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New "Satellite" Tested

Satellite radio and weather balloons appear to be the future of combat communications for Marines on the ground, in the air and at sea.

Marines with the 11th Marine Expeditionary Unit coordinated with the I Marine Expeditionary Force Science and Technology department to test out the Combat SkySat System at the 21 area parade deck at Camp Pendleton, California, on October 24th.

Retired Marine Stephen Heywood, Science and Technology coordinator with I MEF G-7, said the Combat SkySat System has been proven effective by the 26th and 13th MEUs which used them while deployed.

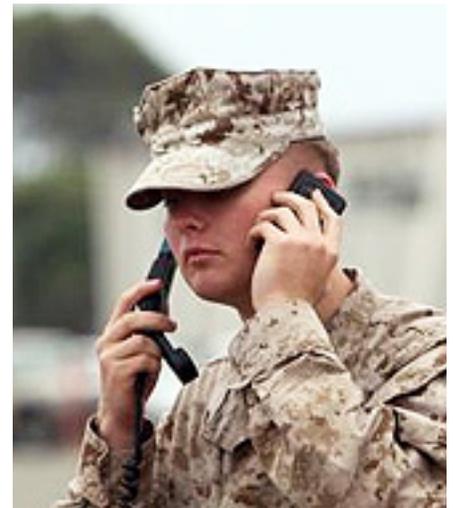
The 11th MEU is slated to use the technology for the first time to support expeditionary operations during an upcoming Western Pacific deployment.

"Our colonel will be able to talk to troops on the ground and Marines flying aircraft simultaneously," Brown said. "You can't do that with any

other form of long-distance communication. A rifleman on the ground can now have a (radio) in his magazine pouch, kick down doors and be able to talk back to a ship more than 500 miles away."

According to Heywood, in order for Marines to use airborne communications, they used to have to put a transmitter in a military aircraft. This technique required aircraft to maintain a specific position in the air in order to sustain capability, which diverted assets from other vital missions and made the aircraft vulnerable to attack.

The Combat SkySat System, priced at \$10,000 per payload, consists of a 2500 gallon helium-filled latex balloon, the Combat SkySat Mil-UHF FM repeater, antenna and portable launch and control system to monitor the position and coverage area.



Lance Cpl. Kenneth W. Klotz, field radio operator with the 11th Marine Expeditionary Unit, does a radio check to test out the new Combat SkySat System at the 21 area parade deck at Camp Pendleton. The 11th MEU is slated to use the technology for the first time to support expeditionary operations during an upcoming Western Pacific deployment.



A latex helium-filled weather balloon and radio transmitting component from the Combat SkySat System floats tethered above the 21 area parade deck. When launched into the air and sustained at 65,000 to 100,000 feet, the system covers a range of 460 to 700 miles.

When launched into the air and sustained at 65,000 to 100,000 feet, the system covers a range of 460 to 700 miles.

Two payloads can cover most of Afghanistan. Because the system is so compact, it can be launched on a ship or on shore. Marines use a tether, unlike similar free-floating systems, which allows them to retrieve the unit, perform maintenance, refill the balloon with helium, or charge the battery. Each system can stay air-borne for six to 12 hours and prevail against inclement weather.

"We can control how high we want it to go and how far we want it to cover," Brown said. "It's pretty cool." ❖

Story by Cpl. Jennifer Pirante

"Newtec has boosted our operational efficiency over satellite- we can now access more data at lower cost."

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Battle Space + Forward Operating Bases Linked

QALAT, Afghanistan — Forward operating bases and combat outposts exist in austere environments. Facilities and services are limited and missions are often crucial. Teams would remain isolated from their parent units if not for one support function — Communications.

Provincial Reconstruction Team Zabul, a forward deployed team tasked to mentor key leaders in rural Afghanistan, relies upon a small team of Communications experts to keep them connected to the rest of the battle space.

"Like right now," said U.S. Air Force Tech. Sgt. Tylan Goss, PRT Zabul operations non-commissioned officer in charge, as he answered a radio call from a unit on a mission. "They're about to blow an Improvised Explosive Device in place and I have to let everybody know."

Goss turned from his workstation in the PRT's Tactical Operations Center, used the FOB Giant Voice system, and announced, "Attention on the FOB, attention on the FOB, there will be a controlled detonation." Quickly and easily, important data from across the battle space was relayed from one geographically separated part of the team to another, all through the use of the PRT's communications tools.

"We bring capabilities to place conversations, intelligence and information assets from anywhere in the world into one room, even in unstable southern Afghanistan," said U.S. Air Force 1st Lt. Michael Palmore, Provincial Reconstruction Team Zabul communications officer. "We ... provide the real-time link from the policy and decision makers state-side to the war fighters on the



Staff Sgt. Joel Crowder, Provincial Reconstruction Team Zabul communications non-commissioned officer in charge, adjusts a Satellite Communication Antenna, Forward Operating Base Smart, Afghanistan, Oct. 18, 2011. PRT Zabul's Communications experts adjust and maintain equipment to ensure that the team remains connected to the rest of the battle space.

ground in Afghanistan."

The Communications team is comprised of a small group of service members from the U.S. Air Force and the U.S. Army National Guard. The diverse team works together to maintain the ties between PRT Zabul and the rest of the battle space, which is not without challenges.

"Not having easy access to additional parts needed, random power outages and the environment are big things," said U.S. Air Force Staff Sgt. Joel Crowder, PRT Zabul communications non-commissioned officer in charge.

"Being in a job where things need to be done yesterday can be very difficult because sometimes you get a need or mission critical thing that you may need to replace or add to one of the

FOBs and it may take anywhere from a couple of months, to almost your whole time here at the PRT to get that part in, sometimes not even then."

Despite the difficult acquisition process for resources and an environment seemingly built to break down technology, the team perseveres. The support required of PRT Zabul's Communications team means that they must overcome obstacles while also acting as subject matter experts in a variety of fields or the PRT mission will fail.

"We have to juggle and support anything from maintenance to being a technical advisor," said Crowder. "[We] provide communications support for radio, computer, Internet, and all kinds of

communications in vehicles, as well as for the Tactical Operations Center.”

The TOC represents the heartbeat of the PRT’s mission to bring stability to Zabul province through governance, reconstruction, and development. The coordination for every mission that the PRT conducts starts and ends at the TOC, but without communications support, none of it would be possible.

“We provide the communications capability for the TOC,” said U.S. Army Spc. Brianna Whaley, 422nd Expeditionary Signal Battalion information systems operator. “Our support helps them track missions

faster and improves their ability to talk to higher headquarters and other units, compared to previous wars. We make them able to do their job faster.”

In a warzone, situations can change quickly. The members of PRT Zabul rely on their TOC to be responsive to those changes in a timely manner, because sometimes a few minutes or seconds can determine mission success.

“Connectivity speeds up the communication process,” U.S. Air Force Senior Airman Jared Shavrnoch, PRT Zabul communications technician, said.

“People use it as a resource,

it’s a morale booster, and people cannot complete the mission without it.”

Communications experts at PRT Zabul maintain connectivity, despite challenging conditions, because they must.

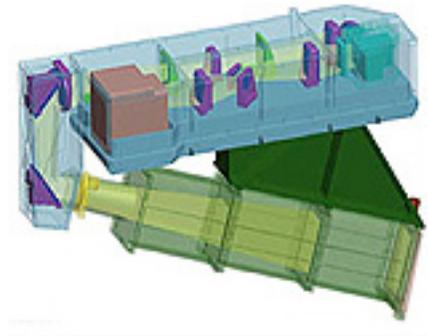
“It is a critical link that brings the world to our fingerprints, even at a remote FOB in south-central Asia,” Palmore said. ❖

*Story by
1st. Lieutenant Belna Marquez*

A MIGHTI Task

A Naval Research Laboratory instrument designed to study the Earth’s thermosphere is part of a future science mission that has been selected by NASA for evaluation for flight.

The NRL-developed Michelson Interferometer for Global High-resolution Thermospheric Imaging (MIGHTI) satellite instrument is part of the Ionospheric Connection Explorer (ICON) mission, led by Thomas Immel at the University of California, Berkeley. The ICON mission will fly instruments designed to understand the extreme variability in our Earth’s ionosphere, which can interfere with communications and geo-positioning signals. Ionospheres act as a boundary between planetary atmospheres and space, containing weakly ionized plasmas that are strongly coupled to their neutral atmospheres, but also influenced by the conditions in the space environment. They experience a constant tug-of-war between these external and



internal influences, and exhibit a remarkable set of non-linear behaviors. The unpredictable variability of the Earth’s ionosphere interferes with communications and geo-positioning signals and is a national concern. ICON makes a complete set of measurements of the state of the ionosphere and all of the critical drivers that affect it to understand this variability.

NRL’s MIGHTI instrument will contribute to reaching the mission goals by measuring the neutral winds and temperatures in the Earth’s low latitude

thermosphere. The MIGHTI instrument uses the DASH (Doppler Asymmetric Spatial Heterodyne spectroscopy) technique, which was co-invented and pioneered by NRL. The payload consists of two identical units that will observe the Earth’s thermosphere with perpendicular viewing directions. As ICON travels eastward and continuously images the thermosphere and ionosphere, MIGHTI will measure the vector components of the vertical wind profile. NRL’s MIGHTI is named for Albert Michelson, a physicist known for his research on the measurement of the speed of light using a related interferometer type. More directly, MIGHTI builds on technology previously used in NRL’s SHIMMER (Spatial Heterodyne Imager for Mesospheric Radicals), a payload aboard STPSat-1.

The ICON mission proposal, that NRL’s MIGHTI is a part of, is one of five proposals selected for Explorer Missions. ❖

Search + Rescue In Australia Packs IsatPhone Pro

Australian search and rescue teams are dropping emergency survival packs that contain an IsatPhone Pro handset to vessels in danger.

The Canberra-based Australian Maritime Safety Authority (AMSA) did exhaustive tests of IsatPhone Pro and other handsets before buying 11 from local supplier Safecity Services.

"The phones are loaded with 100 minutes of pre-paid talk time," explained Gary Stevens, AMSA search and rescue training and resources officer.

"Each of our tier one Aero-Rescue Dornier aircraft, based in Cairns, Brisbane, Melbourne, Perth and Darwin, have been issued with two handsets. They include them in emergency packs when asked to by the rescue coordination centre."



AMSA has so far supplied seven of the handsets in emergency packs for incidents involving stranded yachts — and also for motorists in the Australian outback who may have broken down.

"The IsatPhone Pro is programmed with several RCC numbers and is the preferred means of communicating with us if there is an extended rescue time

expected," said Gary.

Simple instructions are supplied with the phone, including how to deploy the antenna and receive incoming calls. They also show how to display the user's GPS position.

The handset is dropped inside a capsule, along with standard radio kit, food, water and first aid supplies.

"The phone is not locked, so survivors may call friends and family as well as the RCC. Due to the availability of our radios in the pack, only one of the phones has so far been used, but it worked and we feel this will become a permanent addition to our survival kits," explained Gary. ❖

Prestigious NOAA Award

Five members of United States Strategic Command and its Joint Functional Component Command for Space were a part of a ground-breaking team awarded the National Oceanic and Atmospheric Administration's Administrator Award in October.

The team established a method to provide critical space situational awareness and collision avoidance warnings to the agency's European meteorological counterpart. This vital partnership protects weather satellites from potential costly damage due to collisions, giving nations around

the world accurate and timely weather information.

Lt. Col. Guinevere Leeder, Maj. Duane Bird, Capt. Erin Dunagan, Capt. Amy Ianacone, and Jessica Tok, all of the U.S. Air Force, and Mark Mulholland of NOAA, were honored and presented with the Administrator's highest annual award.

"I am so proud of our people for their ground-breaking work in sharing emergency space situational awareness information to encourage the responsible use of space. The members of our team are highly trained professionals and when tasked with building this program from the ground up, they followed

through with great success," said Maj. Gen. Susan Desjardins, director of Policy and Plans, U.S. Strategic Command.

In 2009, the joint team from NOAA's National Environmental Satellite, Data, and Information Service and the members of United States Strategic Command began work to develop and implement policies and procedures to provide collision avoidance data to NOAA's European satellite partner using the website, www.space-track.org.

This website is the command's method for distributing space situational awareness information directly from JFCC SPACE's Joint Space Operations Center. Through

the website, a user can login and gain information about the United States satellite catalog and reentry predictions, among other information.

The Joint Space Operations Center also issues collision warning information directly to satellite owners and operators in emergency situations. If a warning message is received, an owner/operator has the ability to request more detailed information, called Conjunction Summary Messages, said Capt. Erin Dunagan.

With these messages, users can accurately assess the risk and decide whether or not to perform a satellite maneuver in order to avoid a costly collision.

U.S. Strategic Command is a global command charged with conducting space situational awareness operations to ensure the safety and viability of space assets, including detecting, tracking, and cataloging space debris.

Members of the command's JFCC SPACE work around the clock, employing ground-based radars and optical sensors to track over 22,000 space objects, some as small as 10 centimeters in diameter. JFCC SPACE provides emergency warnings to all entities and has Space Situational Awareness agreements with 28 commercial companies to share advanced information and protect space assets.

According to NASA's Orbital Debris program office, there has been a 40 percent increase

in the number of collision warnings since 2006.



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Through USSTRATCOM's space situational awareness mission, we analyze potential close approaches for approximately 1,100 active satellites. Together, we are able to minimize risk to vital satellites, which ultimately assists NOAA in delivering up-to-date weather information to countless users," Desjardins said.

Since the establishment of the new data sharing policies and procedures, NOAA's partner receives an average of one collision warning message per week from the Joint Space Operations Center for its geostationary and polar-orbiting weather satellites. The agencies work closely together from

initial warning until the time of the debris' closest approach. In April, the organization was able to maneuver a satellite and avoid a major collision based on warnings received. ❖

Needed: Input from U.S. Army's Space Soldiers

The Soldier 'signaliers' of the U.S. Army Space and Missile Defense Command/Army Forces Strategic Command got a special visit by the Army's Signal Corps senior enlisted leader, Command Sgt. Maj. Ron Pflieger, regimental command sergeant major, U.S. Army Signal Center of Excellence, Fort Gordon, Georgia, October 24-26.

Accompanying Pflieger was Command Sgt. Maj. Gerald Williams, 9th Signal Command (Army), U.S. Army Network Enterprise Technology Command, and Sgt. Maj. Nathaniel Hatchett from the 15th Regimental Signal

Brigade, Fort Gordon, Georgia. The visit, sponsored by the 1st Space Brigade, covered briefs and tours of the command's Directorate of Training and Doctrine and the 1st Space Brigade. The highlight of the visit came on Tuesday with a luncheon and meeting with Soldiers at the Peterson Club.

Pflieger has been on the job only 90 days, and is already making changes. "We are taking the Signal Corps in a different direction," he said. "When you look across at what the Army asks the Signal Corps to do right now, based on our strength, the way our equipment is laid out, and the way we are designed we can only



The U.S. Army's Signal Corps. Command Sgt. Maj. Ron Pflieger

support 34 percent of that requirement — in anybody's eyes that is a non-starter."

The answer, according to Pflieger, is micro-cyber, "Basically this is a re-look as to how we want to train, procure and use equipment. You have got to give us some feedback. We don't want to change the Signal Corps in a vacuum. We need ideas from you guys out there in the field."

Williams addressed the Soldiers by adding, "You, as Soldiers (signaliers), represent



every member of your regiment and you need to be the best damn Soldier that they have ever seen. I challenge each and every one of you not to 'drag your duffle bag' as you go through the required series of training and certifications in your field.

"The things you do in space impacts the freedoms that we share each and every day as American citizens.

"Our Army is downsizing — you all know that. But I will tell you your mission here in Army Space and Missile Defense Command is increasing tremendously. So never take light of what you bring to the table as an individual.

"Nothing that they do here in SMDC/ARSTRAT can be successful if they cannot connect to the network. They can talk about us, but they cannot talk without us. And you guys are the backbone to allow the mission of SMDC/ARSTRAT to be successful."

After the group departed on Wednesday Command Sgt. Maj. Marcus Campbell, 53rd Signal Battalion, reflected on the visit — "The Soldiers of this command are charged with an awesome responsibility."

"It was good to see the senior enlisted leadership of the Space and Missile Defense Command and the Signal Corps work together to enhance our

ability to train the Soldiers of the 1st Space Brigade." ❖

*Story by D.J. Montoya,
1st Space Brigade*



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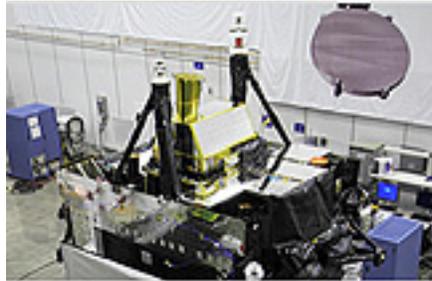
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Chipper CHIRP

The in-orbit testing has been completed...The U.S. Air Force has successfully completed initial on-orbit testing for the Commercially Hosted Infrared Payload. Initial on-orbit testing included the actions necessary to initialize the CHIRP payload and complete functional check out. The payload is performing nominally and providing valuable on-orbit performance data to guide development of future wide field-of-view infrared sensors and associated technology.

CHIRP is a technology maturation and risk reduction experiment to collect real-world wide field-of-view infrared data, investigate spacecraft-sensor interactions and sensor behavior in the space environment, explore operational issues relevant to these sensors, and evaluate long-term suitability of commercially hosted payloads. CHIRP technology provides continuous coverage within the field of view and allows for increased performance with a simplified design. Completing the initial on-orbit testing is the first step towards comparing the pre-launch predicted performance with actual on-orbit data. The 9.5 month demonstration period will collect data from a wide range of targets against a variety of backgrounds and seasonal conditions to gain real-world experience.



