MilsatMagazine

COMMAND CENTER spotlights...

Colonel Larrimore, Director
Defense Weather Systems Directorate
Space & Missile Systems Center

Jay Hennig, President, Moog

Worlds Apart—Giles Peeters

SATCOM's Birthday—Bob Gough

The Case For Hosted Payloads—NSR

Bandwidth Efficiency—Hughes

Morale, Welfare & Recreation (MWR)—Newtec

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A Delta IV rocket on November 4th, 2006, launched the U.S.A.F.'s DMSP-17 from Vandenberg's Space Launch Complex 6 to its orbital slot.
U.S. Air Force photo/Joe Davila

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Birthday Greetings For ORS-1

Goodrich Corporation announced an important anniversary, the ORS-1 satellite has celebrated its first year in space.

ORS-1, the first Operationally Responsive Space (ORS) satellite specifically designed to support combatant command operations, was launched from Wallops Island Flight Facility aboard a Minotaur I launch vehicle on June 29, 2011, at 11:09 p.m. EDT.

Designed, manufactured, integrated and tested by Goodrich's ISR Systems business in Danbury, Connecticut, ORS-1 is a 500kg class satellite providing game-changing impacts. In recognition of its ground breaking importance, ORS-1 was named one of the nation's 25 most important concepts by C4ISR Journal in 2011.

Initiated to fulfill requirements from the Commander of U.S. Strategic Command (STRATCOM) to support U.S. Central Command (CENTCOM), the satellite moved from the drawing board to delivery in 30 months. Less than 90 days after launch, ORS-1 earned early acceptance and has been satisfying CENTCOM's mission needs for multispectral EO/IR imagery and enhanced battlespace awareness ever since.

"The ORS-1 satellite has been meeting or exceeding expectations since its launch. We continue to support the Government operations team providing this valuable capability supporting CENTCOM mission objectives," said Andreas Nonnenmacher, vice president, Goodrich's ISR Systems business.

"CENTCOM is extremely pleased with ORS-1. It has met or exceeded its projected capabilities and additional capabilities and applications continue to unfold. ORS-1 provides superb collection... CENTCOM will continue to rely on its capabilities as an integral component to our ISR architecture and collection plan," stated Colonel Berry, Chief, Intelligence Surveillance and Reconnaissance Division, Directorate of Intelligence, Headquarters Central Command.

Rapidly developing and fielding ORS-1 was an important step in demonstrating the in-theater value of low-cost tactically focused EO/IR satellites to meet emerging and persistent warfighter needs in operationally relevant timelines.

Moreover, ORS-1 has demonstrated an alternative to the normal acquisition process for space programs and its lower cost, when compared to more traditional space-based ISR platforms, makes it an affordable contributor to the ISR "force mix" in today's fiscally constrained environment. CENTCOM indicated they were "... extremely impressed with the imagery they had gotten from ORS-1. They were not only happy with the responsiveness of it, but they were also happy with the quality of the imagery that they were getting. And, it was a warfighting advantage, no question about it...," according to a statement by General Shelton, Commander, AFSPC, to the U.S. House Armed Services Committee.

The Goodrich payload features a modified version of its SYERS-2 multispectral sensor, the primary imaging sensor on the U-2 reconnaissance plane. A ground segment that formats the satellite's data products to be compatible with existing Processing, Exploitation and Dissemination (PED) infrastructure was also developed and provided by ISR Systems.

The ORS-1 Program is managed by the Space Development and Test Directorate located at Kirtland Air Force Base on behalf of the Operationally Responsive Space Office at the same location.

#

Mission Critical Ops Showcased

Harris Corporation has successfully conducted the first live, multi-state demonstration that showcased the powerful capabilities of 700 MHz Band LTE (Long Term Evolution) for first responders.

Users at multiple sites across the United States tapped into the LTE network to share streaming video, voice, mapping and presence to support various simulated mission-critical surveillance operations.

In recent months, Harris has provided 700 MHz Band LTE "pilot" programs to key public safety organizations including the Las Vegas Metropolitan Police Department and Miami-Dade Police Department.

With these programs, officers there have been

experiencing Harris' LTE capabilities—such as presence, real-time video, mapping, data applications, and voice and messaging.

In addition, Harris has Band 14 LTE Radio Access Networks (RAN) on the air and operating at its Chelmsford,

Massachusetts, location and in Rochester, New York. All the locations are connected to the Harris LTE core in Chelmsford.

For the Harris demo, participants experienced wireless broadband capabilities for public safety—in real time. Using the Harris BeOn® application, which possesses the full feature set of Project 25, Harris in Chelmsford coordinated the efforts of three vehicles simulating surveillance scenarios in the field. Chelmsford participants viewed the presence of remote

users in Las Vegas, Miami-Dade and Rochester, as well as a streaming video feed from dash cams mounted on cars representing local public safety agencies.

The nationwide public safety LTE demo was the first of its kind, connecting "pilot"

programs around the nation over 700MHz spectrum. This and ongoing "pilot" programs support public safety agencies' exploration of the potential power of a nationwide LTE network, designated for emergency responders, while also helping to ensure that Harris network capabilities and equipment are field-tested to meet the future needs of emergency responders.

#

NATO's Needs

Selex Elsag Ltd. has selected ViaSat Inc. (NASDAQ: VSAT) to provide X-band antennas and the MD-1366 Enhanced Bandwidth Efficient Modem (EBEM) to expand NATO static ground satellite communications in Belgium and Italy, and upgrade services in Greece and Turkey.

ViaSat technology is designed to provide the Selex and NATO Satellite Ground Station (SGS) project with multicarrier-capable antennas and a secure, bandwidth efficient, open standard system to ensure coalition interoperability.

The value of the contract is in excess of $10 million. The order is for multiple 16m and 11.3m X-band Earth stations, ViaSat MD-1366 modems, and services. The new terminals are scheduled to be installed and commissioned at NATO European sites with delivery starting by end of calendar 2012.

The MD-1366 EBEM replaces legacy, FDMA modems and ensures future interoperability with joint, allied, and coalition forces.

The MD-1366 is the industry's only DSCS and WGS certified, fully STANAG 4486 ed.3 compliant modem. The modem eliminates the need for a separate Inline Network Encryptor (INE) with FIPS 140-2 Level 2 certified AES-256 bulk encryption.

#

A Nod To A Mod

The U.S. Air Force Space Command has awarded a $111 million contract modification to Boeing Space and Intelligence Systems.

The contract is for the development and production of an enhanced payload channelizer for Wideband Global Satellite Program's eighth and ninth satellites. This enhancement nearly doubles communications bandwidth on each satellite which will be available to worldwide U.S. and Allied military forces.

AFSPC's Space and Missile Systems Center MILSATCOM Directorate is procuring WGS-7, 8 and 9 under a new commercial-like operating model that resulted in a savings to the U.S. government of several hundred million dollars.

The MILSATCOM Directorate was able to leverage some of these savings for use as a Space Modernization Initiative to improve WGS capability by inserting a new generation of integrated circuits into the payload channelizer.

Completion of this effort will enable the enhanced channelizer to be incorporated into all future

Block 2 series, WGS, photo courtesy of Boeing

WGS satellites—a 90 percent improvement in satellite bandwidth—without additional cost to the government.

WGS-1, 2 and 3 are operational and in geosynchronous orbit providing wideband communications to warfighters around the globe. WGS-4 was launched in January and is being readied for operations. WGS-5 through 9 are currently in production, with WGS-5 and WGS-6 scheduled for launch in 2013.

Wideband Global SATCOM provides anytime, anywhere communication for warfighters through broadcast, multicast and point-to-point connections. WGS is the only system that can support simultaneous X- and Ka-band communications.

The WGS cross-banding capability makes communicating across terminal types transparent to its users. WGS currently collects and routes real-time data through more than 700 X-band, 3,100 Ka-band and 400 X/Ka-band terminals in all theaters of operation.

Artistic rendition of WGS satellites, courtesy of Space and Missile Center, Los Angeles Air Force Base

#

In The Competition Is...

Raytheon Company is competing for an alternate U.S. Air Force satellite terminal program and has currently produced three Advanced Extremely High Frequency (AEHF) military terminals that already meet 80 percent of the Air Force's requirements.

Raytheon submitted a proposal to the Air Force in June for the Family of Advanced Beyond Line of Sight Terminals (FAB-T) alternate program, which will provide secure, anti-jam, communications for the U.S. president and senior military advisers.

All three of Raytheon's AEHF terminals have passed production acquisition milestone decisions and successfully tested with the on-orbit AEHF satellite. They demonstrated interoperable communications using the satellite's Extended Data Rate (XDR) waveform, one of the military's most complex, low probability-detect, anti-jam waveforms. It moves data more than five times faster than legacy EHF systems.

Raytheon's U.S. Army, Navy and Air Force terminals currently support military operations on Milstar satellites, and are deployed and ready to operate with the newest AEHF satellites as soon as they are operational.

Additionally, Raytheon Company has also connected 37 different types of radios from U.S. military and coalition partners on its vehicular soldier radio system while providing a robust and integrated backbone for on-the-move tactical communications. The system, featuring Raytheon's Next Generation Mobile Ad hoc Network Waveform (NMW), will be tested at the next phase of the U.S. Army's Network Integration Evaluation (NIE) in lab and field environments this fall.

Raytheon's Mobile Ad hoc Interoperability Network Gateway (MAINGATE) radio, with an industry leading 10 megabits per second capacity and 128-node scalability, allows for timely and reliable interoperability with coalition partners for sharing voice, text and full-motion video across the battlefield. The unmatched 10 megabits per second capacity allows soldiers to view at least 27 videos at the same time.

MAINGATE with NMW will be tested as part of the NIE 13.1 Coalition/Joint Participation at Aberdeen Proving Ground, Maryland, and White Sands Missile Range, New Mexico. NMW has recently been provided to the U.S. Department of Defense's Joint Tactical Radio System library.

#

Taking Comms To A Higher Level

The demand for UHF satellite capacity still exceeds supply by over 200 percent, according to recent Government reports.

Here to assist is Harris CapRock Communications. The Company has signed a multi-year, multi-channel agreement with Astrium Services to offer end-to-end Ultra-High Frequency (UHF) Tactical Satellite solutions to international and U.S. Government users.

The joint Harris CapRock and Astrium Services end-to-end commercial UHF service will be launched in spring 2013.

Harris CapRock now joins Astrium Services in providing UHF solutions across the entire Skynet Fleet as a global channel partner. Astrium Services owns and operates a fleet of military-grade geosynchronous communications satellites with both UHF and X-band payloads.

UHF is the ultra-critical communications link designed for users at the tactical edge, and for command and control reach-back. As the most robust beyond-line-of-sight communications available, access to scarce UHF satellite capacity is becoming increasingly important.

In February, the U.S. Government launched the first of five next generation UHF satellites known as the Mobile User Objective System (MUOS). Despite the substantial increase in capacity and capability offered by MUOS, the demand for UHF satellite capacity still exceeds supply by over 200 percent, according to recent Government reports.

The joint Harris CapRock and Astrium Services end-to-end commercial UHF service offers domestic and international users access to an unprecedented level of control over UHF capacity compared to today. The service will include dedicated 25 kHz and 5 kHz satellite channels for use with any UHF Tactical Satellite (TACSAT) capable radios, including several prevalent Harris models such as its Falcon II® and Falcon III® product lines. Using a new Harris TACSAT waveform, offered as part of the end-to-end service, users will be able to actively manage their channels by splitting the capacity into multiple networks for simultaneous users—a significant improvement over current levels of capability.

The UHF service also will support legacy UHF waveforms such as DAMA and IW when using government infrastructure.

Harris CapRock provides comprehensive, end-to-end related products for space missions

"UHF is essential when assured tactical communications are a must," said Tom Eaton, president, Harris CapRock. "Because we are part of Harris Corporation, we are able to combine industry-leading radios and waveforms with Harris CapRock's satellite and terrestrial infrastructure to offer end-to-end UHF solutions to customers operating in extreme environments. We also are enabling something our customers have never had before—full control over their UHF missions."

"Astrium Services pioneered the concept of commercially supplied military-hardened SATCOM capacity, and this represents another step forward in delivering real capability directly to the end users," said Simon Kershaw, executive director Telecom Governmental, Astrium Services. "Combining our military-hardened Skynet space segment with Harris' market-leading radios and end-to-end solutions gives users a greater choice, straight capacity or managed UHF services, without worrying about integration, licensing or support. This combination and the launch of a fourth Skynet-5 satellite toward the

end of this year means we can reach out to even more customers with this very capable, world-class system."

Harris CapRock Communications provides managed satellite and terrestrial communications solutions, specifically for remote and harsh environments including the energy, government and maritime markets. Harris CapRock owns and operates a robust global infrastructure that includes teleports on six continents, five 24/7 customer support centers, local presence in 23 countries, and over 275 global field service personnel supporting customer locations across North America, Central and South America, Europe, West Africa and Asia Pacific.

#

Secret Satellite Into Space!

A great way to end a week of consternation—in spite of hurricane Debby, send the most powerful rocket into space on a secret military spying mission.

A United Launch Alliance (ULA) Delta IV Heavy rocket carrying a payload for the National Reconnaissance Office (NRO) lifted off from Space Launch Complex-37 here on June 19th at 9:15 a.m. EDT. Designated NROL-15, the mission is in support of national defense.

"Today's successful launch of the NROL-15 mission is the third of four launches for the NRO this year and the second EELV launch for the NRO in just nine days," said Jim Sponnick, ULA vice president, Mission Operations. "We congratulate the combined NRO, U.S. Air Force and ULA team along with our mission partners for their continued focus on mission success as we deliver the critical capabilities to support the soldiers, sailors, airmen and Marines."

This mission was launched aboard a Delta IV Heavy configuration vehicle, which featured a center common

booster core along with two strap-on common booster cores. Each common booster core was powered by an RS-68A Liquid Hydrogen/Liquid Oxygen engine producing 797,000 pounds of thrust.

A single RL10 Liquid Hydrogen/Liquid Oxygen engine powered the second stage. The booster and upper stage engines are both built by Pratt & Whitney Rocketdyne.

The payload was encased by a five-meter diameter (16.7-foot diameter), 65-foot, metallic tri-sector payload fairing. ULA constructed the Delta IV Heavy launch vehicle in Decatur, Alabama.

This was the inaugural flight of the RS-68A engine, which was upgraded from the RS-68 under the Heavy Upgrade program for the Delta IV Heavy configuration.

With the RS-68A engine upgrade, the thrust has been increased from approximately 758,000 pounds to 797,000 pounds and the engine overall efficiency (specific impulse) has also been increased.

"The upgraded Delta IV Heavy vehicle was developed with an extremely thorough

This launch was the third of four launches for the NRO this year and the second launch for the NRO in just nine days. Photo by Pat Corkery, United Launch Alliance

and comprehensive system engineering process by the ULA and Pratt-Whitney Rocketdyne teams, along with substantial involvement by our U.S. government customers," said Sponnick. "Congratulations to the entire team on today's successful inaugural flight of the upgraded Delta IV Heavy launch vehicle and the RS-68A engine."

Commercially developed in partnership with the United States Air Force to provide assured access to space for Department of Defense and other government payloads, the Evolved Expendable Launch Vehicle Program supports the full range of government mission requirements, while delivering on schedule and providing significant cost savings over the heritage launch systems.

ULA's next launch is the Atlas V NROL-36 mission for the NRO scheduled August 2 from Space Launch Complex-3 at Vandenberg Air Force Base, California.

ULA program management, engineering, test, and mission support functions are headquartered in Denver, Colorado. Manufacturing, assembly and integration operations are located at Decatur, Alabama, and Harlingen, Texas. Launch operations are located at Cape Canaveral AFS, Florida, and Vandenberg AFB, California.

#

Lose That Latency

Hughes Network Systems, LLC has successfully demo'd wireless 4G/Long Term Evolution (LTE) transmissions over satellite backhaul at download speeds of more than 10 Mbps and upload speeds of 786 Kbps, including video phone calls.

The testing involved the combination of a Hughes satellite modem with JUPITER™ high-throughput technology and Lemko Corporation's Distributed Mobility Wireless Network (DiMoWiNe).

"The growing need for the dissemination of real-time video to our warfighters requires the combination of wireless 4G/LTE and high-throughput satellite backhaul," said Rick Lober, vice president and general manager of Hughes Defense and Intelligence Systems Division. "The

Welcome Home-land Security

Whew!...”to keep the homeland safe, including border protection, customs enforcement, drug interdiction, and emergency response to natural and man-made disasters.”

The U.S. Department of Homeland Security (DHS) has awarded Thales Communications Inc. of Clarksburg, Maryland, a Prime Contract to provide public safety and tactical communications products to DHS under its new Tactical Communications (TacCom) program.

Through this multiple-award, indefinite-delivery, indefinite quantity (IDIQ) program, DHS will quickly procure vital tactical radio equipment and other products and services.

The agency will use the equipment to support reliable and interoperable public safety communications for its missions to keep the homeland safe, including border protection, customs enforcement, drug interdiction, and emergency response to natural and man-made disasters.

“Communications for DHS agencies that interoperate with all first responders is critical to protecting national security and supporting local governments during disasters,” said Michael Sheehan, President and CEO of Thales Communications, Inc. “Thales is positioned to offer DHS, through the TacCom program, the critical multiband band, multi-mission radio equipment it needs to keep America safe, while offering the greatest value to taxpayers.”

