SATCOM For Net-Centric Warfare January 2013

MilsatMagazine

"Perfect Storm" Creates The Need For More Small Satellites

Image: Flooding in Sao Joao Da Barra, Rio de Janeiro, Brazil, as captured by Surrey's UKDMC-2 satellite, an imagery asset for first responders, NGOs and military aid.

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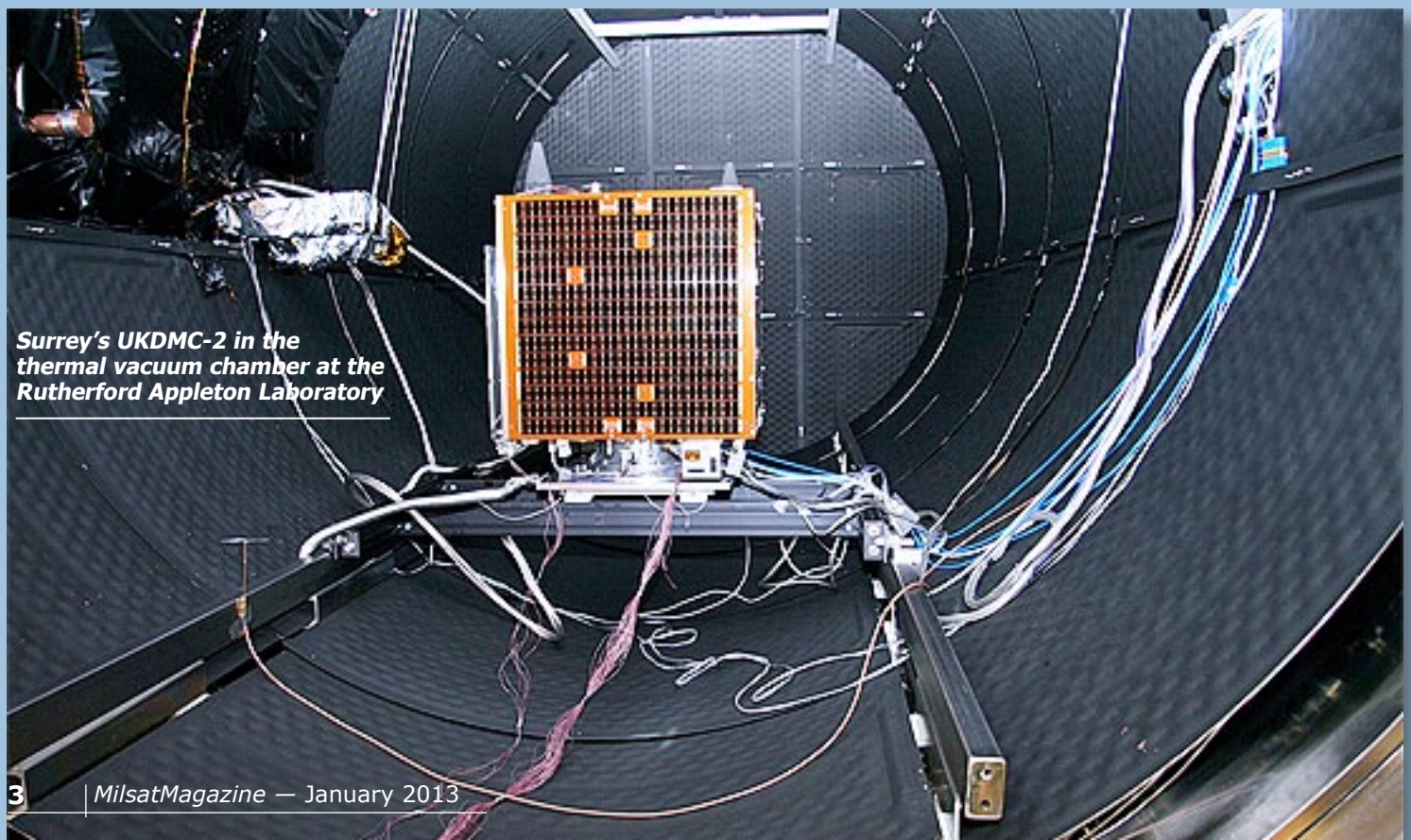

Surrey's UKDMC-2 in the thermal vacuum chamber at the Rutherford Appleton Laboratory

DISPATCHES

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SES MOURNS THE LOSS OF A TRUE BRIGHT LIGHT

Some gifted people live and achieve phenomenal accomplishments in their short life…this is one such inspirational individual.

With profound sadness, SES S.A. (Euronext Paris and Luxembourg Stock Exchange: SESG) announces the passing of Robert (Rob) Bednarek, former CEO of SES WORLD SKIES and member of the SES Executive Committee, after a long and courageous battle with cancer at the age of 55.

As SES' Executive Vice President Corporate Development and member of the SES Executive Committee since January 2002, Rob was instrumental in the execution of the company's geographic expansion strategy.

During his tenure, Rob and his team led the acquisition of New Skies in 2006, as well as the integration process which followed. Rob became President and CEO of SES NEW SKIES in 2006, and later of SES WORLD SKIES.

In 2011 he took on an Executive Adviser role to the President and CEO of SES while fighting his illness. Rob joined SES from PanAmSat, where he held the position of Chief Technology Officer. In this position he was responsible for the overall operation of PanAmSat's satellite fleet and associated terrestrial facilities.

"Rob will be remembered as a dedicated and innovative professional who helped shape the world of modern satellite communications through his visions and inspirations," stated Romain Bausch, President and CEO of SES. "His accomplishments at SES significantly contributed to establishing the company in its current leadership position and his life will remain a source of inspiration for generations of satellite executives. But perhaps most of all, Rob will be remembered for the dignity and respect with which he treated all who were fortunate enough to know him. Rob will be sadly missed by all of us at SES and by many in the satellite industry. Our thoughts and deep sympathies are with his wife Elisabeth, his children Michael and Stephanie, and all other members of Rob's family."

In 2011, Rob's outstanding contributions to the development of the satellite industry were honoured publicly when he was inducted into the SSPI's Hall of Fame (Society of Satellite Professionals International). This highly prestigious industry award recognizes individuals who have devoted their careers to the advancement of technology and to helping build the political and commercial foundations of the satellite industry.

Prior to joining PanAmSat, Rob was the co-founder and partner of a Washington DC based technology-consulting firm, Rubin, Bednarek and Associates, specializing in communication systems engineering and technical regulatory matters pending before the Federal Communications Commission.

From 1979 to 1984 he served as deputy chief scientist for the U.S. Corporation for Public Broadcasting (CPB) where he managed the research, development and application of new telecommunications and information technologies.

Robert Bednarek held a B.S. in Electrical Engineering, with a specialty in communications theory and mathematical analysis, from the University of Florida. He was also the holder of several U.S. Patents involving GPS (Global Positioning Systems). #

IS THERE A NEED FOR HTS??

The GVF's first industry roundtable event, the GVF Ka Roundtable Assembly 2012, focused on Ka-band and High Throughput Satellites (HTS).

It wrapped up last week in London and the consensus was that the satellite industry is going through a series of innovations that will lead to satellite becoming a mainstream connectivity offering.

The group of nearly 100 people listened to several roundtable sessions regarding the emergence of HTS and, specifically, Ka-band. Discussions focused on:

- *Is there user demand?*
- *Do we have the technology innovations to meet the demand?*
- *Are we able meet the user needs of higher bandwidth, lower cost and ease of use to truly enable mass adoption?*
- *Are the ground segment innovations matching the space segment innovations with new HTS on the way?*
- *Is Ka-band really a viable option given the issues with spectrum and rain fade?*

Throughout the three days of presentations and discussion, the common response to the questions was a resounding—"Yes!"

Bottom line: User demand is up across the board, HTS brings the promise of abundant bandwidth and potentially lower costs—and enabling smaller terminals with ground segment innovations will match the space segment to help overcome rain fade, enable higher data rates and allow service providers to take advantage of the opportunity to deliver enhanced service level agreements to customers across the globe. (Source: ***iDirect Satellite Connection*** site) #

DISHES TO SWEDES

"...we are able to reliably meet FMV's requirement for secure personnel communication between Sweden and Afghanistan and are keen to expand on our supply throughout the duration..."

Astrium Services – Government Communications (formerly the Vizada Networks Defence Division), the Swedish Defence Material Administration (FMV) and other contractors have signed a new framework agreement for the supply of satellite capacity to the Swedish Armed Forces (SwAF) on C- and Ku-band between Europe and Afghanistan, until 2016.

FMV is a Swedish civil authority whose main task is to procure goods and services for the SwAF and in some circumstances other public and private clients.

The first contract under the framework agreement was awarded by FMV to Astrium Services – Government Communications under tender and is for the supply of satellite capacity for Europe and Afghanistan to the SwAF throughout 2013.

Delivery started for the capacity, which will be used by SwAF personnel when required, on October 22nd 2012. Using 33 MHz Satellite capacity for secure communication between Sweden and the Operation Theatre in Afghanistan will be delivered on the Ku-band.

The SwAF mission camps are equipped with VSAT stations as the main communication between the camps and the SwAF organization in Sweden.

"The framework agreement and subsequent contract for satellite capacity follows our development and installation of a custom designed VSAT Camp Antenna System (VCAS) in Sweden," adds Thomas Åström, Business Development Director, Astrium Services – Government Communications. "With strong connections in the space segment, we are able to reliably meet FMV's requirement for secure personnel communication between Sweden and Afghanistan and are keen to expand on our supply throughout the duration of the framework agreement."

The SwAF has since 1948 participated in peacekeeping missions in several countries under the umbrella of the UN and, during the last decade, the EU.

Currently, SwAF personnel are participating in KFOR, Kosovo, and ISAF, Afghanistan, which are operations that Astrium Services is also involved in through the supply of satellite capacity, services and systems to various stakeholders, including FMV. #

SAFE PASSAGE IN SPACE

Members of the 1st and 7th Space Operations Squadrons at Schriever Air Force Base took notice when an upper stage Russian rocket disintegrated in *low Earth orbit* (LEO) on October 16, 2012.

The break-up introduced an estimated 500 pieces of debris into an area where the U.S. operates a multitude of satellites, further congesting an already crowded orbit around Earth.

This event sheds light on an ever-growing issue for the space and satellite industry—one that seemed far fetched only a few years ago.

"The idea that big space would someday become crowded was more theory than fact," said Lt. Col. Mike Manor, 1 SOPS commander. "Now, the reality is that space is growing seemingly smaller as more objects are now orbiting Earth. Few people realize there are men and women dedicated to assuring safe passage for our assets in space."

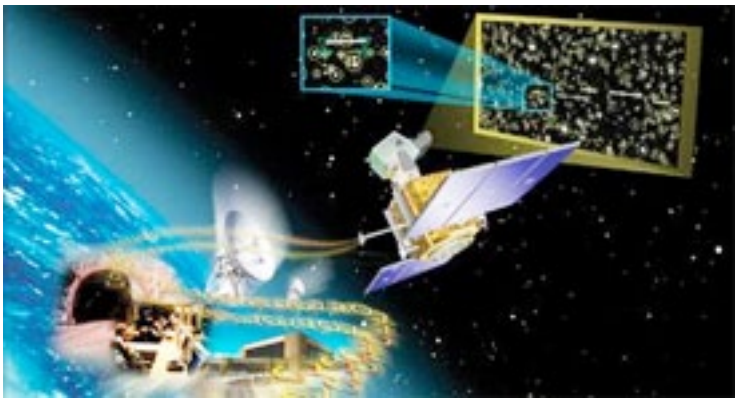
The Space Based Space Surveillance satellite and its sister, the Advanced Technology Risk Reduction satellite, were designed to provide space situational awareness of the geostationary belt, but increasingly are being tasked to support space situational awareness in other orbits as well.

A collision with something as small as a bolt, a rivet, even bits of shrapnel, traveling at a high rate of speed can render a satellite inoperable, if not totally destroy it, thus it's becoming ever more important to accurately track such debris.

Along with radar and optical sensors on the ground, SBSS and ATRR are providing that tracking data to the Joint Space Operations Center, the organization that keeps a real-time catalog of orbiting objects.

Maj. Patrick Slaughter, 1 SOPS assistant director of operations, says demand for this tracking data will do nothing but grow in the years ahead as space gets more congested and contested.

"For the longest time, we as a nation, held on to the idea that space is a big place, but most people don't understand what's happening up there," he said. "Break ups like this add to the congestion, but we also have events like the Chinese Fengyun incident, that brought attention to the idea of contested space."



An artist's depiction of the Space Based Space Surveillance satellite. The Joint Space Operations Center uses data collected from SBSS to track orbiting objects in geostationary and low Earth orbit, providing space situational awareness to U.S. military and commercial space users. Members of the 1st and 7th Space Operations Squadrons command and control the satellite.

In 2007, the Chinese government demonstrated the effectiveness of an anti-satellite system by destroying one of its own weather satellites, the Fengyun-1C weather satellite, via a ground-launched missile. Besides creating a large debris field, the event showed that China possesses the capability to "kill" a satellite in LEO. Manor pointed out that it's not a big leap to assume they could do this to a U.S. satellite.

"The number of debris avoidance maneuvers required by the International Space Station has significantly increased since that incident," Slaughter said. "Then we had the Iridium-Cosmos collision in 2009, where a U.S. and Russian satellite collided over Siberia. We have to maneuver our LEO satellites around that debris field as well."

Manor said these combined events, among others, have not only helped drive international policy negotiations, but signaled that the world has recognized a need for better awareness of what's happening in space.

"We can use the evolution of air travel as a model," he said. "When the Wright brothers first took flight the skies were open. Gradually, more aircraft shared the skies and eventually we reached a point where we needed air traffic controllers and regulation to keep air travel safe. Now, we've taken the rudimentary steps for space traffic control."

When the JSPOC detects a satellite is on course to collide with something, they provide a warning to that system's operators. No doubt similar conversations happen hundreds if not thousands of times a day between air traffic controllers and pilots.

Placing this all in perspective, why does it matter what operations crews at 1 and 7 SOPS do?

"Along with the ground tracking stations and the JSPOC, our team is keeping watch over space and will remain vigilant in keeping the domain as safe as possible," Manor said. "These collective efforts not only help minimize the potential for disastrous events, but also keep the space domain in a condition for continued utilization by all nations."

Story by Scott Prater of the Schriever Sentinel, Air Force Space Command

#

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A NARROWBAND WIN

VT iDirect, Inc. (iDirect) has announced that TMC (a global media company) has named the Evolution X1 satellite remote as a recipient of the 2012 INTERNET TELEPHONY Product of the Year Award.

iDirect introduced the Evolution X1 satellite remote in 2012 as a key element of its iDX 3.1 platform upgrade, enabling service providers to extend their market reach by supporting large-scale narrowband networks.

Large-scale narrowband networks represent a segment of the IP satellite communications market that is growing in size worldwide.

With the X1 and iDX 3.1, iDirect partners can grow their revenues with new service offerings for energy and utilities, distance education, pipeline monitoring, business continuity, and point-of-sale customers.

These markets require a bandwidth-efficient and energy-efficient satellite solution that is cost-effective to deploy, and is able to prioritize a mix of critical and non-critical applications over what is typically a very small return channel, as well as difficult outdoor environments.

The X1 combines a low power, compact satellite remote router with a highly efficient BUC and LNB, reducing the average power required for a given satellite terminal by as much as 50 percent.

The X1 features a DVB-S2/ACM demodulator, TDMA modulator, VLAN functionality and Group QoS. iDirect also released an outdoor version of the X1, which features an IP67 weatherproof housing to withstand extreme temperatures and multiple power options, including AC, DC, or rechargeable batteries powered by solar or an alternative power source.