By offering hosted payload opportunities on board SES spacecraft, the U.S. Government is provided with consistent, dependable and affordable access to space. Photo courtesy of SES.

“This is an important first step for the Air Force,” says Col. Scott Beidleman, Space and Missile Systems Center’s Development Planning Director. “Now that the payload completed functional check out, the next step is calibration followed by execution of planned experiments. Analysis results will provide actionable information for acquisition decision makers. Also, given the path-finding nature of CHIRP, the Development Planning Directorate is gathering invaluable lessons learned on these technologies and commercial hosting.” ❖

DIRECTV Approach

Astrium has been selected by DIRECTV to design and manufacture DIRECTV 15, a new high-power telecommunications satellite to provide back-up capacity and fleet expansion for television services to U.S. customers in homes and businesses.

Based on ASTRIMUM’s highly reliable Eurostar E3000 platform, the new satellite, DIRECTV 15, will have a payload comprising 30 high power transponders in Ku-band, 24 transponders in Ka-band, 18 transponders in Reverse Band, and will be able to operate from up to five orbital locations from 99 degrees West to 119 degrees West, covering Continental U.S. (CONUS), Alaska, Hawaii and Puerto Rico. DIRECTV 15 is scheduled for launch in 2014. The spacecraft will have a launch mass of 6,300 kg, an electrical power of 16 kW and is designed to deliver more than 15 years of in-orbit operations. ❖



Astrium’s E3000 platform

Supplying A COTS Solution

One rarely thinks about the assets the U.S. Navy has tied up in non-combatant vessels...

Stratos Government Services Inc. (SGSI) and Segovia, Inc., wholly owned subsidiaries of Inmarsat plc, have been awarded an Indefinite Delivery/Indefinite Quantity contract by the Defense Information Technology Contracting Organization (DITCO) for the U.S. Navy Military Sealift Command's (MSC) Next Generation Wideband (NGW) commercial satellite communications (COMSATCOM) infrastructure and service.

MSC operates approximately 110 noncombatant civilian-crewed ships that replenish U.S. Navy ships, conduct specialized missions, strategically preposition combat cargo at sea around the world, and move military cargo and supplies used by deployed U.S. forces and coalition partners.

The contract, with a \$315 million ceiling price, replaces the MSC's Afloat Bandwidth Efficient Satellite Transport (BEST) COMSATCOM infrastructure. The eight-year period of performance includes a four-year base period plus four, one-year option periods. Performance will be at strategic locations worldwide.

To meet the requirements of the MSC contract, SGSI

and Segovia joined forces to develop a solution that



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Air Intelligence



SGSI and Segovia services create an IP communications pathway linking MSC ships and assets. [SGSI homepage](#)

supports a Commercial-Off-The-Shelf (COTS)-based NGW system. SGSI and Segovia services create an end-to-end IP communications pathway linking globally deployed MSC ships and assets. The pathway includes space-segment services, satellite infrastructure, shipboard terminal hardware, supporting software, and a terrestrial-backhaul infrastructure for redundant global connectivity. The SGSI/Segovia solution also includes worldwide installation and sustainment services for the MSC fleet.

"This award demonstrates the ability of SGSI and Segovia to effectively combine their considerable strengths to meet the complex communications requirements of one of the U.S. Government's most important organizations," said SGSI President and CEO Bob Roe.

"This network will improve the capabilities of MSC to support our troops by delivering supplies and conducting specialized missions across the world's oceans."

Segovia President and CEO Michael Wheeler added, "By leveraging the capabilities of both SGSI and Segovia, this solution ensures MSC will use the most advanced maritime-communications technology, supported by a global network of experts to manage deployment and provide ongoing support." ❖

U.S. Navy Military Sealift Command [infosite](#)

Hughes Network Systems, LLC has been awarded a contract to provide satellite communications for an airborne solution to be used by a U.S. government agency for in-flight intelligence, surveillance, and reconnaissance (ISR), including air segment, ground segment, and network management services.

"We are pleased to have the opportunity to provide airborne intelligence, surveillance, and reconnaissance for the U.S. government," said Rick Lober, vice president and general manager of Hughes Defense and Intelligence Systems Division. "Our HX System is ideal for airborne systems as it has the capability to transfer video, audio, and data in real-time. The HX System offers the most bandwidth efficient airborne solutions in the marketplace, providing our ISR customers significant savings in their operational requirements."

The Hughes airborne solution employs the advanced HX System, including the HX satellite Gateway, HX 200 satellite router and Expert Network Management System (ExpertNMS). ExpertNMS provides superior usability, featuring a highly intuitive and interactive interface with advanced diagnostics and network monitoring capabilities to optimize performance. ❖

Airborne Advantage

Gilat Satellite Networks' Wavestream® has introduced the AeroStream™ family of airborne-qualified, solid-state transceivers for integration into military and commercial airborne and unmanned satellite communication systems.

Included are compact Ku-band transceivers in 25W and 40W transmit output and full Ku-band receive options for pressurized and non-pressurized airborne environments.

AeroStream products are designed to meet the requirements of RTCA/DO-160G, Boeing, Airbus, and ARINC specifications for commercial aircraft, and MIL-STD requirements for military aircraft. Based on Wavestream's patented Spatial Power Advantage™ technology, AeroStream provides high output power with greater efficiency and reliability, all in more compact, lighter product package designs suitable for the extreme airborne environment.

The new AeroStream 25W and 40W Ku-band transceivers offer the necessary interfaces to work seamlessly with leading modems and Antenna Control Units, providing system integrators with a convenient turnkey solution. AeroStream Ku-band products are available for integration into airborne SATCOM antenna systems based

on customer-defined application requirements and speci-

fications. Ka-band support is planned for early 2012. ❖



RELIABILITY Wavestream solid state power amplifiers provide the reliability and efficiency required for extreme environments, comms-on-the-move, and fixed SATCOM applications. Our patented spatial power combining technology puts power and performance in compact, lightweight, rugged packages suitable for today's mobile antenna and flyaway systems. And with our no warm up "instant on" feature, Wavestream amplifiers conserve precious energy resources to help keep comms operational in any situation. Call Us.

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Flyaway Connections A Blue Force

New orders for the Company's antenna products have been flying in, and they're going to show off the reason why at an upcoming trade show...

C-COM Satellite Systems Inc. (TSXV: CMI) has recently received \$2,000,000 worth of new orders for its iNetVu® mobile antenna products from Russia, Europe and the Middle East. The orders from Russia are in addition to the \$1.5 million worth of orders announced in August. The iNetVu® mobile antennas will be used for emergency and disaster management as well as for security.

These new orders include the recently announced rapid deployable new generation advanced technology Airline Checkable and the Flyaway iNetVu® antenna systems. The majority of the revenue from these orders is expected to be booked in the 4th quarter of this fiscal year. C-COM is also now reporting the completion of delivery of the final balance of \$1,070,000 worth of iNetVu® mobile antennas to one of its Asian resellers. This contract (worth \$2.3 million) was announced last fiscal year, but due to customer requested delays, the order could not be finalized until now. ❖

tions Corp. (Nasdaq:CMTL) announced that its Maryland-based subsidiary, Comtech Mobile Datacom Corporation, received additional funding of \$11.7 million and \$0.5 million to support the U.S. Army's Blue Force Tracking ("BFT-1") Program and Movement Tracking System ("MTS") Program, respectively. Total orders received to-date under the \$384.0 million BFT-1 contract are \$357.8 million.

All of these orders, together with these related order funding increases, have now been finalized and provide for the continued supply of satellite bandwidth, satellite network operations, engineering services, program management and related professional support services to the U.S. Army for the MTS and BFT-1 Programs through December 31, 2011 and March 31, 2012, respectively.

The Company also announced that it continues to have ongoing discussions with the U.S. Army related to a potential multi-year sustainment contract to support the BFT-1 and MTS Programs. Fred Kornberg, President and Chief Executive Officer of Comtech Telecommunications Corp., said, "We are pleased to receive this additional funding to provide delivery of MTS and BFT-1 services by Comtech to the U.S. Army." ❖



X Marks The Spot

Government users will now be able to acquire X-band capacity in a far easier manner.

XTAR, LLC, the first U.S. commercial provider of services in the X-band frequency, announced that the company has been awarded a Future COMSATCOM Services Acquisition (FCSA) Schedule-70 Special Identification Number (SIN) for transponder services. The award gives XTAR's government users an additional option for acquiring commercially-available, high-speed X-band capacity. It also reinforces XTAR's ability to serve the government's varied mission requirements for both bandwidth-only and value-added solutions through its relationships with resellers.

The DISA/GSA FCSA transponder services SIN pertains to leasing short- and long-term satellite bandwidth. XTAR's SIN award covers a period of five years, with two five-year renewal options. The U.S. government has awarded several task orders for X-band to support the warfighter and anticipates the number and frequency of such task orders to increase under FCSA as demand for space segment increases. This demand is driven by applications requiring greater bandwidth, including Airborne Intelligence, Surveillance and Reconnaissance (AISR).

XTAR-EUR, located at 29 degrees East, entered service in April 2005. It carries 12, 100W wideband X-band transponders in both right- and



XTAR-EUR satellite, image courtesy of Space Systems/Loral

left-hand circular polarization. This extremely flexible payload makes it ideal for X-band services from Eastern Brazil and the Atlantic Ocean, across Europe, Africa, the Middle East, and South East Asia. The satellite covers a large geographic area with its two global beams, one fixed and four steerable beams that can be repointed within the satellite's coverage area. This flexibility, combined with coverage of Africa and North- and South America by XTAR's second payload, XTAR-



XTAR-LANT coverage map

LANT, adds tremendous capabilities for government and military users across most of the globe.

As the first commercial provider of services in the X-band frequency, XTAR is exclusively dedicated to serving the long-haul communications needs of U.S. and Allied military and government organizations. Its two owned and operated payloads provide 4 GB of X-band capacity from Denver east to Singapore. XTAR is committed to the success of all its customers based on providing a highly responsive commercial and operational experience designed to meet or exceed the unique mission requirements of governments around the world. ❖



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Falcon III® Takes Troops To The Tactical Edge

Harris Corporation has introduced the Falcon III® AN/PRC-152A, the first and only NSA Type-1 certified handheld radio to with the capability to send and receive voice, video, images and data—in the hands of the dismounted warfighter.



The AN/PRC-152A is a Type-1 certified handheld radio that includes high-bandwidth data services and narrowband legacy waveform support.



The introduction of the AN/PRC-152A will transform tactical communications through the expanded use of network-enabled missions in areas such as mission planning, intelligence gathering, force protection and checkpoint security. Harris began deliveries of the AN/PRC-152A after receiving Type-1 certification from the National Security Agency. The radio is the next generation of the widely deployed AN/PRC-152(C) handheld and addresses wideband communication requirements of teams operating at the tactical edge of the battlefield. The Falcon III wideband handheld serves as an interoperable companion to the Harris AN/PRC-117G multiband wideband manpack radio.

The AN/PRC-152A allows the U.S. Department of Defense to extend tactical networking across the entire battlefield and offers warfighters the broadest set of capabilities in a handheld radio.

In addition to wideband networking, initially provided by the Harris Adaptive Networking Wideband Waveform (ANW2), the AN/PRC-152A operates SINCGARS, VHF/UHF Line-of-Sight (VULOS), HaveQuick, IW for tactical satellite communications and other combat net radio waveforms. This makes the AN/PRC-152A the only wideband networking handheld radio that is also fully interoperable with deployed DoD radios.

Consistent with its investments under the JTRS Enterprise Business Model, Harris is in the process of adding the JTRS Soldier Radio Waveform (SRW) to the AN/PRC-152A. Developed by the Joint Tactical Radio System program, SRW is a key building block in the DoD's plans for a fully networked force. ❖

Support For Prowlers

The U.S. Navy has awarded ORBIT Communication Systems, Inc. (USA), a subsidiary of Orbit Technologies Ltd. (TASE: ORBI), a maintenance contract for Communication Management Systems (CMS) purchased from ORBIT between 2003 and 2010. ORBIT's fully digital Audio Intercommunication System (AIS) modules have been installed on the Navy's EA-6B Prowler electronic warfare aircraft since 2003. The maintenance contract covers repair and support of AIS equipment until the end of 2012.

ORBIT's Audio Intercommunication System (AIS) is a highly secure communication management system, integrating the routing and distribution of audio and data between the crew members and the recording systems. Supporting up to six users, eight radios, eight receivers, eight warnings and 16 discrete lines, the AIS is a modular COTS system, specifically designed to meet the requirements of applications in helicopters and mid-size crew aircraft, such as VIP, transportation, and medical evacuation.

ORBIT's Communication Management Systems (CMS) portfolio features flexible and robust systems used to manage the complex voice, video and data communication on board mobile platforms (airborne, seaborne and ground applications). These systems include a digital switch that seamlessly integrates the routing and distribution of inbound and outbound communication on board the mobile platform, as well as an intercom that can be used among crew members, maintenance personnel and technicians. ❖

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STEM Professionals Must Inspire Our Nation's Future

by Rear Adm. Patrick H. Brady, SPAWAR, + Carla Voorhees, Web Strategist, DoD Public Web



Rear Adm. Patrick H. Brady is Commander of the Space and Naval Warfare Systems Command (SPAWAR). SPAWAR is the Navy's Information Dominance Systems Command with the mission to make the Navy's Information Dominance vision a reality. He offers his thoughts in this article regarding the importance of STEM training.

Through the development, delivery and sustainment of warfare capabilities in the fields of intelligence, surveillance, and reconnaissance; cyber warfare; command and control; information and knowledge management; and meteorology and oceanography; SPAWAR provides the Navy and Navy partners Information Dominance capabilities necessary to accomplish their missions. Rear Adm. Brady was recently selected for the 2011 HENAAC (Hispanic Engineer National Achievement Awards Corporation) Engineer of the Year Award from the Great Minds in STEM organization.



Students from China's Harbin Engineering University perform in-water checks on their autonomous underwater vehicle (AUV) during the 14th annual International RoboSub Competition at Space and Naval Warfare Systems Center Pacific. The contest, co-sponsored by the U.S. Office of Naval Research and the Association for Unmanned Vehicle Systems International (AUVSI), challenges teams of student engineers to design AUVs to perform realistic missions in a simulated ocean environment. (U.S. Navy photo by Rick Naystatt/Released)

Each year, the Space and Naval Warfare Systems Command (SPAWAR) hosts the International RoboSub competition in our acoustic research pool in San Diego. The International RoboSub competition is sponsored by the Association for Unmanned Vehicle Systems International and the Office of Naval Research. This year I toured this very intense competition with my son and had an opportunity to see it through his eyes.

College teams from around the world test their autonomous underwater vehicles by running them through an underwater navigation course while accomplishing various demanding tasks along the way, like dropping a marker in a box or passing through different elevated gates.

The vehicles varied in size and complexity, from basic to very advanced, but one thing that was common was the excitement and enthusiasm of the participants as they prepared for their robot's turn in the pool.

The competition reinforced for me the value of science, technology, engineering and math (STEM) outreach. We're facing a real challenge in our country to produce the number of graduates with technical degrees we need to remain competitive in the coming years. Events like RoboSub are fun and inspire our kids.

The part I enjoyed the most was watching teams help each other through the technical challenges. It reminded me of how teamwork is so essential



Noah Olsman, a University of Southern California student, prepares his team's autonomous underwater vehicle (AUV), SeaBee III, for a practice run during the 14th annual International RoboSub Competition at Space and Naval Warfare Systems Center Pacific. The competition, co-sponsored by the Office of Naval Research and the Association for Unmanned Vehicle Systems International (AUVSI), challenges teams of student engineers to design AUVs to perform realistic missions in a simulated ocean environment. (U.S. Navy photo by Rick Naystatt/Released)

in science and engineering. Success in these fields is rarely a solo effort, but usually the result of a strong team working together to solve a problem.

Trying to convince your average teenagers they should pursue a STEM career field can be challenging. At the individual level, SPAWAR's STEM professionals make a real difference by getting out into our local schools and communities. STEM professionals need to inspire, mentor and be the role model for our nation's young people so they can see there are fun, challenging and rewarding careers waiting for those who put in the effort to excel with a STEM education.

If you're a student, STEM can be your ticket to success. If you're already working in the field, ask yourself, "How can I help the next generation succeed

and take over where I leave off?" Science and engineering is more than solving technical challenges, it's igniting that spark of innovation and discovery that has made our nation great. It is critical that we sow the seeds of STEM inspiration in order to secure our nation's future.

For more information about DOD STEM initiatives take a look at the following three resources:

Research & Engineering Enterprise: STEM
DOD STARBASE A Department of Defense Youth Program
Navy STEM2Stern

The STEM Education Coalition

This organization represents all sectors of the technological workforce, they support STEM programs for teachers and students at the U.S. Department of Education, the National Science Foundation, and other agencies that offer STEM related programs.