In addition to DHS, other federal agencies, including the Departments of Interior, State, and Justice, and the White House Communications Agency, can use the TacCom IDIQ contract vehicle to acquire the multiband radios they need to perform their missions.

The two-year program has three option years and a potential ceiling value of $3 billion for all awardees.

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unique combination of these technologies eliminates the latency issues that can disrupt LTE traffic backhauled over conventional satellite links.”

Deploying wireless 4G/LTE systems using a satellite backbone enables important applications for mobile broadband in tactical communications for both military and public safety markets. Warfighters will have the most advanced mobile communications available with rapid deployment capabilities, as will first responders in the critical minutes after a disaster.

“DiMoWiNe is a key innovation breakthrough needed to bring mobile 4G LTE networks to warfighters and public safety officers,” said Chris White, executive vice president at Lemko. “LTE over satellite completes the 4G ecosystem. Because of the need to have interoperability across networks and devices, remote and rapid deployment applications can leverage the massive worldwide ecosystem for hardware and applications.”

Hughes JUPITER high-throughput technology operates over ECHOSTAR® XVII, the company’s next-generation Ka-band satellite. This satellite system employs an advanced multi-spot beam and bent-pipe architecture, and will provide well over 100 Gbps capacity in North America. Lemko has efficiently connected hundreds of GSM, CDMA, UMTS and EVDO commercial and tactical wireless networks via satellite. Lemko’s DiMoWiNe solution virtualizes the core, and all the switching and routing is moved to the network’s edge, significantly reducing latency and jitter.

#

Microwave Makings

COM DEV International Ltd has been awarded three significant contracts to deliver hardware for commercial and military communications satellites.

The combined value of the contracts is in excess of $11 million. In addition, one of the contracts is initially structured as an Authorization to Proceed, and is expected to lead to a fully funded contract valued at a further $3 million, bringing the total expected value of the three contracts to more than $14 million. All figures are stated in Canadian dollars.

COM DEV will provide switches, multiplexer assemblies and other passive microwave equipment for the satellites. Work on the contracts will be carried out at the Company's facilities in Cambridge, Ontario and El Segundo, California, over the next 18 months.

#

FAB-T-ulous + #5 Completed

Boeing has successfully demonstrated end-to-end communication using a terminal from the Family of Advanced Beyond Line-of-Sight Terminals (FAB-T) system and the Advanced Extremely High Frequency (AEHF) satellite.

This first on-orbit test with the AEHF SV-1 satellite accomplished both extended-data-rate (XDR) and low-data-rate (LDR) communications using the FAB-T system.

"This critical test used an on-orbit satellite, proving the integrity of our FAB-T system and moving us closer to delivering this extremely important capability to our U.S. Air Force customer," said Paul Geery, Boeing vice president and FAB-T program manager. "We have conducted additional successful high-speed data tests as we work to complete

the remaining software integration and prepare for functional qualification tests."

When operational, FAB-T will provide the Air Force with protected and secure wideband satellite communications to support command and control of U.S. nuclear forces.

The system's advanced XDR capability offers Internet-like functionality and improved speed compared with earlier systems and software. The on-orbit testing, conducted late last year through February at Boeing's Systems Integration Lab in Huntington Beach, California, involved a Block 8 FAB-T and the on-orbit AEHF SV-1 satellite. As part of the testing, FAB-T acquired backward compatible LDR and XDR uplinks and downlinks.

The terminal then logged onto the AEHF satellite and exchanged backward compatible LDR and XDR data with the Single Channel Anti-jam Man Portable and Secure Mobile Anti-jam Reliable Tactical Terminal used by the U.S. Army, the

U.S. Navy Multiband Terminal and Follow On Terminal, and the Air Force Minuteman Minimum Essential Emergency Communications Network Program Upgrade terminal.

The demonstration also included AEHF Calibration Facility-Interim Command and Control terminal testing, during which FAB-T successfully transmitted and received data at 8 Mbps.

The FAB-T system additionally demonstrated terminal rekey and rekey requests via crosslink, as well as Air Force report-back capability. Since the initial test with the on-orbit AEHF satellite, the FAB-T program has demonstrated, via a satellite simulator, 24 Mbps receive capability, Navy report-back functionality, and XDR Air Force report-back functionality.

The series of tests has thoroughly demonstrated the key interfaces and functionalities used in FAB-T operations. FAB-T's success demonstrates progress toward functional qualification testing.

Boeing has also completed the fifth of 12 Global Positioning System (GPS) IIF satellites the company is building for the U.S. Air Force.

The spacecraft was built at the Satellite Development Center in El Segundo using the GPS IIF pulse-line manufacturing approach, which draws on commercial production line practices

to build satellites faster and more efficiently.

Of the five completed GPS IIF satellites, two are on orbit as part of the current 31-satellite constellation; both satellites are meeting mission requirements. Three satellites are in storage on standby for launch by the Air Force.

The remaining seven are in various stages of pulse-line production and will likely be added to the constellation over the next three to five years as determined by the Air Force to ensure robust constellation availability.

The next GPS IIF launch is scheduled for the fourth quarter of 2012. The satellite will be launched aboard a United Launch Alliance Delta IV vehicle from Cape Canaveral Air Force Station, Florida.

All images are courtesy of Boeing.

#

WAPS The Big Deal...

Sierra Nevada Corporation and ITT Exelis have teamed to build Vigilant Stare, a manned aircraft-based Wide-Area Airborne Persistent Surveillance (WAPS) system capability.

This partnership will offer customers proven, advanced solutions in airborne wide-area surveillance on an affordable, fee-for-service basis, saving upfront costs and risks.

Hosted on a Twin Otter aircraft, the Vigilant Stare system is derived from a U.S. Air Force operationally-proven system.

Vigilant Stare will provide visible and infrared coverage of city-sized areas, providing real-time motion imagery directly to diversified users involved in domestic support missions. Vigilant Stare motion imagery simultaneously covers three tiers:

• *The full field of regard*

• *Multiple sub-views of the full field of view*

• *Best-resolution tactical chip-outs*

These products will be provided to users through an enterprise dissemination backend with best-resolution chip-outs provided directly and in real time to users engaged in ground operations.

The Vigilant Stare partnership between SNC and Exelis brings mature operational capability to market, delivering ready-now Wide-Area Airborne Surveillance capabilities with multiple service options that help customers meet their mission needs on a more affordable and flexible basis.

The Vigilant Stare is based on technology used on board the U.S. Air Force's Gorgon Stare UAVs but is tailored for domestic security agency applications.

#

Honoring Achievements

The Society of Satellite Professionals International (SSPI) has opened nominations for its seventh annual Promise Awards.

These awards honor young leaders in the satellite industry for outstanding achievement. Nominations are also being accepted for the Mentor Award,

which recognizes an industry executive for mentoring rising young professionals. The Awards will be presented at the Future Leaders Dinner in Manhattan on Tuesday, November 13, which is the opening night of the SATCON and Content & Communications World events. A portion of the proceeds from the dinner will go to SSPI's Educational Fund. Nomination criteria and forms can be downloaded from the SSPI web site. Nominations close September 14, 2012.

Nominees for the Promise Award must demonstrate initiative, innovation, creativity and problem-solving skills that positively impact their company's financial performance, marketing effectiveness, technical advancement or research capabilities.

Past winners of Promise Awards have included young employees of SpaceX, Hughes Network Systems, the Space & Missile Systems Center of the United States Air Force, RRsat Global Communications, Space Systems/Loral, CNN, Boeing Satellite Systems, CapRock Government Solutions, Willis Inspace, Intelsat, Lockheed Martin Commercial Space Systems, and Futron.

Mentor Award nominees are distinguished by their voluntary contributions to industry causes and track record of coaching, motivating and fostering young professionals to elevate their professional capabilities and leadership potential.

Past Mentor Award winners have included Tom Eaton, President, Harris CapRock, Dick Tauber of CNN, Dom Stasi of Avail/TVN, Francesco Frenza of the Cisneros Group, and Andrew Werth of Hughes Network Systems.

# #

Coyotes + The Black Hills

The South Dakota National Guard's 28th annual Golden Coyote training exercise is underway in Rapid City and the southern Black Hills, with more than 2,200 service members participating from across the country and the world.

The two-week training exercise, which began June 9 and continues until the 23, allows military forces to conduct combat support and combat service support missions in a realistic training environment and provide valuable services to the public.

Created in the mid 1980s with the cooperation of the National Forest Service and Custer State Park, the exercise provides relevant training opportunities in support of overseas contingency operations and homeland defense.

Golden Coyote has developed into one of the nation's top training opportunities for National Guard, reserve and active-duty forces, as well as military personnel from foreign countries.

"This exercise is a great opportunity for units to tailor their training to their needs," said Brig. Gen. Jeff Marlette, commander of forces for Golden Coyote. "Nationwide there are very few exercises that are designed for National Guard, U.S. reserve and international forces to come together and train. It helps to prepare units to be able to go abroad and support operations overseas, as well as train on homeland security missions right here in the United States."

There are 37 units representing 17 states and six foreign nations participating in the exercise and from multiple branches of military service—Army, Navy, and Air Force—working together to create an invaluable training experience.

This includes medical, chemical, transportation, signal, aviation, military police, engineer and quartermaster units. These military forces train on their equipment and employ tactics to prepare them for any future overseas deployment.

"Military forces are able to participate in numerous warrior training tasks and battle drills, such as urban combat operations, medical aid, and day and night convoy operations," said Maj. Travis Eastman, exercise coordinator.

Units can also participate in combat patrols, fire arms training and reacting to improvised explosive devices, said Eastman.

Participating units also complete various projects that help improve the forest and local communities. Local residents receive numerous benefits of the many engineering projects conducted during the training exercise.

Units will be repairing roadways, providing reclamation of hazardous wilderness areas and hauling cut timber from the forest.

"We have transportation units moving timber cut by the National Forest Service for fire control purposes to Native American reservation communities who can use it as firewood," said Eastman.

Spc. Derrick Patterson, a satellite operator with Charlie Company, 98th Expeditionary Signal Battalion, U.S. Army Reserve of San Diego, secures a cable on a Satellite Transportable Terminal at Camp Lancer during the Golden Coyote training exercise June 10, 2012, in Rapid City, S.D. Patterson is one of 2,200 service members from the National Guard, U.S. reserve and international forces participating in the exercise, which provides training opportunities in support of overseas contingency operations and homeland defense.

Soldiers from the 860th Military Police Company, Arizona Army National Guard of Tucson, and the Danish Home Guard Force Protection Platoon conduct a joint patrol on West Camp Rapid during the Golden Coyote training exercise June 10, 2012, in Rapid City, S.D. National Guard, U.S. reserve and international forces use the exercise as an opportunity to conduct joint training in support of overseas contingency operations and homeland defense.

"Our engineers will also repair hazardous wilderness areas and make them safe for public use, and re-surface local roadways that have fallen into disrepair."

"This exercise is a great testament to how we come together with the civilian public," said Marlette. "We coordinate with the National Forest Service, Custer State Park and other local agencies, and the event allows both their agencies and us to be better prepared to meet homeland security missions and provide services to the public."

This year's exercise also includes members from the United Kingdom, Denmark, Canada, Australia, New Zealand and Suriname.

"The training aim for this exercise is the interoperability with our allies and synchronization between different work forces and equipment," said United Kingdom Territorial Army Maj. Andrew Inglis, Headquarters, 71st Engineer Regiment. "We are looking to provide aid to your civil community here; mainly to conduct route construction, hauling missions and other construction projects.

"As combat engineers we are soldiers first, so we will take part in the exercise's warrior lanes," continued Inglis. "The majority of (soldiers) here will probably deploy in the next two to three years, so this is a method of the sub-unit commander to look at his people and make sure they are ready to deploy."

"The international units here provide us an opportunity for joint operations that we will conduct serving our counties abroad," said Marlette.

Story by Maj. Anthony Deiss

#

Joining Forces For JISR

SES has an agreement with Northrop Grumman Corporation (NYSE:NOC) to supply satellite capacity and services for the NATO Alliance Ground Surveillance (AGS) system.

Operating under NATO command, AGS will be a major data source for NATO's system for Joint Intelligence, Surveillance and Reconnaissance (JISR).

AGS supports NATO's intelligence, surveillance and reconnaissance requirements and a broad range of missions, including protecting ground forces, border and maritime security, counter- and anti-terrorism, crisis management, peacekeeping and enforcement, humanitarian assistance and natural disaster relief.

SES will deliver Ku-band capacity over the U.S. and Europe, as well as engineering support in the design and development of the system.

As prime contractor for the NATO AGS program, Northrop

NATO AGS artist's concept, courtesy of Northrop Grumman Corp.

Grumman will provide the necessary five Global Hawk air vehicles, supporting systems and payloads. The payloads include the Multi-Platform Radar Technology Insertion Program (MP-RTIP) radar system capable of detecting and tracking moving objects as well as providing radar imagery of target locations and stationary objects.

Northrop Grumman signed a $1.7 billion (1.2 billion euros) contract with NATO and 13 participating nations in May

2012. In addition to the air segment, the contract also includes the purchase, initial operation and maintenance of the ground stations, comprised of mobile and transportable units and providing real-time data, intelligence and target identification to commanders within and beyond line of sight.

AGS participating nations include Bulgaria, Czech Republic, Estonia, Germany, Italy, Latvia, Lithuania, Luxembourg, Norway, Romania, Slovak Republic, Slovenia, and the USA.

The AGS Core will be able to look at what is happening on the Earth's surface, providing situational awareness before, during and, if necessary, after NATO operations.

The AGS Core will be an integrated system consisting of an air segment and a ground segment.

The air segment will be based on the Block 40 version of the U.S. RQ-4B Global Hawk high-altitude, long-endurance unmanned aerial vehicle (UAV). The UAV will be equipped with the state-of-the-art multi-platform radar technology insertion program (MP-RTIP) ground surveillance radar sensor, and also with an extensive suite of line-of-sight

and beyond-line-of-sight long-range, wideband data links.

The ground segment will provide an interface between the AGS Core system and a wide range of Command, Control, Intelligence, Surveillance and Reconnaissance (C2ISR) systems to interconnect with and provide data to multiple deployed and non-deployed operational users, including reach-back facilities, remote from the surveillance area.

The primary ground segment component will consist of a number of ground stations in different configurations, such as mobile and transportable configurations, which will provide data link connectivity, data processing and exploitation capabilities, and interfaces for interoperability with C2ISR systems. The AGS Core ground segment will also include dedicated mission support facilities at the AGS Main Operating Base (MOB), and ground stations for flight control of the UAVs. The Main Operating Base will be located at Sigonella Air Base, Italy.

The composition of the AGS Core system will provide NATO with considerable flexibility in employing its surveillance capabilities in a manner that can be tailored to the needs of any emerging situation.

The Core system will be supplemented by interoperable national airborne stand-off ground surveillance systems from NATO countries, thus forming a system of systems.

#

Will Deliver DoD Upgrades

Harris Corporation has been awarded a $26 million indefinite-delivery, indefinite-quantity contract to upgrade and maintain the U.S. Department of Defense Soldier Radio Waveform (SRW) for wideband tactical communications.

The U.S. government will leverage Harris' expertise in wideband networking to add greater capabilities to the open-standard SRW waveform software and make it more widely available to U.S. forces in next-generation tactical radios.

Developed by the Joint Tactical Radio System (JTRS) program, SRW is a DoD voice and data waveform standard used to extend battlefield IP networks to the tactical edge. Under terms of the contract, Harris will deliver improved capabilities, maintenance and ongoing support for the waveform over five years.

Key enhancements developed by Harris will be placed in the JTRS Program Information Repository (IR), which was established to facilitate software re-use in DoD tactical radios.

The Harris Falcon III® AN/PRC-117G manpack is NSA certified for a Type-1 implementation of SRW.

Additionally, Harris has integrated the AN/PRC-117G and AN/PRC-152A with the JTRS Joint Enterprise Network Manager to assure interoperability with tactical radios developed by other vendors. Both the AN/PRC-117G and AN/PRC-152A operated SRW in the recent U.S. Army Network Integration Evaluation at Fort Bliss, Texas, and White Sands, New Mexico.

A principal goal of the NIE was to validate the Army's network architecture, which includes both the AN/PRC-117G and AN/PRC-152A radios, for Capability Set 13.

#

Special Ops Special

L-3 Communications' announced its L-3 GCS subsidiary has been awarded a contract by the U.S. Special Operations Command (USSOCOM) to develop and manufacture VSAT satellite systems.

The program, known as Special Operations Forces Deployable Node-Family of Terminals (SDN-Lite FoT), will provide tactically deployed Special Operations Forces (SOF) users with worldwide communications connectivity.

The total contract value is up to $500 million over the next five years.

#

Space + Cyberspace Priorities...

The following is a new list of Air Force Space Command's space and cyberspace priorities. Included is a brief explanation of why the priorities are in place and a definition of each priority.

The Air Force defines itself through **12 Service Core Functions:**

- *Air Superiority*

- *Building Partnerships*

- *Global Precision Attack*

- *Personnel Recovery*

- *Nuclear Deterrence Operations*

- *Special Operations*

- *Rapid Global Mobility*

- *Agile Combat Support*

- *Global Integrated ISR*

- *Command and Control*

- *Cyberspace Superiority*

- *Space Superiority*

The Secretary of the Air Force designated the AFSPC Commander the Core Function Lead Integrator (CFLI) for the Space and Cyberspace Superiority core functions.