The X1 is designed to extend satellite connectivity to a growing range of field applications such as substation automation, smart meter data collection and pipeline monitoring. #

AVOIDING SANDY'S WRATH

Raytheon Company's successful deployment of new backup ground station capabilities in advance of Superstorm Sandy significantly reduced the risk of losing critical weather information.

The Joint Polar Satellite System (JPSS) Common Ground System's (CGS) two backup locations made critical contingency support available during one of the United States' most devastating weather events. Under NASA's authorization, Raytheon deployed a backup ground station at the Fairbanks Command and Data Acquisition Station, located at Gilmore Creek, Alaska, along with an emergency backup control center at the Raytheon campus in Aurora, Colorado. These two locations are designed to ensure that meteorologists, emergency response teams and others will have critical weather data when needed. #

MORE THAN REMOTELY INTERESTING

iDirect Government Technologies (iGT), a wholly owned subsidiary of VT iDirect (iDirect), has released the iGT Downlink Configurator free of charge to enable users to create a basic options file locally at a deployed location for compatible remotes.

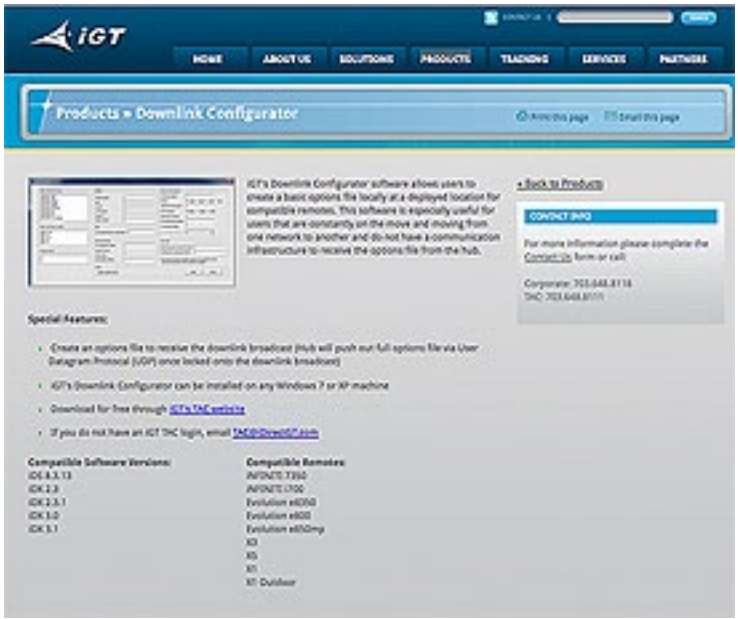
This software is especially useful for users who are moving from one network to another without having a communications infrastructure to receive an options file from the hub. Features include...

- *Ability to create an options file to receive the downlink broadcast. Hub will push out full options file via User Datagram Protocol (UDP) once locked onto the downlink broadcast*
- *iGT's Downlink Configurator can be installed on any Windows 7 or XP machine*
- *Compatible with iDS 8.3.13, iDX 2.3, iDX 2.3.1, iDX 3.0 and iDX 3.1 software versions*
- *Works with the following remotes: iNFINITI 7350, iNFINITI i700, Evolution e8350, Evolution iConnex e800, Evolution iConnex e850mp, X3, X5, X1 and X1 Outdoor*

"Our military and government users do not always have the communications infrastructure necessary to receive the options file, and now this complementary software download gives our users more functionality in the field," says Karl Fuchs, vice president of technology. "Our emphasis is to support our users' needs and deliver the solutions to meet their growing mission-critical applications."

The iGT Downlink Configurator is available at iGT's TAC website.

If you do not have an iGT TAC login, email ***TAC@iDirectGT.com***. #



THE ARMY'S EYES + EARS—ON THE MOVE

Four hours into an early morning desert operation during the Army's latest Network Integration Evaluation, Col. Thomas Dorame, 2nd Brigade, 1st Armored Division commander, was following his units in his Warfighter Information Network-Tactical Increment 2-equipped vehicle.

WIN-T Increment 2, the Army's tactical communications network backbone, enabled him to obtain the situational awareness needed to command his forces and to even conduct a staff meeting with his troops, all from the front seat of his vehicle.

"I could make decisions on the move and rapidly provide priorities and focus back to the tactical operations center based on what I was seeing on the battlefield," Dorame said of his WIN-T Increment 2 technologies. "I could continue the operation without having to deliberately stop. It extends your capability; it extends your range and allows us [as a force] to move more rapidly."

During Network Integration Evaluation, or NIE, 13.1, WIN-T Increment 2 provided Soldiers down to the company level the on-the-move communications and situational awareness needed to conduct real-world battlefield operations.

NIE 13.1, which concluded in November, was the fourth evaluation of its kind and was conducted at Fort Bliss, Texas, and White Sands Missile Range, New Mexico, utilizing 3,800 Soldiers of 2/1 AD, who executed their missions in realistic operational environments. NIE 13.2 is scheduled for May of 2013.

The NIEs aim to rapidly mature and integrate the Army's tactical communications network, and accelerate and improve the way network technologies are delivered to Soldiers.

The WIN-T Increment 2 Initial Operational Test and Evaluation was held in conjunction with NIE 12.2 last spring and the Army took advantage of NIE 13.1 to implement improvements and reduce risk prior to the WIN-T Increment 2 Follow-on Operational Test and Evaluation scheduled to be held during NIE 13.2.

Through focused follow-on tests and leveraging the NIE environment, the Army and Project Manager WIN-T plan to continue to make improvements to the tactical network and provide increased capability to the Soldier.

WIN-T Increment 1, formerly known as the "Joint Network Node - Network," began fielding in 2004 and provides Soldiers with high-speed, high-capacity voice, data and video communications down to battalion level units, at-the-quick-halt.

WIN-T Increment 2 provides Soldiers with a single, integrated and on-the-move network down to the company level. It further increases capability by introducing self-forming, self-healing networking radios and enhancing Network Operations, a suite of integrated monitoring tools used by communications officers to command and control the network.

"WIN-T Increment 2 is tremendously powerful, because you can transfer not just voice communications, but (also) data over extended distances," Dorame said.

From his point of presence, or PoP, vehicle, Dorame was able to download and review his staff estimates, the data slides used inside the tactical operations center, known as a TOC, to manage overall operations. He was then able to make a voice phone call and tie into a conference call at the brigade TOC.

His operations officer, miles away in a different part of the desert in his own WIN-T Increment 2-equipped vehicle, was also able to tie into that call. In roughly 10 minutes time, Dorame conducted the conference call with his staff and had them rapidly update him on what he needed to know about what was happening on the battlefield.

Unlike battles of the past, he said, he never had to leave his vehicle or battlefield position to go to a fixed structure to conduct these critical tasks. He could remain at the decisive point in the fight.

"The ability to do all that was tremendous," Dorame said.

The PoP vehicle that Dorame had been driving in is a WIN-T Increment 2 configuration item to be installed on select platforms at division, brigade and battalion echelons. It enables mobile mission command by providing secret level on-the-move network connectivity, both line-of-sight (terrestrial) and beyond-line-of-sight (satellite).

Among the on-the-move mission command applications leveraged by the WIN-T Increment 2 PoP during NIE 13.1 were Tactical Ground Reporting, a multimedia, patrol-level reporting system; Command Post of the Future, which provides a collaborative common operating picture; and Joint Capabilities Release, the second generation of Force XXI Battle Command Brigade and Below, which tracks friendly and enemy forces on a geospatial imagery map.

Soldiers were also able to take advantage of enterprise services accessible via the network and chat from their WIN-T Increment 2 equipped vehicles.

WIN-T Increment 2 is being fielded as part of Capability Set 13, which began fielding in October 2012 with two brigade combat teams from the 10th Mountain Division. CS 13 is the first fully-integrated package of radios, satellite systems, software applications, smartphone-like devices and other network components that provide connectivity from the stationary command post to the commander on-the-move to the dismounted Soldier.

WIN-T Increment 2 is the tactical communications network backbone that binds the capability set together.

The Army leveraged NIE 13.1 to continue with follow-on CS 14 development to add additional capability to the force.

"The [WIN-T Increment 2] network gives us tremendous capabilities, not just stationary, but on the move with our on-the-move platforms," said Maj. Ralf Radka, Dorame's executive officer. "A commander can go in and through his vehicle he can access many of the same systems that we access in our TOC. So he can review it where he is, and working with his other battalion commanders, who have similar systems that are all tied into the network, he can fight the fight."

Story by Amy Walker, staff writer for PEO C3T

#

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Harris Corporation received $7 million in orders to supply the U.S. Special Operations Command (USSOCOM) with additional Falcon multiband manpack radios and accessories.

The combat-proven Falcon III® AN/PRC-117G allows operators to communicate by Type-1 secure voice, video, and wideband data and supports a growing number of network-enabled missions, including intelligence reporting and analysis, collaborative chat, e-mail, biometric enrollments and more.

"The AN/PRC-117G's software-defined and upgradeable platform enables Special Operations Forces to use high-speed data, voice and real-time video to address its command and control and intelligence, surveillance and reconnaissance requirements," said George Helm, president, Department of Defense business, Harris RF Communications. "Widely deployed across all branches of the U.S. Department of Defense, the AN/PRC-117G meets emerging mission requirements by providing unprecedented situational awareness for dismounted and vehicular warfighters."

The Falcon III AN/PRC-117G is the world's most widely fielded next-generation radio, combining line-of-sight, beyond-line-of-sight and wideband communications capabilities in a single lightweight package. The radio provides enhanced battlefield situational awareness by connecting warfighters to the tactical Internet.

Harris has shipped more than 25,000 AN/PRC-117G radios to all branches of the U.S. military as well as more than a dozen allies including Canada, France, the United Kingdom, Germany, Italy, Australia, Poland and several other countries.

The radio is combat proven and exhaustively tested in field exercises and laboratory environments, and has been employed as a secure wideband tactical networking radio in Operation Enduring Freedom since 2009. #

SEALING THE DEAL WITH MDA

Christian Paradis, the Canadian Minister of Industry who is also responsible for the country's RADARSAT mission, has launched the next and final stage of the project.

Christian Paradis is the Minister of Industry and Minister responsible for the Canadian Space Agency (CSA).

"Our Government is ensuring we have the tools to assert our sovereignty, monitor and manage our resources, and keep watch over our vast territory and coastal areas," said Paradis. "The world-class RADARSAT Constellation Mission keeps Canada at the forefront of the design and operation of radar satellites."

The RADARSAT Constellation Mission will provide complete coverage of Canada's vast land mass, oceans and coastal approaches, at least once per day, and up to four times daily in the high Arctic.

Data produced by the Constellation will support key priorities of the Canadian Government related to: the Northern Strategy, especially in the Arctic; Defence; Safety, Sovereignty and Security; the Environment; Natural Resources; and Agriculture.

"Canada has a hard-won reputation for expertise in a highly competitive global environment. Through strategic investments in R&D and space, our Government is fostering industrial innovation, promoting commercialization, creating high-quality jobs, and positioning our industry for continued growth in the global economy," the Minister added.

In the federal budget of 2010, the federal government allocated funds to complete the design and begin construction.

MacDonald, Dettwiler and Associates Ltd. (MDA), signed a $706-million deal with the Canadian Space Agency for the Radarsat Constellation Mission to build, launch and provide initial operations for what is planned to be a constellation of three satellites.

The new program will build on technology that MDA has developed through the Radarsat-1 and Radarsat-2 missions. The space agency's website says the satellites will provide complete coverage of Canada's land and oceans with launches planned for 2016 and 2017.

The satellites would be used for maritime surveillance, disaster management and monitoring of environmental change. MDA has developed space and satellite technology for many missions, including the Canadarm on the International Space Station. The contract with MacDonald Dettwiler and Associates, announced today, will lead to the completion of construction; the launch of the three satellites, planned for 2018; and the first year of operation of the mission.

The RADARSAT Constellation Mission project is led by the CSA and supported by its principal users: the Department of National Defence, Fisheries and Oceans Canada, Agriculture and Agri-Food Canada, Environment Canada, Natural Resources Canada and Public Safety Canada.

It will support the ecosystem monitoring requirements of Natural Resources Canada, Environment Canada, Parks Canada and Agriculture and Agri-Food Canada by enabling wide area change detection, supporting water quantity monitoring, as well as wetlands mapping and coastal change monitoring. #

Advantech Wireless

Ultimate Mobility

from a world leader
in satellite communications

Advantech Wireless accredited products and advanced technologies have provided leading-edge innovations for over 20 years. We provide diverse and extensive technologies and products for video and data transmission and proven flexibility for specialized solutions.

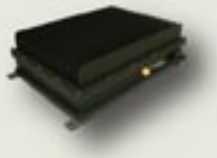
Advantech Wireless' S5920M Ruggedized VSAT Terminal is a complete DVB-RCS modem that can be used in very harsh environment as in military and desert operations. The AMT 73L was the World's first deployed modem with certified compliance to the MIL-STD-188-165A standard, designed to fulfill two way satellite communication requirements in Defence Satellite Communications Systems (DSCS).

The Raptor series of transportable hubs are turn-key systems which can be deployed in less than 1 hour, to enable a wide range of public and/or private network topologies with satellite interactive terminals. The RAR9160 Ruggedized Router is designed to provide best in class performance for critical applications under harsh environments. Advantech Wireless' new line of ruggedized products, the KR Series, are perfect for government and military application.

Solid State Pulse Amplifier

AMT 73L Modem DISA CERTIFIED

Ruggedized Router RAR9160



S5920M Ruggedized DVB-RCS VSAT Terminal

Raptor - DVB-RCS Compact Transportable Hub

KR Series - MCU-2000 Mobile Mesh Networking System

KR Series - 3G Router

KR Series - WBR-2000 Mobile Wireless WAN or LAN

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PUMA POWER

"Our tremendous success rate is a record we are proud of."

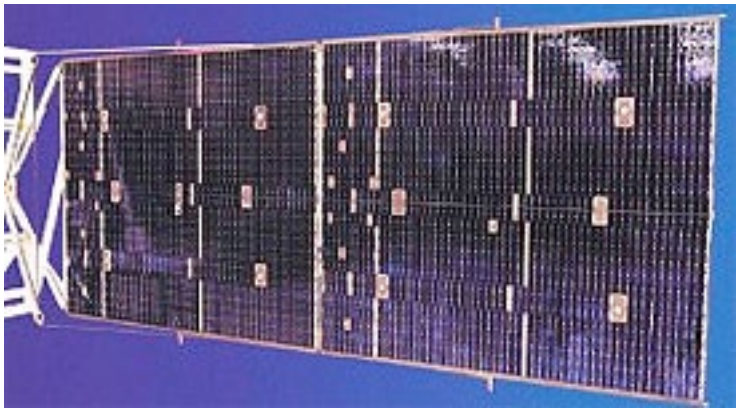
ATK's Space Components Division in Goleta, California, signed a contract with Israel Aerospace Industries (IAI) to provide the solar array to power the AMOS-6 (Affordable Modular Optimized Satellite).

The solar array is ATK's heritage Planar Unfolding Modular Array (PUMA), which has demonstrated low non-recurring engineering cost (NRE), low risk, ease of satellite implementation, and 100-percent flight success performance on more than 50 solar array wings on-orbit.

With variants having been in continuous production for more than 10 years for programs like Boeing's GPS-IIF satellites and Orbital's STAR2 geosynchronous (GEO) satellites, ATK's PUMA array platform was a natural fit for IAI's high-power commercial needs.