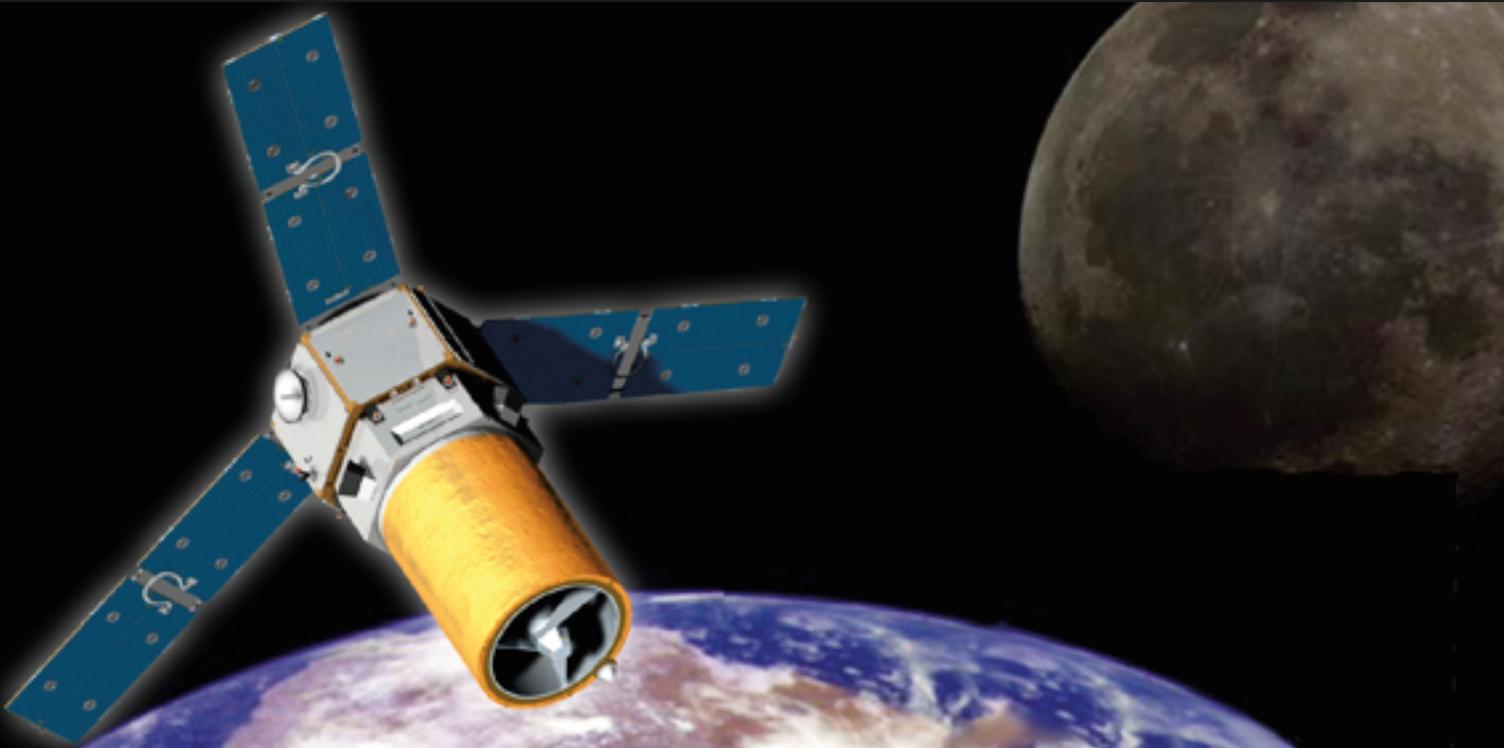
Their mission is to foster new and innovative policy initiatives designed to:

- *Encourage and inspire more of our best and brightest students, especially those from underrepresented or disadvantaged groups, to study in STEM fields*
- *Improve the content knowledge and professional skills of the PK-12 STEM*
- *Recruit and retain highly-skilled STEM teachers*
- *Improve the resources available in STEM environments;*
- *Encourage partnerships between state and local educators, colleges, universities, museums, science centers, STEM research and development organizations, and the business, science, and technology communities that will improve STEM education*
- *Encourage better coordination of efforts among federal agencies that provide STEM education programs.*
- *Build and maintain strong relationships with key Congressional and Administration policymakers and serve as a valued source of expertise to their staffs on STEM education issues.*
- *Provide a valuable source of information on STEM issues, programs, and initiatives.*

Jim Armor, V.P., ATK Spacecraft Systems & Services

by the Editors, MillsatMagazine

Jim Armor is Vice President, Strategy and Business Development for ATK Spacecraft Systems & Services, Beltsville, Maryland. He is responsible for producing and executing the market strategy for the small satellite, satellite thermal systems, and engineering services business lanes. Major General Armor retired from the U.S. Air Force in January of 2008, where his last position was as director of the National Security Space Office (NSSO) in the Office of the Under Secretary of the Air Force, Washington, D.C. He was responsible for coordinating all defense and intelligence space activities. Prior to the NSSO, he was Director, Signals Intelligence Systems Acquisition and Operations at the National Reconnaissance Office (NRO), Vice Commander of the Warner Robins Air Logistics Center at Robins Air Force Base, Georgia, and Program Director of the NAVSTAR Global Positioning System (GPS) at Los Angeles Air Force Base, California. He earlier served as a combat crew missile launch officer, a laser signal intelligence analyst, and a satellite launch system integrator. In addition, he was selected and qualified as a DoD Space Shuttle payload specialist, and was first to study information warfare while a research fellow at the National War College.



Jim Armor is also an associate fellow of AIAA and is on the Board of Advisors of the Secure World Foundation, a not for profit advocacy and think tank for sustainable space. He has been a member of several National Research Council Studies including the NASA Technology Roadmap Review; Rationale & Goals for U.S. Civil Space Program; and AF Scientific, Technical, Engineering and Math (STEM) Workforce Needs; and a reader for Defending Planet Earth: Near-Earth Object Surveys and Hazard Mitigation Strategies. ATK is an aerospace, defense and commercial products company with operations in 24 states, Puerto Rico and internationally with revenues of approximately \$4.8 billion.

MilsatMagazine (MSM)

Mr. Armor, having served as the director of the National Security Space Office (NSSO), and as a retired Major General in the U.S. Air Force, how did you accomplish the difficult task of moving from the military side of space activities into the commercial world? Was the transition somewhat of a challenge?

Jim Armor

Yes, it was and still is challenging. Having worked in government acquisition I was very familiar with the industry and procurement processes, and intellectually I understood the issues from



The ORS-1 launch aboard a Minotaur rocket

the industry's point of view. But living the industry role is different from watching it. The pace is relentless, more like combat than the measured pace of acquisition milestone reviews. Making sure you've squeezed the best possible value into your system design — cost, schedule, performance — is a 24-7 job, because you know several other capable companies are doing exactly the same thing.

I've found the competition to be invigorating. But then, on the next program, you may be partners with the same firm you were competing with the last time — fascinating.

Protecting information is also different. We all, as a matter of course, protect classified information and we're all affected by cyber hacking. However, the added layers of protection for intellectual property and proprietary information is a new skill set for me.

MSM

How did you select ATK as your new home once you had left the Air Force?

Jim Armor

I first, and foremost, wanted to stay in the space business. After I left the Air Force I did a couple of years of independent consulting and got a very good feel for the business trends and the options available in the space industry.

I selected ATK Spacecraft Systems & Services because they were doing what I thought were the right and important things for the future of space: Small satellites in novel roles and missions. The culture at ATK is creative and innovative, open to new systems and approaches.

Command Center

In addition to the small innovative satellite business, the larger ATK enterprise does the full range of space activities, from components, to launch, to engineering services for all agencies, manned and unmanned. I felt this was an ideal environment to contribute and grow.

Oh, yeah. I really liked the people here, too!

MSM

The military world is rather different than the commercial world... how have you assisted ATK in gaining the ears and attention of those in the government who are responsible for program development and product acquisition with so many firms clamoring for their voice to be heard?

Jim Armor

ATK already had a decent relationship with the government, especially NASA and some of the national security organizations both for disciplined engineering services, and satellite bus integration.

I joined ATK due to the Company's agile and innovative small satellite business in which I wanted to participate and felt I could make a contribution. I'd like to think many of my government associates noted my decision and perhaps paid a bit more attention to ATK, but you'd have to ask them about that.

ATK also has robust supplier relationships with major satellite manufacturers such as Space Systems/Loral, Boeing and Lockheed. Internal make-buy decisions by our industry customers in many ways are even more competitive than sales to the government. This was new to me — industry to industry relationships on subsystems and components — and I have learned a great deal that I should have known when I was in the government.



ORS-1 satellite bus, photo courtesy of ATK

I'm discovering that, above some minimum level of communication, it is delivering system performance that counts for future business. That's as it should be.

MSM

Please explain to our readers what your duties as the vice President of Strategy and Business Development are at ATK Spacecraft Systems and Services. What projects are you responsible for leading?

Jim Armor

Two aspects. On strategy, I'm responsible for laying out our firm's roadmap for growth in the space business. This includes which markets to pursue — civil, national security, commercial and international — how much and in which technologies to invest our IRAD funds, as well

as any mergers and acquisitions. This requires a great deal of research as well as active participation in global space industry activities to knowledgeably strategize about what it all means and where it is going.

Business development is basically engaging in conversations with our industry and government customers. What are their needs? What are the options and risks for addressing all or part of those needs? What capabilities are available in industry? What technologies can be developed? It's a back and forth discussion between the state of the need and the art of the possible. Once a customer has decided what she wants, then business development means we put together our best value proposal, and compete.

Fortunately, I love talking about space, so this is a great job for me. I hope my boss agrees.

MSM

Given the breadth of our industry and all of its ancillary components, what areas are of most concern to you regarding the space and satellite enterprises? How can these areas of concern be overcome, in your estimation?

Jim Armor

My biggest concern is the U.S. space industry's dependence on the government. There are several interrelated issues:

- » One, if the U.S. stops funding truly advanced technology and limits development of exquisite programs, such as manned and flagship space exploration programs and next generation reconnaissance systems, other nations will begin to catch up and pass the U.S. in space. It's not just funding — agencies are having difficulties finding and retaining qualified professionals even to do advanced space systems development. I can't even imagine the geopolitical and global military consequences of the U.S. not having preeminence in space.

- » Two, the current U.S. space organizations are geared to building and operating satellites, but the space industry is

mature and can build and operate without much oversight in many classes of standard satellites. In those cases, industry

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doesn't need detailed government regulations and oversight, which drives huge inefficiencies in cost and schedule. The government needs to transition its processes and organization towards purchasing space services, not satellites, for many standard functions. Imagery and communications are good examples. There are many other opportunities like navigation, space weather, space situational awareness, climate monitoring.

- » Three, current U.S. trade regulations, like ITAR, have devastated the U.S. space industry over the last decade. There are good signs that this is changing, but we can't relent — these rules must be changed and the U.S. government must change to a culture of active support for space systems exports. Otherwise, the U.S. space industry will be swamped by global innovation and competition.

The shrinking U.S. budget is aggravating all these issues.

MSM

The globalization of satellite launch capabilities is an obvious fact. How does ATK work with off-shore companies to ensure the Company has a role to play in the worldwide rocket engine, launch vehicle, and satellite markets? What challenges must be overcome?

Jim Armor

In my domain of satellite systems and components, it is very difficult to export due to both specific U.S. trade limitations on satellite systems and components (ITAR), and import barriers from other nations that have, or are developing, their own space manufacturing capabilities. That said, we are beginning to actively engage in global



The ViviSat Mission Extension Vehicle (MEV), image courtesy of ATK

opportunities. This administration has made some significant strides in relieving the trade restrictions, and has very actively supported some ATK space exports. It's still an uphill battle, but for the first time in both my Air Force and industry career, I have developed some optimism. I know U.S. industry can compete globally — if unleashed.

Many new developing countries recognize the importance of space and are trying to purchase capabilities and well as develop their technologies. There are opportunities for sales as well as building global industry strategic relationships that will be profitable for everyone.

MSM

You have served in a number of

positions in the U.S. Air Force, including that of a combat crew launch missile officer. The need for our industry to do all in its power to ensure the success and safety of our warfighters in opposing those that would harm our nation is crucial... how does ATK support such efforts?

Jim Armor

ATK supports some national security space programs, but the most visible and recent example is ORS-1 which directly supports the warfighter. It is tasked by CENTCOM to provide the "boots on the ground" in Afghanistan, Iraq, and other operations with the fast overhead imagery they need. We also provided the satellite bus for TACSAT-3 which is providing hyperspectral imagery to the military today.



ATK's UltraFlex Solar Array technology was selected by NASA as the technology of choice for its Man-rated Multi-Purpose Crew Vehicle serving the International Space Station and potentially other near-Earth missions.

We are, of course, quite proud of our participation in developing these capabilities and hope we can provide additional advanced elements in days to come.

I would also point out that commercial space systems are finding larger roles in military operations, such as for communications links that are used by UAVs actively in operational roles. ATK provides significant portions of the structure and components, like thermal control systems, propulsion, fuel tanks, solar arrays, and other mechanisms in most commercial and military COMSATS.

MSM

One area of concern for most space and SATCOM firms is that of trained personnel to fill the critical roles within their programs... there is now a realization that there is an ever-increasing dearth of candidates with the necessary skill sets to fill these positions. How can our industries become involved in helping today's students become more aware and amenable to STEM training in middle and high schools and at the college level? Does ATK support of have interest in any current STEM programs, or are there plans to do such?

Jim Armor

This is an enormous problem. I've been a member of major studies on STEM, including one by the National Research Council of the National Academies focused on STEM professionals in the Air Force, and I have also spoken at conferences on this crucial issue.

There's no silver bullet, and the current economic situation and manufacturing climate in the U.S. is not helping. The aerospace industry, I think, has begun to gain momentum

nationally by leveraging the major professional organizations, like AIAA, for STEM outreach programs at all levels of education, as well as by lobbying for increased levels

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Snow Shield Cover

The Snow Shield Cover is designed for antennas in size from 0.6 meters to 6.3-meters in diameter. The Snow Shield consists of PTFE coated GOR-TEX® material, which is virtually invisible to RF, stretched over the satellite antenna. The Snow Shield can be used as a passive, Ice Quake, or heat system that can be added for a higher level of protection.



Ice Quake System

The Ice Quake system (U.S. patent pending) enhances the reliability of the Snow Shield. The Ice Quake System also acts as a Rain Shield to prevent water from sheeting on the antenna reflective surface causing rain fade on a Ku or Ka band antennas.



De-Ice System

The original de-icing system includes a behind the antenna plenum (enclosure) which is heated with hot air from either liquid propane, natural gas or electric heating units. These systems are for antennas ranging in size from 5.0-meter to 32-meters in diameter. This is the original de-icing system originated over 30 years ago.

An Ice Quake can De-Ice a 6.3 meter antenna with only 200 watts of power, a 4.5 meter antenna with only 100 watts of power and a 2.4 meter antenna with only 50 watts of power!



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ATK and NASA's successful ground test of the second, five-segment, solid rocket motor, furthering the design of a new rocket motor for use in America's future heavy lift launch vehicles.

of RDT&E funds across all the government agencies that will attract young engineers into new projects.

ATK is trying to hire technically trained personnel but it is extremely difficult; we're finding ourselves competing for a dishearteningly small pool of experienced aerospace engineers.

ATK has a relationship with next-door University of Maryland for facilities and research, and some student study projects and employment.

MSM

An additional concern is the safety of citizens and the health of our military and commercial satellites due to the hazards of near-Earth objects and "space junk". How do you see mitigation of this growing threat to military and commercial spatial resources being handled? Is ATK working with other agencies to offer assistance with such strategies?

Jim Armor

The first step is to properly characterize the debris problem. I know Space Command, the Consolidated Space Operations Center (CSPOC), is making strides in space situational

awareness, but far more is needed with both space and ground-based sensors, and just as importantly, analysis of the data on the ground. The commercial satellite industry has established the Space Data Association (SDA) which shares orbital data among the commercial operators and with the CSPOC, and has processes for "conjunction analysis" to avoid collisions. There are many proposed techniques for mitigating the buildup of space debris. Like many innovators in industry, ATK has offered some debris mitigation systems for consideration to the government, including a system that "sweeps" small debris — less than 1cm — out of heavily trafficked orbits. However, in the first instance, it's probably most important to have policies that limit debris in the first place. ATK complies with international debris limitation standards in all systems we build.

MSM

Looking forward over the next year or two, what can we expect to see from ATK? And what are your opinions as to trends to watch for in this industry?

Jim Armor

Three trends I'm watching. One is the commoditization of the small satellites. There are more and more firms capable of building small, utility satellite buses and missions. More and more countries are investing in developing domestic capabilities. Furthermore, technology advances are enabling more compact sensors and other payloads, further shrinking the size of the bus needed. All of these technologies are brought into play to limit the cost to orbit, as the launch itself remains the significant cost factor. You can see this in wider initiatives on hosted payloads and ride-sharing as well. Staying ahead of this commoditization requires a continuous flow of innovation and cost control while maintaining quality. ATK is successfully competing with successes such as ORS-1 and TACSAT-3, but the competition is inexorable.

Second is satellite servicing, an exciting new area which is maturing in both government



The MEV about to dock with a satellite for refueling purposes.

and commercial environments. ATK has a strong legacy in satellite servicing, having provided award-winning support and astronaut tools for all the Hubble Space Telescope repair missions and tools for the International Space Station (ISS). We are currently supporting the Robotic Refueling Mission (RRM) on the ISS. ATK has, by investing in robotics technologies and related ground simulation and test capabilities, positioned itself to support U.S. government on-orbit servicing programs, but has initiated a line of commercial vehicles for satellite servicing as well. Simple life extension service is now reaching a price point that is attractive to commercial COMSAT operators who are doing cost trades for replacement satellites. We, with our partner U.S. Space LLC, are very confident that our ViviSat Mission Extension Vehicle (MEV) satellites will be providing life extension services to GEO belt operators by 2015.

The third trend is the way the U.S. Government acquires space capabilities. Except for the very high end, exquisite satellites, they are slowly but surely looking at commercial fee-for-service approaches, rather than building and operating space systems themselves. This is a difficult transition for them as existing space organizations — the Air Force, NRO, and NASA — are specifically organized to develop and operate space systems. It's now the users of space data, such as NGA, NOAA, DISA, and combatant commands, that must learn how to purchase space services, something relatively new to them. Transition to commercial business practices for imagery

and satellite communications, is leading the way for other missions. In example, ATK is offering a commercial fee for service options to NGA for radar imagery and to NOAA for solar weather data.

MSM

Lastly, Mr. Armor, as you look over your career both in the military and commercial world, what are two of the projects that bring a true sense of satisfaction to you...?