In this role, the AFSPC Commander is responsible for defining Service-wide investments supporting these Core Functions, and for establishing a desired end state in the Core Function Master Plans (CFMPs) to guide Air Force investment decisions.

While all capabilities fielded within a CFMP are important to the Air Force, the CFLI evaluates current military doctrine, operations, policy and potential threats to prioritize capabilities within the core functions. Prioritized capabilities then guide the strategic planning, investment decisions, and development and fielding of space and cyberspace systems.

The 15 Prioritized Space Capabilities are:

- **Nuclear, Survivable Communications.** *Global satellite communications designed to operate in a highly contested environment in support of national and military needs. These types of satellite systems are designed to fight in and through an adversary's denial and disruption techniques as well as continue to operate when exposed to high levels of man-made or environmental radiation.*

- **Launch Detection / Missile Tracking.** *These space systems, often supported by ground-based radar systems, have sensors that detect the infrared heat signatures of missile and rocket launches around the world. Through a network of information sharing, this sensor data is processed to provide early warning of launches to U.S. and coalition forces.*

- **Position, Navigation and Timing (PNT).** *PNT, commonly referred to as GPS, provides precise location, elevation, direction and speed for land, sea and airborne assets equipped with a receiver. The timing signal from these space-based systems is also used in many data transfer and communications systems that require precise timing signals.*

- **Space Situational Awareness & Battlespace Awareness.** *Space situational awareness, or SSA, is comprised of both ground and space-based optical and radar systems that provide "visibility" into orbital operations, satellite position and space debris tracking. This information is provided to space operators for cataloging space systems, avoidance maneuver and protection. Battlespace Awareness is the knowledge gained from processing and presenting information necessary to plan and control military space operations.*

- **Defensive Space Control (DSC).** *DSC consists of actions taken (e.g., certain maneuvers) or defensive sub-systems built into our space systems (e.g., shutters to protect sensors) that enhance the survivability of space systems when exposed to the natural environmental hazards of space or when purposely targeted by adversaries who possess electronic, high-energy or kinetic anti-satellite weapons.*

- **Assured Space Access / Spacelift.** *The ability to launch payloads into space, which includes the launch range assets required to conduct space launches.*

- **Space Command and Control (C2).** *Space C2 is the ability to provide reliable and unimpeded observation, orders, direction and effects-based monitoring for military space operations, space units and space systems.*

- **Satellite Operations.** *Spacecraft and payload operations conducted to monitor, configure, maneuver, operate and sustain on-orbit assets. This includes telemetry, tracking and commanding (TT&C), maneuvering, monitoring state-of-health, and maintenance and sub-functions for the spacecraft and payloads.*

- **Protected, Tactical Communications.** *Satellite communications which are designed to operate in a day-to-day and contested environment to support worldwide national and military communications.*

- **Offensive Space Control**. *Operations conducted to prevent an adversary's hostile use of U.S. and/or third party space capabilities and service, and to negate an adversary's space capabilities (e.g. disrupt, deny, deceive, degrade, or destroy).*
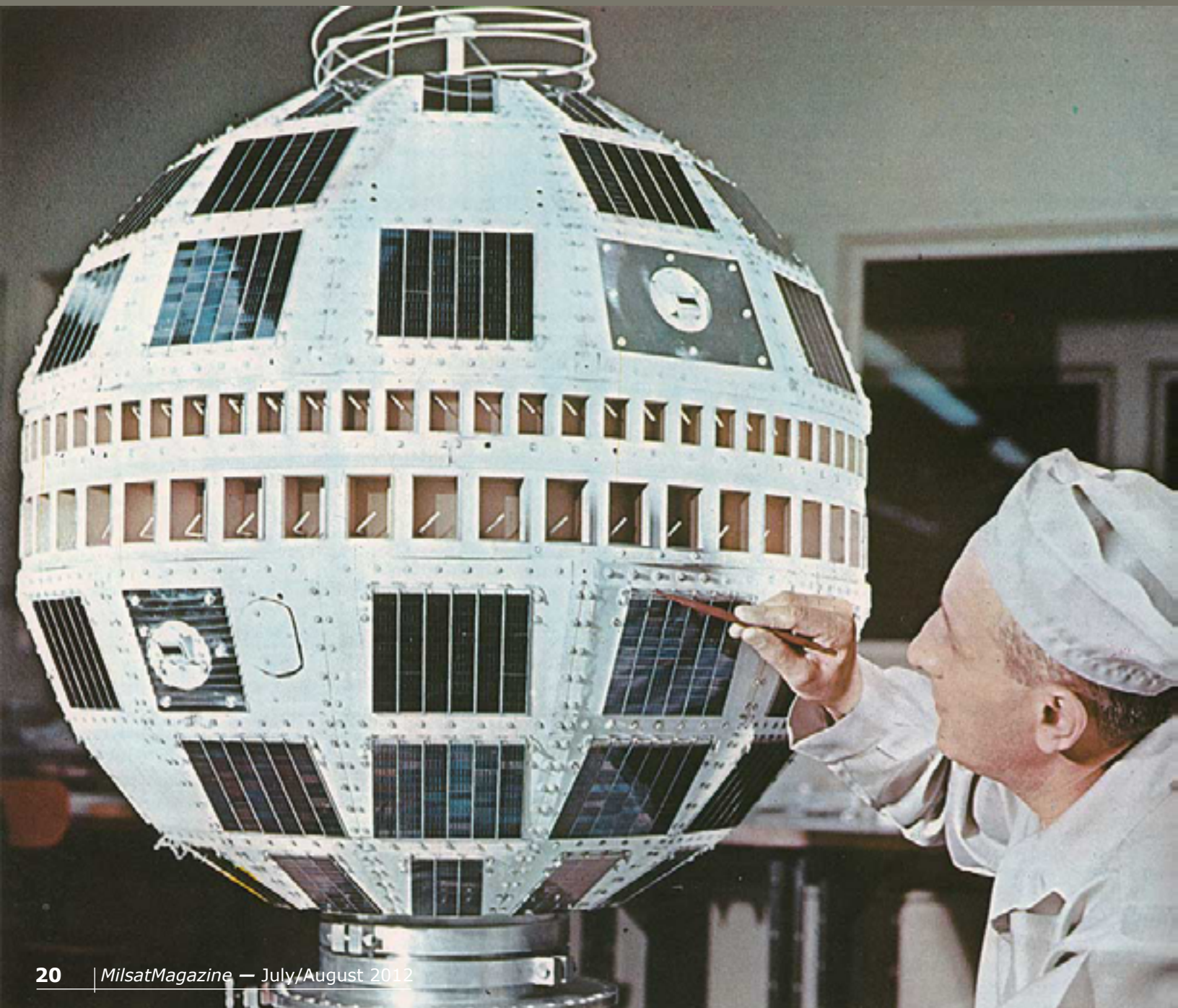
- **Unprotected Communications.** *Satellite communications which are designed to operate in a day-to-day (benign) environment to support national and military communications worldwide.*

- **Space to Surface Intelligence Surveillance and Reconnaissance (ISR)***. This capability is comprised of sensors that can detect or image objects, geographic features, physical change, movement of objects and electro-magnetic spectrum variances on the ground.*

- **Terrestrial Environmental Monitoring.** *Characterization, analysis and prediction of meteorological and oceanographic environment factors (surface, sub-surface and air conditions) that might affect military operations.*

- **Nuclear Detonation Detection***. Persistent, global and integrated sensor capability providing global surveillance of nuclear detonations and their specific place, height of burst and yield.*

- **Responsive Spacelift.** *The capability to rapidly deploy, augment or reconstitute satellites/ payloads, including the capability to responsively place payloads on orbit to meet the warfighter's needs.*

The Nine (9) Prioritized Cyberspace Capabilities are:

- **Proactive Defense.** *Comprises the continuous measures taken to secure and protect AF and DoD cyberspace assets from attack and exploitation.*

- **Defensive Counter Cyberspace (Recon/ Counter Recon).** *The employment of defensive measures that ensure the military can continue to operate in cyberspace.*

- **Cyberspace Intelligence, Surveillance and Reconnaissance & Situational Awareness.** *The integration of systems in support of operations providing accurate, relevant and timely intelligence.*

- **Persistent Network Operations.** *The continuous and agile operation of worldwide AF garrison and deployed networks. Data Confidentiality & Integrity Systems. Activities that safeguard information that resides on the Air Force Network and is provided to the joint warfighter.*

- **Cyberspace Operations Center.** *Activities that provide real-time command and control over military cyberspace forces.*

- **Offensive Counter Cyberspace for Global Reach & Access.** *Operations conducted to project power against adversaries in or through cyberspace.*

- **Net Extension and Resiliency.** *The U.S. Air Force will extend and expand cyberspace services for military and business operations.*

- **Influence Operations.** *Influence operations serve to amplify the effects of traditional military operations and influence perceptions and behaviors of leaders, groups or entire populations by means other than force (e.g., operations security, public affairs, counterintelligence operations, etc).*

#

The Birth Of Satellite Communications

By Bob Gough, Contributing Editor, Asia-Pacific

J **uly 10, 1962, marked the birth of satellite communications. Exactly 50 years ago on this date, the Telstar satellite commenced its journey into space from Cape Canaveral and became the first ever active communications satellite. It carried the first live trans-Atlantic TV broadcasts.**

These days, satellite launches are commonplace and polar orbits, MEO orbits, Molniya orbits, Tundra orbits and the geostationary orbit are filled with communications satellites operating at frequency bands from UHF through L-, S-, C-, X-, Ku-, Ka-band and above. As of January 1, 2012, there were 419 satellites operating in the geostationary orbit alone.

I'm not writing this as a "third party commentator", but as someone who has been intimately involved with, and has contributed to, the development of satellite communications over the last 35 years. I've worked with some of the organizations and people who gave birth to satellite communications—this is really a story from the heart.

My encounters were not just with those people who worked with these early satellites, but also with even earlier efforts including "Moon bounce" stuff, much of which remains classified.

What a dramatic transformation has occurred in just 50 years. Today, there are hand-held phones not much bigger than an *iPhone* that can be used anywhere on the planet to provide immediate connectivity to anywhere else. *Direct-to-Home* (**DTH**) satellite TV is the norm and even high data-rate, network-centric business communications can be achieved with ground terminal antenna sizes of only a metre in diameter. Obtaining phone and Internet connectivity from a plane is easy.

In the area of defence, the current satellite communications capabilities are just awesome—apart from strategic and Government communications, I guess you all know how UAVs are used and controlled!

Wind back the clock 50 years, and what a different world. *Twitter* and *Facebook* by telegram would be a bit dull!

One of the leading communications companies, **Bell Telephone** in the USA, poured massive resources into many areas

of fundamental physics research related to telecommunications. This all came together with their ***Telstar*** satellite and the equally important ground station developments. They funded the lot, including the launch, which was undertaken by **NASA**.

Telstar, a 34.5-inch diameter ball covered with 3,600 solar cells, weighing 170 pounds and containing 10,000 components, was launched by a 90-ft. long **Douglas *Thor Delta*** rocket (well, missile) into a 2.5 hour period inclined elliptical Earth orbit. Waiting for evidence of it were ground stations at Andover, Maine in the USA, Pleumeur Bodou in France, and Goonhilly in the U.K., with Fucino in Italy not far behind.

There are two excellent videos on YouTube covering the event. The first is a short "newsy" one, with an almost 1950s science fiction feel to it:

http://www.youtube.com/ watch?v=xdaHYAReYkg

In 1962, the first satellite telephone and television communications made news worldwide. The signals that enabled these messages to be transmitted went through the Earth Station in Andover, which communicated with the privately owned Telstar satellite. Photo is courtesy of the Maine Memory Network.

The world's first parabolic SATCOM dish—Goonhilly's Arthur 1

The second video is located at

http://www.youtube. com/watch?v=uKH-GijnAGk&feature=related

and has to be the definitive story of Telstar. It's a lengthy video produced by AT&T and is the real inside story of Telstar. Thank goodness this footage has been preserved and uploaded for all to see.

For a really detailed description of Telstar and the events at that time there is nothing to beat the Wikipedia entry at this URL...

http://en.wikipedia.org/wiki/Telstar

Finally, I have penned a couple of blog posts on my *Satellite Spy* website as well as a *SatMagazine* article covering the U.K. Earth station, **Goonhilly**. You might want to have a look:

http://www.satellitespy.net/blog/ earth-stations/help-save-goonhilly-earth-station-complex-139/

http://www.satellitespy.net/ blog/earth-stations/good-news-for-goonhilly-space-science-cornwall-299/

The SatMagazine article is available at...

http://www.satellitespy.net/go/ GHY1

About the author
Bob Gough has spent more than 35 years in the satellite communications business and has experience in most aspects of satcoms. This includes seven years with the European Space Agency (ESA). Bob was one of the first six staff members of Filtronic Components, which specialized in the critical microwave subsystems for naval and airborne EW applications. He is also the Asia-Pacific Editor of SatMagazine and MilsatMagazines. These are published monthly by the long-established Satnews Publishers.

Worlds Apart

By Giles Peeters, Defence Sector Director, Track24 Defence

The relationship between communities of military engineers and operators have traditionally been tense even though they heavily impact on one another, and communications between the two groups are more important than ever before as the nature of operations evolves. The influx of new technology and changing battlefield requirements have presented new challenges for operators and engineers and it has never been more important for both parties to work together to achieve the desired capability. Both groups must keep the higher-level concept of operations planning at the forefront of their minds in order to successfully collaborate.

Maj. Rachel Levy, commander of Company A, 450th Civil Affairs Battalion (Airborne), talks on a radio before leading her company on a training exercise.

Community Cohesion

Operators and engineers often have competing mindsets compounded by different deliverables. The engineer's role is to meet the needs of the operator by delivering the services and capability they require. The operator in the field, with an end goal, objectives and requirements, has the responsibility of defining these needs by stating to the engineers what, where and how quickly they need to achieve their capability objective.

A well-articulated operator information exchange requirement lets engineers understand the desired effect, or end result, and provide a solution accordingly. The breakdown often occurs between the two groups when they deviate from satisfactory communication: Engineers shouldn't push technology onto operators, and, conversely, operators shouldn't ask for products and devices. Instead, the operator community should define their needs, such as stating

Sgt. Andrew W. Morey looks up grid coordinates on an Apple iPad during a troop in contact mission supporting Forward Operating Base Edinburgh, Afghanistan. Rashaun X. James/Courtesy U.S. Marine Corps.

a requirement for smartphone capability rather than requesting an iPhone.

This disparity is highlighted by experiences in Afghanistan, where personnel were limited by line-of-sight radio communications technology that was inadequate for the vast and rugged terrain. Until that point, vehicle-mounted communication systems were enough to maintain situational command-and-control, but in the last decade the operation requirement has changed.

Now it's mission-critical to fulfil the requirement for *beyond line-of-sight* (**BLOS**) situational awareness capability that is robust, secure and highly portable, such as the blue force tracking systems used by NATO. These systems are becoming mandatory for most militaries—but it has only been recently acknowledged that satellite communication is the only technology appropriate to deliver this service; it has taken far too long to recognize this fact.

The communications breakdown is combated by joint organizations, such as the **U.K. Permanent Joint Headquarters** (**PJHQ**), which provides interoperable strategies and tactics for the combined armed forces and is responsible for providing operational effect. But even with dedicated bodies providing vital leadership, military organisations still struggle to match operational capability with appropriate technology.

The Changing Nature Of War

Warfare has radically changed from what it was 20 years ago; the strategy and provisions, designed for future conflicts up to the end of this decade, are not easily adapted to the changing nature of warfare—the mass interoperability required for allied military action was seriously underestimated.

Intra-community, as opposed to industrial warfare, has impacted heavily on both operator and engineer communities, who have had to quickly adapt as military forces engaged in new and unfamiliar environments. The speed of change has meant urgent operational requirements for mission-critical provisions that can make the difference between life and death, have been implemented without correct process. Now that war among the people is central to Western military strategy, both communities need to learn to effectively feed information to one another in order for engineers to procure new technology that equips operators for modern day conflicts.

Let's take a look at a classic example—the initial deployment of soft-skinned vehicles in Afghanistan that had to be haphazardly covered in metal sheeting by men on the ground when faced with the threat of IEDs. Acquired for battles with defined front and back lines, the vehicles were quickly rendered redundant in an environment in which guerrilla tactics favor IEDs and insurgents are indistinguishable from the civilian population.

It's clear that the user cases have changed, and so the operator community must be flexible in its concept of operations in order to give engineers the best chance of designing an appropriate solution using available technology.

Solutions In A Suitcase

Engineers are starting to react to these challenges with *commercial off-the-shelf* (**COTS**) solutions. COTS technology can form part of the engineer's design that directly meets needs defined in user cases. It's cost effective and can be easily adapted if requirements were to quickly change. It's also important to point out that COTS does not equal consumer.

Commercial technology can be adapted SATCOM with encryption upgraded to AES256, which is a recognized military level security measure, for example. You wouldn't send soldiers into Afghanistan using an iPhone without evaluating the security risk and making process and or technology upgrades. The benefit from a COTS perspective is that the core device/solution already exists; modifications are easy to implement and can be introduced quickly in order to make the item fit for military purpose.