"We are pleased with this award for our modular PUMA solar array platform, which was adapted to meet the required 10.3 kW end-of-life power for the AMOS-6 communication satellite," said David Shanahan, vice president and general manager, ATK Space Components Division. "Our tremendous success rate is a record we are proud of." The contract calls for delivery of ATK's solar array in 18 months, with the option to perform work on the AMOS-7 solar array should IAI receive the follow-on contract from Spacecom in Israel.

ATK is an aerospace, defense, and commercial products company with operations in 21 states as well as Puerto Rico and internationally. #



JOINING FORCES

A conference is soon to be held in an area of the world that has garnered much attention.

Milsatcom Middle East is a two day conference developed specifically to meet the satellite communications needs of the Middle East military, government and security agencies. The most efficient business platform for the regional milsatcom industry is now co-located with the Global Space and Satellite Forum. Milsatcom offers new business contacts, networking opportunities and first-hand information about regional and global milsatcom projects. The new and improved program for 2013 will feature:

- *Pre-arranged closed door meetings*
- *Invited defence delegations from GCC and Greater Middle East, Afghanistan, India and Pakistan*
- *Mini expo area*

Learn more here.

A COMMANDING INVESTIGATION

ATK has also just been awarded a contract from the U.S. Air Force Space and Missile Systems Center (SMC) Defense Weather Systems Directorate to execute a study of Network-Centric Small Satellites as an element of SMC's Weather Satellite Follow-On Activities.

This study will provide comprehensive insight into the capabilities and characteristics of a 21st century weather data service that can systematically augment the legacy Defense Meteorological Satellite Program (DMSP).

The study will focus on two aspects of such a mission system: 1) net-centric architectures, and; 2) small, agile, cost-effective heritage spacecraft buses that can be used to support a variety of future weather payloads.

ORS-1, photo courtesy of ATK

Net-centric architectures can enable an orderly transition from historically stove-piped systems to a true 21st century system that provides for rapid processing and dissemination of key weather data directly to the warfighter.

Systems engineering trade studies will define a distributed ground system that uses commercial infrastructure to the greatest extent possible to enable cost-effective, robust, faster data distribution for weather and other missions.

Small and agile spacecraft concepts based on the heritage ATK A200 spacecraft bus (previously used for the TacSat-3 and ORS-1 spacecraft) will be developed to demonstrate ATK's ability to host candidate Weather Satellite Follow-on (WSF) instruments and to provide a path to affordable and reliable spacecraft.

ATK has, through the success of NASA's EO-1 and THEMIS, and the military's TacSat-3 and ORS-1 programs, proven itself as a leader in the design, fabrication, integration, and test of innovative and cost-effective spacecraft systems.

"ATK is delighted to have this opportunity to play a key role with Space and Missile Systems Center in an early exploration of disaggregated, affordable, resilient architectures," said Tom Wilson, ATK Space Systems vice president and general manager. "We support the U.S. Air Force Space Command and SMC Space Modernization Initiative that could change the future of military space systems." #

GIS FACILITATES MILITARY RESPONSE TO HURRICANE SANDY

Federal response experts supporting relief efforts in New York and New Jersey following last month's Hurricane Sandy landfall are using interactive maps to plot key data and provide emergency responders and military commanders on-the-ground with real time information to identify areas of need or interest.

The geographic information systems (GIS) instantly provides the commander and other decision makers with information that they need to know, such as critical infrastructure damage or, as displayed in the above graphic, a satellite image and associated map overlay detailing damaged residential areas

During the emergency, federal and state responders for the Hurricane Sandy relief operation used state-of-the-art computer-based technology to provide help where it is needed most.

Response experts from Joint Task Force Civil Support—which was designated as the Joint Forces Land Component Command Coordination Element—are assisting federal, state and local responders coordinate a variety of federal military support to aid the Hurricane Sandy relief efforts in New York and New Jersey. They're using GIS to graphically display affected area information which allows the commander to make decisions.

GIS is an interactive mapping system that, in the wake of a disaster, instantly provides the commander and other decision makers with information that they need to know. GIS analysts plot locations of electrical outages and fuel shortages which assist planners on where their teams need to be dispatched.

The decision makers at response agencies, like JTF-CS and the Federal Emergency Management Agency, rely on vital, real-time information in order to direct response teams to locations where they can provide assistance. During disaster responses, the commander needs more than just a standard paper map to maintain real-time situational awareness to conduct life-saving and life-sustaining operations, according to GIS experts.

"We're not restricted to one source to pull information from," said Harold "Ritchie" Richardson, Jr. JTF-CS GIS program manager. "By taking information from all of the different agencies and using it in one place we enhance situational awareness for the commander."

Richardson is working with GIS experts from other military units to streamline information to direct military aid in support of on-going FEMA relief efforts after Hurricane Sandy devastated the region last month. Richardson has worked in the GIS field for more than 10 years and believes the software's only limitation is the creative reach of the analyst using it.

U.S. Army Chief Warrant Officer 4 Jason Feser, U.S. Army North GIS coordinator and U.S. Army Chief Warrant Officer 2 Julio Toala, U.S.Army South GIS coordinator, are working hand-in-hand to plot destroyed houses in Breezy Point and other locations along the Jersey coast.

With the information provided by Feser and Toala, Sailors and Marines with the 26th Marine Expeditionary Unit deployed aboard the USS Wasp (LHD-1), were able to use the plotted GIS information to locate areas of destruction in Breezy Point, N.J. and assist in clean-up, dewatering and supply delivery missions to help those in need.

Multiple agencies can use the same GIS map, connected through the world wide web, and add layers that provide agency-specific information. For example, a power company can add the locations and status of electrical plants while gas companies can see where fuel stations are located and their status.

"If you have a large cluster of gas stations without power, that's probably a good fuel distribution point," said Richardson. "From a planning perspective, the commander can gain all of this information and he is no longer guessing."

GIS analysts use that information to plug into a graphical display that allows the commander to see those gas stations in the affected area that have–or don't have-fuel, experiencing power outages, as well as hours of operation.

JTF-CS, along with GIS experts from Army North and Army South, use GIS to discover isolated areas of need in New York and New Jersey. They are able to observe NASA's live satellite feed of New York and New Jersey to show the commander where response units need to be deployed to.

GIS team help commanders see and understand critical pieces of information so they can act immediately to support federal, state and local responders provide de-watering, debris removal and temporary power, according to Feser.

"We give commanders a lay down of critical infrastructure," said Feser. "GIS shows what's going on and who's out there. The commander can see everything in one picture.

Marines and Sailors of the 26th Marine Expeditionary Unit step off a landing craft onto the shore of Breezy Point, a small coastal community in New York City, November 9th, to aid in emergency efforts for victims of Hurricane Sandy.

Feser and Toala both agreed that GIS is the best way of getting all of the essential information to the on-the-ground responders who need it without having to actually be on scene.

But this is not a new technology used only during disaster response operations. Ever get your grocery store membership card scanned at checkout line or inquire about the location of a package? GIS is the technology used to build customer shopping statistics and track parcel. Likewise, GIS allows a military commander or emergency operations director to obtain instant situational awareness through a real-time graphical display of on-going response operations and areas of need.

"Have you ever heard the saying that a picture tells a thousand words," asked Richardson. "Well, GIS tells an entire story."

JTF-CS, serving as the JFLCC Coordination Element, has overseen more than 1,400 federal military responders who have delivered critical supplies such as fuel, water, and food; cleared debris; pumped more than 90,000 gallons of water from flooded buildings, and helped establish temporary housing units for nearly two weeks in New York and New Jersey.

As of this writing, U.S. Northern Command—the combatant command responsible for defense support of civil authorities' missions within the U.S.—has nearly 4,000 personnel supporting the Hurricane Sandy relief, according to the Department of Defense. JTF-CS is a subordinate unit to U.S. Northern Command, the combatant command responsible for overseeing defense support to civil authorities in the U.S., and operationally controlled by U.S. Army North.

Story by Petty Officer 1st Class Brian Dietrick

#

SMALL SATELLITES: IN-ORBIT OPERATIONAL SOLUTIONS ARE @ HAND

by Anita Bernie, Surrey Satellite Technology

The combination of shrinking government budgets, increasing scrutiny of cost and schedule overruns, and the need to rapidly deliver new operational missions—as well as the replacement and augmentation of current systems—is creating a "perfect storm" in the form of demands for a different approach to delivering reliable in-orbit operations and end-user applications.

In addition to the traditional government sectors, the commercial and entrepreneurial environment requires cost-effective space and ground-based assets and innovative business models to ensure a rapid return on investment. Small satellites can more than meet these market challenges.

Image: Flooding in Sao Joao Da Barra, Rio de Janeiro, Brazil, as captured by Surrey's UKDMC-2 satellite

Small Satellites: Many Pluses

Small satellites are acknowledged for occupying a well-established niche for science, technology demonstration, and Earth observation missions. Additionally, as their utility grows, they are increasingly being baselined as solutions for **MaG** (*Military and Government*) operational and commercial applications.

Customers are signing up for missions with established small satellite vendors to take advantage of a wide range of cost and schedule benefits. While there will always be an enduring need for satellites whose challenging mission requirements demand a highly customized solution, most missions do not need to carry the high level of cost and schedule risk and mission assurance paperwork associated with these types of programs.

Small satellite development and delivery programs typically span less than 24 months from kickoff to launch readiness, enabling a rapid exploitation of data; and because of the short timeline of small satellite projects, customers benefit from the latest enhancements to proven heritage spacecraft technology.

Use of *commercial off-the-shelf* (**COTS**) technologies and processes, which are generally more readily available and have been proven to be robust and reliable in high-volume terrestrial applications, also leads to reduced mission cost, schedule, and risk.

Smaller satellites are generally dedicated to fewer tasks. This means any required developments can be more focused. The high complexity of mission requirements is an issue that frequently stalls the progress of larger missions which are expected to satisfy many competing and often conflicting demands.

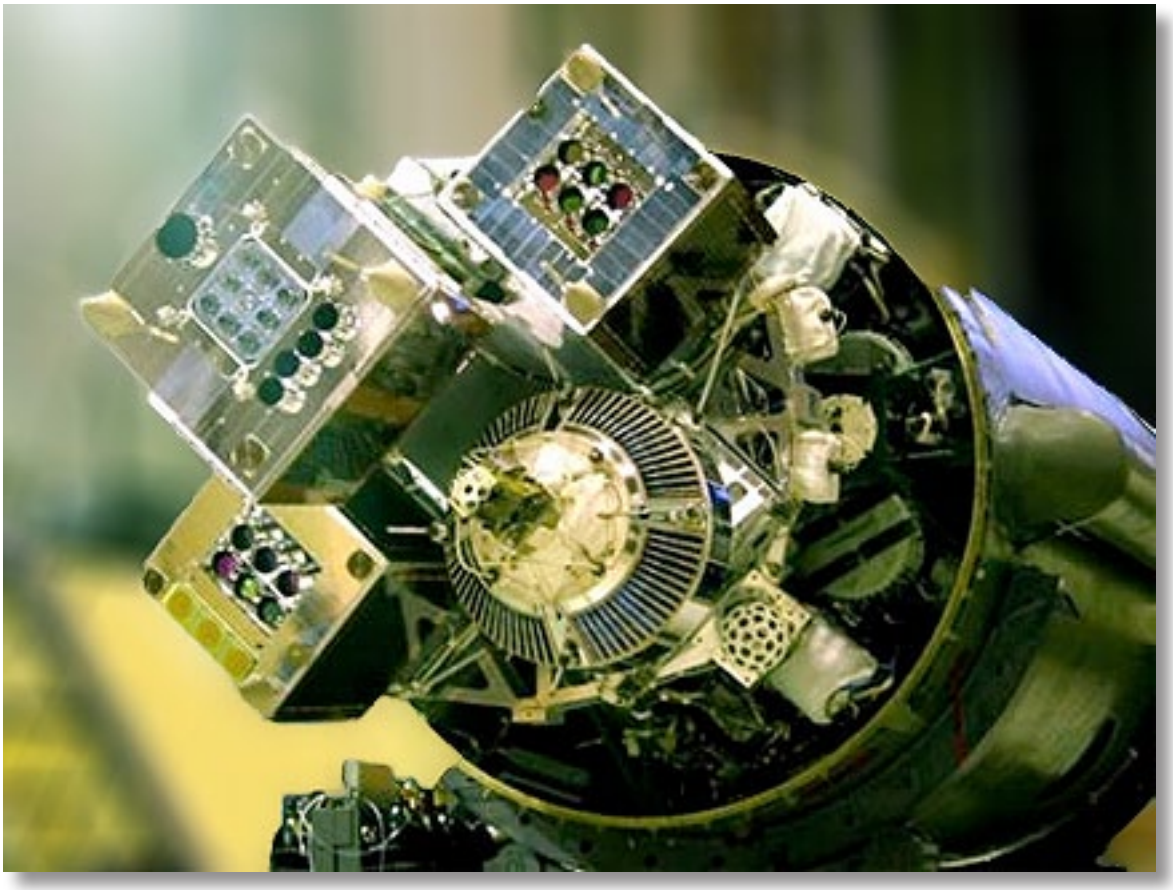
Launch costs of small satellites are naturally lower than those of large satellites due to the smaller spacecraft size and mass. Also, small spacecraft that have been designed to be compatible with a range of launchers are able to readily take advantage of opportunistic "*piggyback*" launch capacity. Multiple small spacecraft can also be manifested on a single launch to accelerate a system's operational status and coverage, and once on-orbit, autonomous spacecraft reduce operational costs by eliminating the need for 24/7 manned support.

Continuity + Assurance

One area in which small satellites are ready to make an immediate impact is in the replenishment of aging remote sensing satellites. The anticipated failure of key U.S. weather satellites—such as those used to track and forecast the progress of last October's *Hurricane Sandy*—and the slipping launch dates of replacement polar-orbiting environmental spacecraft, such as ***LDCM*** and ***JPSS-1***, mean there will be coverage gaps that could be readily filled by small satellites which are already able to provide ***Landsat***-like imagery.

These small satellites are significantly quicker to implement and offer price points in the region of $15 million for a Surrey ***DMC*** mission—and will be certainly far easier to finance.

Since 2008, when **NASA** and the **U.S. Geological Survey** started providing free access to Landsat's image database, international governments, research organizations, and commercial firms have used Landsat's scientific data for environmental and resource management, climate change monitoring, and the creation of new data applications.



Surrey's NigeriaSat-1, BILSAT-1 and UK-DMC small satellites positioned on the launch adapter, photo courtesy of SSTL

Artistic rendering of the Landsat-7 satellite, image courtesy of NASA

On the one hand, while this helps to stimulate data use and grow the imagery customer base, the cost of the Landsat program cannot be ignored—since the first Landsat was launched in 1972, $5 to $10 billion has gone toward its development and maintenance. Since then, before free access became a reality, various initiatives to commercialize the system saw the price per scene range from $200 for multispectral images to $4,000 for thematic mapper images. These prices were prohibitive for nations whose needs for such data may have been perceived to be the most critical, while only generating $5 to $10 million in annual revenues.

There are more financing demands on the horizon for Earth observation programs in the form of replacement spacecraft, data storage facilities, global transmission infrastructure, the creation of data processing and analysis tools, and the training of the talent and expertise required to manage the increasingly complex architecture.

Dr. *John Paffett*, CEO of **Surrey Satellite Technology US** (**SST-US**), part of the larger **Surrey Satellite** group of companies (**Surrey**), said that while the industry acknowledges the global benefits of making Landsat data available and accessible worldwide, he firmly believes that there is "*no such thing as a free lunch*."

He said that a lower-cost infrastructure will ensure the long-term viability of the data capture and provision supply chain. A sustainable business model is also essential to encourage more commercial firms, whose business models rely on the ability to provide time- and location-specific data "on demand," to follow the lead of companies such as **RapidEye AG**, whose 5-satellite, 5-meter resolution agri-intelligence constellation was built by Surrey.