Jim Armor

As the GPS Director, I was able to help in the migration of the system from a critical military system to a global utility. Helping evolve the military's growing dependence on GPS with new user equipment and a robust new signal structure was fundamentally important; but helping address the policy and performance needs of the huge variety of global communities that had growing reliance on GPS — precision farming, scientists' use for time transfer,

cell phones location for 911 calls, money transfer in banking and commerce, power grids, and many, many more — was exhilarating.

Later, as the Director of Signals Intelligence (SIGINT) at the National Reconnaissance Office (NRO) directly after the 911 attack, I was able to collaborate with the rest of the intelligence community and the military deployed in theater to contribute directly to combat operations in tremendously innovative ways. I couldn't have been more proud of the people and missions I had the honor to lead.

Now, here at ATK, helping to break into new space markets — responsive small satellites, and on-orbit satellite servicing — in extremely competitive global markets is exciting and bracing in a completely different way than my military roles. I'm very much enjoying learning how to succeed in industry. ❖

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Digital Video Off Boresight

by Dan Makinster and George Mancuso, Agile Communication Systems, + Dr. Yendo Hu, Sculpture Networks

Video is pervasive in consumer and military applications and the video requirements are constrained by both similar, and different, factors. The need to deliver consumer video to a large audience is primarily governed by available bandwidth. The military and other government agencies, although working with a smaller audience, are also restricted by bandwidth. In addition, they also have a need to deliver video in real-time.

Due to bandwidth limitations, transmission of uncompressed video to even moderate size audiences would make distribution impractical. Encoding systems are therefore employed to compress video to manageable data rates. As illustrated in Figure 1, a typical encoding process introduces picture delay, which provides a false indication to the observer of target location that can adversely affect mission objectives. Moreover, picture delay increases the difficulty of tracking objects, especially when magnification is required and, or, targets are moving at moderate velocities. New techniques are, however, available which can greatly minimize encoding system delay.

Video encoding systems normally specify picture delay in terms of latency measured from the input of the video encoder to the output of the decoder. Mission critical video systems are required to have a low delay to maintain situational awareness; that is, what is being viewed has not changed since the image was initially captured. Using current video encoding technology, latencies in the order of 100 to 500ms are achieved at the expense of transmitting the signal at high rates (20 Mbits/s or greater).

Alternate design approaches exist to achieve low latencies at reduced transmission rates, but they result in the inability to handle motion without an accompanying distortion in the form of picture macro blocking or other picture artifacts.

The technology presented herein is based on a combined High Definition (HD) encoder / decoding system delay of 30 ms at a transmission data rate of 5 Mbps.

Video Encoding System

A video encoder system represents the video source (picture) material by a model that is a close reproduction of the original. The model construct reduces redundancies in the original source thereby allowing transmission in a compressed format. A decoder deconstructs the model into a near original format.

Video compression is necessary to limit transmission bandwidth since the source signals run at high data rates. For HD, the input source data rate is 1.5 Gbits/s (109) whereas the encoder output may be 10 Mbits/s (106), resulting in a compression factor of 150:1.

Digital Video Encoder

An aircraft moving through a clear sky can visualize redundancies. The video source is represented by a series of picture frames, each showing the aircraft in a unique position

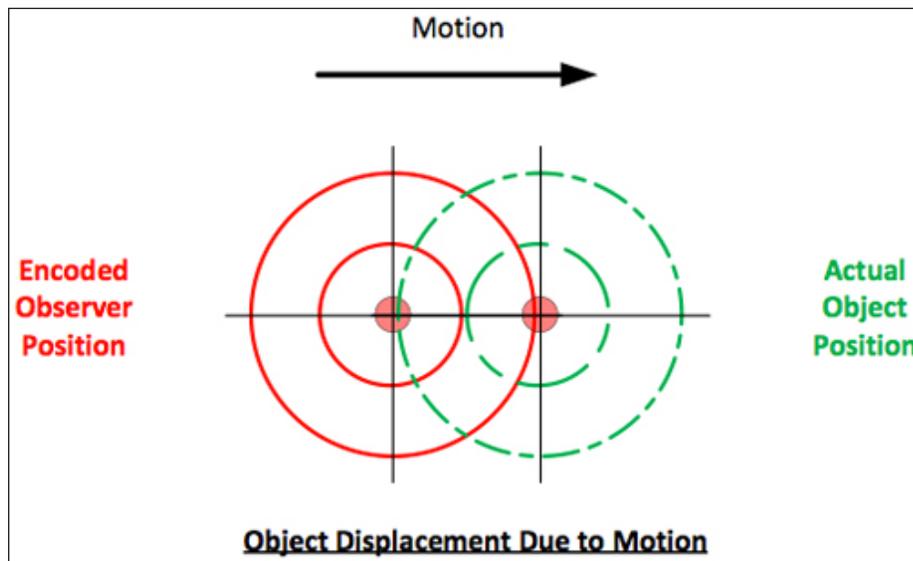


Figure 1

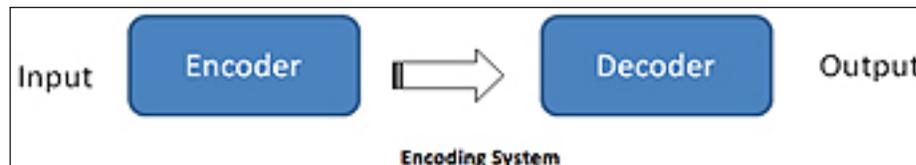
with the background remaining unchanged. For this example, the majority of the video sequence is static. Consequently, the background needs to be transmitted only once, overlaid by the aircraft movement in steps correlated to each video frame. Other statistical and human visual redundancies also exist which are eliminated in the transmitted video sequence, further reducing bandwidth, but are re-assimilated during the decode process.

Two of the primary factors contributing video quality are source material complexity and latency. To maintain video quality as complexity increases, a higher transmission bandwidth is required. MPEG-4 has an improved algorithm that allows for a reduction in bandwidth for material of similar complexity as compared to the bandwidth required when using MPEG-2. Standard techniques for reducing latency consist of limiting

the bits transmitted or running the encoder at higher data rates to rapidly clear buffers. Reducing the bit rate impairs video quality and is used for motion-limited applications. Running at higher data rates mandates a greater bandwidth.

Video Compression Background

Video compression technology continues to advance as the theoretical framework improves. Video compression research started as early as the 1960s, but the first commercially viable standard did not appear until the early 1990s. The specific classes of techniques supporting these standards form the basis of the modern day video compression evolution framework. To date, the compression standards community has introduced several significant evolutionary standards, including MPEG-2 and MPEG-4, Part 10 (H.264). The requirements within the transmission community will



continue to change, pressing the need for better compression and improved performance.

The video transmission space addresses the needs of a diverse set of markets, including the broadcast, surveillance, Internet, government and teleconferencing segments. Within each of the markets, the deployment scenarios further broaden the scope of applications video compression can address. The compression requirements to address the needs of this area vary significantly as the application and the deployment setups change. In general, though, the differences between the compression needs are listed next:

- » Bandwidth Gain
- » Distortion artifact types
- » Stream robustness
- » Compression delay
- » Compression complexity
- » Footprint
- » Power
- » Flexibility

The reality is, depending on the requirements, the implementation approach and the resulting performance associated with

each of the category can be drastically different. Furthermore, most of the listed requirements are inversely correlated with each other, resulting in the constant battle to balance the tradeoffs between the various parameters. A prime example: Bandwidth gain, stream robustness, and compression delay work in opposite directions.

General Digital Video Encoding System

The video encoder block diagram illustrates the techniques used to compress source video into a form that can be decoded with an appropriate device.

The temporal block (inter encoding) reduces time dependent redundancies by exploiting similarities between neighboring video frames (stored) by constructing a prediction of the current frame. A prediction is then formed from one or more previous or future frames. The output of the temporal block is a residual frame and a set of motion vectors (used to predict position). The spatial block (intra encoding) makes use of similarities within the frame to reduce spatial redundancies.

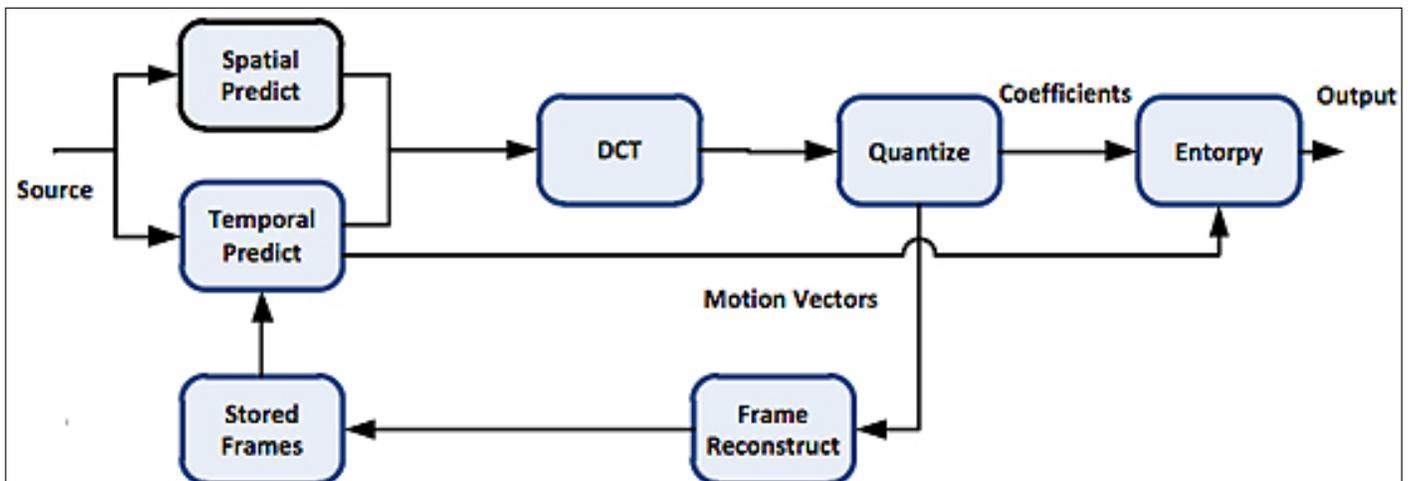


Digital Video Encoder

The Discrete Cosine Transform (DCT) transforms spatial and temporal information into the frequency domain. The resultant DCT coefficients are quantized and coded. Quantizing reduces the number coefficient bits and also gives preference to those based on human perception. Coding is also performed so that redundant coefficients are processed once to reduce data.

The coefficients and motion vectors of the temporal and spatial blocks are further compressed by the entropy encoder to eliminate statistical redundancy.

The output of the encoder is a compressed digital packetized bit stream including motion vectors, residual coefficients, and f5. The compression process represents the video source



Video Encoder Block Diagram

by a Group of Pictures (GOP). A generic GOP consists of I-, B- and P-frames. Other more advanced types of frames also exist. Intra I-frames represent a fixed spatial image, which is independent of other picture types. Each GOP begins with an I-frame. Predictive P-frames contain motion compensated difference information from the preceding I- or P-frame. The Bi Directional B-frame contains difference information from the preceding and following I- or P-frame within a GOP. The video compression process results in loss of information. P- and B-frames accumulate loss and I frames are inserted to limit loss by refreshing the GOP. I-frames, however, contain the largest amount of information requiring the most bits to be transmitted.

From a compression perspective, the Bi-directional frames will achieve the highest degree of compression efficiency, given the fact they can predict from both from the future and the past. However, from a latency perspective, B-frames are detrimental as they required the storage of future frames. For an implementation where only I- and P-frames exists, the theoretical minimum delay is less than 1ms for a 1080p video at 30fps — for a configuration given in the diagram, the minimum theoretical delay is two frames, 66ms. Thus, for low delay applications, Bi-directional encoding is typically not used.

Low Latency Encoding Architecture

Low latency entirely goes against compression efficiency for a simple fact:

Low Latency Limits Complexity Distribution over Time

Due to this fundamental limitation, the approach to designs targeting for low delay are fundamentally different from the traditional video encoder

system designs. A video encoding architecture created by Sculpture Networks Inc. was built from the ground up, specifically intended for the low delay mission critical requirements. In conjunction with this platform, Sculpture Networks has developed a tightly coupled compression pre-processing, mode decision, and rate control management package to realize the full potential of this platform, achieving the best-of-breed low delay encoding.

The Sculpture Networks compression engine is built with two-pass architecture and a preprocessing engine. For low delay benefit, the engine is built with a top down pipeline architecture for extremely low delay throughput.

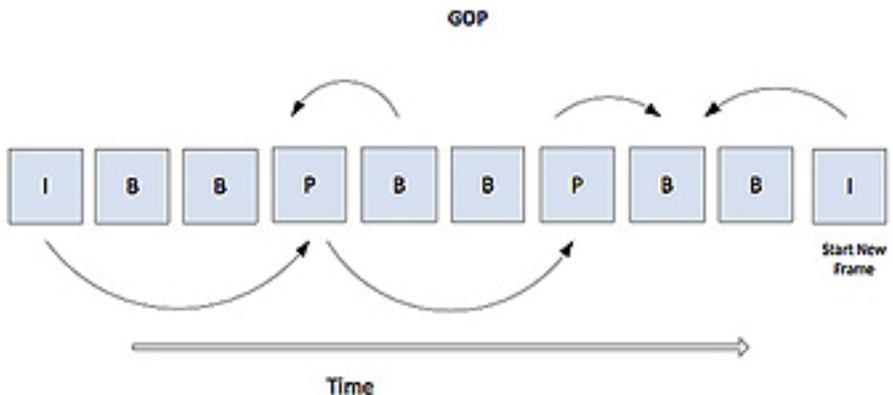
The first pass compression analysis engine carries out full frame analysis of the pixel complexity, both in the temporal and the spatial domains. This complexity data is then distributed to both the Rate Control and the Mode Decision engine as inputs to the decision making process. Look-ahead visibility introduces a significant advantage to the compression control process. With this knowledge, the engine can better determine the appropriate compression levels and the compression modes for the best distribution

of information. The first pass awareness directly benefits the rate control engine to tightly manage the decoder buffers, so that minimum delay is maintained without unexpected underflows or overflows. Underflow and overflows translates to hesitation in rendering, which forces unnecessary frame delays.

The Compression Distortion matching engine follows an advanced proprietary algorithm capable of reducing the distortion differences between the different compression methods, specifically, the distortion artifacts between intra encoding and inter encoding. The low compression efficiency inherent in intra-encoding is then distributed across the inter-encoding frames to balance the load.

The compression inefficiency due to intra encoding is distributed across a row of inter-encoding period. This method effectively removes the need to introduce a large decoder buffer, which is typically required to store the large I-frames. As a result, a much tighter delay can be achieved.

The forced mixing of intra- and inter-encoding methods within the same frame does result in a fundamental issue: The distortion differences between intra- and inter-encoding introduce a difference in the noise, which is



Group of Pictures (GOP)

perceivable by the human eye. Through subjective tests, even with the same PSNR (figure of merit for video quality), a direct correlation between the intra coded regions verse inter coded regions will result in a visible shading effect at the intra-/inter-encoding boundaries.

Through Sculpture Networks' technology, the encoder is able to correlate the distortions between the two and minimize the perceived noise differences between the two encoding methods.

The Sculpture Networks' engine carries out the delicate balancing act so to achieve the best compression quality without the cost of delay and robustness. The rate control and mode decision algorithms are implemented in hardware, with real time rate control and mode decision compensation at the macroblock level.

In meeting the sub-frame delay capability, the decoder buffer model is updated at the macroblock level. To balance the compression efficiency verses recovery robustness, the encoding engine utilizes a dynamic refresh mode decision algorithm that maintains refresh capability with minimal compression inefficiencies and delay impact. Through dual pass pixel analysis, transform domain data collection, pre-processing, and encoding

distortion processing, the low delay encoding platform is able to optimize the trade offs between compression effectiveness, delay, and the perceived distortion.

Summary

Real time video encoding is often required for mission critical applications. Current low delay video encoding systems reduce latency either at the expense of bandwidth or video quality. The encoding technology presented herein, supports high quality HD video having a delay of 66 ms or less, at one-quarter the rate achieved by a traditional compression approach. ❖

About the authors

Mr. Dan Makinster Is the President of Agile Communication Systems (ACS). As a Communication Systems Engineer, Mr. Makinster has developed advanced communication systems for the Banking, Broadcast and Military markets for the past 30 years.

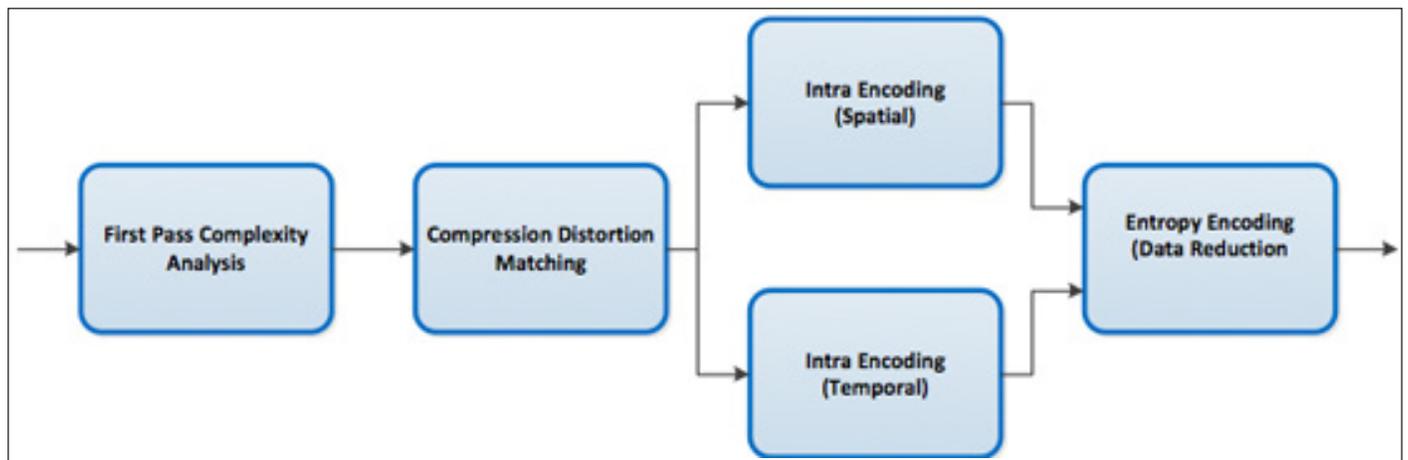
Mr. George Mancuso serves as Manager of Strategic Accounts for Agile Communication Systems (ACS). He is building on the current success of ACS as it continues to expand the Company's presence within the video, satellite communications and military markets.