Satellite communications is an excellent example of the COTS concept in action and the U.S. military is already realizing the benefit. They use commercial satellite carriers for up to 80 percent of their BLOS communications capability in active operations, in the knowledge that it is low cost, robust, secure, and flexible to the evolving needs of modern day warfare.

A British Army vehicle after an IED attack.

Therefore, defining the need is critical and can mean the difference between using COTS technology as an intuitive, practical tool for operators, and as a quick-fix that places limitations on the available range of activity. The perceived risk of a COTS solution is that it isn't fit for purpose, but this is a notion which only applies when it is procured as a band aid, where the requirement and the concept of operation have been poorly executed. The truth is that it's reliable and readily available on a large scale that, when used intelligently as part of an engineered response to user cases, will give operators exactly what they need.

Let's Just Get Going

The disparity between operator and engineer communities will always exist, but an educated vigilance of this communications problem will undoubtedly mitigate its effect. Operators need to articulate their user case and the challenges they face in conjunction with the concept of operation, rather than request specific technologies, whilst engineers need to make the most of the available COTS solutions in order to reactively meet the needs of the operators on the ground.

When both communities learn to work together, the resultant effect will be a reduction of avoidable casualties, higher levels of interoperability resulting in mission success and reductions in military spending and inefficiency.

About the author

Giles Peeters commenced his military communications career at RAF Digby in 1997 before moving on in 1998 to the Engineering Office at 751 Signals Unit on the Falkland Islands. In 1999 Peeters joined the Defence Communications Security Agency (DCSA) Corsham, as the Duty Operations Officer of the Global Operations Security Command Centre (GOSCC), before becoming the Military Liaison Officer for Signal Intelligence at GCHQ Cheltenham in 2001. Peeters then worked with the DCSA Corsham Satellite Integrated Project Team (SAT IPT) as their MOD Commercial Satellite Service Delivery Officer. From 2004 to 2007 Peeters' significant expertise in commercial satellite communications proved invaluable in Iraq and Afghanistan as he provided front line tactical communication and deployment capability for the Joint Helicopter Command (JHC) J6 SO2 from HQ Land Command, Wilton. Peeters' final rank was RAF Squadron Leader. In 2007 Peeters moved to the private sector to consult for organisations such as NATO, on blue force tracking requirements. Now Defence Sector Director at Track24 Defence, Peeters is the driving force behind the launch of the company's new, commercial-off-the-shelf (COTS) blue force tracking solution, situational Command & Control (SCC). Giles is also a Senior Contributing Editor for MILSATCOM for MilsatMagazine.

Ruggedized vehicles and improved battlefield communications.

Colonel Scott C. Larrimore

Director

Defense Weather Systems Directorate

Space and Missile Systems Center

Los Angeles Air Force Base

Colonel Larrimore leads a program team of more than 150 government and 500 contractor personnel to provide worldwide strategic and tactical forces with weather and space environmental data to support air, ground, naval, and space operations. His $4 billion portfolio includes launch, check out, and sustainment of the Defense Meteorological Satellite Program Block 5 spacecraft, supporting ground systems, and the development of successor terrestrial and space weather programs. Colonel Larrimore is directly responsible for the development, test, acquisition, and sustainment of these system elements to meet Department of Defense operational requirements. Colonel Larrimore entered the Air Force in 1986 through the Air Force Reserve Officer Training Corps at Princeton University. He has served in a variety of space operations, acquisition, command, and staff assignments. He is a Senior Materiel Leader, a member of the Department of Defense's Acquisition Corps, and a fully-qualified Joint Specialty Officer. Colonel Larrimore previously commanded at the Squadron and Group levels, and served as an Air Force National Defense Fellow.

MilsatMagazine (MSM)
Good day, Colonel Larrimore... given your service in the United States Air Force since 1986, how did you determine that you wanted to serve and build a career with this branch of our Nation's Armed Services?

Colonel Larrimore
As many in my generation, I joined the United States Air Force because of the space program. I remember being glued to the television as a young child, watching with awe and excitement as Neil Armstrong took his tenuous steps on the Moon. Ever since that day, I knew I wanted to help advance our knowledge in this mysterious new environment. The Air Force continues to offer fantastic opportunities to meet this ambition while protecting our nation.

MSM
How did you evolve into the space command division of the U.S.A.F.? What aspect(s) of the space programs attracted you to this arena?

Colonel Larrimore
I've been fortunate to be involved in most major aspects of our space enterprise within the Air Force. I started out in space operations which gave me an appreciation of what capabilities our warfighters need each and every day. Later, I worked more traditional engineering projects which pushed the technological state of the art. Now, I am working larger scale system development and acquisition, linking available technology to affordable and resilient space capabilities our operators need and depend upon.

MSM
Looking back to your formative years in middle and high school, and then at Princeton and Purdue, how important was STEM training to your life goals?

Colonel Larrimore
Science, technology, engineering and mathematics form the foundation for innovation and advancement in almost all endeavors, and the space enterprise is no exception. A strong STEM background gave me the tools to understand how and why space systems work the way they do, and what we could do to improve on existing capabilities. STEM remains crucial to our nation's technological competitive advantage.

MSM
What can the industry, from the military point of view, do to offer more STEM training to ensure an array of qualified personnel for enlistment into the U.S.A.F. and other branches of our services?

Colonel Larrimore
I encourage industry, as well as government, to keep offering engagement opportunities to students across the education spectrum. Demonstrations, competitions, and assistance to schools help generate the sparks of curiosity. Our nation's science and math teachers need support throughout the community to ensure they have the resources, material, and access to expertise to nurture their students' curiosity into new ideas and invention.

MSM
Would you please explain to us exactly what the Defense Weather Systems Directorate provides that supports our armed services and government programs?

Colonel Larrimore
The Defense Weather System Directorate acquires and fields our nation's space and spaceborne national security weather systems. We develop and launch the Defense Meteorological Satellite Program, a capability our nation has relied upon in various increments for 50 years. We build upon the DMSP foundation by fielding affordable, smaller space weather sensors; incorporating relevant data from our civil and international partners; and leveraging usable data from non-traditional weather sensors. The Directorate works hand-in-hand with our operational customers at the Air Force Weather Agency (AFWA) and the Navy's Fleet Numerical Meteorology and Oceanography Center (FNMOC) to ensure the perishable weather data is getting to the right forecaster to support military operations on land, sea, air, and space.

MSM
What is the Defense Meteorological Satellite Program Block 5 program? How important is this program to our overall national security?

Colonel Larrimore

The DMSP Block 5 is the current fleet of weather satellites providing critical weather data to our national strategic leaders and deployed forces. Block 5 actually consists of several increments. We are currently flying the 5D-3 satellite increment, with two spacecraft left to launch and operate. The satellite's optical sensors show worldwide cloud data for the Air Force; its microwave sensor tracks typhoons and sea surface winds for the Navy and determines soil moisture for the Army; the satellite's space weather sensors help predict GPS weapon accuracy and long distance communication outages. I'm pleased to say DMSP will be providing very important support to all Services well into the future.

MSM
What support services are required for DMSP missions?

Colonel Larrimore

We operate the DMSP mission (in partnership with the National Oceanic and Atmospheric Administration) with several support services. First we need launch services to get the satellites in orbit. We can launch DMSPs on either Evolved Expendable Launch Vehicle (EELV), the Delta IV or Atlas V.

Once in orbit, we use the Air Force Satellite and Control Network (AFSCN) worldwide antennas for command and telemetry contacts with the spacecraft. We also use dedicated weather ground receive antennas at Fairbanks, Alaska to augment

AFSCN. The DMSP system uses a variety of communication services to quickly provide perishable weather data to operational forecasting centers such as AFWA and FNMOC.

MSM
How is the acquired weather and space data applied to air, ground, naval and space operations? What sort of delay is there in the transmission of such data to the appropriate command center? Do "boots on the ground" have access to such operational data when in the field and, if not, when would they be able to acquire this information to ensure mission success and casualties prevention?

Colonel Larrimore

Weather data collected by DMSP is provided to the Services' operational forecasting centers. There, a variety of tools and algorithms are applied to generate appropriate weather tools, such as cloud and storm forecasting, typhoon tracking, sea surface wind modeling, and land surface moisture predictions.

The DMSP satellites operate in a 101 min polar orbit. That means that we can collect weather data at least every two hours as the satellite passes over the Fairbanks, Alaska ground site.

In addition, the Air Force and Navy also operate tactical weather receive stations with their MARK IVB and FMQ-17 systems, respectively. These systems take advantage of DMSP's real-time data broadcast capability. Theater commanders can obtain data almost immediately as DMSP satellites fly over the tactical terminal.

Artistic rendition of the DMSP satellite, image courtesy of U.S.A.F.

MSM
With your team, what is the process required to determine the development of current and future programs within your command?

Colonel Larrimore
We follow the procedures provided in Department of Defense Instruction 5000.02, Defense Acquisition System. This structure ensures the requirements for a new system have been validated, several alternatives are considered to choose the most cost effective system to meet those requirements, and the appropriate amount of oversight is applied to guide the acquisition.

MSM
The Space Environmental Sensing System plays an important role within the DWS efforts—could you explain how such operates and what its goals are in relation to combatant support?

Colonel Larrimore
Our Space Situational Awareness Environmental Monitoring (SSAEM) program satisfies some space weather requirements demanifested from the National Polar-orbiting Operational Environmental Satellite System from that program's Nunn McCurdy recertification in 2006. The program will deploy three payloads: a Global Positioning System (GPS) Radio Occultation sensor that will provide ionospheric research and space weather forecasting as well as atmospheric vertical temperature and moisture profiles; an Ion Velocity Meter (IVM) that measures the in situ ion velocity vector, ion temperature, and ion composition to better predict the affect of the ionosphere on communications; and a radio frequency beacon that will help predict atmospheric scintillation. This is important for GPS weapon accuracy and satellite communication services to deployed forces by better predicting errors attributed to the space environment.

MSM
Given your experience with the U.S.A.F., what "challenges" are ahead for DWSD programs, given current budget restrictions enforced by shortsighted politicians. How will you manage your current and future operations with your hands somewhat tied? And will Space and Missile Systems Center be able to continue to deliver the current high level of support to all troops? If so, how?

Colonel Larrimore
Any new space system will face challenges never experienced before. The space environment is becoming increasingly congested, contested and competitive as new nations, international organizations, and corporations gain the ability to operate in space. The national fiscal environment forces us to address these challenges with a tight focus on affordability. But in the face of these challenges come opportunities.

We have the opportunity today to apply new technologies and methods to create smaller, flexible, and resilient spacecraft to meet our national security needs at a fraction of the cost of past proposals. We also have the opportunity to leverage our civil and international partners investments to ensure we are getting the right weather data to operational forecasters as efficiently and effectively as possible.

MSM
Looking back over your career, which projects bring a true sense of satisfaction and a smile to your face?

Colonel Larrimore
At first, one might think about exciting operational accomplishments such as launching the SBIRS GEO-1 satellite or seeing an idea come to fruition such as the GEOlite satellite, but I think I'm most gratified when thinking about how teams I've been associated with have reached out to help others. It's extremely rewarding to see a child in a local elementary school get excited about a subject, become intellectually curious, and yearn to learn. Our Weather Directorate continues this long tradition of community outreach with an active association with local schools.

An artistic concept illustration of the DSMP satellite, courtesy of the U.S.A.F.

OPS

Enhanced Mobile Command In A Reduced Budget Environment

by Mark Lueker, Director, Advanced Products Group, 308 SYSTEMS, inc.

Whether you were there or not, the images of the devastation in South Asia created by the 2004 tsunami are unforgettable. Wreckage was everywhere. The large numbers of responders in Indonesia, where the tsunami wrought the worst damage, worked around the clock in their search, recovery and rescue efforts.

However, efforts were stymied by the unavailability of reliable communications and command centers that weren't able to coordinate among personnel. Vehicle based mobile command found most of the terrain impassable, cell towers were down and access to satellite signals were degraded because of debris and mountainous terrain creating responder Beyond Line of Sight (BLOS) signal issues. The sense of desperation responders felt in the face of unreliable and even unavailable communications was unimaginable. Several man-portable TAC-PAK mobile command centers, manufactured by 308 SYSTEMS of Fort Collins, Colorado, were on the scene and the poor communications situation was instantly reversed.
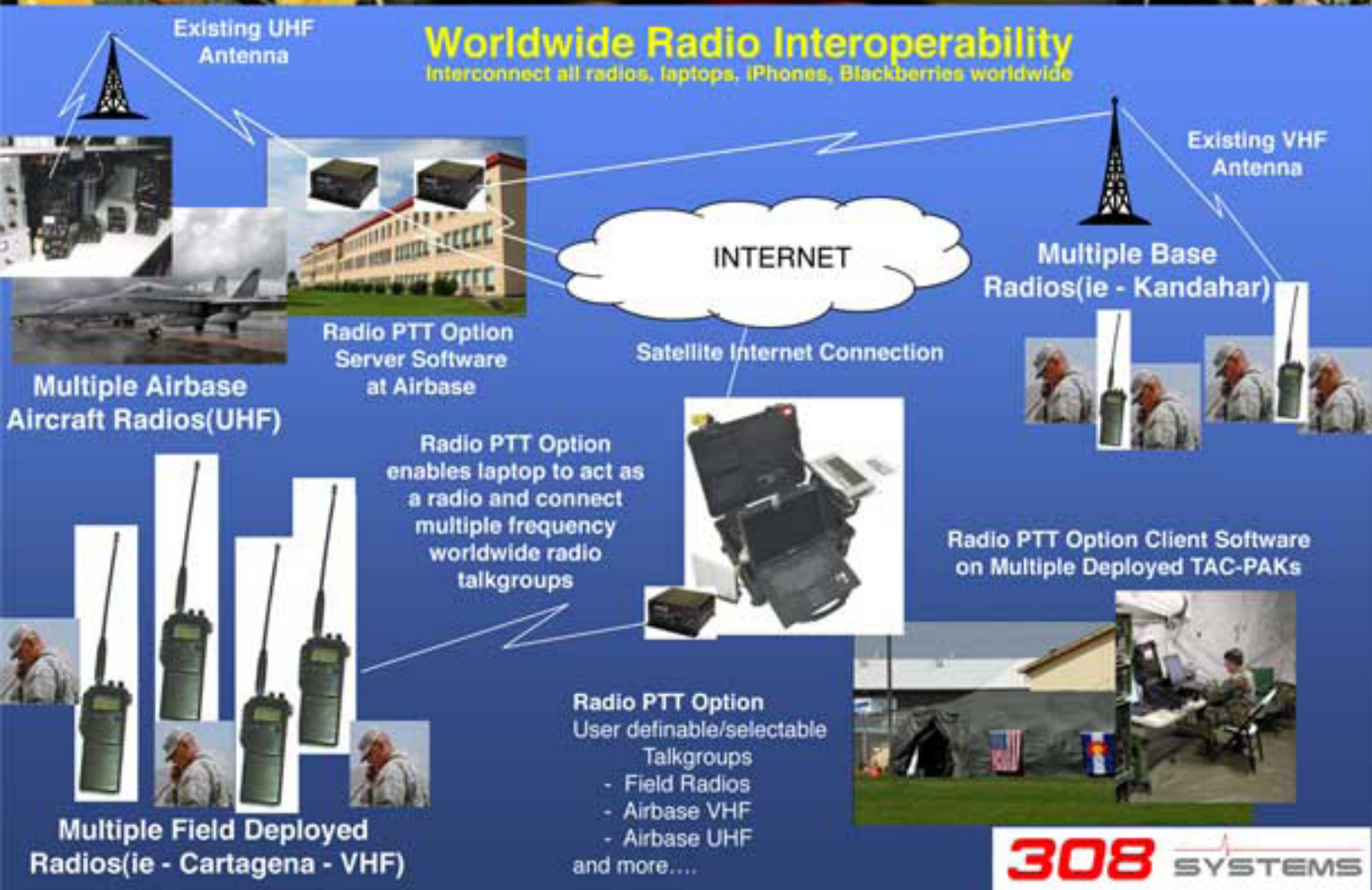
The TAC-PAK is an ultra-agile mobile command system housed in a briefcase that can be hand carried into any situation and deployed within minutes. In the case of the tsunami, the TAC-PAK restored communications connectivity for the responders as well as a true sense of hope. With the TAC-PAK in play, command posts created wireless data networks and team leaders were able to coordinate essential tasks. All command staff were able to access satellite-based data messaging, telephone connections and interoperable radio, no matter how remote, devastated or treacherous their location. Information flowed, coordination improved—morale rose.

The BLOS SATCOM signal degradation issues caused by the wreckage and terrain can be instantly resolved, thanks to the addition of a **SATPAK**, also manufactured by 308 SYSTEMS. When a SATPAK is used with a TAC-PAK, robust, reliable BGAN and VSAT satellite connections are ensured, no matter what BLOS challenges the terrain presents. With the TAC-PAK/SATPAK combination, effective mobile command and resource coordination is possible where otherwise none would have been available.

The communications situation was uncannily similar when the 8.8 magnitude earthquake hit Chile in South America in 2010. Natural disasters on such a grand scale have a knack for hindering the legacy communications infrastructure that is so necessary for any successful response. Thankfully, responders have access to the cost effective and easily deployed briefcase mobile command systems.

