio, or **JEM**, is now available with SATCOM IW. In addition to the newly fielded AN/PRC-148 JEM radios, users of the 70,000+ JEM radios currently fielded can access SATCOM IW via simple software download. On top of that, there are more than 130,000 AN/PRC-148 MBITR radios currently fielded that can be upgraded to the AN/PRC-148 JEM, making SATCOM IW available to more than 200,000 existing users.

The AN/PRC-148 JEM with SATCOM IW will enhance capabilities of the dismounted warfighter and recent tests have proven successful in using the radios in vehicle configurations for SATCOM On-The-Move capability as well.

The AN/PRC-148 JEM can facilitate a rapid and efficient distribution of the SATCOM capability across the battlefield. Adding SATCOM IW to the existing waveforms supported by the AN/PRC-148 JEM radio, like ***SINCGARS Frequency Hopping 1*** and ***2***, ***Project 25***, and the 56 kbps ***High Throughput Waveform***, further enhances the overall effectiveness of our warfighters.

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"We brought to market new and more efficient SSPA technologies based on a line of GaN (Gallium Nitride) products. Being first to market quickly propelled us to a leadership position."
...David Gelerman, CEO Advantech Wireless

10W Ku-Band (fanless)

Advantech Wireless Broadband's line of GaN-based products exhibit increased power efficiency, reduced power dissipation, more linear amplitude response, increased MTBF and are available to support Ku and X bands.

All Advantech Wireless' SSPAs are available with an L-Band block up converter to provide the function of SSPB (BUC). Complementing our full line of SSPB's (BUC), Advantech Wireless has developed a line of Compact and Lightweight BUCs. Compact in size and light in weight, this line shares all the performance features in terms of linearity and phase noise performance of our standard product line.

100W C-Band

100W X-Band

100W Ku-Band (GaN)

Available Models

C-Band	**Model 110-C**				**Model 2100-C**						
	8W	16W	25W	30W	40W	50W	60W	80W	100W	125W	
X-Band	**Model 110-X**				**Model 2100-X**						
	8W	16W	25W	30W	40W	50W	60W	80W	100W	125W	
Ku-Band	**Model 110-K**				**Model 2100-K**						
	8W	10w	16W	20W	25W	30W	40W	50W	60W	-	
Size	8.0 x 6.22" x 3.5"				10" x 8"x 4.8"			13" x 8" x 4.8" DC - 13"x8"x5.2" AC			
	203 x 158 x 89 mm				254 x 203 x 114 mm			330 x 203 x 114mm - 330x203x132mm			
Weight	5.3 lbs (2.5 kg)				14.4 lbs (6.5 kg)			18 lbs (8.2 kg)			
Ku-Band (GaN)	-	-	-	-	-	-	40W	50W	80W	100W	
Size							8.1"x5.25"x5"		12.5"x7.9"x5.4"		
							206x133x127 mm		317x200x137 mm		
Weight							8.6 lbs (3.9 kg)		21.1 lbs (9.6 kg)		

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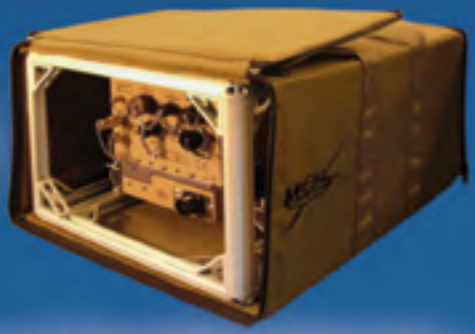

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