Dr. Yendo Hu is a founder of Sculpture Networks, a company that specializes in the content of multi-media transmission space. He has introduced breakthrough technical advances in compression, aggregation, and transmission for both wired and wireless networks.

About Agile Communication Systems

Agile Communications, Inc. is a dedicated group of engineers with hands-on experience in the architecture and design of large scale networks and applications for harsh environments. The Company has expanded to include industry experts in Modeling & Simulation as well as Software Development.

Agile offers an organization with hands-on experience in large-scale systems and "system of systems" deployment — experience runs from design and modeling to testing and analysis in mobile, distributed, and harsh environments, applying this expertise to legacy and next generation systems of all sizes. Our knowledge of, and experience with, all forms of terrestrial and satellite communications technologies and their users gives us a broad view, and allows us to keep our customers informed



Low Latency / Delay Compression Block Diagram

and away from developmental dead ends. Agile maintains a robust Research & Development team – uncommon for a small business. Our NetRAT™ suite of automated network test and analysis software and hardware is becoming a standard for evaluating modern wireless network communications.

About Sculpture Networks

Sculpture Networks Inc. (SN) is an advanced compression technology company, developing the next generation compression architecture capable of low delay, low bandwidth HD transmission at the lowest possible cost. SN is positioned to introduce the next generation compression implementations that are capable of reducing transmission and storage bandwidth by half. The SN leadership consists of an exceptional team of industry veterans in video compression and ASIC implementations, and software experts to build the next generation FPGA and software based engine core that is protected by a strong IP portfolio. SN is currently positioned to complete the integration effort, targeting the compression transmission industry with a next generation engine, achieve low delay at 50 percent the bandwidth. It is expected that this SN implementation will

address specific needs within the transmission market including the broadcast, teleconferencing and defense industries. SN

expects to further the algorithms and implementations to address all compression applications.



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Vibrations Tailored For Every Purpose

by Noel Brown, Brüel & Kjær

Hailing from the longest standing company in sound and vibration, Noel Brown spells out the details of the many kinds of vibro-acoustic testing that are necessary to launch reliable satellites. Since 1943, when Brüel & Kjær launched the world's first charge accelerometer and entered the world of vibration measurement, the company has been supplying a diverse range of integrated solutions. For the space industry particularly, Brüel & Kjær has been helping with complex test analysis requirements for more than four decades.



A launch vehicle leaves with the flight model as its payload after thorough acceptance testing, as opposed to the structural model satellite, which has been through the more demanding qualification testing.

Satellite vibration testing requires a range of solutions that provide a repeatable and controlled way of introducing a satellite to a simulated real-life testing regime. Launch vibration and shock levels can be reproduced using electrodynamic shaker systems and acoustic chambers that test combinations of temperature, pressure and mechanical stress in a myriad of different combinations — where the slightest variables can be altered.

Common to all these tests is the many hundreds of channels of response accelerometer data that need to be recorded simultaneously. Forty years ago, our two-channel systems, random noise generators, spectrum shapers and more were in operation at India's National Aerospace Laboratory (NAL) Acoustic Test Facility, but nowadays, data acquisition units must handle hundreds of input channels, sampling the input signals at very high frequencies. Then, high-capacity workstations are needed to handle the vast amount of data produced for post-processing analysis.

Recording data at these very high sampling frequencies is vital, particularly for shock measurements, which by nature are of very short duration. Sampling frequencies are the number of times the analogue signal is sampled in one second, which should, ideally, be in excess of 250kHz to get the best results. This is because with shocks from events like explosions, the data all comes from a very small amount of time.

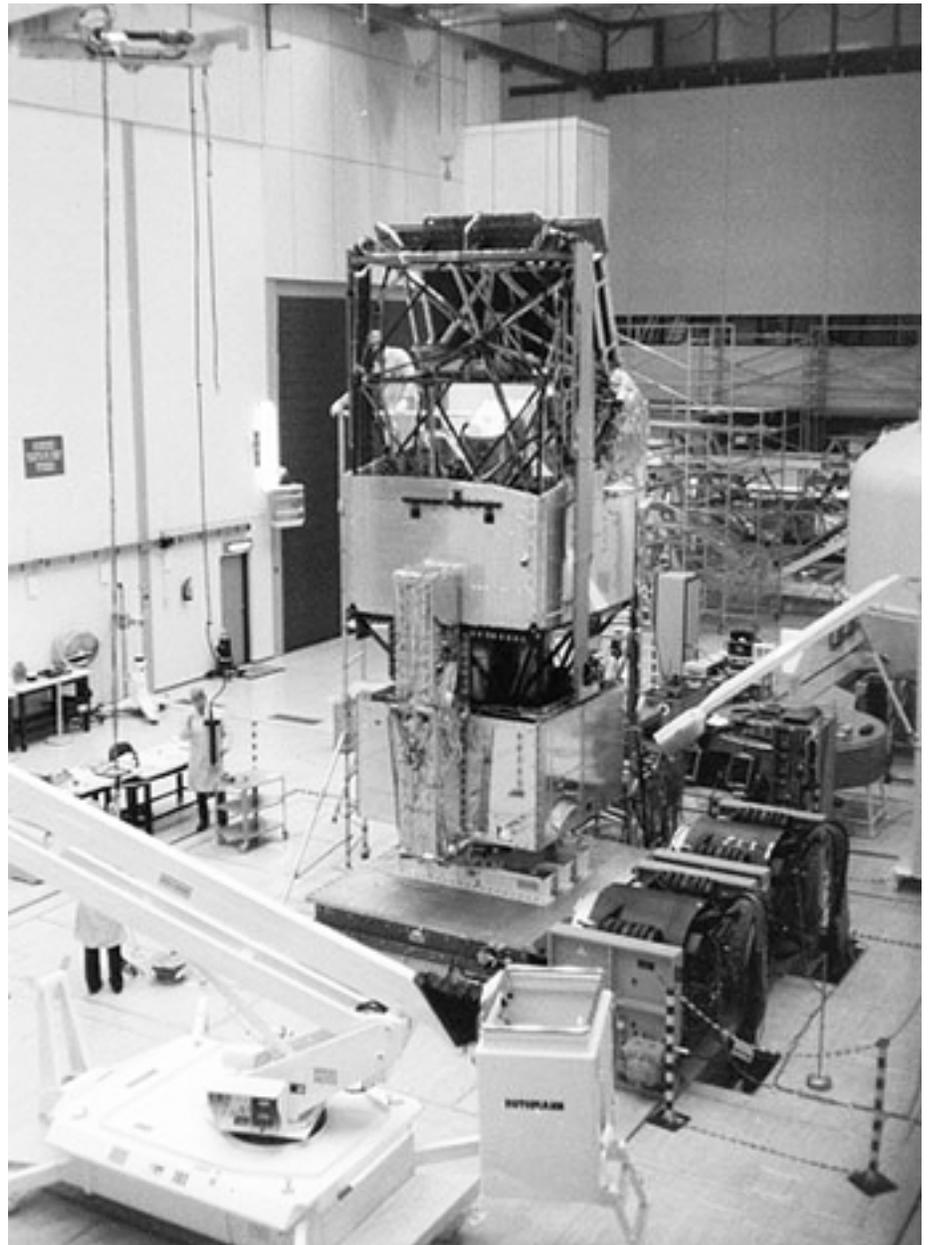
Qualification and Acceptance Testing

Qualifying the stability and durability of satellites is a critical stage in their construction, and consequently the space industry has the world's most demanding requirements for vibration testing. These strict testing regimes are adopted during the design, development and production stages to

establish the robustness of components, subsystems and fully assembled satellites.

Design qualification tests are usually carried out on a structural model, which is a complete physical replica, in order to demonstrate that the design

enables the equipment to withstand the vibration levels it will see during launch, by a healthy qualification margin. Acceptance tests are then carried out on the actual flight model of the satellite, in order to verify workmanship and ensure the equipment



Satellites have long been at the forefront of vibration testing. Forty years ago, Brüel & Kjær systems were in operation at NALs Acoustic Test Facility. Photo: ESTEC

does indeed operate satisfactorily in its final configuration, and will not degrade during launch.

The satellite Qualification Test Procedure (QTP) is consequently quite different from the Acceptance Test Procedure (ATP). It's more comprehensive than the ATP, and is performed only once to qualify the design, and of course it is performed only on the 'twin' satellite that will never leave Earth. The QTP typically includes environmental testing like humidity, vibration and shock tests, while the ATP is a production test performed to show that the structure meets the performance specification.

All these test requirements have led to the development of many different testing types to suit different applications.

Acoustic Testing

It goes without saying that lift-off is a noisy time, and the high acoustic levels experienced by the launch vehicle and payload can have a dramatically damaging effect. Satellite subsystems with a large surface area and low mass can be very sensitive to acoustic excitation, and significant structural responses to the acoustic excitation, especially in the low frequency range, can lead to critical stress levels in the load-carrying structure itself. Equally, high acoustic levels can induce excessive random acceleration levels for the sensitive electronic and optical equipment mounted on satellites, such as equipment panels, antennae and



Small explosions that separate the used rocket stages from the vehicle cause unique acceleration peaks known as pyroshock events. These high-frequency, high-magnitude shocks can destroy sensitive payload equipment.

solar arrays.

During acoustic tests, high-intensity acoustic horns blast the satellite with extremely high sound pressure inside huge chambers, to simulate the launch environment. The acoustic tests are designed to induce dynamic responses in the test specimen similar to those experienced in flight, and require nitrogen to actually drive the horns, typically for two-minute-long tests.

Sound levels up to a staggering 160 dB are used, which to the unacquainted may not sound

like much, but the threshold of pain is at about 120dB, so being in the chamber would be a decidedly bad idea! For a rough comparison, 160 dB is about equivalent to multiple jet aircraft lifting off simultaneously from a few metres away.

Swept-sine Testing

Swept-sine testing involves vibrating the satellite on a large shaker to locate structural weaknesses, and to assure that no significant structural dynamic changes have taken place during pre-launch assembly and testing. One form of sine testing typically used in satellite testing is a resonance search. All structures have a frequency at which they resonate and amplify the effects of vibration, so it is vitally important to know when and where this occurs in a satellite.

In resonance search testing, the mechanical shaker vibrates the satellite at low amplitude, and sweeps from a low frequency to a higher frequency. This is usually done at a constant logarithmic rate. As the shaker's control system sweeps the shaker up in frequency, the resulting vibration is tracked and measured.



Brüel & Kjær supplies the entire measurement chain for vibration testing, from shakers to final reporting – backed up by a global service organization.

Typically, a transmissibility or transfer function plot is then produced, showing any difference between the input signal and the actual measured movement of the test object. This ratio between response and input allows the particular resonance of the structure to be known and documented in detail.

Another form of sine test is an endurance test, which vibrates the test object with a varied frequency range that sweeps up and down for a specified number of sweeps or a defined test time, which is typically hours.

As with the resonance search test, this test does not simulate a specific real-life environment in the way that acoustic testing does. Instead this tests for material fatigue in a highly controlled and prescribed manner, which in turn facilitates highly accurate expectations of material performance.

For a more realistic simulation of a real-life environment, broadband random vibration is often used. The random vibration excites a defined band of frequencies. Here, the resonant frequencies of the unit under test, as discovered by the resonance search testing, are excited regularly together to cause interaction and document the results.

Pyro-shock Testing

Launch vehicles, payloads and spacecraft designs often use numerous pyrotechnic devices over the course of their missions, such as during the separation of launch rockets, or during solar panel deployment. These events can emit a high-frequency, high-magnitude shock pulse that can be very damaging to sensitive equipment.

By way of comparison, we all know how a gentle tap on an empty wineglass can result in a loud response, and this is because the resonances of the glass are excited by the shock that the tap imparts. Just like with the glass, the pyro-shock

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High channel counts and high sampling frequencies necessitate advanced data acquisition systems. Here an engineer sets up Brüel & Kjær's modular LAN-XI platform.

rarely damages a satellite structure itself, but a shock to the structure on which sensitive equipment is mounted can easily cause failures in electronic components that are sensitive to the high-frequency pyroshock energy. Damage to mission-critical components can be severe, and thus a structure's response to shock needs to be ascertained.

Shock Response Testing

Shock response testing is considered essential to mission success, and can not only determine whether sensitive equipment will survive, but is also used during the design phase to determine where best to fasten the satellite to the launch vehicle. For the shock test, a rapid pulse of short duration and high energy is imparted to the unit under test by the shaker system or a real pyrotechnic device, and the resulting dynamic movement recorded.



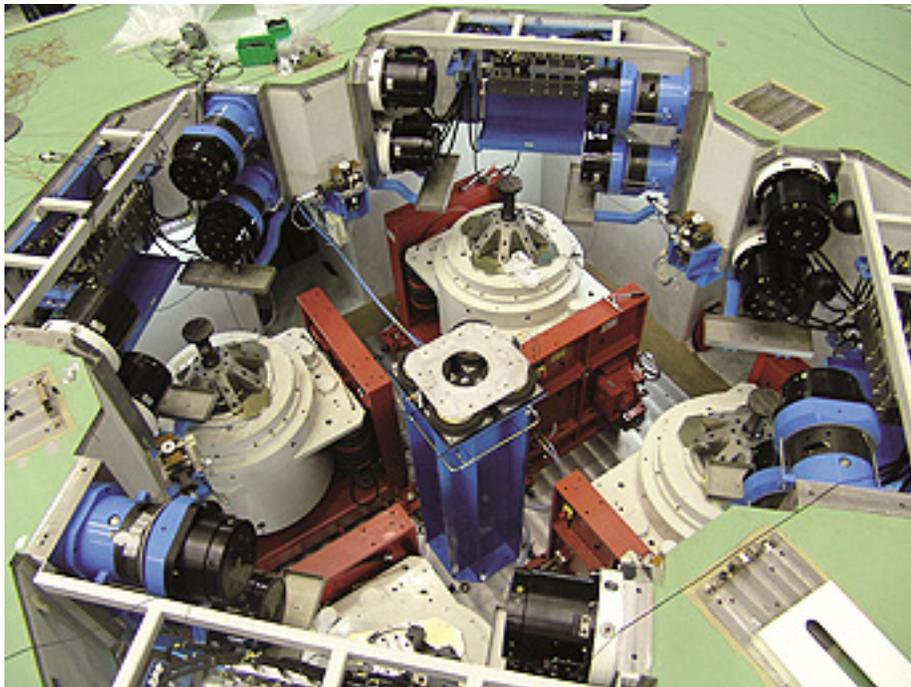
Shock Response Analysis is used to compute the response of a structure to pyroshocks, and recreate the effects mechanically.

From this recorded data a 'Shock Response Spectrum' is calculated. This details the response to the pulse at individual frequencies, and provides an in depth understanding of the response of the structure to the event.

Faithfully reproducing and recording pyroshock effects on components in laboratory conditions is beset with difficulties as even the best shakers cannot accurately simulate an explosion. As a result, the response of the structure to a pyroshock is measured and then the data from the peak acceleration is converted to show the effects of the pyroshock in simple terms for each frequency.

These simplified terms are Single Degrees Of Freedom (SDOF) that show the response of the structure in a single dimension, like a weight on a spring, instead of the complicated mess of forces produced by the explosive pulse.

The significance of this technique is that it allows mechanical shakers to produce a shock pulse that accurately recreates the same shock response spectrum as from the pyrotechnic explosion. Also, where design changes are made to a structure, the components on that structure might not be able to be subjected to more shock than in the previous version of the structure.



Modern shaker systems can combine multiple units such as this quad arrangement of LDS shakers here at an ESTEC facility. A large load-bearing platform (not seen here) will typically sit atop this setup to combine the force of the shakers to 640 kN, and carry the test object.

Photo: ESA/ESTEC

Here, a shock response spectrum of the new version can be compared to the old one, to pre-test the structure.

Over the years, Brüel & Kjær has developed technically advanced solutions to innumerable customer problems, pioneering many firsts and driving industry standards. Brüel & Kjær provides complete integrated satellite test solutions for vibration sine testing, short and long transient testing, and acoustic fatigue testing. These cover the entire vibro-acoustic measurement chain — from high-force electrodynamic shaker systems, amplifiers, vibration controllers and high-shock/vibration transducers. Brüel & Kjær also produces data acquisition systems capable of handling many hundreds of channels at

high sampling frequencies and sophisticated analysis tools such as Shock Response Analysis software.

- » High force LDS electrodynamic shakers with associated slip tables, fixtures and amplifiers
- » Precision vibration controllers
- » High-shock vibration transducers
- » High-speed, high-channel, modular data acquisition systems
- » Data acquisition, analysis, recording and database software



About the author

Noel Brown is the Aerospace Project Manager at Brüel & Kjær Sound & Vibration A/S, Denmark

About Brüel & Kjær

Brüel & Kjær Sound and Vibration Measurement A/S supplies integrated solutions for the measurement and analysis of sound and vibration. As a world-leader in sound and vibration measurement and analysis, we use our core competences to help industry and governments solve their sound and vibration challenges so they can concentrate on their primary task; efficiency in commerce and administration.