Experiences such as the South Asian tsunami in 2004, or the Chilean earthquake in 2010, have given emergency and security personnel all over the globe pause as they realize that traditional van- or trailer-based mobile command centers can be costly and impossible to deploy where and when needed. In the event of natural disasters, traditional mobile command vans can be stymied by damage to the unit itself or due to impassable terrain—such can certainly slow down units, which can lead to missed, crucial response times. Furthermore, traditional van- or trailer-command centers may not be equipped with all of the technology needed to ensure communication persistence. They are also quite costly to operate and maintain. When natural disasters or urban emergencies occur, BLOS satellite connectivity is often threatened. Reliable, ultra-agile and cost-effective communications responses are necessary—that's why mobile command systems such as the TAC-PAK are becoming coveted by first responders and NGOs.

TAC • PAK COMMAND CENTER

Worldwide Radio Interoperability
Interconnect all radios, laptops, iPhones, Blackberries worldwide

Existing UHF Antenna

Multiple Airbase Aircraft Radios(UHF)

Radio PTT Option Server Software at Airbase

INTERNET

Satellite Internet Connection

Existing VHF Antenna

Multiple Base Radios(ie - Kandahar)

Radio PTT Option enables laptop to act as a radio and connect multiple frequency worldwide radio talkgroups

Radio PTT Option Client Software on Multiple Deployed TAC-PAKs

Multiple Field Deployed Radios(ie - Cartagena - VHF)

Radio PTT Option
User definable/selectable Talkgroups
- Field Radios
- Airbase VHF
- Airbase UHF
and more....

308 SYSTEMS

One result of the 8.8 magnitude quake near the coast of Chile and the city of Concepcion in 2010

The TAC-PAK and SATPAK represent a new paradigm in mobile command that allows personnel to do far more with a lot less. Such portable command systems have proven successful in situations, such as the aforementioned tsunami and the earthquake disasters, as these units can literally be carried into any situation and be deployed within minutes.

There are no worries about impassable terrain or BLOS issues. There are no maintenance costs and no recurring

operational costs. Each TAC-PAK is custom-configured to agency-specific needs from more than 30 reachback and local mode options, including everything from satphone/cellular Internet, radio interoperability, videoconferencing, and printer/copier to HAZMAT software, and more.
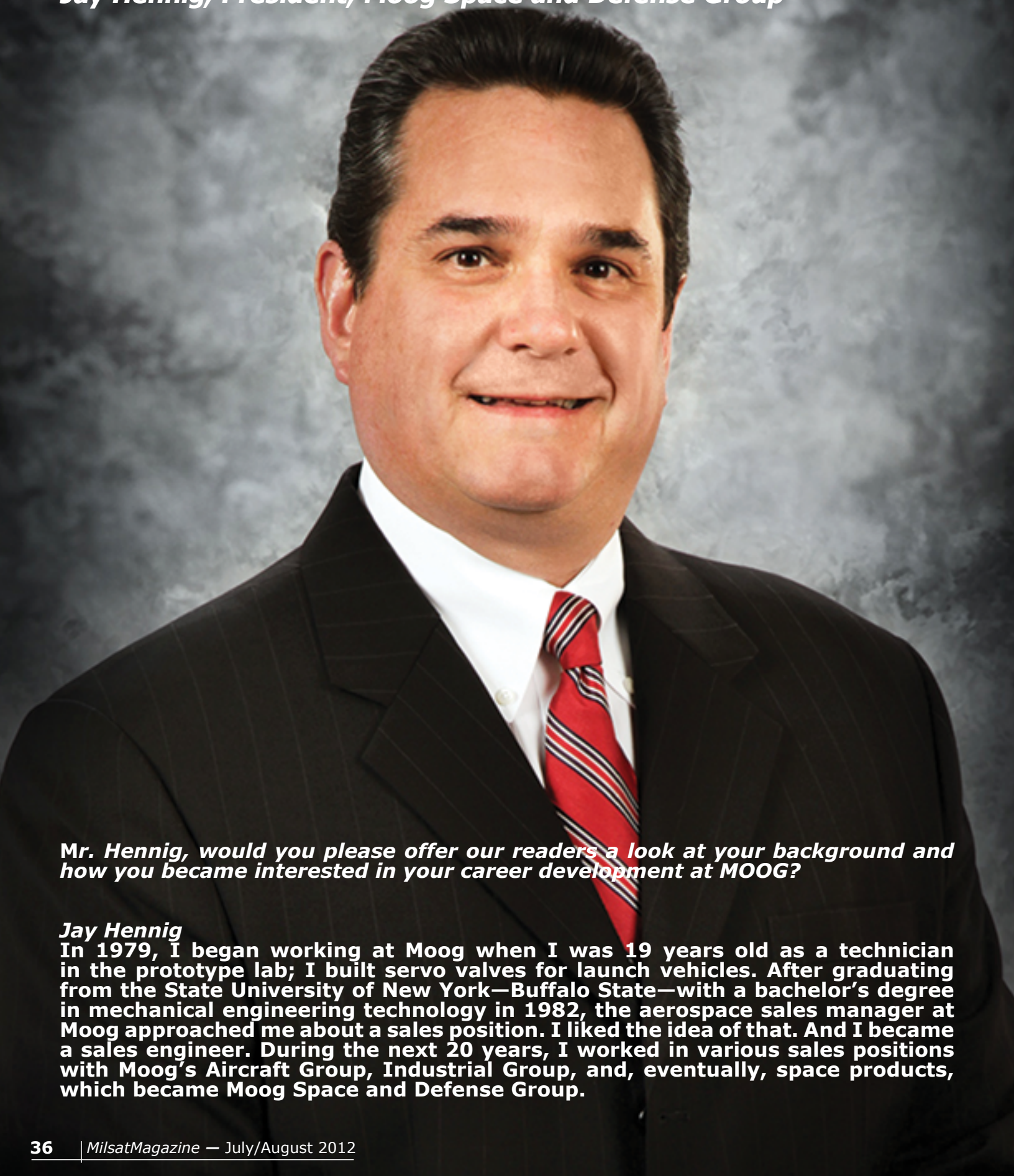
Systems such as these are cost-effective, customizable and ultra-agile, offering increased agency deployment options. Regardless of the varied communication needs of military, government and non-governmental organizations, 308 SYSTEMS is able to configure and integrate their specs into a rugged, reliable, ultra-agile and battery powered mobile command briefcase.

About 308 SYSTEMS

The Company has been providing state-of-the-art communications solutions for nearly 15 years and supports more than 315 commercial, government, and military agencies around the globe. The company is constantly innovating and has proven that it is possible for personnel to successfully perform all communications from ops in the field—where previously, communications were bound to one center. With products such as the TAC-PAK and SATPAK in the field, the possibilities of who, what, where, when and how mobile communications are used become endless.

Jay Hennig, President, Moog Space and Defense Group

Mr. Hennig, would you please offer our readers a look at your background and how you became interested in your career development at MOOG?

Jay Hennig
In 1979, I began working at Moog when I was 19 years old as a technician in the prototype lab; I built servo valves for launch vehicles. After graduating from the State University of New York—Buffalo State—with a bachelor's degree in mechanical engineering technology in 1982, the aerospace sales manager at Moog approached me about a sales position. I liked the idea of that. And I became a sales engineer. During the next 20 years, I worked in various sales positions with Moog's Aircraft Group, Industrial Group, and, eventually, space products, which became Moog Space and Defense Group.

MSM
*What interests and conditions led to your appointment as the President of **Moog's Space and Defense Group**? What are your responsibilities?*

Jay Hennig
In 1998, I became director of sales and programs. After Moog acquired **Schaeffer Magnetics** in Chatsworth, California, I became the general manager of the newly acquired company. Schaeffer's products included electromechanical actuators and motion control systems for the positioning of solar panels, antennae and optical devices in satellite and space systems.

In 2002, I was named president of Moog's Space and Defense Group. Part of landing that job probably had to do with the fact that I had built relationships with so many customers from my years as a sales engineer and had worked in the space industry from 1987 to 2002. The space industry doesn't have a lot of turnover, and I had worked with many of the people in the industry on one project or another. I guess you could say I had "connections" [Laughing].

MSM
Within the Business Development segment of any business, knowledge covering the various segments addressed by the company must be attained… how did you manage such with Moog, given the firm's diverse concentrations?

Jay Hennig
I knew the space industry, but I had to learn the defense side of our business. I did what anyone else would do: I went out and met the customers. I listened to what they had to say. I attended the AUSA Meeting & Expo. I went to the Paris Air Show to learn what the defense industry was concerned about.

One of the fundamental differences between the ground defense sector and space industry is the depth of qualification testing that goes on with space systems. There are less ITAR restrictions when it comes to defense—the restrictions that do exist are not as severe as with space hardware. The Space and Defense Group evolved from the Aircraft Group at Moog. Today my group handles all space hardware and all defense systems that are not within Moog's Aircraft Group.

MSM
How much demand is there from organizations that want to place satellites on a launch vehicle as secondary payload?

Jay Hennig
There's quite a bit of demand. There are at least six missions for which Moog is planning to supply **ESPA** rings. And there are another six programs and organizations (including **NASA** and **ULA**) that have cooperated with Moog to develop ways to use ESPA as part of their respective plans.

MSM
Speaking of secondary (or piggyback) payloads… you had on display at the National Space Symposium 2012 in Colorado Springs this year your company's Evolved Expendable Launch Vehicle (EELV) Secondary Payload Adapter—the ESPA Ring. Could you tell us how ESPA came to fruition?

Jay Hennig
I'll describe ESPA first and then explain how it came to be. The ring mounts up to six, 400-pound secondary satellites to share a ride to space with a primary payload up to 20,000 pounds. Our standard ESPA weighs 290 pounds and attaches between the primary payload and the *Evolved Expendable Launch Vehicle* (**EELV**) upper stage on *Atlas V* or *Delta IV*.

Beginning more than 10 years ago, **CSA Engineering**—which Moog later acquired—developed ESPA under *Small Business Innovation Research* (**SBIR**) funding from the **Air Force Research Laboratory** (**AFRL**) and *Space Test Program* (**STP**), which gives us certain rights to the design.

Originally, we designed ESPA to be 24-inches tall with six, 15-inch ports. As different missions arose, we designed new configurations with 4, 5 or 6 ports and taller rings, as well as other features inside the rings. Sometimes we call the taller rings, the ones with 24-inch ports, the "***ESPA Grande***."

MSM
What missions has the ESPA already been involved with, and what was their outcome?

Moog's ESPA Ring

Jay Hennig
The missions include ***STP-1*** and the ***Lunar Crater Observation and Sensing Satellite*** (**LCROSS**). STP-1 was the maiden ESPA mission in 2007. The primary satellite was **DARPA**'s ***Orbital Express***. Four secondary satellites were released from ESPA.
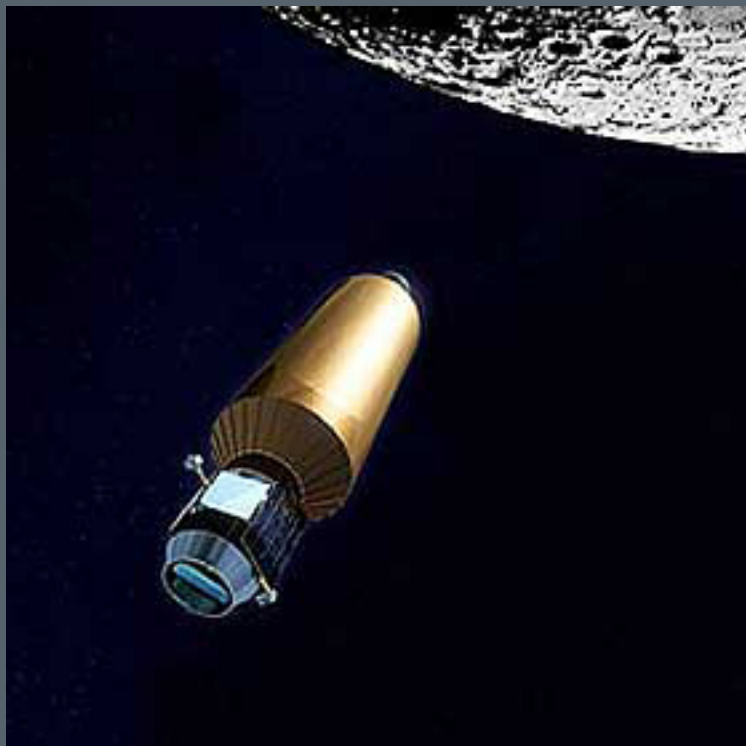
LCROSS was a NASA program launched in June 2009. When the ***Lunar Reconnaissance Orbiter*** (**LRO**) moved from a Delta II to an Atlas V, NASA called for innovative, secondary missions. **NASA Ames** proposed LCROSS with **Northrop Grumman** as the prime contractor. There were 18 other proposals from various NASA centers, and all the viable concepts used ESPA. LCROSS completed its mission by impacting the Moon in October of 2009 and confirmed the presence of water ice.

STP-1 photo courtesy of Comtech AeroAstro

MSM
What steps has Moog taken to market the availability of ESPA as a piggyback ride into space for universities, commercial space companies and the government?

Artist's concept drawing of the LCROSS Shepherding Satellite 3 with the Moog ESPA ring as the hub.

Jay Hennig
Moog attends industry conferences such as the **National Space Symposium** and **Small Satellite Conference** to showcase ESPA, which is really a family of adapters; we stay abreast of missions that organizations such as NASA, the Department of

Defense and Spaceflight Services have in the queue. Plus, we promote any new developments with ESPA by talking to reporters and bloggers covering the space and defense industry.

MSM
Do you currently have any new contracts for use of ESPA for future satellite placements?

Jay Hennig
Yes. We've delivered an ESPA for the U.S. Air Force's **DSX** mission. The Air Force **EAGLE** program will carry an ESPA, as well, and Moog will supply it. We expect to start this program in the summer of 2012.

MSM
What is SoftRide and how would it complement the ESPA Ring?

Jay Hennig
Our **SoftRide** vibration isolation systems protect satellites from the stress and vibration that goes along with getting into orbit. The

Artistic rendition of the U.S.A.F.'s DSX, which includes four science payloads that will be integrated onto an ESPA ring.

technology also isolates some shock and reduces the transmission of some of the energy that comes from acoustic loading.

MSM
What portion of your space business is commercial versus government?

Jay Hennig
That depends upon the year, of course. But, currently, it's roughly a 50-50 split.

Moog's SoftRide ensemble: From left to right, SoftRide Uniflex, SofRide Omniflex, and SoftRide Shockring

MSM
Earlier this year, Moog acquired Bradford Engineering. Why did Moog acquire this company?

Jay Henning
We acquired **Bradford** to have a manufacturing presence for space components and systems in Europe. Bradford is uniquely positioned in the industry. With a strong commercial space business, Bradford doesn't rely completely on ESA funding. These factors set them apart from other companies we looked at, and it made an acquisition attractive for us.

MSM
Given the astounding lack of STEM training in our middle and high schools and college coursework, how do you see the future for hiring within the United States of crucially needed personnel within high tech sectors, such as yours? How can we, as an industry, not only promote STEM training, but also reveal to students the highly satisfactory career that can be obtained within the various satellite and space industries?

Jay Hennig
Moog has an active cooperative and intern program with **Howard University**, **Northwestern**, **Rochester Institute of Technology** and **The University at Buffalo**. Our programs fill a pipeline of engineers who are interested in space and defense. When we have an opening for an engineer, we already have a pool of qualified and interested engineers to draw from. Our intern and coop students come to Moog throughout the year to work, so it's not just a summer onslaught of students.

If our industry wants young people to get excited about engineering and science, we have to bring it to them. For example, we supply a high-performance motion-control system to The University at Buffalo's engineering department. This is the same technology used by the Department of Defense. UB uses our technology as part of its summer engineering program for high-school females. These are young ladies who've shown an interest in becoming engineers. During the program, the ladies design a rollercoaster and program the Moog six-degree-of-freedom motion base to simulate their design in the lab as part of a final project.
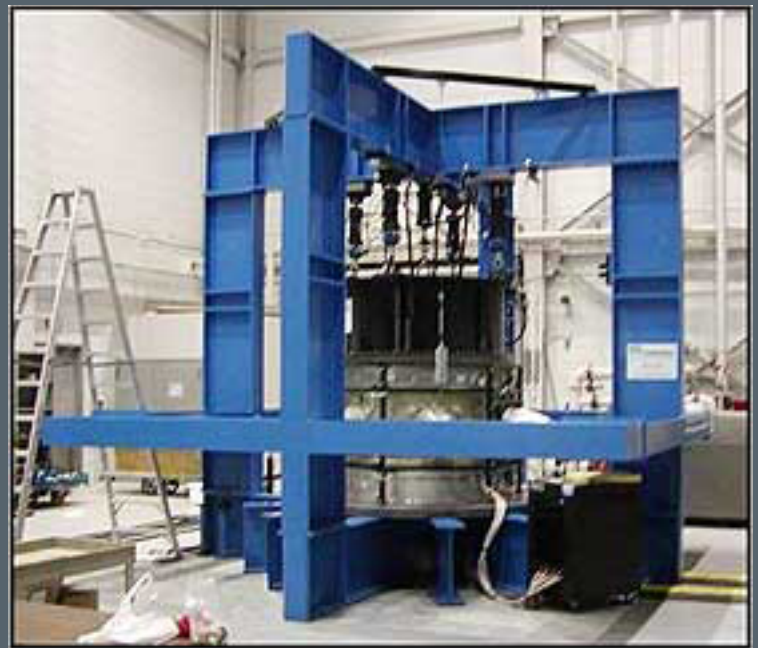
MSM
As you look back over your career, what project or projects bring you a true sense of satisfaction?