Safety In Numbers

The low cost of small satellites, the ability to do more for less mass, and the economies of scale that can be achieved when building repeat bus designs make them highly suitable for constellation applications that can provide higher performance at a lower total cost than a single large spacecraft.

Constellations of lower-cost small satellites can surpass the services currently being provided by single large satellites by providing faster revisit times, greater data generation and delivery, as well as providing redundancy at the constellation level and continuity of service. Rapid rebuild times also allow for swift replacement of end-of-life spacecraft.

Maritime domain awareness (**MDA**) is a growing area of interest in the geospatial intelligence community. Small satellite constellations can be used in tandem to augment existing MDA systems to better meet user timelines and maritime needs. A system comprising a **GEOEye** Earth observation satellite, **exactEarth**'s Surrey-built ***eV-1*** *Automatic Identification System* (**AIS**) satellite, and a Surrey

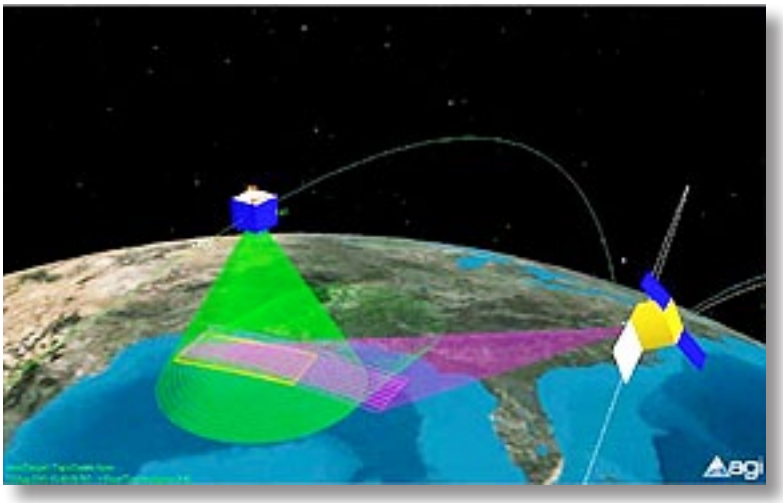
The Great Salt Lake, Utah, U.S. Image courtesy of RapidEye AG

synthetic aperture radar (**SAR**) satellite were unveiled at the **2012 SmallSat** conference and highlighted the benefits of merging different spatial data sources to enhance situational awareness.

Small satellites are also being seen as a way to augment existing constellations. For example, the Air Force Research Laboratory recently awarded SST-US a contract to investigate next-generation small satellite GPS architectures to supplement areas of low signal coverage and to provide rapid replacement and constellation resiliency.

Surrey's Recipe

Surrey differentiates itself from other small satellite manufacturers with its unique small satellite approach.



SAR/AIS coverage simulation (Credit: COM DEV USA LLC/ GeoEye, Inc. SST-US)

For Surrey, the "*small satellite*" label applies to the size of the spacecraft produced as well as the philosophy and approach that permeate through all aspects of the mission. Surrey's solutions encompass the design and manufacturing processes through to the organizational and management structures and the costing approaches applied consistently for all products and solutions, whether for the delivery of a satellite subsystem, a satellite bus, a turnkey single or multiple satellite mission, or a know-how transfer and training program.

Over the past 30 years and 39 satellites launched for a wide range of customers and end-user applications, Surrey's success has been built on a handful of "*common-sense*" factors.

The combination of a vertically integrated organization and the reduction of top-level mission requirements to the core objectives allows flexibility of trades and margins across the satellite system as a whole and minimizes the contractual interfaces and associated management overheads.

A "*one-size-fits-all*" approach to data and electrical interfaces sounds like a good idea—in principle—however, sounds like a good idea in principle, but just ends up building in unnecessary complexity, cost, and schedule risks into the bus design. Surrey's approach is to maintain the baseline bus architecture and either use payload interface units to ensure compatibility between bus and payload, or work with the customer to incorporate interface changes early on in the design process.

Surrey's "*heritage baseline*" approach allows for a balanced blend of low-risk, space-qualified designs to fly alongside newer developments, and use of dual-redundant avionics for critical systems, rather than a single, complex high-reliability unit, is a lower-cost and proven approach to providing in-orbit reliability and risk reduction.

Surrey's rapid and regular launch schedule and low staff turnover allow engineers to follow the end-to-end mission process in several months rather many years, enabling the specialist knowledge and experience base in the organization to be maintained and transferred throughout the product and project teams.

Quality is the responsibility of the whole Surrey organization and is not isolated to just one department—quality, performance verification, and mission assurance form integrated functions throughout the project and technical matrix.

About Surrey

Since the 1980s, Surrey has been the world's leading developer of small satellite technologies and applications and from the early 1990s in particular, has leveraged rapid advances in bus and payload technology to reduce the costs for delivering reliable, high-performance solutions within short timescales. Surrey's new "leapfrog technology" developments in high-resolution optics and sensors and in more efficient and agile bus avionics are being implemented on-board some of the latest systems to provide high-quality Earth observation imagery at a fraction of the price of previous systems. Examples include a constellation of three S-1 spacecraft delivering sub-meter imagery for a total of $160 million including launch and insurance; the agile SSTL-300-based NigeriaSat-2 providing 2.5-meter imagery for under $30 million; and the wide-area SSTL-100-based "always on" Earthmapper satellite providing global land coverage in five days for $7.5 million per spacecraft. Surrey's 6-meter-resolution, all-weather, day-and-night NovaSAR system offers a market-leading swath-resolution-price solution that outperforms existing SAR systems.

An example of S-1 imagery, courtesy of SSTL

Rapid evolution of heritage bus technologies are also supporting the delivery of low-latency AIS data at an unrivaled quality, as is being demonstrated by exactEarth's Surrey-built MDA satellite, ***exactView-1*** (**EV-1**).

In addition to these, Surrey's low-risk heritage bus avionics are an important element of the space assets being developed for the ***FORMOSAT-7/COSMIC-2*** program. This program is a joint Taiwanese–U.S. collaboration that will see the launch of a 12-spacecraft constellation to provide atmospheric data for regional and global meteorology and climate forecasting for an international customer base, including **NSPO/NARL**, **NOAA**, and the **U.S. Air Force**.

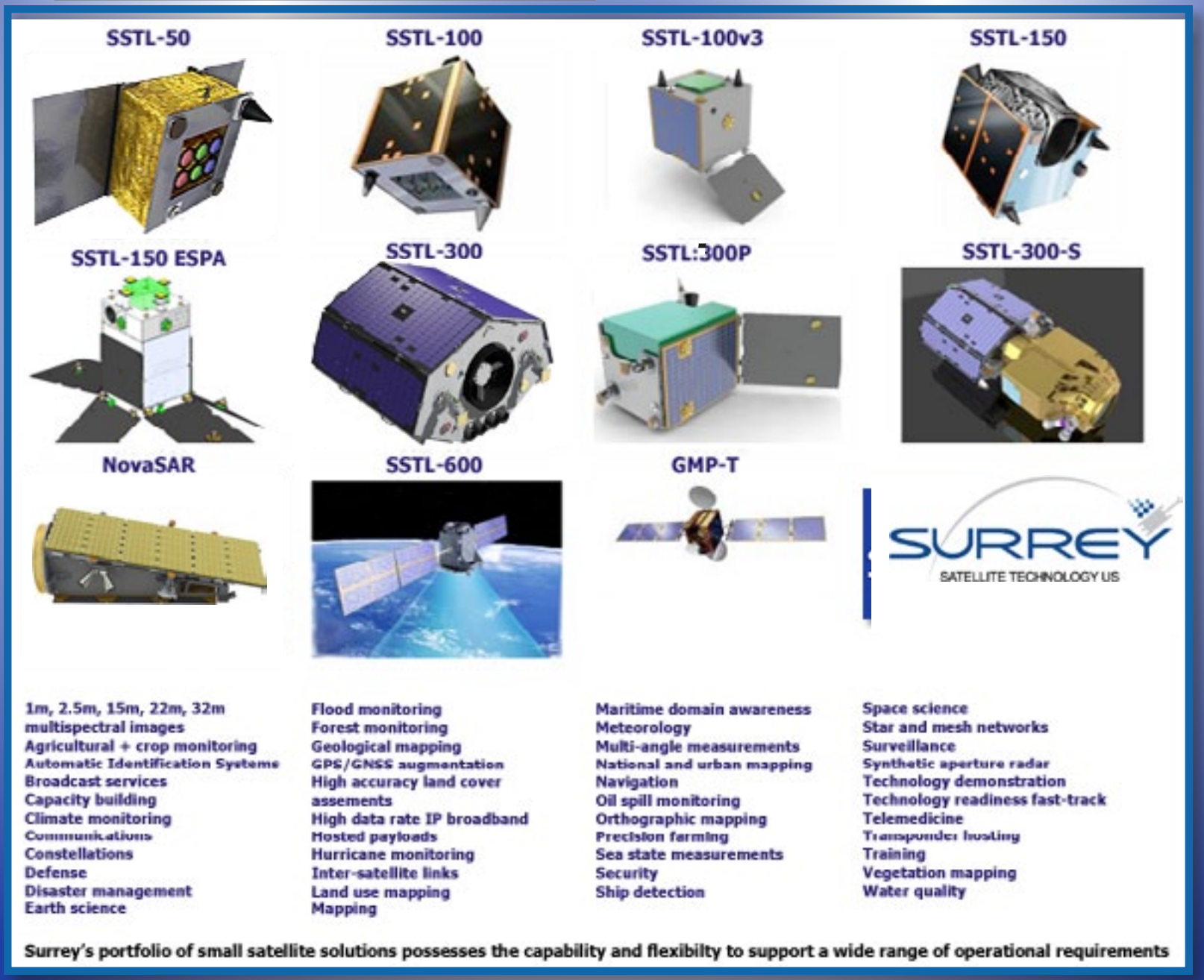
This mission is the latest in a series of GNSS and weather programs that Surrey is supporting, following on from the 22 GNSS payloads being manufactured by Surrey for the European ***Galileo*** constellation, and the 8 ***SGR-ReSI*** radio occultation payloads being developed for **NASA**'s ***Earth Venture-2*** (**EV-2**) ***CYGNSS*** hurricane monitoring and prediction constellation.

Surrey Satellite Technology US LLC was established in 2008 to address the needs of the U.S. market and its customers for the provision of

The Formosat-7/Cosmic-2 constellation will observe and monitor the global meteorology, climate and ionosphere. Credit: SSTL

small satellite solutions, applications, and services. SST-US is stimulating the space industry's awareness, acceptance, and implementation of innovative models for delivering the immediate and future requirements of government, commercial, and entrepreneurial systems.

For more information about SST-US and to subscribe to SST-US updates and blogs, visit **www.sst-us.com**. Follow SST-US on *Twitter*: **www.twitter.com/SurreySatUS**. Follow SST-US on *LinkedIn*: **www.linkedin.com/company/surrey-satellite-technology-us-llc**



COMMAND CENTER: PETER HADINGER, INMARSAT

Peter Hadinger is the Vice President, Government Markets, Global Xpress and the President, Global Government Services, Inmarsat. He leads the development of the government offerings for Inmarsat's new *Global Xpress* satellite program. Global Xpress will provide worldwide high-speed connectivity to mobile users via a constellation of Ka-band satellites, starting in 2013. He also runs Inmarsat's U.S. Government operations as a trusted partner for sensitive applications.

Mr. Hadinger's background includes 30 years as a leader in technology development, engineering and spacecraft programs at TRW/Northrop Grumman. His efforts focused on MILSATCOM, ISR, air-space integration, cyber, and international initiatives. He was the designer of the first MILSTAR protected signal processing payload and holds four U.S. patents. In his strategic planning roles he specialized in startups, technology assessment and identifying new opportunities to create strategic advantage by organic differentiation and M&A.

Mr. Hadinger has a strong regulatory and policy background. He served as co-chair of the satellite industry delegation that helped to craft the global Telecom Services Agreement at the WTO, Vice-Chair of the FCC's WRC-07 Advisory Committee and Vice-Chair of the Satellite Task Force for the President's National Security Telecom Advisory Commission. He is past chairman of the Satellite Industry Association and served as a Brookings Congressional Fellow in the U.S. Senate. He received his BSEEE from California State Polytechnic University, an MBA with emphasis in finance and strategic planning from George Mason University.

MilsatMagazine (MSM)

Mr. Hadinger, would you tell us about your background and what brought you into the world of MILSATCOM?

Peter Hadinger

Before joining **Inmarsat**, I spent 30 years working at **TRW/Northrop Grumman** in the area of technology development, engineering and spacecraft programs. You might say that MILSATCOM has been at the core of my career—within months of leaving university, I found myself working on a key part of the R&D that led to the first protected satellite system—***MILSTAR***. It was a great place to start because the challenges of protected SATCOM really force you to think about every possible contingency in order to deliver the robustness required for essential missions. That discipline and understanding of mission drivers made a great foundation for everything that followed in my career, from ISR to air-space integration to cyber.

MSM

You joined Inmarsat Government Services in April of 2011 after working at Northrop Grumman for 30 years. What attracted you to Inmarsat and how different is your Inmarsat work from your previous employment?

Peter Hadinger

I've spent my entire career working at the leading edge of technology and space systems. Inmarsat's investment in ***Global Xpress***, as the first—and so far, only—global commercial wideband system is an incredibly appealing opportunity to create a new MILSATCOM augmentation capability. These sorts of opportunities don't come along every day and it has been my great pleasure to work with a talented and motivated team to bring it to reality.

In that sense, it is quite similar to everything I accomplished at Northrop Grumman. However, I must say that doing work that has a solid commercial funding—not annual appropriations—has been a refreshing change.

Inmarsat is currently the leading player in mobile satellite communication services—the company has invested significantly over the last 15 to 20 years to ensure that it has the most up-to-date technology to support its customers. Inmarsat has been playing a critical role in supporting government and military users on a global scale; and what I saw in the company and its project to develop and launch Global Xpress is a great opportunity, not to be missed.

You see, in their part, many commercial systems had attributes that were attractive to governments that eventually lead to their use. Global Xpress will be the first commercial system that was designed for government purposes from the start. It will support government and military users at a whole new level.

My experience at TRW/Northrop Grumman has helped position me well for my roles at Inmarsat. The scope here is much larger; I need to work with governments, military, peace-keeping, disaster-relief and aid operations on a global scale. It is really challenging, at the same time interesting to specially introduce our new Global Xpress to the Governments, to show them the capabilities that we can provide to fulfil their requirements. My regulatory and policy background has also enabled me to contribute to the team here at Inmarsat.

MSM

Intelligence, surveillance and reconnaissance (ISR) have become fundamental to successful military operations. With the capacity of Wideband Global Satellite (WGS) bandwidth being limited, how do military communication operators ensure they have enough, or reliable, bandwidth to get the data to war-fighters in the field?

Peter Hadinger

Governments are making prudent investments in next-generation MILSATCOM to ensure cost-effective access to bandwidth for their missions. Ka-band is at the core of those investments—***WGS***, ***Athena-Fidus*** and other programs are leading the recapitalization of government space and terrestrial infrastructure to take advantage of the inherent advantages of higher frequencies. However, the cost-effectiveness of government-owned MILSATCOM applies only where it can be highly loaded, which is for augmentation in bandwidth or coverage.

It is prudent to incorporate commercial solutions where resources are shared with other markets and MILSATCOM can leverage investment made on a larger user base. By procuring terminals that can simply tune between the military-Ka and the commercial-Ka frequencies next-door, governments give themselves tremendous access to on-demand resources to address present demand and future contingencies.