The Company's Mission is to help our customers measure and manage the quality of sound and vibration in their products and in the environment. Their corporation vision is to be the first choice and long-term business partner, delivering innovative technical solutions which create sustainable value for our customers, delivering advanced technological solutions and products of renowned quality. These cover the entire sound and vibration measurement chain from a single transducer to a complete turnkey system.

The product portfolio covers all of the components and tools required in the measurement and analysis of sound and vibration. It is unique in the industry that all components can be sourced from a single company. Products fit together intelligently as systems, simplifying the process of creating systems optimised to solve specific customer issues. A full range of services for products and systems, including installation, training, support, software updates, calibration, planned maintenance, repair, and rental, are offered.

Bob Dunn, CEO, PacStar

by MilsatMagazine editors

Bob Dunn was appointed PacStar's Chief Executive Officer in June 2010 after rejoining the company in early 2010 with the main goal being to expand and develop the company's technology penetration in Department of Defense programs and with large system integrators. In addition to his responsibilities as CEO, Bob continues to spearhead these business development efforts. Prior to rejoining PacStar, Bob served as Senior Vice President of Sales and Marketing for Ericsson Federal Inc. (EFI). Bob joined EFI in October of 2008 and directed all Business Development efforts across U.S. federal, state and local government agencies that demand the same broadband applications and communications capabilities as commercial markets. His team helped customers leverage Ericsson's worldwide commercial leadership and massive research and development investment to achieve mission success.



Before working with Ericsson, Bob served as the Senior Vice President Sales and Marketing at PacStar, where he maintained a client roster that included numerous influential U.S. government agencies, including the Department of Defense, Defense Information Systems Agency, the Department of Homeland Security and the Director of National Intelligence. Previous to his work with PacStar, Bob served as President of the Product Solutions Sector for Nortel Government Solutions (NGS). There he played an active role in the merger between Nortel and PEC Solutions as well as the consolidation of the business units. In addition to these executive roles, Bob held numerous business development and management positions for NYNEX, Northern Telecom and Bell Atlantic. He is a member of the Armed Forces Communications and Electronics Association (AFCEA), where he serves on its international board.



Tactical communications
— calling for an airstrike

MilsatMagazine (MSM)

You've been involved with communications and telecom throughout your career, and the Federal Marketplace for the last 10 years. What attracted you to PacStar and what market opportunity did you see for the company?

Bob Dunn

PacStar is a proven leader in the tactical marketplace. We have some of the most talented engineering and business development professionals in the Federal

Marketplace who are supported by an experienced management team and board. We also partner with some of the most advanced communications companies in the world. Our challenge is to take that advanced technology and deliver tactical, ruggedized solutions in a SWaP (Size, Weight and Power) that exceeds our customers' requirements. Once we assemble the solution we apply our IQ Core management software that enables easy set up and access to the associated applications.

MSM

DoD budget cuts increase the appeal of commercial-off-the-shelf (COTS) technology that can be ruggedized and used by warfighters. How will this trend impact PacStar?

Bob Dunn

The trend defines our business model. Ruggedizing COTS, utilizing our network, systems and software engineering, and delivering comprehensive tactical solutions is what we do. As DoD looks for big cuts (i.e.



PacStar IQ-Core Software screenshot

Government & Military



big iron, big programs, etc.), and applies a more commercial cost cutting model, the men and women in the field will always need to communicate. We find ourselves extolling the benefits of tech refresh, efficiencies, and cost saving measures without giving up quality or security.

MSM

Your customers need the latest technology, but sized to meet their needs. It's all about size, weight, power and immediacy — particularly in the military. How does PacStar fit into these DoD requirements?

Bob Dunn

Perfectly. We often whiteboard new designs that illustrate "the art of the possible." At the end of several sessions, we find ourselves asking, "Can we really get 3, 4, 5 enclaves in one unit that weighs under x pounds?" "There is only one way to find out," is how PacStar Engineers answer this question. We make our Operations/Assembly team crazy sometimes, but the results speak for themselves. IQ Core Solutions are deployed globally.

MSM

You've announced some product and technology partnerships this year with General Dynamics, Cisco, and, more recently, Riverbed. When you tie all of these together — how does it reflect PacStar's approach to the market?

Bob Dunn

It's the model of "Coopetition." Sometimes we compete with GD, sometimes we partner with them. Let's face it, GD is one of the best tactical solutions providers in the world, and DoD works very closely with them, along with several other leading Systems Integrators. We are proud to be a part of their team, especially when we truly add value.

We are finding that IQ Core Software is really making a difference to the men and women in the field. It provides that "easy to use" experience that is essential when you need comms fast, both in set up and speed. Cisco, Riverbed and other soon to be announced partners, deliver the most advanced technology that applies to the mission. Whether it's routing, voice compression, WAN acceleration or simple analog voice, PacStar focuses on SWaP, ease of use and delivers the same mission critical technologies in a form factor demanding by our customers.

MSM

Network management, ease of use and increased efficiencies are becoming more important than ever. How are you building

product/technology solutions around demand for voice, video and data by warfighters within a user-friendly environment, all the while meeting such metrics?

Bob Dunn

We achieve this through our patented IQ Core technologies. We reengineer products, bundle them in the expected form factor, and apply IQ Core software. Imagine having a kit that provides Cisco routing and video, VMWare virtualization and Fortress security. The user wants to turn it on, and use it rather than having to pore through four different manuals. PacStar IQ Core Software does all of the complex work behind the scenes so that all the user is thinking about is what to say, send, or show another user or Command and Control.

MSM

What is your Company's IQ-Core ruggedized technology, and how does such assist in the implementation of fixed and tactical communications services?

Bob Dunn

The Company's patented IQ-Core Software and hardware technology and integration/installation services provide secure, command control and communications systems particularly in remote, or infrastructure-starved, areas. In addition, PacStar provides a full range of communications solutions to commercial businesses as well as telecommunications service providers.

Disaster Preparedness



MSM

Would you discuss PacStar's approach to the critical issue of communications security — how does your firm solve this problem to the satisfaction of all involved? What products do you present that incorporate these technologies?

Bob Dunn

We work closely with all technology providers ensuring their security features transfer to our bundled solutions. If the customer requires type-1 or other high level security protocols we'll either build it "in-skins" or inter-operate with another enclave. We also have high-level security in our IQ Core Software designs.

MSM

How does PacStar manage to navigate through the various channels and over the numerous bridges of federal and state acquisition systems to get their product and technology messages not only heard, but understood?

Bob Dunn

There is no question that the Federal procurement process can be cumbersome, but we appreciate the fact that our customers just want to get it right the first time. We deliver high quality solutions that meet customer requirements. When we respond correctly and professionally, and work closely with the engineers on the desired deliverables, the process usually works well. It helps to have a couple of procurement specialists on the team as well.

MSM

Looking back over your career and past experiences, what one or two projects that you have been responsible for completing bring a great deal of satisfaction to you?

Bob Dunn

I worked with a particular group of people, customers, and patriots, and we delivered solutions that helped save lives. If they are reading this article they know who they are, they know what we accomplished; and, they how deeply proud I am to have worked with them.

I also worked with a talented team to upgrade DISA's DSN to VoIP. Back in the day when analog was king, and "they" said it would never happen, I took a great deal of satisfaction in knowing the customer trusted the team and me enough to move forward with the transition. Now VoIP is commonplace.

MSM

Where do you see tactical communications heading over the next couple of years?

Bob Dunn

Look for smaller and lighter, needing less power, all running on IQ Core Software.

MSM

What challenges do you see facing our warfighters as the demands of smaller, but more mobile, combat units continues to demand attention?

Bob Dunn

Some companies that supply wireless communications need to focus on applications that are mission critical to the warfighter and the needs of our men and women in battle. Too often, Plans of Record are not geared towards military requirements. That said, our brave men and women have enough to worry about out there. The last thing they should worry about is communications. Creating a hassle-free communications experience is PacStar's top priority.

MSM

With additional technologies and more complex systems offered in various, hostile environments, then with these capabilities moving downstream from command to the warfighters themselves, how can product implementation be sped up and training administered more effectively and with proper support?

MSM

Through IQ Core Solutions. When the men and women in uniform stop or pass by our booth at LandWarNet, AUSA, etc., and say, or better shout, "Hey there's our PacStar"!!, you know you're doing something right. PacStar will always be there for our bravest with the latest technologies, regardless of environment.

We also sponsor, and I am on the Board of, GallantFew, an organization that supports wounded Rangers. It's a very small way of saying thank you. Check them out and help support the troops. ❖

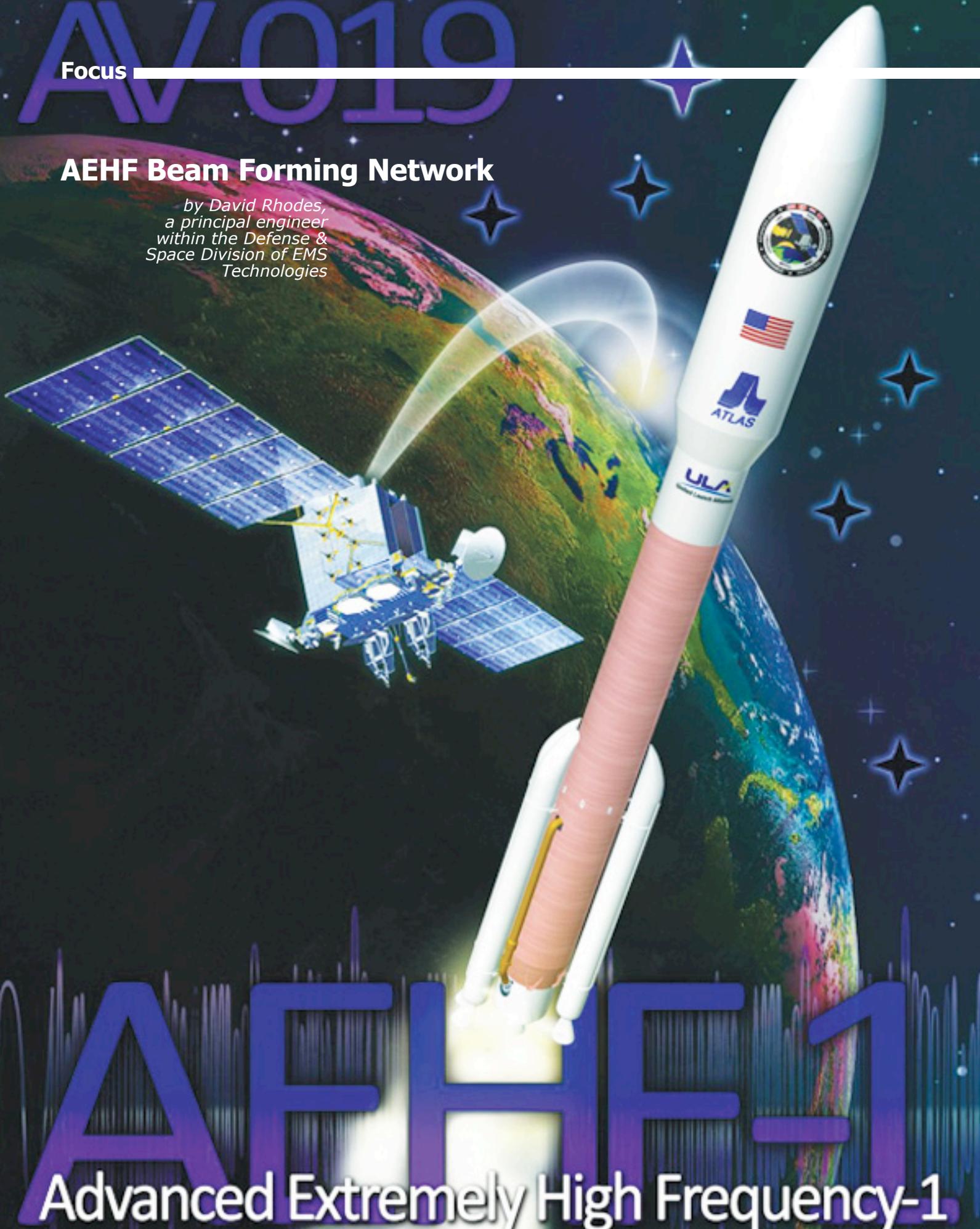


AV 019

Focus

AEHF Beam Forming Network

*by David Rhodes,
a principal engineer
within the Defense &
Space Division of EMS
Technologies*



AEHF-1

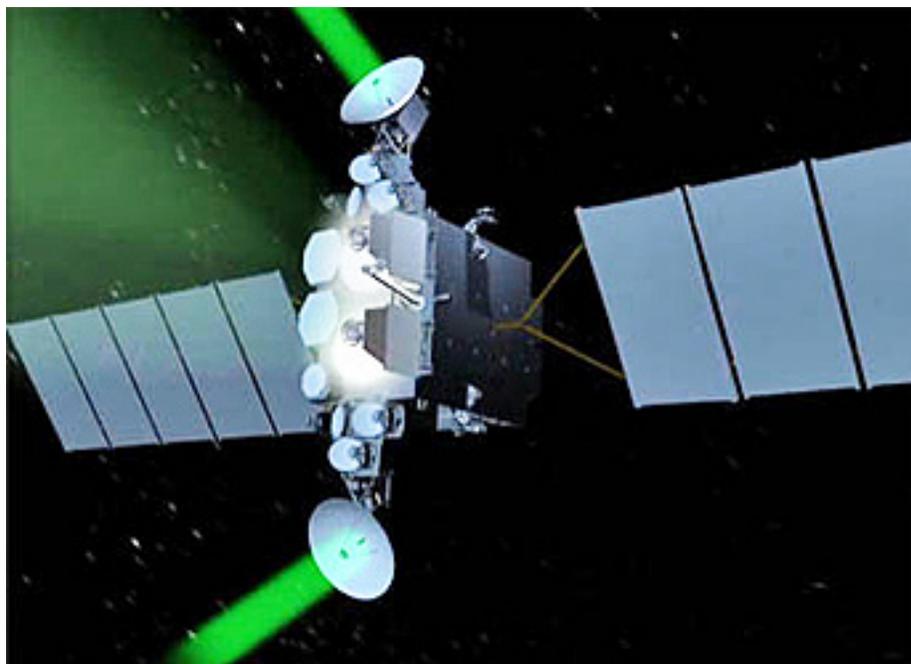
Advanced Extremely High Frequency-1

The U.S. Air Force's Advanced Extremely High Frequency (AEHF) system is the nation's next-generation military strategic and tactical relay system, which will deliver survivable, protected communications to U.S. forces and selected allies worldwide. When fully operational, the system will consist of four crosslinked satellites, a ground mission control center and user terminals. The AEHF system provides joint, interoperable, assured connectivity for warfighters in operations in all levels of conflict, a capability not available through other planned military communication networks."¹ "The satellite serves as a smart switchboard to establish, maintain, reconfigure and disassemble required communications circuits as directed by the users. The terminals will provide encrypted voice, data, teletype, or facsimile communications."² One key to the success of this communications satellite is the ability to provide reliable, high speed, secure, anti-jamming, survivable tactical communications capability. The AEHF beam-forming network (BFN) is at the heart of one of these on-board systems.

EMS Technologies, Defense & Space division, now a part of Honeywell, recently announced the award to build the AEHF BFN, nicknamed "nuller", for the fourth AEHF satellite,³ under contract to Northrop Grumman. The satellite is under contract to Lockheed Martin, the AEHF prime contractor and overall space system manager. Northrop Grumman builds and integrates the AEHF payload that consists of processors, antennas, radio frequency subsystems and crosslinks."⁴ The first satellite is on orbit, launched October 14, 2010, and is due to come online in the fall of 2011.

The AEHF satellites build on the capabilities of the Milstar satellites, and are interoperable with those communication systems, providing 10 times the data throughput of the Milstar satellites.⁵

AEHF provides the Milstar LDR (low data rate) and MDR (medium data rate) waveforms as well as the new AEHF XDR (extreme data rate) waveforms. "AEHF protections included anti-jam capabilities, Low Probability of Detection (LPD), a Low Probability of Intercept (LPI), and advanced encryption systems."⁶ In addition, the waveforms use frequency hopping to communicate over narrow bands that constantly move within the total bandwidth of the system. The equipment



Artistic rendition of the AEHF-1 satellite, courtesy of Lockheed Martin

is nuclear-hardened to provide survivable protected communications systems that do not degrade in either tactical or strategic environments. These communications systems service the warfighter on land, sea, and air.

The AEHF BFN is a Q-band (EHF) uplink satellite RF receive network that is a part of the High Resolution Coverage Antenna system, providing two spot beams per satellite. The antenna normally receives signals from its entire field of view, but the BFN provides the capability to produce nulls, or areas where no signal is received, within its field

of view. In operation, the AEHF BFN acts to null out jammers from the field of view, thus its nickname, the "nuller". This is accomplished through multiple RF receive ports that overlap in the field of view and combine to provide the RF data stream. Each of the ports can be observed for the presence of a jamming signal. If jamming is present, a null can be formed to block that region of the field of view.