Jay Hennig
The one I worked the most on as a younger man was the **International Space Station**. Moog developed a highly specialized *fluid quick disconnect*, or **FQDC**, device used in the electric power and thermal control systems. Any payload that needs cooling gets it from Moog's FQDC. If you have electronics to cool, they plug in with Moog's FQDC. Without that technology, you'd have to "hard plumb" the cooling.

The Shuttle was another great program. Moog handled the flight control actuation on the orbiter and the thrust vector control on every engine built for the program. We worked on that one from the 1970s until 2011; I'm proud to have worked on a team that contributed to something as important as the Shuttle program. And there's still more to come!

Moog's ESPA Ring undergoing structural qualification testing.

ESPA: An Inexpensive Ride to Space for Secondary Payloads

by Bill Perry

Jason Andrews, president and CEO of **Spaceflight Inc.**, says he plans to leverage the ESPA ring concept to meet his business plan objectives. Andrews' company offers a new business model for the cost-effective launch of small spacecraft.

Spaceflight packages small satellite missions and delivers a bundle of secondary payloads to a launch vehicle provider such as **SpaceX** or **United Launch Alliance**. As an integrator of small and secondary payloads and provider of launch services, Andrews says Moog's **ESPA** ring meets a unique need.
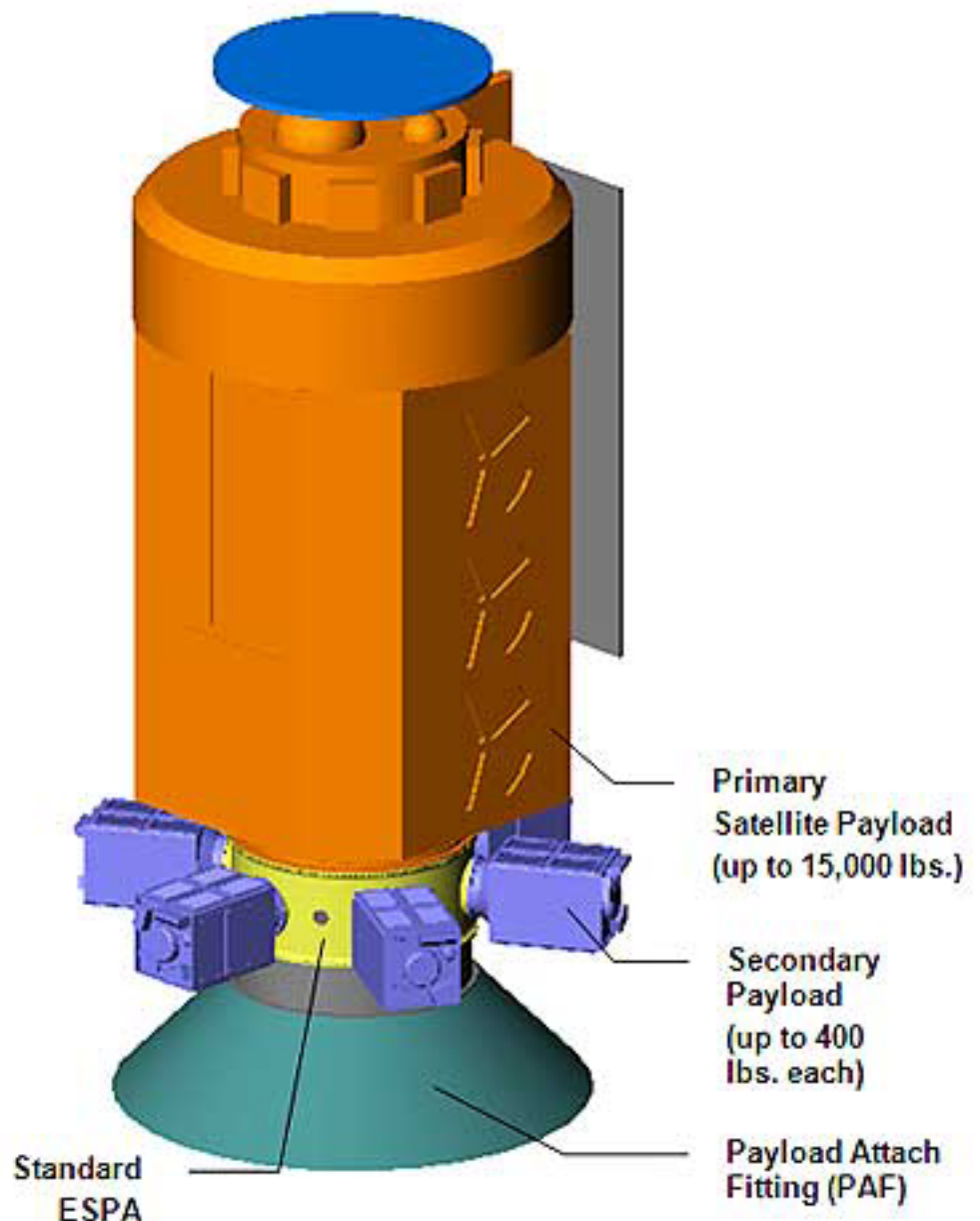
"We buy extra space on a wholesale basis, and then we market it," adds Andrews. *"We work with Moog CSA Engineering to build ESPA rings. And we come up with an adapter to manifest a wide range of secondary satellites from 10 lbs. up to 400 lbs."*

Andrews says his company's **Spaceflight Secondary Payload System** can fly on a range of medium- and intermediate-class launch vehicles. The SPSS is derived from a five-port ESPA ring that can launch a spacecraft up to 660 lbs.

Moog's ESPA ring is also the core of Spaceflight's **SHERPA In-Space Tug**, says Andrews. SHERPA builds on the SPSS by adding a propulsion and generation system to host payloads.

"Going forward, launch vehicles are going to look a lot like airplanes," said Andrews. *"You'll see a lot more small satellites getting into orbit."*

For an organization that wants to launch an ESPA-class satellite, Spaceflight's pricing for low Earth orbit begins at approximately $4 million. Compare that to the approximately $25 million Andrews says it would cost to put a small satellite into low Earth orbit on a **Pegasus** rocket, and ESPA looks even more attractive.

Primary Satellite Payload (up to 15,000 lbs.)

Secondary Payload (up to 400 lbs. each)

Payload Attach Fitting (PAF)

Standard ESPA

ESPA's Beginnings

Dr. **Peter Wegner** was the **Air Force Research Laboratory** Program Manager for Moog CSA Engineering's ESPA contract when Moog teamed with AFRL to design, build and qualify the ring in the early 2000s. Wegner is now the director of the **Operationally Responsive Space Office** at **Kirtland Air Force Base**.

"In the late 1990s, the Space Test Program at Kirtland, part of the Air Force's Space Development and Test Wing, was told its budget would include a medium-class rocket every few years to fly technologies," said Wegner. "STP realized a lot of the payloads they wanted to fly were smaller than the primary payload these rockets could accommodate, and STP wanted to come up with something."

STP's team crossed the parking lot at Kirtland and met with the Air Force Research Lab. They discussed ways to come up with technology to take multiple payloads into orbit. AFRL carried out some studies and looked at concepts including the ASAP ring developed for the Ariane rocket.

At the time, says Wegner, STP and AFRL were also working with Boeing and Lockheed to develop secondary payload accommodations for the **Evolved Expendable Launch Vehicle** (**EELV**).

"We asked them to do a clean-sheet design for a secondary payload, how much volume we would have inside the fairing and how high we could we lift the primary payload," said Wegner.

Wegner added that Moog CSA Engineering entered the talks and helped conceptualize a round adapter ring with six ports on it. The ring didn't look like any other adapter because, heretofore, the hardware had always been built in the shape of a plate.

When the team studied the loads, they were identical, whether on a flat plate or cantilevered via the ESPA ring. "It's a little counter-intuitive," said Wegner. "But it's a pretty efficient way to mount small satellites and integrate them."

*Wegner worked with the **Small Business Innovative Research** (**SBIR**) program at Kirtland AFB to obtain the funding necessary to develop the concept. Before the ESPA ring's maiden mission on **STP-1** in 2007, the team changed the structure of the ring from composite with bonded aluminum rings to one piece of forged aluminum, which was less costly and more reliable.*

"When you look at it, it's kind of a beautiful structure," added Wegner. "The ESPA ring is like a LEGO, you can build on it in many ways."

According to Wegner, the ESPA ring's modular architecture opens a whole new set of opportunities.

*For example, the upcoming **ESPA Augmented Geostationary Laboratory Experiment** (**EAGLE**) mission is an AFRL program that has ESPA carrying several satellites into orbit and staying attached to a couple of others for a six- to 12-month mission in Earth orbit.*

*The **Demonstration and Science eXperiments** (**DSX**) mission, slated for 2015, will turn the ESPA*

The original Luncar Reconnaissance Orbitoer (LOR), artistic concept illustration, courtesy of NASA

ring into a hub of a satellite once it separates from the launch vehicle. "Having tools like the ESPA ring enable you do things cheaply and effectively," said Wegner.

*Wegner also revealed that he and his colleagues never thought of the ESPA ring guiding an upper stage into the Moon, but that's exactly what it did as part of NASA's **Lunar Crater Observation and Sensing Satellite** (**LCROSS**) mission in 2009.*

*"We heard rumblings at NASA that there was interest in analyzing for the presence of water on the Moon, so we started brainstorming ideas that might work for exploring that," said **Daniel Andrews**, deputy director of engineering at the **NASA Ames Research Center** and former project manager for the **LCROSS** mission.*

Artistic rendition of LCROSS

When NASA upgraded the **Lunar Reconnaissance Orbiter** (**LRO**) mission's launch vehicle to an Atlas V, it freed around 2,200 lbs. of additional mass for what would later become LCROSS. NASA held a competition to see how best to use the space and a number of proposals came from the **Ames Research Center**.

The winning proposal included Moog CSA Engineering's ESPA ring launching the LCROSS as a secondary payload under the LRO. LCROSS ultimately impacted the lunar surface and confirmed the presence of water ice.

"ESPA was an incredibly stout secondary structure, and it was fine that the LRO was bolted on top of the ESPA and the ring bolted on top of the rocket," said NASA's Andrews. "LCROSS was the first mission to turn Moog's ESPA ring into a spacecraft bus, each of the ring's ports with a different element and a tank in the middle."

Because ESPA is a ring, NASA was able to set up a table around the perimeter of the ring in the clean room during integration and testing. Each team could build independently of one another. When the team encountered delays, it did not serially delay any work.

"The ESPA ring's ports are like the petals of a flower, so we could work on everything independently and move based on circumstance," said Andrews. "Many space bus designs are in a box. So, for example, you have to take out the communications system to get to the avionics system.

It just becomes sequentially complicated to do."

In contrast, NASA's Andrews says ESPA is "very simple, clean, tough, inexpensive and easy to modify."

About the author
Bill Perry has written for the manufacturing, financial services and software industries for approximately 20 years. He lives in Upstate New York and can be reached at... bperry@march24media.com

SATCOM Assets Can Assist In Offsetting Piracy

O f growing concern across the globe are the deadly pirate attacks on commercial and leisure vessels. How many have died in these maritime attacks? It's unknown, and probably will never accurately be determined. In some cases the attacked ship has disappeared—some may have been sunk or taken to a hidden locale by the pirates, and further complicating the situation, such attacks are bereft of witnesses as no survivors have been found of such incidents.

July 4th

Six pirates in a long wooden boat powered by sail and oars came alongside an anchored LPG Carrier at the Visakhapatnam Anchorage, India. Two of the pirates boarded the tanker and stole property belonging to the ship.

July 2nd

Approximately 25 nautical miles southwest of Guayaquil, Ecuador, five to six pirates in two speed boats approached and boarded a container ship that was underway using hooks attached with ropes and monkey ladders. The ship's Master raised the alarm, the crew was mustered and armed themselves with crowbars and proceeded to the boarding area and the location of the pirates. The ship's Third Officer noticed that one of the robbers was armed with a gun and the Master immediately ordered all crew members to retreat back to their accommodations and to lock all of the doors. The robbers then commenced throwing some boxes into their boats. The Master was unable to increase speed or take evasive maneuvers due to the limited depth and width of navigable water. Once the robbers' boats were full of stolen items, they jumped back into their water craft and moved away. Due to the darkness and distance, the Master was unable to determine if the pirates stole cargo from the containers or ship's stores.

June 25th

Estimated to be 50 nautical miles southeast of Lagos, Nigeria, 12 pirates armed with guns in a speed boat boarded a drifting chemical tanker. All of the crew were forced to muster in the mess room—the Master and Chief Engineer were allowed to remain on the bridge and the engine room, respectively. The vessel was then ordered by the pirates to sail toward Togo and back. The pirates raided all of the crew's cabins and stole cash, personal effects as well as the ship's cash. They then disembarked off Escravos Terminal after 45 hours aboard the tanker. Fortunately, all of the crew are reported as safe. The Officer of the Watch noticed the boat and informed the duty A/B watchstander to investigate. Upon seeing the robbers at the poop deck, the duty A/B chased them. The pirates jumped into the water and escaped with the stolen items as their accomplices were awaiting them in the boat. An alarm was raised, port control was informed and a search was conducted with negative results.

June 30th

Around 120 nautical miles southwest of Bonny Island, Nigeria, a container ship adrift awaiting berthing instructions was approached by five armed pirates in a wooden speed boat with two outboard engines. As the pirates approached the vessel, they fired, causing damage to some bridge windows and equipment. The vessel raised the alarm, activated SSAS (Ship Security Alert System), started main engines and maneuvered away from the approaching boat. Non-essential crew retreated into the citadel—all the crew are safe.

According to ICC Commercial Crime Services (www.icc-ccs.org), the world's only manned center that receives and disseminates reports of piracy and armed robbery 24 hours a day across the globe, there were 168 piracy attacks, worldwide, as of June 25th, 2012. Hijackings number 19. For the Somalian area, there were 67 incidents, with 13 total hijackings and 195 hostages taken prisoner. There are currently 13 vessels being held by Somali pirates, as well as 13 hostages. (*Please see the sidebar for additional ICC IMB information.*)

*The preceding information is courtesy of the **ICC International Maritime Bureau (IMB)**.*

According to a 2008 BBC report, the pirates can be divided into three main categories:

- Local fishermen, considered the 'brains' of the pirates' operations due to their skill and knowledge of the sea. Many think that foreign boats have no right to cruise next to the shore and destroy their boats

- Ex-militiamen, who previously fought for the local clan warlords, or ex-military from the former Barre government used as the muscle

- Technical experts who operate equipment such as GPS devices for the pirates

Protection

According to *Wikipedia*, international ships equipped with helicopters now patrol the waters where pirate activity has been

Anti-piracy efforts are coordinated by the Combined Maritime Force.

reported. However, this area is extremely large. Some ships are equipped with anti-piracy weaponry, such as an **LRAD** (*Long Range Acoustic Device*, developed by **LRAD Corporation**). This device directs a sonic wave toward a target, creating a sound so powerful that it shocks and bursts the eardrums of pirates— they then become so disoriented they drop their weapons—the vessel under attack increases speed and engages in evasive maneuvering.

An LRAD device aboard ship.

Additionally, while the non-wartime 20th century tradition has been for merchant vessels not to be armed, the U.S. Government has recently changed the rules so that it is now "best practice" for vessels to embark with a team of armed private security guards aboard. The crew themselves can also be given weapons training, and warning shots as well as the use of less-lethal ammunition can be fired legally in international waters and/or when sailing under an Israeli or Russian flag. Similar to weapons training, remote weapon systems can also be implemented.

Other measures vessels can take to protect themselves against piracy are implementing a high free-wall and vessel boarding protection systems (*e.g.*, hot water wall, electricity-charged water wall, automated fire monitor, slippery foam).

In an emergency, warships can be called upon for aid. In some areas, such as near Somalia, naval vessels from different nations are present that are able to intercept vessels attacking merchant vessels. For patrolling dangerous coastal waters (and/or keeping financial expenses down), robotic or remote-controlled sea craft are sometimes used and both shore- and vessel-launched UAVs are used by the U.S. Army.

Capture + Release

According to *Strategy Page*, the anti-piracy patrol off Somalia has captured and prosecuted some 800 pirates so far. However,

more than five times that number have been captured and released. More prisons are being built in Somaliland and Puntland but these must be paid for and supervised by Western nations if they are to have any effective role in detaining pirates.

The key problem is that most nations contributing ships to the anti-piracy patrol are not willing to prosecute and imprison Somali pirates. This has led to the "catch and release" method used by most European navies, mainly because the legal systems back home makes it difficult for the pirates to be prosecuted and easy for the pirates to claim asylum if brought back for trial.

Under international law, captured pirates may be prosecuted by any nation. Nevertheless, many countries lack domestic law which conforms to international law—local courts in several nations have denied they have jurisdiction over the pirates. Until the Western nations develop the political will to initiate prosecution, these international criminals will continue to win in the war on piracy. Meanwhile, hundreds of sailors continue to be held captive under horrible conditions by Somali pirates, while offshore the mighty world navies play catch and release. This *Old Salt Blog* entry also states that more than five Somali pirates are released for every one that is prosecuted.