Communications play a crucial role in the success of any government or military operation. Over the years, MILSATCOM has always been the "*core*" solution for government users, purposely built for high-performance global coverage with a high level of security. Since 2000, ISR have become more and more important in military operations; and it is getting more difficult for MILSATCOM to keep up with the increasing demands while not all the governments have enough budgets to use MILSATCOM, which is limited and comes at a high cost.

This has meant Governments must now turn to commercial SATCOM more to complement MILSATCOM capacity in providing bandwidth and coverage for their operations at an economy of scale. Nowadays, commercial SATCOM solutions are more secure and reliable, and come at a lower cost when compared to MILSATCOM, being able to address Governments' concern in the ensuring the confidentiality and security of their operations.

At Inmarsat, our Ku-band has always been the choice for government and military users, thanks to its efficient, low-cost infrastructure and equipment. Now with Ka-band providing global mobility with data-efficient spot-beam technology and small terminals, it will be a great advantage for militaries.

MSM

How can Commercial SATCOM complement MILSATCOM in providing broadband satellite solutions to military users? How do you foresee the roles of Commercial SATCOM and MILSATCOM changing over the next three to five years?

Peter Hadinger

Let me compare the COMSATCOM/MILSATCOM dynamic to how you and I use cars: We own the one at home that we use every day but we rent the one we use when we fly somewhere else. It simply wouldn't make sense to own a car in every city you might visit or, similarly, to own a delivery truck just to handle your occasional moves.

To become a more effective augmentation partner, I see commercial SATCOM becoming similar to MILSATCOM—focusing on global, rather than regional, implementation, incorporating military frequencies to support legacy terminals and adopting an on-demand capacity model that better matches the dynamic nature of military requirements.

MSM

How can Inmarsat's Global Xpress fill this gap?

Peter Hadinger

Global Xpress is first and foremost—GLOBAL. Just like every generation of U.S. MILSATCOM, Inmarsat has always considered global coverage an essential requirement. Efficiency and responsiveness are maximized when you can invest in a single kit of equipment that can be deployed at anytime, anywhere.

Second, Global Xpress incorporates military Ka-band frequencies that leverage the large investments that governments are already making in Ka-band equipment. Just as important, Global Xpress is offering on-demand commercial service that allow militaries to fill in the gaps between high-intensity spot beam coverage, which is ideal for supporting en-route communications, small unit deployments, and long-track AISR.

MSM

What is the timeline for Global Xpress? When are you launching the service?

Peter Hadinger

We're in the final stages of preparation of our global space, ground, product and service infrastructures for Global Xpress. The first satellite is planned launch around Q3 2013. With a successful launch, service will begin across the Indian Ocean region by 2014. Successive launches will bring service to the Atlantic and Pacific Ocean regions so on our current timetable global services should be available by the start of 2015.

MSM

What are Inmarsat's broad plans and vision for 2013, specifically along the support for government and military users?

Peter Hadinger

In 2013, we will continue working with our partners to expand the products and services available across our existing L-band infrastructure while preparing for the addition of Global Xpress capabilities. We will roll out higher speed and more cost-effective L-band services

Artistic rendition of Alphasat, courtesy of Inmarsat

and launch the fourth of our ***Inmarsat-4*** generation satellites, a system with improved performance known as ***Alphasat***. In 2013, we will also focus on extending our support to customers and partners in even more countries around the world.

Artistic rendition of Inmarsat-4, courtesy of Inmarsat

MSM

Emerging Asia is increasingly modernizing its military capabilities. How is Inmarsat leveraging this trend? Do you see an increased investment in satcom technologies and by which Asian countries?

Peter Hadinger

Asia has always been on the forefront of satellite technology investment trends. Spot-beam satellites, hosted payloads, Ka-band and other innovations have deep roots in Asia-Pacific needs, which include challenging coverage demands, the requirement for efficient cooperation between commercial and military uses across multiple countries, and insatiable growth in bandwidth driven by the region's economic forces.

Inmarsat's current and future systems bring consistent capability and performance across all of Asia, while being dynamic and flexible in resource allocation to address both long-term trends and short-term contingencies. That's been a great combination for us all along and we're not going to change it. We will be spending more time and effort focused on our government partnerships and customers in Asia, knowing that while our coverage may be global, the demands and investments by governments are quite local and unique to each country.

MSM

How do you manage to lead the Asian and other market segment work as well as the Company's U.S. Government operations?

Peter Hadinger

Inmarsat has established two market-facing government organizations—our **Global Government Business Unit** and our **U.S. Government Business Unit**. Their teams focus on the unique needs of their respective partners and customers and are very good at what they do.

Our Global Xpress team is the company's focal point for bringing our new Global Xpress global wideband capability to the government marketplace. We are working closely with these existing business units and our strategic partners to ensure that governments worldwide understand the opportunity that an entirely new global MILSATCOM augmentation capability brings to executing their increasingly dynamic missions in a cost-effective manner.

MSM

An area of concern for many SATCOM companies is the ability to hire professionals from what appears to be a shrinking pool of trained candidates... what are your concerns regarding future hires, and is Inmarsat involved in supporting and encouraging STEM training in middle/high school curriculums as well as in college courses?

Peter Hadinger

Every technology-driven company head knows that their most important resource isn't the plant or the equipment but the brainpower that walks in and out of the door every day. Leadership depends on attracting and retaining the industry's best minds, while investing in development of new talent for the long term. Inmarsat's reputation for technical excellence, buttressed by strong financial performance and innovative new programs such as Global Xpress, have made us a preferred employer in the market and we have been able to selectively hire leaders with extensive industry and government experience.

At the same time, we are all incentivized to invest in **STEM** activities as individuals—I personally enjoy the opportunity to participate in an engineering advisory board at **Virginia Tech** and at the same time to lead the formation of an elementary school program, and especially, its science curriculum. Members of my team similarly play a variety of advisory roles in academia and occasionally teach in their areas of expertise. This is also the case in every other unit; and as a company, we've formed partnerships with various universities and industry associations to make broader investments in support of STEM education worldwide.

MSM

Given your years of experience in our industry, what are your prognostications for SATCOM and its related industries over the next year or two? What major challenges will need to be surmounted? (i.e. financial, technical and so on).

Peter Hadinger

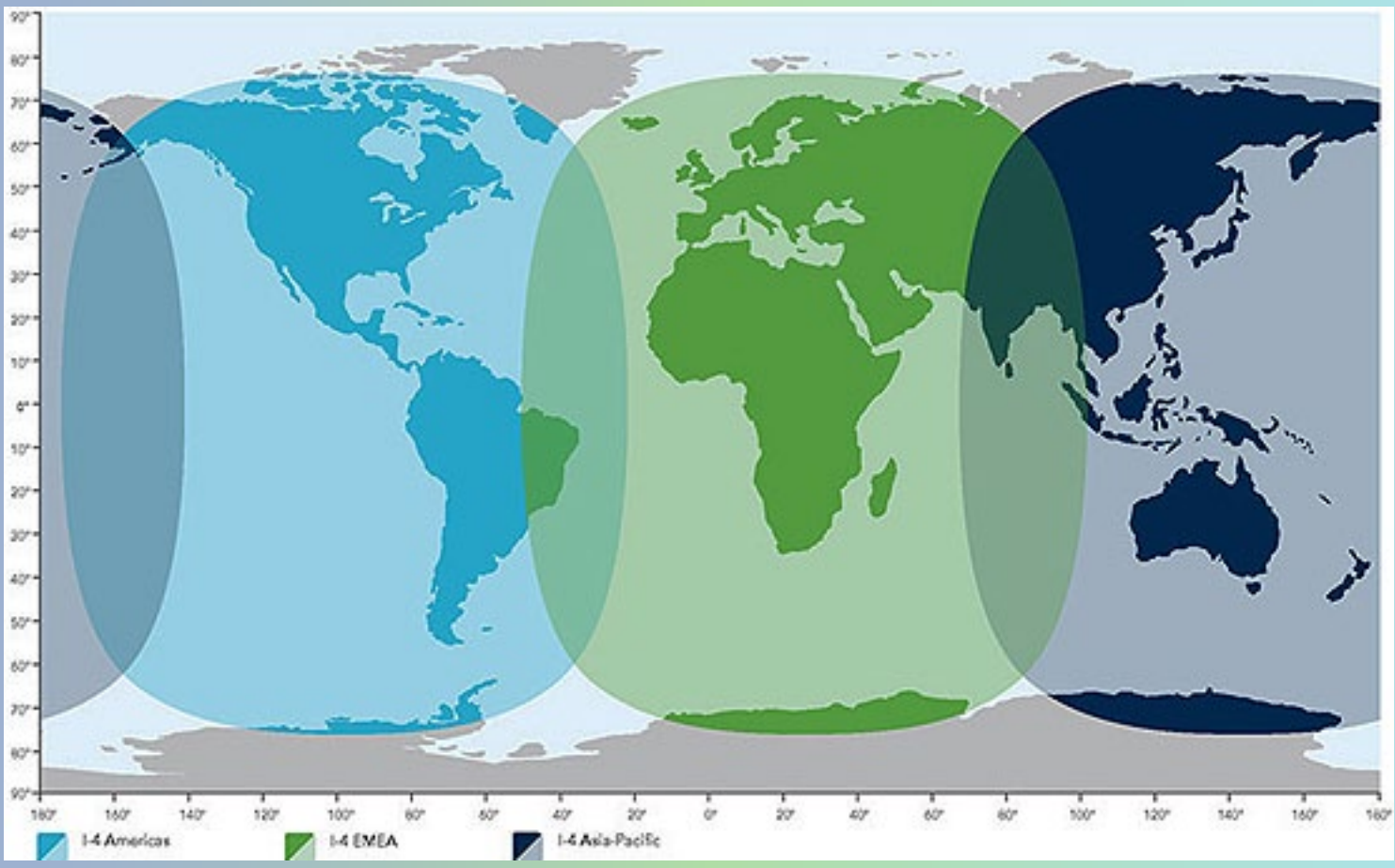
The history of SATCOM, whether military or commercial, is marked by a series of leaps in terms of capability, brought about by new investments and generational innovations, followed by a slower and more gradual adoption as technology is rolled out to users. Customers and partners can only outfit so many ships, airplanes and organizations at a time—with timing depending as much on the rotation of assets out for maintenance as it is on the availability of hardware and talent for installation.

We are at the cusp of one of those leaps, with the introduction of Ka-band in military and commercial satcom. While satellites are lasting longer, the need for new capabilities has continued to space these leaps about every seven years so there is more overlap in generations—which further facilitates the transition process. Inmarsat's last big leap was the launch of the Inmarsat-4 series in 2005-2008 and we are launching ***Inmarsat-5*** (Global Xpress) in 2013-2014.

On the adoption side, the next couple of years will see the continued reduction in Ka-band terminal costs, as consumer rollout brings Ku-equivalent scale to the electronics manufacturing, and military investment focuses on improvements in size and efficiency of key components at the high-end. The 75 percent smaller size of Ka- terminals also brings similar weight and cost reductions in the antenna structures and pointing mechanisms. When coupled with the higher peak speeds and lower per-MHz cost of Ka- capacity, the transition of existing users from Ku- to Ka- will accelerate, while new markets in mobility and high-speed that have been poorly addressed—such as commercial aero—will be opened.

We will see L-band reposition to leverage its unbeatable strengths in handheld, small (<60cm) mobile and low-cost M2M services as well as providing an increasingly high-speed complement to Ka-band service for spatially and spectrally robust applications.

Financial challenges abound. Resources in the market are finite and money will follow performance. Ku-band will remain strong and relevant for broadcast, where it has durable differentiators, but I expect that the rapid introduction of global MSS-like end-to-end managed services to the historically lease-based FSS



Inmarsat global coverage.

This map depicts Inmarsat's expectations of coverage, but does not represent a guarantee of service. The availability of service at the edge of coverage across fluctuations depends upon various conditions. BGAN coverage February 2009.

VSAT industry will change the ways that government buys service and with it, streamline the layers of firms that built-up based on the older model. Inmarsat has low debt, high cash flow and has already committed to the next generation of global connectivity with Global Xpress Ka-band. I believe you will see a lot of companies trying (or at least wishing) to do the same.

MSM

Do you see Hosted Payloads as playing a critical role as MAG and the Commercial sides of the business become more and more dependent upon one another?

Peter Hadinger

Hosted payloads can be great ways for government to leverage satellite launches but they are nothing new—Australia's ***Optus C1*** is a stellar example of military leveraging commercial SATCOM and is now nearly a decade old.

Inmarsat-4 satellites have all carried hosted GPS augmentation payloads and the new Alphasat will carry technology experiments in Q/V-band and lasercom which represent long-term growth investments in SATCOM. But there is a difference between hosting demonstrator payloads and implementing long-term global infrastructure around which governments will build CONOPS and investment roadmaps.

Governments will continue to insist, rightfully, on owning a core part of their own infrastructure—while CHIRP is a good example of technology demonstration on a commercial ride, I don't expect global missile surveillance to become a commercial mission. Similarly, MILSATCOM will remain primarily the province of dedicated government resources, especially for protected services that have no commercial equivalent and place high demands on spacecraft design and operational flexibility.

The correct long-term strategy for commercial operators is to support hosted payloads where they can help customers explore new concepts as well as to realize that the real problem for government these days is in acquiring the resources needed to expand and improve their core global constellations.

By investing in long-term solutions that align with government roadmaps, programs such as Global Xpress, that include MILSATCOM capabilities, not as a hosted payload but as a core part of a global service offering, are going to play the most critical role in commercial augmentation of military and government SATCOM.

MSM

As you look at your impressive career, which project or missions truly brings you a sense of satisfaction?

Peter Hadinger

I am at heart an inventor—solving problems in new ways and creating new teams and systems from scratch is my passion. I've been fortunate to have worked on the most challenging leading-edge of government space capabilities while at Northrop Grumman, and now at the leading edge of commercial augmentation to government at Inmarsat.

You never forget your first "*fingerprints in space*" job; for me that was MILSTAR, or some of the national security missions that really do change the world—but for an inventor it is the current challenge (and just maybe the one after that) that really gets you excited. The Global Xpress team has already made a number of very impressive accomplishments—and that is before launch. I can hardly wait for the next steps.

The Inmarsat 5 satellite being built by Boeing. Photo courtesy of Boeing

DISASTER COMMUNICATIONS: A PROVEN SOLUTION

by Paul Seguin, Satellite Application Specialist, C-COM Satellite Systems, Inc.

On March 11, 2011, at 2:46 p.m., a 9.0 magnitude earthquake occurred 100km off the coast of Japan, centered just East-Northeast of the city of Sendai. The underwater quake created a tsunami 10 meters high, which crashed into the shores of Northern Japan, devastating 140km of the coastline and travelling inland as far as 10km. The devastation was beyond belief. The massive wave removed almost all evidence of civilization. What remained was a debris field that resembled an active war zone.

The most obvious and convenient communication tool for any disaster survivor is his or her cell phones. Given the magnitude of this earthquake in Japan, the resultant tsunami, the interruptions of electrical power as well as the breakage in the copper and fiber communication lines connecting remote sites, the cellular network was almost completely disabled throughout the affected areas.

Telemann Communications Co. Ltd., located in Tokyo, is a *Factory Authorized Reseller* for **C-COM Satellite Systems Inc**. Telemann's client, S**oftbank Mobile Corp**., the third largest cellular provider in Japan, was working feverishly to replace the area's disabled cellular network. Softbank, a corporate entity with a strong sense of civic duty, embarked on the epic task of restoring missing, destroyed and inoperable cell towers. The temporary structures they employed were able to provide continued communications coverage for the survivors of this monumental catastrophe.