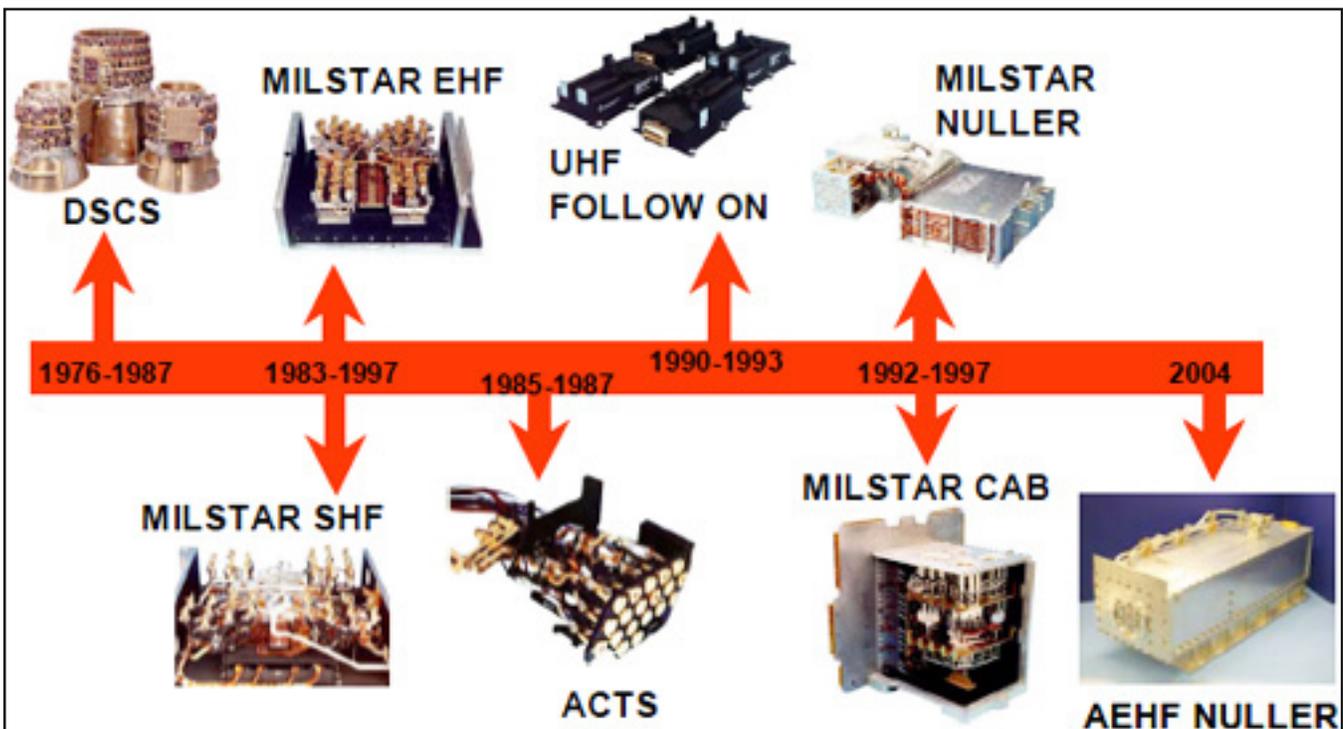
This nulling acts on RF microwaves like a sun visor acts to shield the eyes from the sun. Imagine that you are shielding your eye from the sun by holding a ping-pong ball at arm's length so as to block the sun from your vision. Now imagine that the position and size of the ping-pong ball is automatically controlled so that it stays between your eye and the sun providing continuous blockage. The remainder of your field of view is not obscured allowing you to see everywhere



AEHF Beam Forming Network (BFN) Nuller

except directly into the sun. This is analogous to the operation of the BFN in the presence of a jammer. An undesirable signal such as an enemy emitter can be blocked (nulled) so as to provide clear communication everywhere in the field of view except directly from the emitter.

The nulling is accomplished by independently controlling the amplitude and phase of each of the overlapping RF ports. Samples of the RF signal are made at each of the multiple ports and these data are used to adjust the phase and amplitude of the multiple of the multiple channels to result in a rapidly converging excitation that minimizes the effects of a jammer and allows users to access the satellite. The size and shape of these nulls can be controlled real-time to compensate for various types of emitters. The resultant signals from all ports are then combined to provide the RF data stream for further processing, demodulation and decoding. The system provides assured communications against both hostile interferers and friendly interfering sources.



Displayed are some of EMS Technologies' heritage products in spaceflight beam forming networks.

The AEHF BFN is based on EMS Technologies' design heritage that was initiated on the Milstar constellation where a similar BFN was developed and delivered in the mid 1990s. The microwave section of the BFN is a waveguide system that consists of low-noise amplifiers (LNA's), phase-amplitude controllers, RF switches, and power combiners. EMS's precision ferrite phase shifters and switches are used to implement the RF control elements. The use of ferrite allows for low-loss RF processing of the signals to be performed, providing broadband beam forming control of the incoming signals. All of these elements are combined into a network that is controlled by electronics taking commands as inputs and translating to the particular desired configuration that is synchronized with the frequency hopping of the signal waveforms. The BFN employs redundancy to implement a highly reliable system.

EMS/Honeywell continues to develop the technology to provide systems that address the warfighter's dependence on secure satellite-based communications. In addition, as hosted payloads augment the military's telecommunications requirements, EMS's advancements in the military use of beam forming network capabilities are being adapted for commercial communication and direct broadcast satellite applications.

The commercial BFN offers similar capabilities as the AEHF application, but without the sophisticated waveforms, enabling safeguards against jamming and unauthorized access. With the military leasing a large percentage of the worldwide SATCOM capacity, continuous and secure communications is imperative. In the highly competitive communications industry, commercial entities that cannot protect their communications link face the possibility of customers moving to other satellite providers or terrestrial applications. ❖



The first AEHF satellite, photo courtesy of Lockheed Martin

Editor's Note:

EMS Receive Beam Forming Networks (RxBFN) offer redundant LNAs, anti-jam nulling, beam shaping, phase control and low loss ferrite phase shifters. Heritage programs include AEHF, LANDSAT, ARTEMIS, TDRSS, NSTAR, ACTS, MILSTAR, DSCS and the Space Shuttle.

About the Author

David Rhodes, a principal engineer within the Defense & Space Division of EMS Technologies, now a part of Honeywell, has worked over the past 20 years on Milstar satellite programs as well as AEHF satellite programs. Rhodes has designed electronics for microwave hardware for both satellite and terrestrial based systems. He also designed wireless computer equipment at LXE, a division of EMS Technologies, prior to joining the Defense and Space Division. After serving in the U.S. Navy, Rhodes began his electronics career at Bell Laboratories where he designed terminal equipment.

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This article's introductory image is courtesy of United Launch Alliance

Compact VSAT Systems for Mission-Critical Applications

by Gabriel Racah, Director of Marketing, ORBIT Communication Systems

Today's world is truly connected with a wide range of technologies that allow communication in homes and workplaces in cafes and airports and while we're on the road. But demand for always-on connectivity goes way beyond the reach of terrestrial and cellular coverage, from special forces with a mandate to report mission-critical field imaging to passengers of ocean-going cruise ships who want to log on their favorite social networks. The expectation to be "online" at all times is truly global.



Satellite communications has earned its rightful place in the arsenal of communications solutions for a connected world and is often the only viable solution for remote areas. There's a wide range of satellite communications (SatCom) technologies that support one- or two-way communications. However, this article will focus on (Very Small Aperture Terminals) VSATs.

Satellite Orbits, Interference and the Need for Regulations

VSAT is a generic name for an entire class of two-way fixed or mobile solutions with a remote

terminal that typically features a dish size between 30cm/12" and 3m/118". VSAT terminals communicate with geostationary satellites that orbit the earth at an altitude of 35,786 km (22,000 mi) over the equator. Communicating from earth to a single satellite at that distance is not in itself a major challenge, but doing it in a crowded sky is a another matter.

The proliferation of geostationary satellites has reached the point where less than two degrees can separate adjacent satellites. Transmission from earth must be focused precisely

on the right spot or it could interfere with another satellite. Stricter regulations mandate that earth stations limit their transmission towards adjacent satellites by pointing exactly towards the target satellite and by testing the antenna emission patterns to ensure they do not contain any "side-lobes" emitting energy off center. This is an easy enough task from a large, fixed system but it can be difficult when transmitting from a compact, mobile platform.

Intense development, simulation and testing efforts are required in order to design and



**Commercial Communications Satellites
Geosynchronous Orbit**

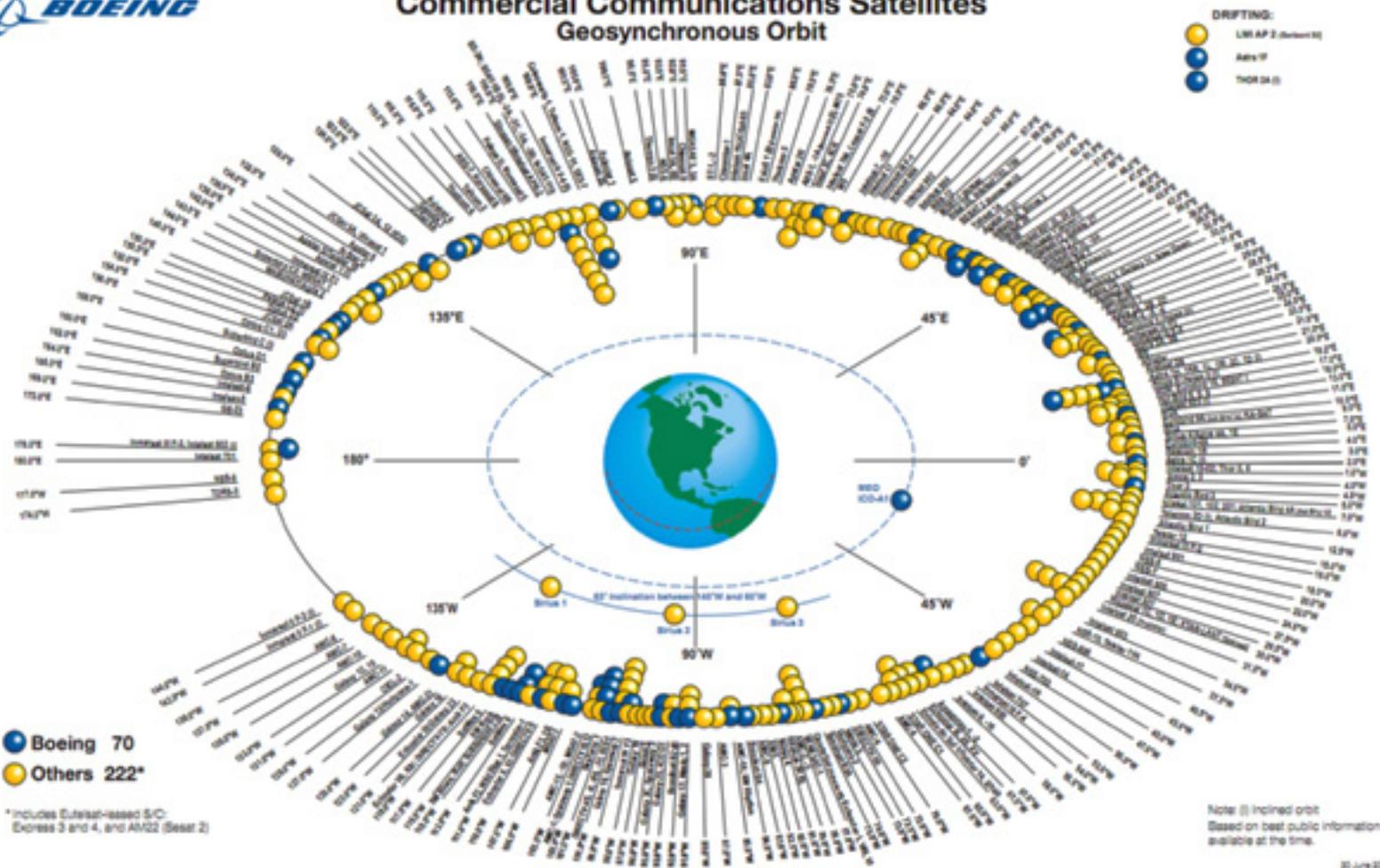


Figure 1: A Crowded Sky — Commercial Geosynchronous Satellites in Orbit (Courtesy: Boeing)

produce antennas that comply with today's regulations. While this task is by no means easy, it becomes even more challenging when the antennas become smaller. This has led the industry to set de-facto standards for minimal antenna size. For example the norm for C-Band systems is to feature a dish of at least 2.4m/94".

Bandwidth, Power, Costs and Efficiency

With the growing demand for bandwidth, the industry is in a continuous race to improve the efficiency of the limited satellite capacity to transmit more data over a given satellite radio capacity. This is the domain of companies like iDirect, Hughes, Gilat, Comtech, Viasat and

others, who keep developing more efficient ways to translate bits in to radio signals and vice versa.

Transmitting higher bandwidth radio signals come hand-in-hand with higher transmission power which, as discussed above, is allowed if the beam is focused on the target satellite and the antenna emission patterns do not contain any "side lobes." Reducing the size of the antenna will have an impact on the RF performance and as a result, in order to meet regulations, the system will be required to limit the power of transmission, and therefore their maximum usable bandwidth.

The easiest and most common way to use small antennas while preventing

interference is to use "spread spectrum." In other words, the transmission is spread over a much wider range of frequencies than that required by the data rate (typically 10 times the actual data bandwidth). This may be acceptable in military and homeland security applications, in which very small terminals can allow the transmission of critical information from the battlefield. However, in a world in which satellite bandwidth is as scarce as it is today, such inherently inefficient solutions bear exorbitant service costs and are often unacceptable in commercial applications.

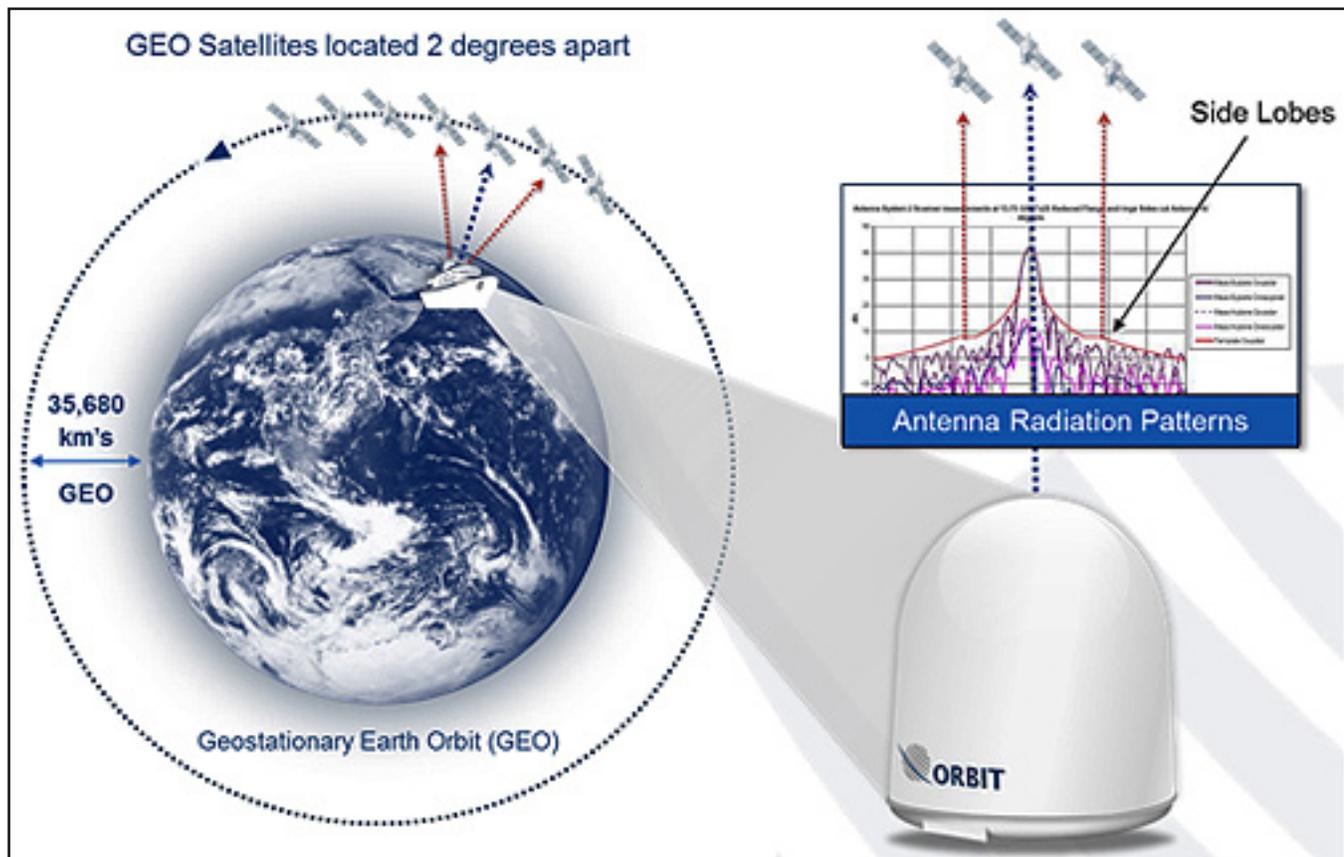


Figure 2: Radiation Patterns and Risk of Interference

VSAT Systems Get Smaller; Maintain Performance & Regulation Compliance

Maintaining high RF performance and fully meeting regulation while reducing the size of the VSAT terminal to a minimum can be challenging as the design has to find the optimal trade-off between size, weight, service cost, RF performance and maximal allowed bandwidth.

For example, in developing a new generation of stabilized maritime C-Band VSAT systems, one must maintain the advantages of the relatively large C-Band (global coverage, all-weather performance) while addressing the challenges that traditionally come with such systems.

A typical maritime C-Band terminal features a 2.4m/94" dish and is hosted in a 3.8m/150"

dome — due to its size, the system must be installed on site over several days and only fits large vessels. The challenge is to maintain RF performance while drastically reducing the deck space, and also to shorten the installation time.

Finding the right formula is a delicate balancing act between several interdependent factors: For example, going from the traditional prime focus antenna to a dual-offset design increases the RF efficiency and improves the radiation pattern. However, such an antenna demands a very special type of stabilized pedestal in order to provide seamless hemispherical coverage, which in turn demands that the stabilization and motion control algorithms allow for complex axis mapping.