Safe Communications @ Sea

Satellite communications plays a pivotal role at sea and is an affordable way to stay in touch and be tracked anywhere, at

India and Mozambique have agreed to work together to improve maritime security in the Indian Ocean.

any time, across the globe. Most modern commercial vessels cover safety issues in many different ways, but basic satellite communications are normally installed on all vessels.

In example, **Beam**'s *Oceana 800* terminal has been deployed onto more than 500 vessels. This offers mariners a host of features, including global coverage for its voice, text and low-speed data services as well as **Inmarsat**'s *SOS* emergency calling capability and an additional SIM for multiple users. The Oceana 800 offers an integrated GPS engine that provides intelligent tracking and *instant message* (**IM**) reporting via SMS. The tracking and IM functionality can be configured to support automated periodic polling or IM reporting by pressing a single button.

Time Bandit, the 34.44m-long (113-ft.) boat, from the **Deadliest Catch** on **Discovery Channel**, is on a mission to

capture king crabs, rather than human beings. Although the exterior of their boat appears to be similar to a pirate ship from yesteryear, the captain brothers *Andy* and *Johnathan Hillstrand*

and their crew prefer to rely on the latest modern technology, such as the Oceana 800 fleetphone systems, while working off Alaska in the Bering Sea. Captain Andy Hillstrand said, "getting the weather forecast can literally be a matter of life and death for us and voice quality is important because we have to state our position before we can get the forecast."

Solutions For Sea Safety

Beam Communications recently launched new satellite piracy solutions for secure communications on board a vessel. These

Beam's Oceana 800 terminal

solutions use **Iridium** or **Inmarsat** satellite networks—the covert antenna systems provides a dedicated system for a safe room or citadel on board a vessel. This ensures that essential communications on board the ship—such as the ability to alert authorities in the event of an attack—can be maintained, even if all power or other communication equipment has been cut off or destroyed by pirates.

Beam packaged solution includes a UPS battery that has a talk time of as much as 16 hours and a stand-by time of up to 89 hours. The **Covert Piracy Solution** is a complete bundled installation that provides an immediate contact/message capability when under threat. The unit's GPS module provides pinpoint accuracy and enables tracking worldwide. Tracking and alert messages can be sent via SMS or Short Burst Data. Tracking and alert messages can be configured to tracking applications, SMS or email address as required. Alert/Alarm messages can be activated on the unit or alternatively via an additional alert button or other trigger that can be connected to the unit.

Once configured, the alert system is always on and will generate an alert message to the preset destination when triggered. Alerts can be triggered to continually send until the alert is cleared either remotely or locally on the unit. The Beam-designed antenna is intended for covert placement and is far less likely to be spotted and targeted by pirates.

The piracy solutions operate with the Inmarsat **FleetPhone** service or the Iridium **Extreme** network and ensure the Captain and crew has access to communications, tracking and alert functionality via the system. In the event of an attack, an alert can be raised and the vessel is immediately tracked.

What Makes Sea Sense

There is no "ultimate" protection against piracy committed upon maritime vessels that does not require some financial commitment by the owners of ships. The alternative to not investing in technologies and communications that can thwart piracy, or bring aid when such is needed, is to continue to have ships pay many insurance agencies that pay huge ransoms...rates will continue to climb, the vessel remains out of service while negotiations are conducted (negating income generation), and experienced crews will be much more difficult to locate as the dangers continue to increase at sea to their lives and to their families.

SATCOM brings communication assuredity to tracking and requests for aid...the investment is certainly worthy of consideration when considering the deadly alternatives.

OPS

PotsDOCK Extreme Covert Piracy Solution

Covert Antenna

The solution uses the Iridium Extreme handset and provides an overall feature rich solution including...

- Voice calling—supports standard corded/cordless phones with runs of up to 600m/1800-ft., with multiple handsets, if required, via Extreme handset
- Tracking—enables tracking and monitoring and uses a compact covert GPS antenna that is separate from the vessels GPS standard antenna.
- Emergency Alert—Panic / Duress buttons on the unit or installed in various locations to trigger an emergency alert.

The BEAM Piracy Solution is a complete bundled installation that provides an immediate contact/message under threat with the added ability to be able to make or receive a telephone call from the "safe room" at any time. Tracking and alert messages can be sent via SMS or Short Burst Data or Both. Tracking messages can be sent via the following means...

- Periodic position reporting, preset during the configuration of the terminal
- Upon an alert being activated via the Alert button on the cradle or connected alert button
- A current location position can be sent at any time by simply pressing a button on the front of the unit

Alert/Alarm messages can be easily activated on the unit or, alternatively, additional Alert buttons can be installed throughout the vessel to trigger an alert. Once configured, the alert system is always-on and will generate an alert message to the preset destination once it is triggered. The back-up battery that comes with the package can last up to 20 hours on standby and/or 10 hours of talk time. The BEAM Covert Piracy Solution is available through Beam major distributors.

*Expertise published in **Marine Insight** offers some information into the Citadel anti-piracy method. The citadel itself is a room where the ship's crew can remain hidden in case of a pirate attack. Such use of a safe room has increased in response to the rise in pirate incursions aboard ships. The publication mentions the following key consideration points for a citadel:*

- The citadel anti-piracy method is recommended to be installed in ships as per the regulations of the International Maritime Security Centre
- The citadel requires having not just food and water supplies but also effective communication channels to be able to communicate with the outside world, with a proper system of ventilation and a first aid kit
- The room can also be fitted with CCTV cameras and should have the control for switching off the engines—both main and auxiliary
- The citadel needs to be properly planned and constructed. The anti-piracy fortification is like a last attempt on the part of the ship's crew to escape from the pirates. This is why there cannot be any loopholes in the construction of the stronghold
- The entire marine piracy stronghold needs to be within a circle of defenses that extend up to 1500 metres

Just as the technique to counter marine piracy should be an effective one, without proper knowledge in the use of the citadel, this technique could prove dangerous. The crew of the ship needs to understand how everything operates in the citadel and what the important points are that require consideration. If these details are not paid attention to, the citadel could itself end up being a fatal prison for the crew who assembled there for protection.

Oceana 800 Covert Piracy Solution

Covert Antenna

The Solution uses the Beam Oceana 800 for the Inmarsat network and provides an overall feature rich solution including...

- Voice calling—supports standard corded/cordless phones with runs of up to 600m/2000ft with multiple handsets, if required
- Tracking—built-in GPS engine enables tracking and monitoring and uses a compact covert GPS antenna separate from the vessels GPS standard antenna
- Emergency Alert—Panic/Duress buttons on the unit or installed in various locations to trigger an emergency alert. Emergency Inmarsat 'SOS' calling.

The Beam Covert Piracy Solution is a complete bundled installation that provides an immediate contact/message under threat with the added ability to be able to make or receive a telephone call from the "safe room" at any time. Tracking messages can be sent via the following methods...

- Periodic position reporting, preset during the configuration of the terminal
- Upon an alert being activated via the Alert button on the cradle or connected alert button
- A current location position can be sent at any time by simply pressing a button on the front of the unit

Alert/Alarm messages can be easily activated on the unit or alternatively an additional alert button can be installed throughout the vessel to trigger and alert. Once configured the alert system is and will generate an alert message to the preset destination once it -is triggered.

- The back-up battery that comes with the package can last up to 20 hours on standby and/or 10 hours of talk time
- The BEAM Covert Piracy Solution is available exclusively through the Stratos Global and Vizada worldwide offices

Moreover, constructing a citadel is expensive. This is because the room has to be thoroughly constructed to withstand any kind of weapon impact and should have the necessary equipment within its confines. Due to the cost factor, sometimes the ship's engine room is used as a citadel to escape from the pirates.

Major shipping companies regard the expenditure of the anti-piracy stronghold as one of the biggest expenditures they need to consider and implement for their ships and crews. This level of expenditure, when compared to the amount of ransom demanded by pirates, does appear to be minimal. For this reason alone, many shipping companies have decided to fund the citadel, especially for those ships that have a route that passes through waters where marine piracy abounds.

With the help of a citadel, hostage situations can be successfully thwarted, making the citadel methodology a highly favorable one. Precautionary steps should be taken to ensure the citadel is safe and secure for the ship's crew. There is further information **at this direct website**...

And, how would it be if mariners didn't have to risk human life to fight pirates at sea—**Edina Robotics**, a robot manufacturing company, has created a magnetized robot that can climb the hull of a ship to spy on pirates. A type of UAV, this robot system has magnetized wheels that help it to climb up the hull of the ship to track pirate activities. This robot, if it successfully passes all of the testing, will serve as a most helpful ally in fighting piracy. There's a video from **TwinCities.com Pioneer Press** of the robot available **at this direct link**.

The Next Satellite Revolution Is... On The Ground

by Rick Lober, Vice President + General Manager, Defense + Intelligence Systems Division, Hughes

The demand for satellite technologies within the Department of Defense (DoD) is continuing to grow even as the DoD draws down its responsibilities in Iraq and Afghanistan. Commanders want to put more information in the hands of soldiers, while greater reliance on remotely piloted aircrafts (RPAs) is requiring more real-time data streams than ever before. Last year, according to DoD estimates, RPAs over Afghanistan collected the equivalent of more than 700 years of video.

To fulfill this demand in the short term, the DoD has been turning to commercial satellite providers, which today fulfills approximately 80 percent of the agency's SATCOM needs. In the long-term, the DoD is looking towards a new satellite constellation in the **Wideband Global SATCOM System** (**WGS**) to balance its wideband demand.

WGS is currently a constellation of four satellites in geostationary orbit, but the DoD has plans to launch six more satellites over the coming years. However, even with the full network operational, WGS will only satisfy 50 to 60 percent of the projected military satellite communications needs of the DoD through 2025. More capacity is critical, and that's where commercial technologies come in.

At Hughes, our commercial satellite technologies use advanced bandwidth efficiency techniques that can maximize a satellite's output. Applying these proven techniques to the management of the WGS system, the DoD can effectively increase capacity by 20 percent, resulting in cost savings by increasing capacity and bandwidth usage without requiring additional resources.

Data Level: More Efficient Coding

The way that satellite data is coded has a major impact on bandwidth use. For example, advanced information coding schemes can transmit four times as much data per second as legacy modem implementations. In the case of satellite, using more efficient coding can make a tremendous difference, especially when the WGS must increase its signal to overcome rain, clouds or radio interference.

Today, in circumstances such as these, the WGS effectively "fences" 10 times more resources to overcome adverse conditions compared to what's required for normal clear-weather operations, which is far more than is necessary. Together with adaptive power and resource control, more robust coding schemes can significantly improve bandwidth efficiency.

Network Level: Better Network Management

In 2009, the DoD cancelled the **Transformational Satellite Communications System** (**TSAT**) program including the *TSAT Mission Operations Segment* (**TMOS**), leaving the WGS satellite system as DoD's primary means to satisfy wideband communications needs. Additionally, the cancellation of the TMOS left DoD without a unified network management program.

The DoD will continue to rely on an ad-hoc network operations approach, which will mean that routine changes to configuration, software upgrades and performance measurements cannot be automatically managed from a *Network Operations Center* (**NOC**) —or even a remote site. Instead, the DoD continues to manually troubleshoot and then deploy subject matter experts to the operational theater. An automated management system could reduce this burden by facilitating remote operations.

Satellite Level: Dynamic Resource Allocation

Satellite capacity requirements are variable as efforts shift from one mission or theater to another. Unfortunately, many of today's WGS-based networks lack flexibility to allocate resources in the same way. They rely on dedicated communication circuits that were set up manually, meaning that even if a user has excess capacity, it is unavailable to others on the network. Communications veterans may recognize this as a throwback to the old circuit-based networks that were used before modern Internet Protocol (IP) packet-based switching. By implementing dynamic resource allocation, WGS can allocate unused bandwidth across the system, increasing overall capacity and making it available where needed. When a high-priority user needs more, these resources can be dynamically re-allocated consistent with a customized priority and precedence-scheme.

All three of these technologies are already widely used in commercially-proven solutions from Hughes. Applying these same best practices across the WGS will have a dramatic positive effect on capacity. And, it can all be done on the ground with no impact to the 10 WGS satellites DoD has procured—all without launching a single rocket.

About the author

Rick Lober joined Hughes in late 2008 as Vice President and General Manager of the Defense and Intelligence Systems Division (DISD). He has over 25 years experience with both COTS-based and full MIL communications and intelligence systems starting as a design engineer and progressing to a P&L executive. He has previously worked at Cubic Communications, Inc. and Watkins-Johnson Company. Mr. Lober received his BS and MSEE degrees from the University of Illinois, Urbana.

The Case For Hosted Payloads

by Jose Del Rosario, Senior Analyst, NSR

Hosted payloads (HPs) are unique and highly viable solutions that address shortfalls in civil and military agency capabilities. They could be especially important given tight government budgets but continued mission-critical requirements across the globe. Although the industry is largely in agreement that little has and will likely take place in the short term in the form of HP deployments, it is certainly not faltering as a viable market proposition over the long term. It is thus useful to examine the HP business case for key market segments and the benefits to the satellite operator, satellite manufacturer and hosted payload client over the medium to long term. Information from the analysis below is extracted from NSR's industry leading research report, *Hosted Payloads on Commercial Satellites, 2nd Edition.*

The Military Case

In past, present and future military activities, the commercial satellite industry was, is and will continue to be a key player in addressing strategic planning for current and future applications for a variety of mission requirements. Leasing of satellite bandwidth has been the most popular and most prominent option governments have used to date. Over time, however, as governments are required to continue and increasingly engagement via tactical and ISR (intelligence, surveillance & reconnaissance) missions, while at the same time working under heavy budget constraints, more creative, cost-effective and quickly deployable arrangements have to be undertaken.

The U.S. Military alone is projected to demand some at least 40-50 Gbps of satellite capacity by 2020. The figure does not include demand by the intelligence community such as the CIA, which is a large user of bandwidth for its own ISR mission requirements, further exacerbating the bandwidth capacity crunch that has been characteristic over the past decade.

Moreover, despite the financial issues that have plagued the global economy, growing concerns over key flashpoints and potential hotspots are leading to a burgeoning arms race in regions such as Asia. Large, wealthy but over-extended countries as well as small, cash-strapped nations are looking for ways to build capabilities quickly and cost-effectively. Hosted payloads present large, wealthy countries with options to quickly deploy

Flashpoints and Hotspots	Description
Asia's Flashpoints and Hotspots	
Korean Peninsula	North and South Korea officially remain at war. North Korea launched a rocket carrying a weather satellite in April 2012. The launch was a failure but region remains highly concerned over the North's nuclear development program and missile technology. Various reports indicate that China has conducted military sales to North Korea despite a ban.
East China Sea	China and Japan continue tensions over disputed islands northeast of Taiwan.
Taiwan Strait	Beijing's military spending has been on the rise and is estimated to be much higher than its officially released figures. As a result, Taiwan has been upgrading its military aircraft and air defenses.
South China Sea	China, Vietnam and the Philippines have competing claims over the Spratly Islands. The surrounding waters are believed to contain vast reserves of oil and gas.
Strait of Malacca	Threat of piracy is constant.

Source: NSR

assets, while cash-strapped nations can exercise the arrangement to achieve some kind of parity with large nations on space-based capabilities.

Citing Asia once again, its many hotspots may be the impetus that could drive the hosted payload arrangement. The focus on military activities has largely been concentrated on Iraq and Afghanistan over the past decade and these activities are likely to continue, albeit at lower levels via training of the local police and military units as well as other key missions that include ISR. However, as U.S. and Allied engagement draws to a close in terms of troop presence, the new focus is headed towards the largest region of the globe via the U.S. Department of Defense's "Pivot Strategy towards Asia." Indeed, some satellite operators have indicated to NSR that the shift in terms of demand has already begun.