A report by *Atul Roach* on March 23rd, 2011, at 9:28 a.m., reported that "*NTT DoCoMo 2,130 mobile base stations were still out of service, as compared to the 6,720 which were inoperative immediately after the quake. Likewise, KDDI had 1,500 non-functioning base stations, down from 3,800, while Softbank reduced its inoperative base stations from 3,786 to 1,157. It seems that Japan is recovering faster than expectations in the telecom sector which is important to keep people connected in such difficult times.*"

Problem Permutations

Softbank developed a platform that consisted of a fixed satellite antenna, a cellular antenna, a cellular switch, and a power supply. This structure provided an excellent, quick-to-deploy solution to a very serious problem. Once the units are deployed, they provided cellular service in specific geographic areas.

The satellite antenna and attached satellite modem provided the necessary link to backhaul the calls to a wired network located elsewhere. Each unit required approximately six hours to deploy, once the team arrived at a site. These platforms provided immediate relief to the people who had been left without communication for days after the earthquake and ensuing tsunami.

Even more of a challenge for the Softbank team were the aftershocks. Hundreds of them were generated in the days following the initial quake, some stronger than "strong" earthquakes that have been experienced in other parts of the world.

These persistent aftershocks foiled an otherwise excellent solution. For the accurate operation of the link from these remotely located cellular stations, a fixed satellite antenna requires pointing accuracy be maintained at all times.

With each aftershock, many of the platforms would inevitably stop working due to incurring pointing issues. The efforts of the Softbank team to provide cellular service to the people who so desperately needed it were, unfortunately, being wasted.

Attempts To Resolve

The solution to the aftershocks seemed simple: Send a team to re-point each failed system. The logistical nightmare that was created by this solution is now easy to understand: Each re-point would take a minimum of two hours—emergency teams would need to constantly change gears from deployment into re-point mode. The teams would be taking one step forward, two steps backwards.

On April 7th, a 7.2-magnitude aftershock occurred, leaving 700 0.98m satellite antennas and 50 1.2m antennas inoperable due to pointing issues. A visit by the Softbank team was required to return the units to operational status. Such work required a minimum of two hours of work per site, with a total time to correct the situation amounting to more than 1,500 hours, plus the driving time required to arrive at each site.

Assuming a drive time of one hour per site, the total time required to fix the antennas equalled 2,250 hours of work—that's the equivalent of 94 days of around-the-clock work.

A Most Viable Solution

Telemann Communications knew of the C-COM built ***iNetVu***® mobile satellite antenna solutions and believed such equipment could provide the needed technological edge to deal the communication difficulties resultant of the aftershocks. Softbank already had a number of iNetVu antennas deployed on vehicles that were used for temporary cellular sites at special events and to backup a fixed site that was down for maintenance.

Softbank, having faith in the solution presented by Telemann Communications, ordered 110 iNetVu systems, of which 55 were iNetVu 1200 systems and 55 were iNetVu 980 systems. Of course, the need for the systems was far beyond urgent—time was of the essence to return vital communications to the people in the affected areas.

C-COM's normal delivery procedure included the testing of each system on satellite prior to shipment. The time required to accomplish these tests on 110 systems was deemed problematic—the decision was made to ship the units directly from C-COM's warehouse direct to Japan and to send two C-COM employees to test the units, on-site, prior to their deployment.

Softbank's and Telemann's staging areas were located in Sendai, one the areas hardest hit by the tsunami. While this area was far from stable at the time of the shipment, it was judged to be the most effective and convenient location to initiate the testing and deployment process.

The initial 15 systems were in the Softbank warehouse when the C-COM employees arrived, and the work began to prepare the systems for deployment.

Quiet Satellite

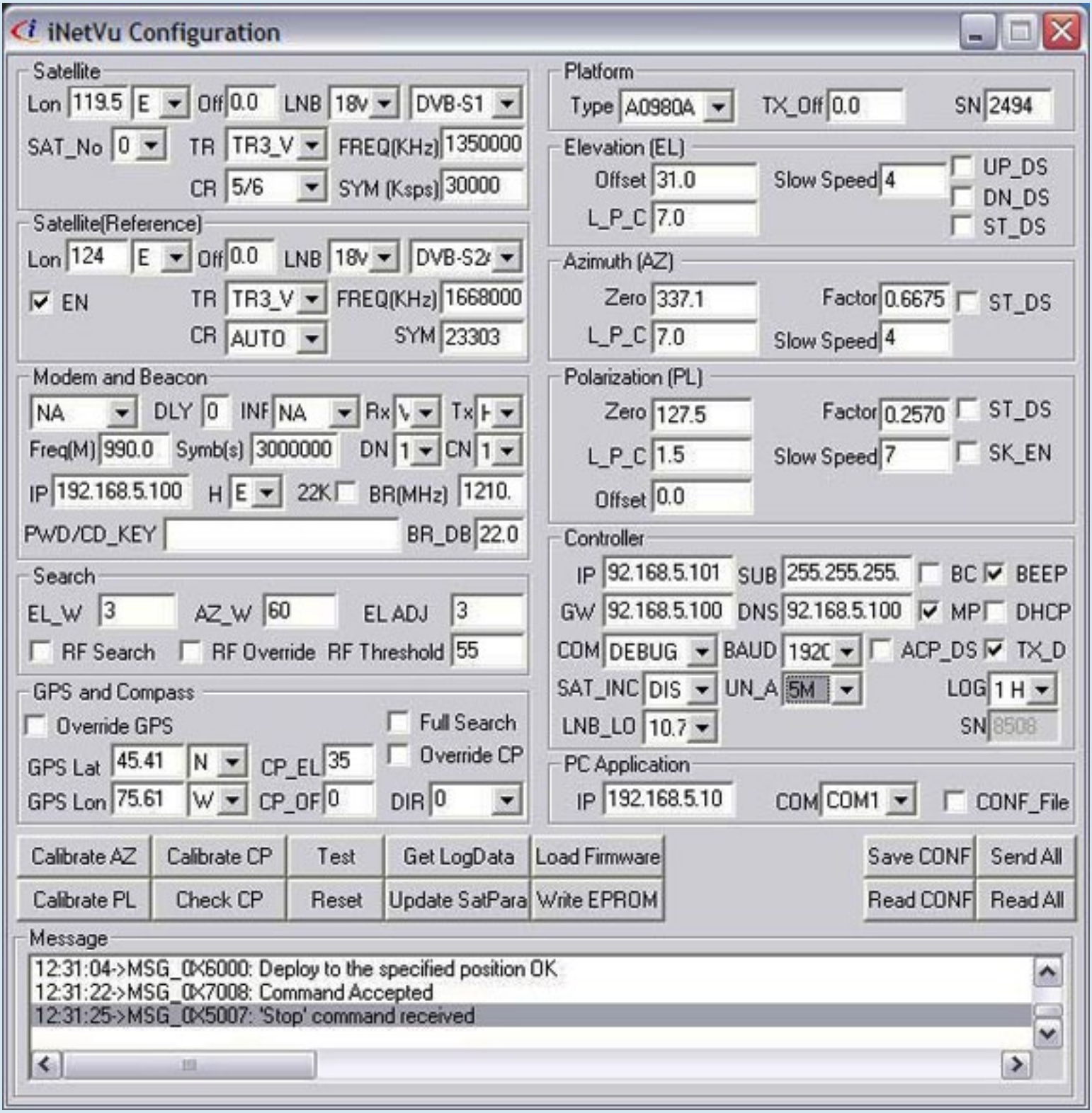
The first hurdle that had to be addressed was related to the ***IPStar 3200*** modem. This modem lacks the ability to communicate to an external device using any of the standard modem protocols. This modem is ideal for a fixed solution, but proved to be a challenge for mobile implementation.

Most mobile platform controllers use *DVB* to locate the target satellite. The particular satellite IPStar was using, unfortunately, did not contain any DVB carriers. This meant another method would be required to locate the target satellite.

The next choice would be to use a method called *RF*. In this method, the Controller talks to the modem to acquire the information to make a positive identification of the target satellite. As the IPStar 3200 modem does not have any native language interface, this method was also unavailable.

Another option for locating the satellite was to use the satellite *Beacon* signal. While this method would have worked quite well, it would have added thousands of dollars of expense to each unit deployed. In an effort to keep costs down, this method was considered as a viable option only as a final solution.

The ***iNetVu Controller*** offered another method of satellite acquisition: *Reference Satellite*. In this method, a reference satellite is found using DVB, RF or Beacon. In the existing case, DVB was the selected method. This allowed the platform to first locate and peak on the reference satellite, and to then move to the target satellite, making the necessary three-axis adjustment. This method can be 'hit-or- miss,' as the target satellite is pointed at blindly with no validation available to confirm acquisition.



As this technique made the best price/performance choice, the C-COM software engineers had to make some modifications to the algorithm to ensure absolute accuracy. To prove this method was stable, hundreds of deployments were completed over multiple days, and the ES/NO values were recorded. In all but one case, the value was within a very high range that was considered acceptable.

The acceptable range selected was a value of 11, and the absolute highest value seen was 13.6. In the one failed case, the value seen was 3.4, and at that level, the system did an automatic re-point due to a connection failure.

3	Apr	5.1	Mb
4	Apr	5	Mb
4	Apr	5.1	Mb
4	Apr	5.4	Mb
5	Apr	5	Mb
5	Apr	5	Mb
5	Apr	5.1	Mb
6	Apr	5.5	Mb
6	Apr	5	Mb
7	Apr	5.2	Mb
7	Apr	7.1	Mw
9	Apr	6.1	Mw
9	Apr	5.4	Mb

9	Apr	5.4	Mb
10	Apr	5.2	Mb
11	Apr	6.4	Mw
11	Apr	5.2	Mb
11	Apr	5.4	Mw
11	Apr	5.6	Mw
11	Apr	5	Mb
11	Apr	5.2	Mb
11	Apr	6.6	Mw
11	Apr	5	Mb
12	Apr	5.2	Mb
12	Apr	5.8	Mw
12	Apr	6	Mw

13	Apr	5.2	Mb
13	Apr	5.7	Mb
13	Apr	6.1	Mw
13	Apr	5.2	Mb
14	Apr	5.1	Mb
14	Apr	5	Mb
14	Apr	5.7	Mw
14	Apr	5.4	Mb
15	Apr	5	Mb
15	Apr	5	Mb
15	Apr	5	Mb

Aftershock

During the two weeks that C-COM employees were on-site, more than 40 aftershocks were felt, some large (7.6 magnitude) and some small (4.0 magnitude). It was obvious that a failsafe method needed to be developed that would put the antenna into automatic re-point mode if the aftershock knocked it off the satellite. The table on the next page represents the earthquakes recorded in the area during C-COM's employees' visit.

In a normal situation the ***iNetVu Controller*** already contained an algorithm to keep the antenna pointed correctly, if selected by the user. As mentioned, the IPStar 3200 modem does not have a native language embedded, and so communication with it was not possible. As the Target Satellite has no DVB signals available, the re-peak algorithm with that option was not possible.

On-site C-COM's personnel turned to their software engineers and requested a special new algorithm that would address the issue at hand. New software was coded overnight, sent from C-COM's Ottawa offices, and field-tested more than 50 times.

This new software allowed the antenna to automatically perform a re-peak if it detected that the target satellite was no longer being pointed to within an acceptable degree of accuracy. The success of this new algorithm provided Softbank with the confidence that the units would not require a re-point each time a major aftershock occurred.

Power Outage

C-COM field personnel conceived another situation that could cause the system to become inoperative. What if a power outage was to occur, followed by an aftershock which knocked the unit off satellite?

When the controller repowered, it would be unable to detect any problems, given the way the satellite was located, and would not know to initiate a re-point sequence. This situation was not improbable as many of the systems were powered by gasoline generators.

Doing a re-point at all power-on situations was a possible solution, but this could also create a different set of problems. As the systems are being used to backhaul a cellular network, if they are automatically put into re-point mode during repowering, this would cause all 'calls-in–progress' to be dropped, and the system would be unavailable for some minutes. It is far better to only initiate a re-point when the units have actually lost their pointing accuracy on the target satellite.

A solution to this situation had to be developed. The C-COM software engineers were put to the test again with another request and an algorithm was developed within a few hours and new software was sent for field testing. The solution worked flawlessly and was tested a number of times with different controllers and antennas.

Now, even in a worst case scenario of a power outage followed by a major aftershock, Softbank was assured that the iNetVu systems would perform their task with no human intervention.

iNetVu 1200 Mobile Auto Acquisition Satellite Antenna System

The Implementation

Initially, Softbank had been busy building additional trucks equipped with the iNetVu 1200 mobile satellite antenna system. These vehicles were to be deployed to disaster areas to provide temporary cellular service to assist with the cleanup efforts. The deployment of the iNetVu 980 units occurred on a case-by-case basis, as Softbank saw fit, based on the need to provide cellular coverage into additional areas affected by the disaster.

Additional orders were placed to C-COM for more iNetVu 1200 and 980 units.

Summary

The client had to have mobile satellite communications, and the type of deployment required presented a number of unique challenges for the mobile satellite controller used. C-COM personnel have worked with many of their resellers around the world to solve these types of technical issues in a timely and professional manner.

COMMAND CENTER: KOEN WILLEMS, NEWTEC, ON AIRBORNE ISR

Koen holds the post of Market Director for Government, Defence and IP Trunking at Newtec, a market leader in satellite communication technologies. He is responsible for the launches of many of Newtec's newest products and technologies including professional IP modems, the all new MDM6000 modem series, and FlexACM®, Cross-Layer Optimization™, Bandwidth Cancellation and S2 Extension technologies. Additionally, he also has a major interest in the area of market development within the government and defence sector.

Mr. Willems has more than 15 years' experience working in the technology industry. His career began in 1998 at speech technology company Lernout & Hauspie, where he held a project management position. Following this he moved to electronics giant Toshiba where he was Product Marketing Manager for the Benelux and later the European market Koen has a degree in English and Scandinavian Languages (University Ghent, Belgium, 1997) and a Masters in Marketing Management (Vlekho Business School in Brussels, 1998). He holds a Six Sigma Black Belt for product development and process improvement. You may recognize Koen as one of the introducers and organizers of the popular Newtec webinar series and his article writings.

MilsatMagazine (MSM)
What is the general role for airborne ISR in today's military context?

Koen Willems
Airborne Intelligence, Surveillance and Reconnaissance (**ISR**) is becoming the most important method for gathering information in military missions around the world. Operations need more intelligence to ensure accuracy and to ensure successful and correct decision making.

For one thing, missions are becoming shorter and more focussed with less of a role for ground forces. The recent Libya missions are a prime example of this. With little or no ground force intelligence available to verify airborne ISR observations and often a great need for precision information, there is an ever increasing reliance on the accuracy and detail of ISR data gathered by both manned and unmanned aircraft.

MSM
What are the general trends you see in the (airborne) ISR market?

Koen Willems
There are growing bitrates, more airborne ISR missions and a greater number of increasingly sophisticated and bandwidth hungry data collection apparatus being used.

During austerity times for governments around the world, airborne ISR activities continue to be seen as high value and of high importance. Whilst more and more ISR missions are being dispatched to collect and process information, they need to be achieved using the same levels of expensive satellite bandwidth once available for far fewer missions. There is a real squeeze leading to a trend for governments to use authorized *Commercial-Off-The-Shelf* (**COTS**) technologies to maximize on bits per hertz.

Different video technologies (HD, 3D, etc.) are sapping capacity on the satellite transponder. For example, a technology called the ***Gorgon Stare*** uses 12 cameras which simultaneously capture data to capture motion imagery of a wide area, perhaps even an entire city, to then be sent back for analysis at base. There are multiple other examples that are expensive in bandwidth, but priceless when it comes to the detail they provide, ultimately resulting in better decision making.