Given the complexity of such projects, computer simulation software for antenna and mechanical design has been instrumental in making the development of high-performance compact VSAT solutions possible.

In conclusion, designing high-performance compact VSAT solutions is complex, but it has become even more complex with the growing importance of satellite utilization, efficiency, and compliance to regulation. Ultra-compact VSAT solutions with lower RF performance are important for special applications in which portability and footprint are necessary, but for the vast majority of defense and commercial applications in which cost and efficiency are required, smaller VSAT systems are expected to achieve the same standards as their larger siblings. ❖

ORBIT VSAT Solutions

By using breakthrough RF design and original pedestal concepts ORBIT has created the OrBand™ - a revolutionarily compact C-band system which offers industry-standard RF performance (G/T and maximum EIRP/bandwidth) while taking 40% less deck space. The system features a 2.2m/87" dual-offset Gregorian antenna which, together with a high efficiency dome, complies with the strictest of industry regulations by satellite operators including Intelsat, Eutelsat and Anatel. With a compact 2.7m/106" footprint the system can now be installed in vessels with limited available deck space (from container ships to frigates) which until now could only host smaller systems incapable to provide true global coverage.



OrBand™ vs. industry standard



OrBand™

An additional example of system optimization is a VSAT solution designed for high-speed trains. Delivering broadband to trains moving at over 300km/h (186mph) required a VSAT system that could fit within the maximum allowed 50cm/20" clearance – sticking to a conventional approach would have resulted in a sub-par RF performance and high service costs. By taking an original approach, the low-profile the stabilized Ku-band OrTes AL-3602 system adds only 45cm/17" in height but hosts a large elliptical dish, increasing system gain and allowing it to meet Eutelsat regulation.

Dr. David Geen, V.P. of Tactical Ground Systems, Skyware Global

by the editors, MilsatMagazine

After receiving his BEng (Hons) in Communications and Electronic Engineering in 1992 (Newcastle, UK), Dr. Geen completed his PhD, which was entitled Hybrid Mode Feed Horns for Reflector Antennas @ 20/30GHz. He began his career working in the USA designing bespoke feed chains for large Earth station antennas. Dr. Geen has more than 15 years of experience in the design of communication systems for terrestrial and satellite applications. David has spent the last nine years managing the development of VSAT, broadband and DTH antenna terminals, with particular emphasis on high volume, high performance equipment for the enterprise and consumer markets.



MilsatMagazine (MSM)

Since Skyware Global's formation in early 2009, the company has developed a solid reputation for comprehensive VSAT terminal solutions. First, could you provide our readers some of the company's history and some background on the new Tactical Ground Systems division.

David Geen

Skyware Global benefits from a rich heritage of key industry companies, having formed from the assets of Andrew, Philips, Channel Master and Raven. We have manufacturing operations in three continents (the US, UK and Asia), employ approximately 400 people worldwide and have a global distribution and reseller network. We are now the largest global provider of DTH, Broadband and VSAT terminal equipment and have shipped in excess of 14 million antennas, 100,000 BUCs, 30,000 transceivers, 200,000 VSAT LNBS and 18 million DTH LNBFs. With a strong focus on Ka-band over the past seven years, we are also the world's leading supplier of Ka-band systems, having shipped more than 1.3 million antennas.

The new Tactical Ground Systems group was formed with a remit of exploiting the company's strengths and experience in its existing markets to deliver

affordable solutions to the tactical community, and beyond, at a time when budgets are being squeezed and the desire to roll out communications to more and more people is increasing.

MSM

Why was the decision made to expand into the tactical and military satellite markets?

David Geen

We are expanding not only into the tactical and military markets but also those adjacent markets with similar needs, such as homeland security, first-responders, commercial broadcasters and other related industries. The decision to move into these markets was made in reaction to observations, from the tactical community, of increasing demand versus decreasing budget, and a desire on our part to exploit our strengths in: in-house antenna/RF electronics design and manufacture; low-cost manufacturing know-how; and unrivalled Ka-band experience; to satisfy the general demand for high-tech, lower-cost solutions.

MSM

How will the company's new structure — including the tactical ground systems division that you lead — facilitate this move?

David Geen

The company is now well poised to take advantage of its solid foundation into the commercial sector in these adjacent markets. Through organic growth, partnerships and potential acquisitions, the Tactical Ground Systems group is the vehicle through which this is being achieved.

MSM

How important is it to have a substantial presence in Washington DC? And what, exactly, is that "substantial presence?"

David Geen

At Skyware Global we firmly believe that in order to best serve our customers we need to have resources positioned in-market and close to our customers. This affords our customers access to our unrivalled engineering and design capabilities. The services provided by Skyware Global in this regard are unmatched in the industry — it means that the customers' engineering groups can work in partnership with our internal expertise to arrive at products that best suit the demands of the market place.

facility to cope with demands. We initiated this strategy by placing an engineering facility in Washington earlier this year and it is our intention to expand this facility to cope with demands as they arise. The Washington facility is one of several we have around the world and augments the existing talent pool within Skyware Global.

MSM

What are your thoughts on the state of the military and tactical satellite market? Are there any notable trends that you're aiming to take advantage of? What are satellite buyers and military contractors currently looking for?

David Geen

With demand for increased bandwidth and communications capability for existing users, together with a desire to push communications further down the command chain to new users, the market is certainly buoyant. This is helped in part by the increased interest around Ka-band and the advantages the new generation of Ka-band satellites offer in terms of capacity.

Viewed in the context of budget reductions, Skyware is well positioned to address these market conditions both in terms of affordability and Ka-band capability. We are a relative newcomer to this market sector but believe there is now a place for a high-tech, lower-cost terminal provider and we want to work closely with military contractors and system integrators to understand their requirements and to tailor our solutions accordingly.

MSM

Do you see hosted payloads as a viable alternative for government agency and military satellite endeavors? Please explain your views... how can Skyware Global offer services and or solutions to such programs?



David Geen

Hosted payloads offer a path for governments to provide dedicated services without the associated risk and cost of a dedicated government-owned satellite. As demand for satellite bandwidth increases, this appears to be a viable option to bridge the gap between demand and government capability. The adoption of hosted services – or not – could ultimately drive the overall available bandwidth for government applications and therefore the services on the ground. Skyware Global's next generation Ka-band RF electronics are designed to operate at civil and military frequency bands and will, therefore, provide the flexibility to operate on commercial, hosted and military satellite platforms.

MSM

What will be Skyware Global's initial product foray into this new and crucial government market segment?

David Geen

We will seek to take advantage of our core skills and are offering micro, mini and sub 1.2m terminals of various forms, together with innovative transceiver solutions specifically for nomadic, Ka-band applications.

At Milcom 2011, for example, we debuted the 45cm Micro terminal, the Ultra Rapid Deploy 69cm, the Cyclone 99 (a quick-deploy 1.0m FlyAway in a box), the Delta 1200 terminal (a motorized 1.2m FlyAway), the DRC3500 (5W Ka-band transceiver with electronic polarization switching) and the XRC3500 (5W Ka-band transceiver with electronic band switching – covers both civil and military Ka frequency bands). Larger antennas and 8W Ka-band RF platforms are on the horizon.

MSM

How does Skyware Global intend to compete with the industry's large, established players? Where do you currently concentrate your focus in the commercial markets?

Command Center

David Geen

Faced with the need to provide more for less, the traditional players may struggle to meet the new price points in such a rapidly evolving market. It's precisely here, in collaboration with the contractors and system integrators, that Skyware Global can deliver affordable solutions that work. Not only for new products, by mobilizing our in-house design expertise and manufacturing know-how, but also for re-engineered and re-packaged versions of our existing product portfolio. We've already had recognition from end-users that solutions built on modified commercial product can meet technical requirements whilst also being cost-effective. Skyware's long history of C-, Ku- and Ka-band product development provides a valuable library of low-cost parts that can be either used as-is or modified for use in products for Tactical applications.

MSM

How has the economic climate affected the industry? At a time when military, defense and other government service budgets have been hit, is this a niche that Skyware Global aims to exploit with its offering?

David Geen

In the face of budget reductions, the industry needs to work together to find ways to meet the increased demand and deploy more terminals, not fewer. On one hand, this requires the equipment providers to focus on lowering the cost of ownership for the end-users — and with the formation of the TGS group Skyware Global has the means and resolve to do just that. On the other hand, this requires a willingness on behalf of the end-users to explore new and alternative means to meet their needs.



Cyclone 99 Flyaway terminal (at Ka-band)

MSM

Skyware Global has been pioneering Ka-band technology in non-military markets for some time. What affect will this technology have on the military satellite market? How will it coexist with more traditional military frequencies such as X-band?

David Geen

The advances in bandwidth capacity achieved with the new generation of Ka-band High Throughput Satellites provides the infrastructure to deliver unprecedented services to assist and safeguard ground personnel. The Ka-band technology developed by Skyware Global for civil applications is directly relevant for military Ka-band applications. In particular, the existing antennas

are military Ka-capable and the RF electronics can be readily modified to suit the slightly different frequencies. Furthermore, we believe that military users want the ability to communicate with both civil and military satellites at Ka-band; hence, we are developing products that allow this through simple electronic switching with no change in hardware.

As for X-band, I think it will always have its place in the communications toolbox and it will continue to sit alongside Ka-band for many years to come.

MSM

In spite of a product's overall technical competencies, how does a company expanding into this market obtain the ear of

those involved in, and supervising, government and military acquisition process?

David Geen

This is not easy. It takes hard work to find the right people to engage with and to build confidence in what we are doing. This is an ongoing process and starts with small steps. In past businesses,



Ultra-Rapid Deploy 69cm Terminal (at Ka- and Ku-band)



45cm Ka-band Micro Terminal

our top management has worked closely with key leaders in United States military and security organizations, and those relationships certainly help in navigating an insular community. Additionally, Skyware Global has relationships with other global military suppliers with whom we are able to partner with to both prove our competencies and to grow our business.

MSM

What kind of products will you be bringing to the market? Do you have any plans for expansion in this area?

David Geen

We intend to offer a range of Fixed, FlyAway, Mobile and ManPack terminals ranging in size from 45cm to 2.4m. Products will be offered with a variety of RF payloads, either commercial reflectors or carbon-fibre reflectors, manual or motorized, for Ku- and Ka-bands (predominantly), and packaged in a variety of ways depending on the application. With the remit to grow the business through both organic and non-organic means, there is always scope for expansion.

MSM

Will Skyware Global also be

selling into, and supplying, equipment to overseas governments and agencies? Given the company's global efforts, is this part of the increased product offering plan?

David Geen

Yes, Skyware Global is a global company and as such will be selling to appropriate overseas markets. Whilst this may drive certain specific product development activities it does not change the broad product roadmap.

MSM

We understand that the company has recently been recognized for its employment practices... would you tell us about this honor?

David Geen

Building a global organization requires an investment in people, including employees with a diverse set of backgrounds and skills to collectively strengthen the overall team. Skyware Global was recently named Employer of the Year as recognized by the Disabled American Veterans and the North Carolina Employment Commission. We are quite proud of our record in hiring veterans into the company.

MSM

Was there a new product from Skyware Global that debuted at IBC 2011?

David Geen

Yes, our 98cm Ka-band terminal with 3W transceiver. It has been very well received.

MSM

Looking back over your career, are there any specific projects that bring you a great deal of satisfaction? Please tell us about those projects.

David Geen

When I first left University I worked in the bespoke feed development group under Roland Schwerdfeger at Vertex in Texas. Every project was unique and cutting edge and I learned more about satellite antennas in those two years than ever before, or since. One project in particular gave me great satisfaction, largely because it had not been done before and was immensely challenging; testing the simulation software of the day to the limit. It was a C-, X-, Ku- multi-band feed for an 18m antenna.

Since then, I would honestly say that the latest products we are developing for the TGS group come a close second! ❖

About Skyware Global

From the first Channel Master antenna in 1949, to becoming the world's only complete ODU provider, specialising in Ka-Band, over three continents; Skyware Global has evolved to serve customers worldwide with complete satellite solutions.

Skyware Global is the combination of one of the largest design and manufacturing companies of antenna systems, VSATs and DTH powerhouses, and one of the most established satellite engineering groups in the world. The company has become the first global provider of complete ODU systems; with an expanded product set, first class engineering capabilities, manufacturing operations and global logistics.

The cornerstone of Skyware Global's success is the technological capabilities of the Company's research and development group. World-renowned engineers continue to deliver complete solutions at price-points that work for customers.

The 'in house', state-of-the-art, research and development group incorporates 3D solid modelling, CAD capabilities, prototype laboratories; while test ranges provide the resources required to design, develop, and test products. With the constant development of the industry, focus and attention on quality is critical to the design and manufacturing process; quality and testing procedures are continually updated. Skyware is able produce

fully operational, hand-made prototypes for functional and aesthetic review.

It is this proprietary design-to-development process that allows Skyware Global to pre-determine the antenna systems performance even before it has been manufactured. This cost-effective, and time-efficient, style of operation has been one of the main reasons Skyware Global's is able to provide state-of-the-art concepts to the major companies in the worldwide Global Satellite Industry.

Skyware Global established a Tactical Ground Systems division in early 2011 to offer affordable solutions for fixed, motorized and mobile tactical terminals for Defense, Homeland Security, Intelligence, First Responder, Emergency Services and other government and stringent commercial applications. The division is headed up by Dr. David Geen, Vice President of Tactical Ground Systems.

Product Update...

At Milcom 2011, Skyware Global debuted its initial Tactical Ground Systems portfolio. This included:

- *The 45cm Ka-band Micro terminal; which features aircraft-grade aluminium and carbon-fiber composite structures that are lightweight, rugged, and quick to deploy and stow. The design is simple and robust for fast operation in tough environments.*

- *The Cyclone 99 terminal; a quick-deploy 1.0m Ka-band FlyAway in a box that can be assembled by one man, without tools, in under 10 minutes.*
- *The Delta 1200; a 1.2m FlyAway antenna with plug and play feed options for C-, X-, Ku- and Ka-band. It is highly portable, compact and lightweight and can be assembled and up-and-running by one man with no tools and little training in under 15 minutes.*
- *The Ultra Rapid Deploy 69cm; which features a single-piece 69cm reflector and unique assembly process that allows for deployment from case to 'ready-to-point' in approximately ONE minute. Available at Ka- and Ku-band.*

Larger antennas and 8W Ka-band RF platforms are on the horizon.

Photos of the new products may be seen in the Close Support article.

For further information, [select this link](#) for the Skyware Global website.

Event: Global Milsatcom 2011, London, United Kingdom

Occasionally, one cannot see the forest for the trees... technology advances for MILSATCOM occur on a daily basis, and keeping abreast of such information is becoming more and more difficult. However, there can be no excuses... the very viability of a company could rest on the next advancement, and if it remains outside the realm of cognizance, opportunities may well be missed.

Leonardo da Vinci is credited to having said, "Learning never exhausts the mind." Therein lies the force behind attendance at industry trade exhibitions. One usually learns much from attending these events, and one of the leading, upcoming

trade shows happens to occur in London from November 29th through December 1st at the Millennium Conference Center.

Global Milsatcom 2011 — the largest MILSATCOM event in Europe — enables attendees to engage in critical thought and analysis with a broad range of international experts from within the SATCOM and related industries. For example, just "signing on" as a speaker is Colonel Mario Arancibia of the Chilean Air Force. He will be focusing on the importance of satellite communications for his command.

Global Milsatcom offers delegates a broad range of international military speakers. Attendees will be able to network with the key European and NATO players and will have the opportunity to learn from these knowledgeable experts. Speakers from South Africa, USA, UAE, Canada and the South American region have committed to Global Milsatcom.

Additionally, information from the key international countries that lead the way in Military Satellite Communications will be present.

When considering the influx of delegates from across the globe, the opportunity presents itself to learn a great deal from one's colleagues in this two-day special event. There will be dedicated Q&A sessions during the conference wherein questions may be asked of those who are knowledgeable in their specific subject fields — all adding to the learning process. Subjects will cover a variety of issues, ranging from national MILSATCOM requirements to cyber security threats and more.

Here is a brief sample of the sessions that will be available on Day 1 of the conference:

- » **Current BLOS requirements**
- » **Managing capabilities on the ground**
- » **Development of new technologies and bringing them into service**

- » Prioritizing air time within the user community and apportioning UHF channels
- » Optimizing available and planned MILSATCOM capabilities within the PFI concession period
- » BLOS program overview
- » Enabling cloud services over satellite access
- » Trends in requirements for small, lightweight, S-, X-,Ku- and Ka-band tactical portable and SOTM terminals
- » Interoperability
- » Strategic, tactical and social SATCOM
- » ETISC: Scouting common requirements for tactical interim SATCOM options at the European level
- » What's different about Military Ka-band and how best to use it
- » Challenges facing the U.S. Government in acquiring space capabilities

These subjects barely scratch the surface of the available sessions, with full details at [this link](#). Additionally, there are numerous executive briefings available — informational and preregistration for each briefing may be accomplished at [this link](#). Plus, **Masterclasses** will offer in-depth information dealing with Continuing Airworthiness, Cloud Computing and Offset Program Development.

The list of sponsors is most impressive for Global Milsatcom 2011 — visit [this web page](#) to learn who is working with SMI Conferences in the development of this conference. Additionally, SMI has prepared an infopage that deals specifically with the accommodations that are available for the show — use [this link](#) to learn more.



There is also a special associated event: **Why Ka? Understanding the benefits and shortcomings of Ka-Band Mobile Satellite Systems**, which will be led by Cobham on November 28th at the Millennium Gloucester Hotel, London. [Info here](#).

This year's conference is finding registrations rapidly exhausting available space for attendance — such happened last year and there were many who were disappointed that they were unable to attend this important event. The information and registration page is locate directly at [this link](#). ❖