While contending with this increased demand for throughput, service continuation is essential and mission critical. During missions in-flight ISR aircraft regularly encounter fading conditions that disturb the transmission of video and data over satellite. Fading conditions can be caused by many different circumstances: the choice of satellite (inclined orbit, rain fade in Ku-, Ka- and X-band), interference (between two adjacent satellites) or blocking of antenna (wing,

tail, mountain, tracking loss). If the satellite link were to go down, or the bandwidth were to drop, leading to the cessation of an important feed it would be unacceptable with potentially dire consequences.

MSM
What are the challenges encountered when flying ISR missions?

Koen Willems
A major constraint is the size of the ISR vehicle—they are becoming smaller and lighter and therefore require smaller and lighter equipment on-board.

The network configuration is also atypical. There is the need for a higher volume of data to be transferred from the airborne vehicle back to control than vice versa. This is directly opposite to what one would expect from the set-up of a typical *Time Division Multiple Access* (**TDMA**) VSAT network. It is a phenomenon we call reverse trunking and is very similar to what you would expect to find in the star network for a satellite news gathering service.

Newtec has more than 27 years' experience in video broadcast, high speed satellite data links and building networks that operate at optimal conditions under these adaptive and reverse trunking circumstances. In the past, governments only required smaller data rates, but because of the combined need for higher data throughput and budget restrictions, more and more governments are opting for CAPEX-friendly and more efficient COTS equipment.

Of course, with these missions being of great sensitivity, and with it not always being possible to plan far in advance, quick and reliable implementation is a must. Everything from testing to programme rollout has to be completed quickly. This has to be balanced against the need to know that each piece of equipment is fit for purpose and reliable. All COTS products must therefore meet stringent certification criteria. We have products and solutions qualified for use in the continental U.S., with governments in Europe and around the world.

MSM
What are the functional requirements to enable successful ISR missions?

Koen Willems
Bandwidth, bandwidth and more consistent bandwidth. Through past implementations Newtec has seen requirements of at least 10Mbps data, video and voice feed to the ground and 2Mbps back up to the ISR airborne vehicle at all times. We can expect the required bandwidth to balloon in the coming years though, and we are ready for that.

Successful ISR missions also rely on the operation of point-to-multipoint networks, meaning multiple aircraft communicating on the network simultaneously. The networks must be compatible with IP and the commercial interfaces must be L-band. The certified hardware and technology must be easily transferable to any kind of airborne vehicle operated within a government's fleet.

Also of utmost importance is an end-user interface that is easy to use. During an ISR operation, when split second decisions are being made, the operation of the interface must not be a constraint and has to be seamless. Even for personnel that do not have engineering degrees!

MSM
What technologies can be implemented to enable higher throughput and maximum service availability?

Koen Willems
Optimizing the data and video link between the ISR aircraft and the ground station is a continuous process that needs to take changing conditions into consideration at all times. Mission critical data needs to be transmitted even when fade has caused a reduction in bandwidth from its optimal level.

Cross-Layer-Optimization™ is a technology available to allow continuous interaction with acceleration, compression, bandwidth management and IP shaping technology. As soon as conditions change the link is auto-optimized following *Quality-of-Service* (**QoS**) and priority settings without the loss of data or even the whole link.

We have also developed the adaptive technology, known as ***FlexACM***® which is integrated in multiple projects worldwide. Video and data rates can be doubled in the same bandwidth without the need to acquire extra satellite capacity. It ensures more efficient *Beyond-Line-of-Sight* (**BLoS**) communications. At the same time optimal service availability can be achieved in any fading condition to keep mission critical communications running at all times.

FlexACM® combines the **DVB-S2** standard with a set of technologies. In 2013, we will also see an update to the DVB-S2 standard with its candidate *S2 Extensions* already incorporated right now with this technology in Newtec equipment.

There is also the capability to auto-adaptively set the modulation parameters to the optimal point to overcome distortion, noise and variation in the satellite link. It is important to get as close to the zero margin limit as possible to ensure full use of the satellite link and limit wasted space. Using this technique, fading conditions no longer interrupt the transmission, nor result in the loss of video or data. In fading conditions the technology switches to more robust modulation and provides optimal availability, while setting priorities to enable mission critical services. As soon as fading conditions are back to normal it automatically switches back to maximum efficiency.

The kind of high data throughput required for ISR tasks are not optimized on a TDMA basis as is typical in a VSAT network. *Single Channel Per Carrier* (**SCPC**) is by far superior, operating in a point-to-multipoint network with feeds from different aircrafts being sent towards the hub.

MSM

What are the results when translating these technologies to real world practice and actual airborne ISR programs/missions

Koen Willems

In real-world use, Newtec technology—including the ***EL501 IP Satellite Hub***, ***EL470*** modems, ***FlexACM***® and *Cross-Layer-Optimization*™—has proven to increase the usable data rate by 30 to 50 percent on average, by converting the extra link margin.

The system is currently operational, supporting multiple aircraft. During testing and operation, the system has been successfully operated on multiple satellites, including ***Skynet 5A***, ***5C***, ***4E***, ***XTAR-EUR*** and ***XTAR-LANT***. Data rates from the aircraft to the ground terminal were maintained in excess of 10Mbps on each of these satellites, with ground-to-air data rates well above required levels, as well.

For more information, visit: **www.newtec.eu**

Manned aircraft readying for ISR mission

SDR-BASED SATCOM MONITORING

by Claus Vesterholt, Technical Program Manager, SATCOM, GateHouse A/S

This article offers an introduction to the challenges, opportunities and advantages associated with Satellite Communication (SATCOM) Monitoring, particularly in the perspective of the current state of *Software Defined Radio* (SDR) technology. Further, discussed will be the technological advances that enable 'plug-and-play' integration processes for RF-to-Ethernet components.

SATCOM Monitoring, as category, spans over many different applications. Across the diversity in application, a common denominator in systems development has been a range of technological, financial and competence-related barriers. Current SATCOM Monitoring solutions are expensive, proprietary, restricted in use, and costly to maintain and keep updated. They offer limited interoperability with other IT systems and, in general, they fail to match the present and future potential complexity of the monitored devices.

A key argument in this article is that SDR technology addresses the aforementioned, listed barriers by enabling a system architecture where the complete range of RF-challenges are handled by one *Commercial-Off-The-Shelf* (**COTS**) hardware module that integrates seamlessly into a *Software Communication Architecture* (**SCA**)-compliant hardware framework.

Presented is an argument that SDR technology paves the way for a new generation of '*plug-and-play*' SATCOM Monitoring solutions by offering the following advantages:

- **Easy integration of Radio Frequency (RF) technology without the costly overhead of RF-expertise, prototyping, test labs and development tools**
- **Deployment-ready, cost-effective RF hardware platforms are available from multiple vendors in the market**
- **Reduced time-to-market and development risks for new SATCOM analysis systems**
- **Versatile, multi-service, and in-the-field programmable SATCOM monitoring and acquisition systems—lightweight solutions fit for tactical use**
- **A high quality platform for testing and feasibility studies (lab tests)**

Challenges + Limitations

Current SATCOM Monitoring systems are caught in a deadlock of technological, financial and competence-related barriers. The challenges are three-fold:

#1—Custom-built RF technology

The interception of radio signals by special purpose *Radio Frequency* (**RF**) systems requires custom-built RF hardware. Unfortunately, normal user terminal equipment is not applicable in satellite interception solutions, generally due to the optimization in cost and applications. In addition, the requirements in the signals interception domain with regard to robustness, flexibility and signal quality cannot be fulfilled with standard electronic devices.

In-house development of RF electronics has always been a big and complex challenge, and subsequently the resulting products and solutions expensive and proprietary. RF electronics development requires years of domain expertise, expensive test lab facilities

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.

and sophisticated, accurately calibrated RF instruments, and CAD development tools. Even the integration of generally available RF components implies a complex design, implementation and test process. As a consequence, the development of special purpose RF technology is associated with long development cycles and expensive prototyping.

#2 – Satellite services

The development of complex radio signal acquisition systems implies decoding and interpretation of binary data and protocols according to the service and standard used. The satellite-based radio frequencies are occupied by hundreds of old and new communication services with different communication topologies and protocols. Few old systems can be intercepted and decoded with standard available IT tools—and all current communication services apply complicated access, error correction and service-dependent mechanisms that in reality prohibit full-service analysis with do-it-yourself protocol and monitoring software.

Satellite services are no longer fixed services. The dynamic nature of communication services that is well-known in the Internet-domain also influences the satellite services enabling new software-based features and applications, and the possibility to introduce software upgrades as new technology becomes available or users push for it. Considerable resources and SATCOM competencies are thus required not only to develop a protocol stack and application features

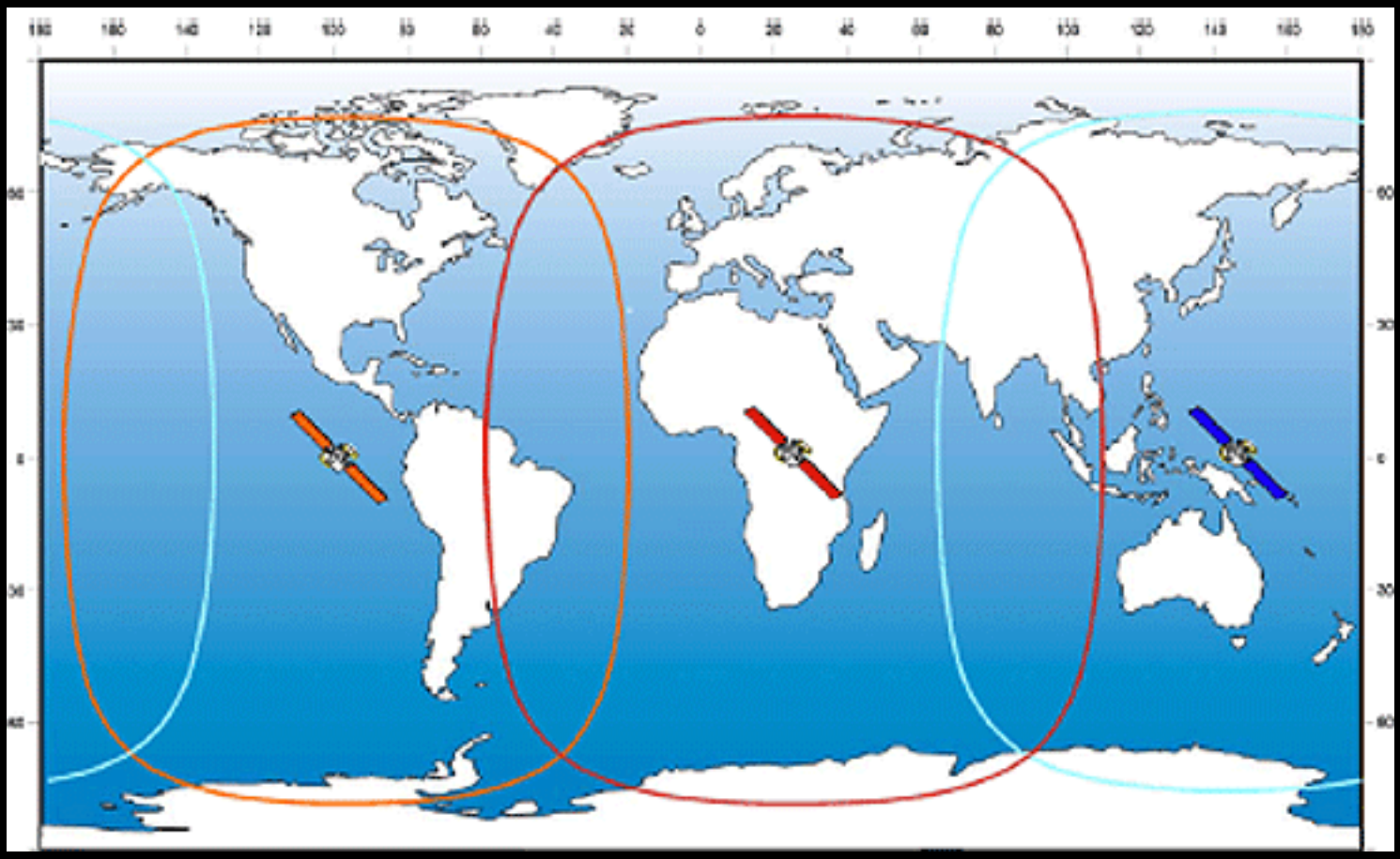


Figure 2. Inmarsat BGAN global coverage is conducted by three geostationary satellites (source: Inmarsat)

but also to maintain them as updates and changes in the satellite system(s) become available. This is pivotal for reliable and correct interpretation of critical information in a monitoring system.

#3 – IT integration

The integration of RF acquisition equipment into general information processing systems implies both integration of heterogeneous special-purpose electronics and the transformation of service-dependent data into standard protocols and storage formats for user data as well as meta data. Integration of RF front-ends in an interception scenario also involves selection and processing of individuals' communication transactions to enable user-friendly presentation and intelligence analysis as part of a larger monitoring operation. Obviously, an important part of the challenge is to make the integration seamless across satellite services.

In tactical scenarios, processing resources are scarce and relaying data to a central hub requires not only standard interfaces and protocols but also intelligent data mapping between systems, *i.e.,* accurate alignment of the interception process and objectives to the selection criteria, be it an individual, a terminal or a location. Effective monitoring coverage is only obtained if this information can be used real-time to (re-)configure the RF electronics.

In case the satellite topologies uses small spot beams, *e.g.,* **Inmarsat *BGAN*** and ***Thuraya***, a distributed monitoring set up with multiple connected receiving stations is required with radio interception equipment placed in the relevant spot beams. This represents a significant challenge in terms of achieving complete monitoring coverage.

Summarizing, providing a SATCOM Monitoring solution with receive-only operation and enhanced robustness, and which meets the demands of tomorrow, calls for alternatives to the current barriers (or excess of resources).

Critical Limitations

Today's SATCOM Monitoring solutions are mainly provided by a few satellite interception companies. However, the handling of different satellite services becomes an overwhelming challenge as new and complicated satellite services are launched—some in isolated regions of the world—and available solutions risk being insufficient and unable to meet the specific needs in certain markets.

Being based on existing, proprietary RF-platforms, these systems tend to miss even minimum requirements for interoperability. In other words, none of them cover the whole range of satellite services used, and they are not able to integrate with each other.

Developing monitoring capabilities in this domain is driven by new services and new user applications. As satellite service providers may want to change core parameters of their systems, satellite acquisition solutions need to be swiftly reprogrammable to cater for such changes. Existing solutions will allow updating and upgrading, but are often limited to the upper layers of the monitoring applications—all other modifications will need to be carried out as '*factory-upgrades*'.

In tactical scenarios, there may be a need for covering multiple satellite services on the same location. This is especially important if critical information is deliberately spread across multiple services, or if the satellite service of interest is unknown prior to initiating the analysis process.

The analysis of satellite services can have many purposes, and organisations interested in this field of activity possess different skills and experiences. However, a common denominator could be to break the current critical limitations and explore the possibility of:

- **A development platform enabling 'plug-and-play' reception of RF signals using standard software development tools**
- **A completely reprogrammable, lightweight solution fit for tactical use**
- **A high quality platform for complete testing and feasibility studies**

SDR Opportunities

The SDR technology is able to address quite a few of the issues mentioned above. SDR allows for a technical architecture where the complete range of RF-challenges is handled by one COTS hardware module that integrates seamlessly into a so called SCA-compliant hardware framework.

Satellite acquisition systems based on a 'plug-and-play' set up with well-defined, generic Application Programming Interfaces is thus no longer a distant future vision—it is reality now.

Not only will this dramatically reduce the RF barriers and technical risks for all organisations working with satellite analysis today, it will also facilitate cost-effective innovation projects and feasibility studies on satellite signals and satellite services.

Rapid prototyping is, by definition, a baseline benefit. However, in this case, differences between prototype and real deployment will not occur as the hardware, the interfaces and the modules are all completely identical.

One of the most important benefits that will actually grow over time is the synergy from using a standard framework for special-purpose systems. As multiple sources for software and hardware will become available at a reasonable cost, the flexibility of the platform will increase.

Being completely re-programmable from RF to software-API the analysis capabilities are in fact unlimited and can be supplied by third party vendors

or home-grown. This will enable special multi-purpose satellite analysers or in-the-field re-programmable receivers for tactical deployment.

SDR Technology

Over the last 30 years, radios have changed from mere 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 consequently 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 receiver to make the receiver perform as required to implement a particular communication standard. The term Waveform refers to the software that executes and controls 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 has decreased and performance has increased, enabling very high performance generic platforms.

The U.S. **Department of Defense** (**DoD**) has invested in SDR through the ***Joint Tactical Radio System*** (**JTRS**) program. The JTRS program has produced a number of SDR radios and waveforms as well as the SCA standard which specifies how radio platform and waveforms must be designed and implemented to ensure interoperability, and in particular that a SCA-compliant waveform can run on different radio platforms as long as they are SCA-compliant.

The GateHouse BGAN Waveform contains all the common functionality required to build a BGAN terminal and is therefore an essential building block for a SDR-based satellite monitoring system.

The BGAN Waveform is developed for SDRs and can be made compliant with the *SCA specification version 2.2.2*. This means that the waveform can run on generic SDR hardware conformant to the SCA specification. 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.

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 the software, leaving the underlying hardware generic and fit for other purposes as well.

In addition to giving 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.

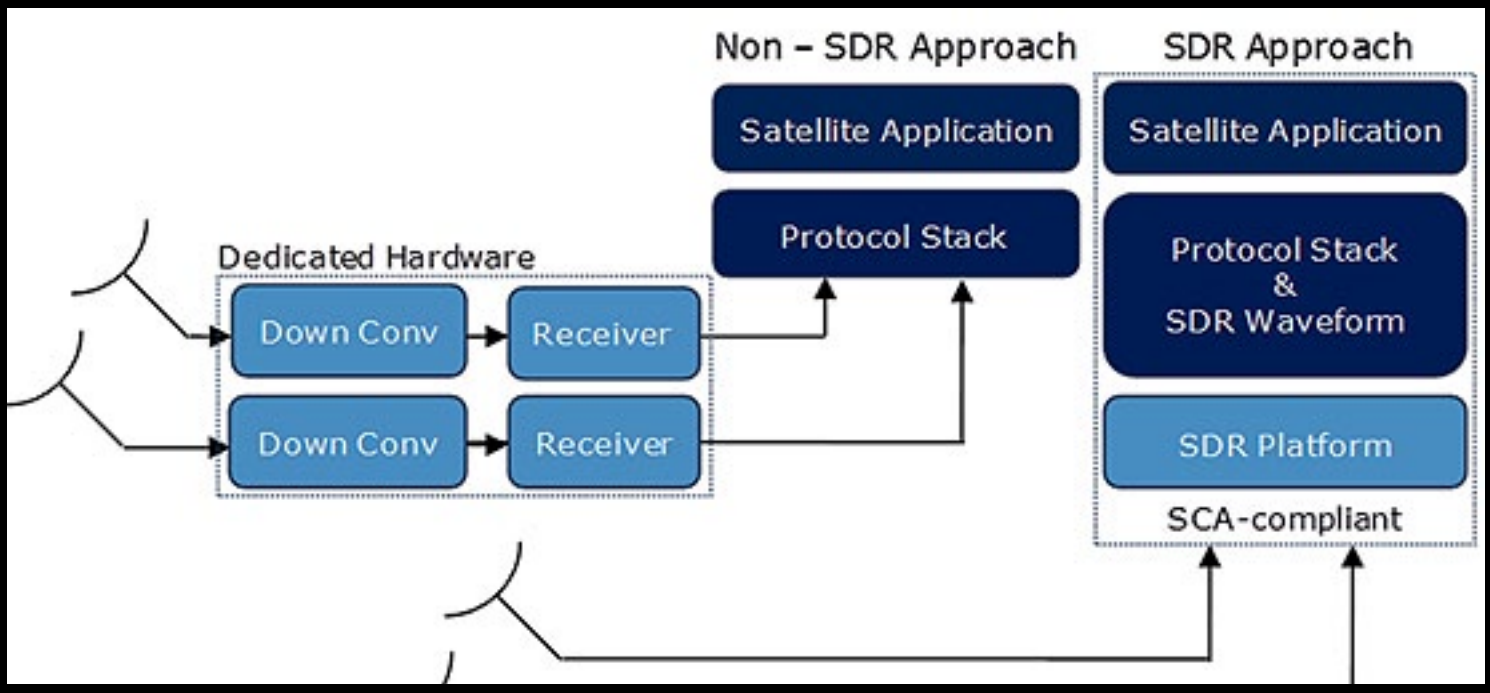


Figure 3. Dedicated, purpose specific hardware can be eliminated by using generic and flexible SDR hardware and software, moving functionality from hardware to software.

The basic components required to build a SATCOM Monitoring solution—all are COTS and software programmable.

Perspectives

There are numerous benefits for organizations already working with SATCOM Monitoring and for those considering activities in this area. A non-exhaustive list of perspectives, *i.e.,* the direct benefits, for different players, follows next.

For companies investing in end-to-end SATCOM Monitoring solutions:

- **Reduced initial cost due to standard hardware platforms**
- **Increased flexibility of real-life applications—scalability and expendability**
- **Supplier-independence**
- **Increased interoperability**

For organizations carrying out in-house technical development of SATCOM Monitoring capabilities:

- **Facilitate own internal development of SATCOM interception capabilities—either as supplement to commercially available solutions or as a direct replacement**
- **Conduct feasibility studies and use rapid prototyping to verify capabilities**
- **Additional waveforms will become available for standard platforms**

For non-SATCOM companies striving to penetrate this area and other organizations who wish to conduct feasibility studies and sand-box activities:

- Inexpensive RF-to-Ethernet reference modules
- Perform rapid prototyping to minimize risks and cut development time
- Develop new applications based on the capabilities 'out of the box'

Over and above the direct benefits for end-users and organizations the general perspective for the industry is a synergetic increase in availability of technology and waveforms:

- **Market growth will gradually encourage development of additional waveforms**
- **New combined solutions will be possible based on compatible satellite services**

For about 10 years, GateHouse has been involved in the satellite communications industry and has developed a range of satellite communications products and services for both governmental/military and commercial use.

More information at the Company website

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 18 years. He has been leading a number of programs and projects on the development of 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.

COMMAND CENTER: DREW MARKS, SPACECOM

Drew possesses more than 15 years of executive experience in sales, marketing and business development positions. He has worked in various industries and markets throughout the Americas, Europe, Asia and the Pacific regions. Drew is the Vice President of Sales, North America, for Spacecom.

MilsatMagazine (MSM)
Good day, Mr. Marks. Would you please tell our readers about your background and how you decided to forge your career within the MILSATCOM industry?

Drew Marks
I've been involved in international sales and marketing for the last 20 years. My background is in business development, working with integrators to develop security solutions specifically for the U.S. Department of Defense (**DoD**). A headhunter originally approached me about the job. While considering the position, I did some research on the military satellite communications industry. What I learned was that SATCOM was a highly intriguing field with tremendous future potential.

MSM
What led you to decide upon Spacecom as the most appropriate company for you to use your talents?

Drew Marks
Spacecom is a publicly traded company. Before joining the firm, I analyzed the company's situation and was amazed at what I found—a very small company with huge expansion plans. The company had a road map to launch five satellites within five years. When I joined Spacecom, we had fewer than 50 employees. Today, we have more than 75 in our employ and our revenue/employee ratio is quite high.

In the past couple of years, the company has transformed itself into a multi-regional satellite operator with a constellation at the **4 degrees West** "*hot spot*" covering Eastern and Central Europe and the Middle East, and the ***AMOS-5*** satellite at **17 degrees East**.

We're continuing our expansion path in coming years. We're scheduled to launch the ***AMOS-4*** satellite in 2013 to the **65 degrees East** orbital location. It will cover a variety of regions and have on board two Ku-band beams and one Ka-band beam. Our ***AMOS-6*** satellite will feature some new technologies and will be launched in 2015 to strengthen our 4 degrees West hot spot and add capacity for Western Europe.

Above: An artistic rendition of the AMOS-5 satellite

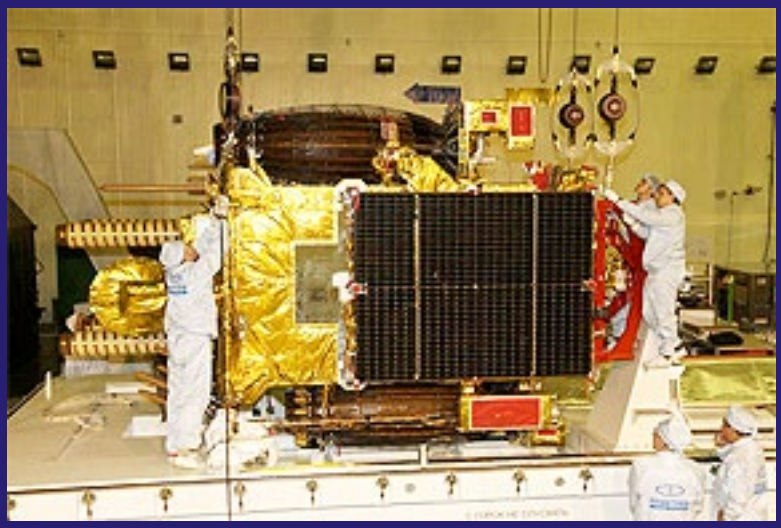
MSM
Given your role as the Vice President of Sales in North America, how much autonomy do you have when dealing with the parent company?

Drew Marks
Spacecom, as a general policy, decided to appoint vice presidents as the sales contacts for customers. The idea behind this is to offer the best and highest level of service to our loyal clients. Our customers are the most important asset we have. Having a vice president in charge allows issues to be addressed and resolved quickly. I've received many compliments from customers about the outstanding response they received from Spacecom.

MSM
What is Spacecom: A satellite operator or integrator for the U.S. government?

Drew Marks
Spacecom is a multi-regional satellite operator with three satellites in operation and another three in various stages of production and planning. We aren't an integrator—and we don't sell directly to the end user—U.S. government agencies. The company has decided to focus on what we do best—designing, financing and operating satellites, as well as selling bandwidth for a variety of applications via integrators. Our customers include teleports, service providers and integrators.

MSM
As you are the Vice President of U.S. Sales for an Israeli company, are you noticing any hesitancy for investment in Spacecom due to the world's political problems?



Spacecom's AMOS-6 under construction

Drew Marks
Not at all. I'm actually noticing the contrary. Israeli companies are highly respected due to the innovation factor. Worldwide companies realize that if they want to be at the forefront of technology, they should have contacts with innovative Israeli companies.

As for the U.S.-Israeli connection, we're probably one of the closest of U.S. allies. Spacecom, as a company, feels very comfortable in the U.S. I've never heard a remark from a customer about not wanting to use our satellites or services due to political reasons.

MSM
How do U.S. military and government firms or, for that matter, companies involved in the commercial environments, work with you to develop their projects?

Drew Marks
We don't work directly with any U.S. agencies; all work is done through an authorized integrator. Integrators are customers with whom we have a very good relationship. Essentially, they act as primes, and we serve as a sub-prime. For these contracts, we treat any information received very discreetly. Our technical teams work closely with military, government and commercial customers to find creative ways to fulfill the specific mission's need and any project assignments.

MSM
What are the implications of the U.S. withdrawal from Iraq on bandwidth requirements?

Drew Marks
Common practice in the past few years has been that the U.S. government would renew COMSAT service contracts and sometimes even expand them. Today, U.S. agencies are much more careful in using their resources. Following the budget cuts, the DoD is doing more re-bids and we are seeing less automatic renewals. With the withdrawal of troops from Iraq, bandwidth contracts are being reduced or even cancelled, and renewals are lapsing. Services that are related to troops on the ground are being cancelled, including the *Morale, Welfare & Recreation* program involving Internet cafés on base. The focus is now on the troops in Afghanistan.

MSM
What are the anticipated bandwidth requirements in Afghanistan before and following the downsizing of U.S. troops?

Drew Marks
A lot of services and new requirements are still coming out of Afghanistan. Although the U.S. government has decided to withdraw by 2014, we still anticipate a great deal of activity on the ground for troops. After

the withdrawal, we expect continued requirements from *Unmanned Aerial Vehicle* (**UAV**) and *Intelligence, and Surveillance and Reconnaissance* (**ISR**) activities, all of which requires SATCOM and bandwidth.

MSM

What are the current and potential future bandwidth trends from the new DoD requirements?

Drew Marks

The prime need for bandwidth is going to change from ground to air over the coming few years. DoD officials have told me that the future is, "*More wings, less boots*." We will see more UAV requirements for the region, more ISR missions and fewer troops being deployed. UAVs are effective, much less expensive to operate, relatively easy to activate, and they save human lives.

MSM

*How will the new bidding contract vehicles (**FCSA**) affect the markets?*

Drew Marks

After the wars started in Iraq and Afghanistan, there was a huge need for bandwidth in the region. This demand created a hike in prices, affecting not only Southwest Asia, but also the rest of the world. The U.S. government decided to create competition by opening the market. They approved more than 25 new authorized vendors to participate in the bidding process to bring prices down.

MSM

What do you believe will be the 'hot' regions and technologies for the U.S. government communication needs worldwide?

Drew Marks

I think that we'll continue to see activity and even new requirements from Southwest Asia through 2014 or early 2015. The U.S. government has also started to be more active in Africa, primarily in the Horn and western regions. The emerging hot spots seem to be Southeast Asia and the Pacific Rim.

MSM

How will the CS-2 contract release affect the market?

Drew Marks

CS-2 is a different contract vehicle with requirements that are much more complex, requiring end-to-end solutions. In this case, there's a need for sophisticated solutions that often require multiple satellites. These types of contracts will require professionals to offer creative ways to supply efficient communication services.

MSM

Given your work within the military and government environments, how do you see the role of hosted payloads addressing crucial MILSATCOM needs in the not-too-distant future?

Drew Marks

We've been hearing the words "*hosted payload*" from the government for quite some time now. It's clear to all that this is the correct route for the government to take. It's a win-win situation for government and industry alike. Industry receives a firm financial commitment in advance, and in return, the government has a clear-cut cost with a rigid timetable for delivery. Of course, discussions for this must be conducted years in advance because the process is very long. Unfortunately, only a few long-term deals have been made so far.

MSM

Will Spacecom's AMOS satellites be involved in such important missions?

Drew Marks

Yes, we're very interested in hosted payloads aboard our future satellites. We're also offering a "*hosted beam*" option to customers—a lighter version of the hosted payload for future satellites where beams are not locked in yet.

Our AMOS-4 satellite, which is scheduled to launch in 2013 to an orbital location of 65°E, has two Ku-beams and a Ka-beam on board. Since the beams are steerable and haven't been locked in yet, we're offering to lease the whole beam. The commitment needed would only be three to four transponders of 108MHz.

MSM

As you review your career, what projects have brought you the most satisfaction?

Drew Marks

For years, I've been promoting or working on projects for military applications and in war zone regions. The most satisfying project that I ever worked on successfully saved a lot of human lives. While I can't disclose the details of the project, it focused on Southwest Asia and brought me a great feeling of satisfaction.

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