There are currently five potential flashpoints in the region that could erupt into a full blown conflict at any given time. Apart from the threat of piracy, China is not only part of the other four potential flashpoints but is considered a major component or player in each.
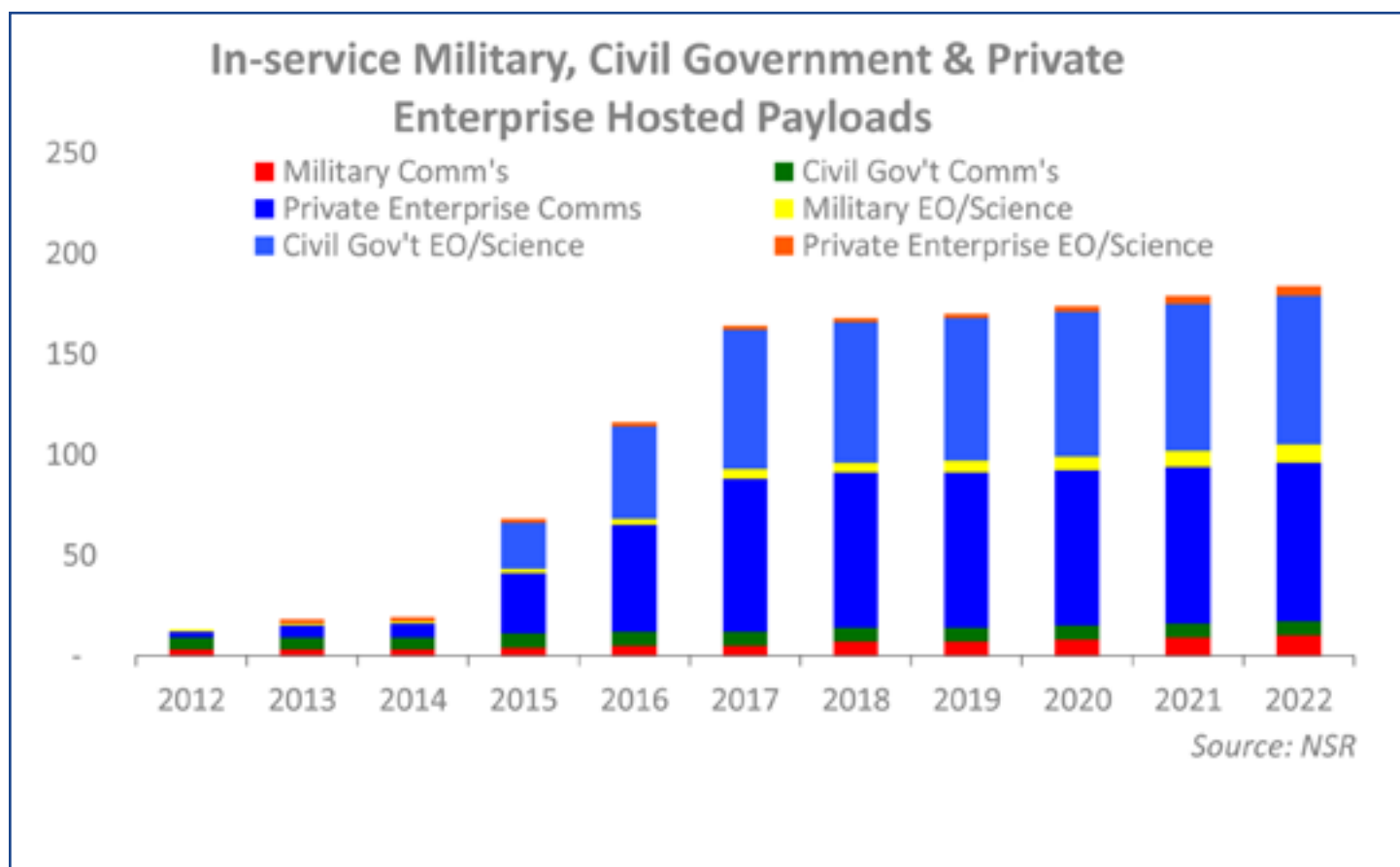
Moreover, various reports indicate that China's growing military spending is towards developing an aircraft carrier, a stealth fighter jet, and missiles that can shoot down satellites.

China's anti-satellite or ASAT weapon provides a direct justification for hosted payloads:

- Hosted payloads can be deployed relatively quickly in case military satellites are shot down

- Hosted payloads in terms of cost are generally less expensive compared to dedicated military satellites, so funds for capacity-building are better spent

As countries in the region cannot match or outspend China in military hardware including space-based capabilities, hosted payloads should provide or become an increasingly attractive option to narrow the gap. As the partnership between governments and the commercial satellite industry becomes stronger, hosted payloads will likely become a growing option by which governments take advantage of more long-term arrangements that help buffer China's build-up.

In addition, in deploying planned proprietary assets for next-generation technologies, hosted payloads once again provide a platform to test new systems in the environment the instrument is intended to operate in as well as save on costs as the instrument is not launched on a dedicated satellite platform.

In-service Military, Civil Government & Private Enterprise Hosted Payloads

Source: NSR

This has been exercised by the U.S. Military via the CHIRP payload aboard an SES spacecraft, and many in the industry indicated that the results of the experiment have been quite favorable, which could result in a CHIRP2 program. Thus, the case for the military is the following:

- HPs provide relatively fast, cost-effective capability building in light of the shifting global agenda
- HPs provide technology test beds for expensive, next-generation programs
- HPs can even provide new, advanced and unique capabilities

The Civil Agency Case

To date, civil agency hosted payload demand has been driven by communications, specifically the WAAS and EGNOS systems. Over time, agencies such as the U.S. Federal Aviation Administration (FAA) are expected to continue to improve communications capabilities for transportation systems such that hosted payloads should continue to be deployed as replenishments as well as new programs to enhance current capabilities. Indeed, Iridium indicated that it expects a major hosted payload agreement with global air traffic control agencies including the FAA and similar agencies around the globe.

Apart from the aviation sector, contributions by other agencies are expected as well. These include NASA and NOAA (among others) that are involved in scientific research as well as addressing the climate change agenda that is part of long term, multi-faceted requirements. Indeed, it was announced in April that a yet-unselected commercial telecommunications satellite to be built by Space Systems/Loral will carry a NASA laser-optical communications terminal as a hosted payload in 2016 under an agreement with NASA's Goddard Space Flight Center. This will be the first hosted payload from NASA; however, the agency indicated that around 70 instruments are currently in inventory looking for a ride. As such, NSR projects that Civil Government EO/Science hosted instruments will account for a relatively large number of deployments and in-service units over the forecast period.

Much like military needs, civil missions are inter-related globally but face serious budgetary challenges. In NSR's view, civil requirements could take a multinational program/access regime where three key features could be part of a hosted payload arrangement that include:

- Budget pooling
- Access management
- Specialized and/or premium content distribution to participating entities

Hosted Payloads Deployments by Orbit

Source: NSR

Thus, the case for the civil government is the following:

- HPs provide relatively fast capability building in light of pressing needs for civil entities.
- HPs provide technology test beds for expensive, next-generation programs
- HPs can even provide new, advanced and unique capabilities for multi-faceted and multi-national needs

The Private Enterprise Case

Cost and capacity sharing is thus far the model followed by private enterprise, exemplified by the XTAR program. XTAR indicated from its founding in 2001 that XTAR's business was designed around the hosted payload model. Launched in 2006, Spainsat is owned by Hisdesat, and it is on this platform that XTAR manages the XTAR-LANT payload of eight 72 MHz X-band transponders accessed through high-powered spot beams, three of which are fully steerable.

Another proposition has been offered by Harris/Caprock in terms of the company's improvement of its competitive position. The company stated, "We're looking for ideas and partners who can help us leapfrog the competition and drastically improve our competitive position in the marketplace. Hosted payloads would certainly be one option for achieving those goals."

Finally, tapping future opportunities is another proposition that private enterprise can justify in deploying hosted payloads. In the Iridium example on the FAA system, the company indicated that it would develop the air traffic monitoring instruments then integrate the system onto the Iridium Next satellites. Iridium would then receive annual service revenue from a consortium made up of the FAA and other customers around the globe. In this model, the traditional hosted payload model where hosting fees are paid to the host does not apply. Rather, Iridium would be the service provider, and the consortium that includes the FAA would pay for the service.

The risk is a calculated one since there is a definite requirement. Over the long term, the FAA requires an automatic dependent surveillance broadcast (ADS-B) system for its next-generation transportation system. By 2020 the FAA will ensure that all U.S. aircraft are equipped with ADS-B hardware.

In NSR's projections, hosted instruments on LEO orbits that specifically reflect deployments on Iridium NEXT far outnumber deployments in GEO and MEO systems. It is important to note, however, that the window of opportunity is fairly limited, driven by the launch schedule of Iridium NEXT to take place from 2015-2017. Thus, the case for civil government is the following:

- HPs provide risk management, cost-sharing benefits for capability building
- HPs provide internal cost management/asset deployment for competitive positioning
- HPs can even provide new capabilities in anticipation of next-generation demand such as the ADS-B system

Market Issues

Despite strong cases in all market segments, a number of key issues have and will continue to impact the hosted payload market. These include among others:

- Annual spending cycles that restrain orders
- Multiyear contracts remain a challenge
- Legal aspects that could be important obstacles
- Expectations from government users that are widely different from commercial customers could restrain demand
- Government protection of programs of record inhibit the hosted payload option
- Compensation and complex contractual arrangements with the host likewise inhibit market uptake
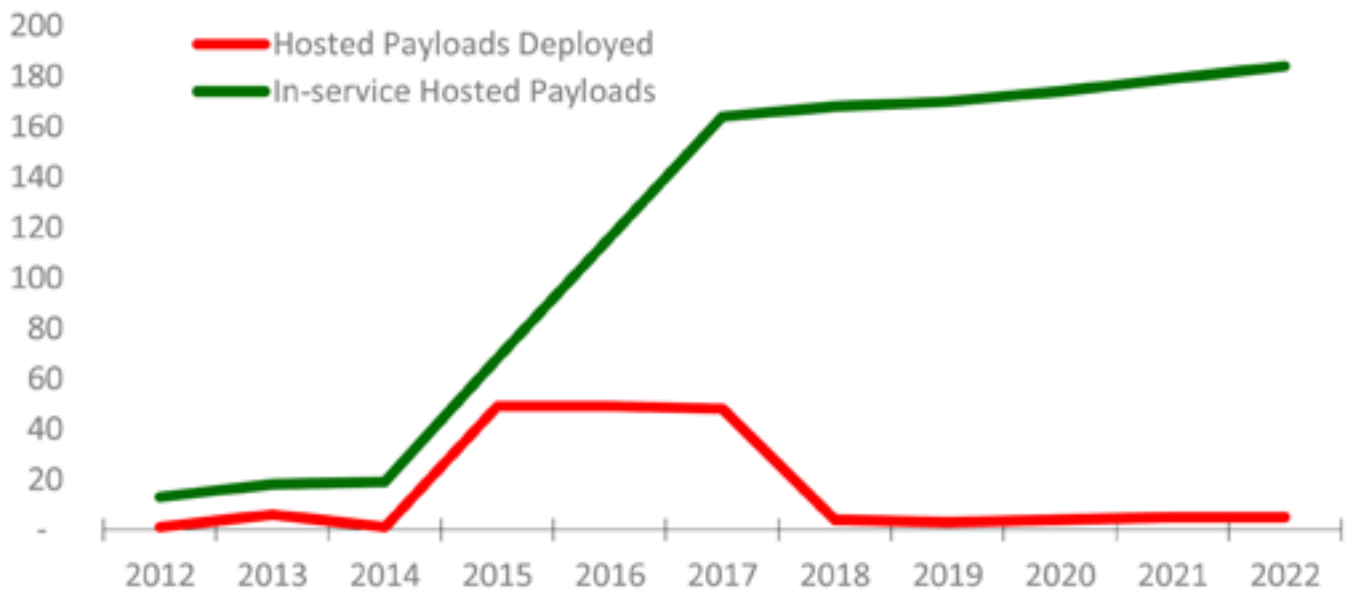
Timeline for Hosted Payload Deployment and Operation

Requirement Definition and Generate RFP	1 month
Proposal Submission by Contractors	1.5 months
Internal Evaluation of Proposals	1 month
Down Select and Negotiate Final Contract	1 month
Satellite Construction	18-30 months (24 month average)
Launch Campaign	1 month
Orbit Raising and In Orbit Test	2 months
Start Commercial Operations	25.5 - 38 months from Reqs. Def. (30 month average)

Courtesy of Intelsat

Moreover, wider risk management issues negatively affect the market. On the client side, instances where the Galaxy 15 satellite carrying the WAAS payload suffered a glitch in April 2010 as well as an Orbcomm satellite (which carried a U.S. Coast Guard Demonstration satellite for Automatic Identification System (AIS) was lost in August 2009) may have affected the market in the following manner:

Deployments & In-service Hosted Payloads on Commercial Satellites

Source: NSR

- Satellite failures or technical glitches mean loss of capability
- Satellite failures mean loss of investment
- Satellite failures or technical glitches mean loss of confidence in HP model as an option

On the host side, risks in a hosted payload arrangement could lead to:

- Manufacturing and launch delays given tight schedules (as outlined by Intelsat)
- HP affecting the primary payload
- HP affecting the satellite bus
- SLA management for commercial clients and government customer could be contentious
- Potential loss of commercial revenue
- Potential loss of commercial customer

Market Prospects

Taking market issues and each case for specific customer segments into account, NSR in its latest market research study, Hosted Payloads on Commercial Satellites, 2nd Edition, found that the market will become more fully developed over the next 10 years where it has been fairly limited as an option exercised by governments during the past decade. From 13 hosted payloads in 2012, the market is expected to grow to over 180 in-service payloads by the end of 2022. Significant factors in this growth are the instruments aboard the Iridium NEXT constellation.
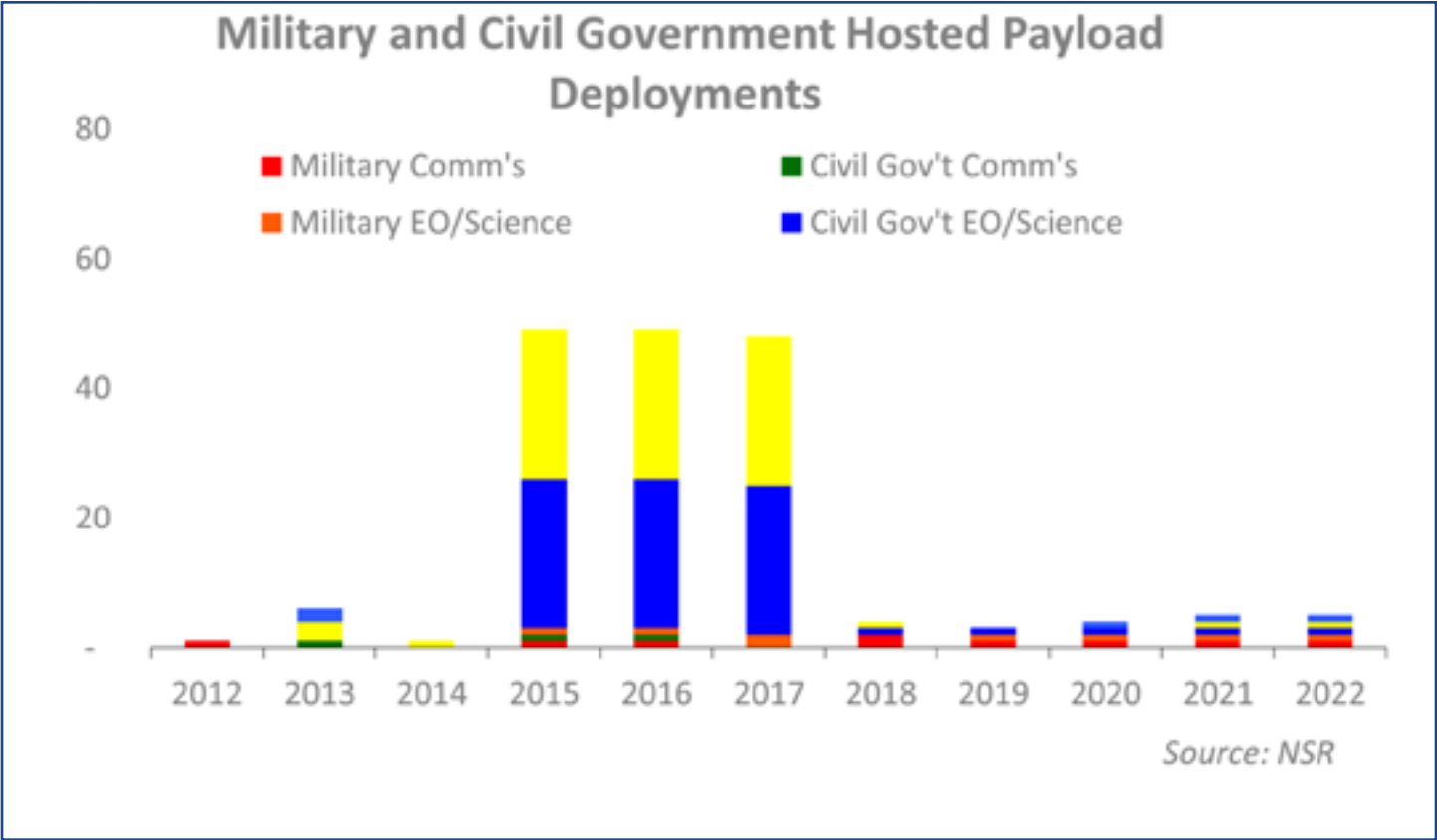
In terms of deployments per mission, civil government and private enterprise are expected to dominate the number of instruments deployed on commercial satellites. It should be noted that the deployments reflect systems aboard the Iridium NEXT constellation, which can carry small instruments on each satellite.

In terms of revenues, however, military communications missions are expected to drive revenue streams for the entire hosted payload market. Historically, the level of procurement has been high in dollar terms, particularly the Australian Defense Force (ADF) contract that carried a $167 million price tag. The recent ADF 2012 launch is likely at the same level as its 2003 predecessor in dollar terms. Over time, more military programs similar to the ADF are expected to emerge.

Globally, from an estimated $106.2 million in 2012, revenues for payload equipment, engineering services and commercial satellite operator hosting services are expected to range from $330.8 million to $554.0 million by 2022, yielding cumulative revenues of $1.8 billion to $2.9 billion over an 11-year period. The range of revenue streams depends largely on the types and varying costs of hosted payload equipment, and here, NSR conducted a scenario-based approach in its forecast methodology to reflect various payload complexities.
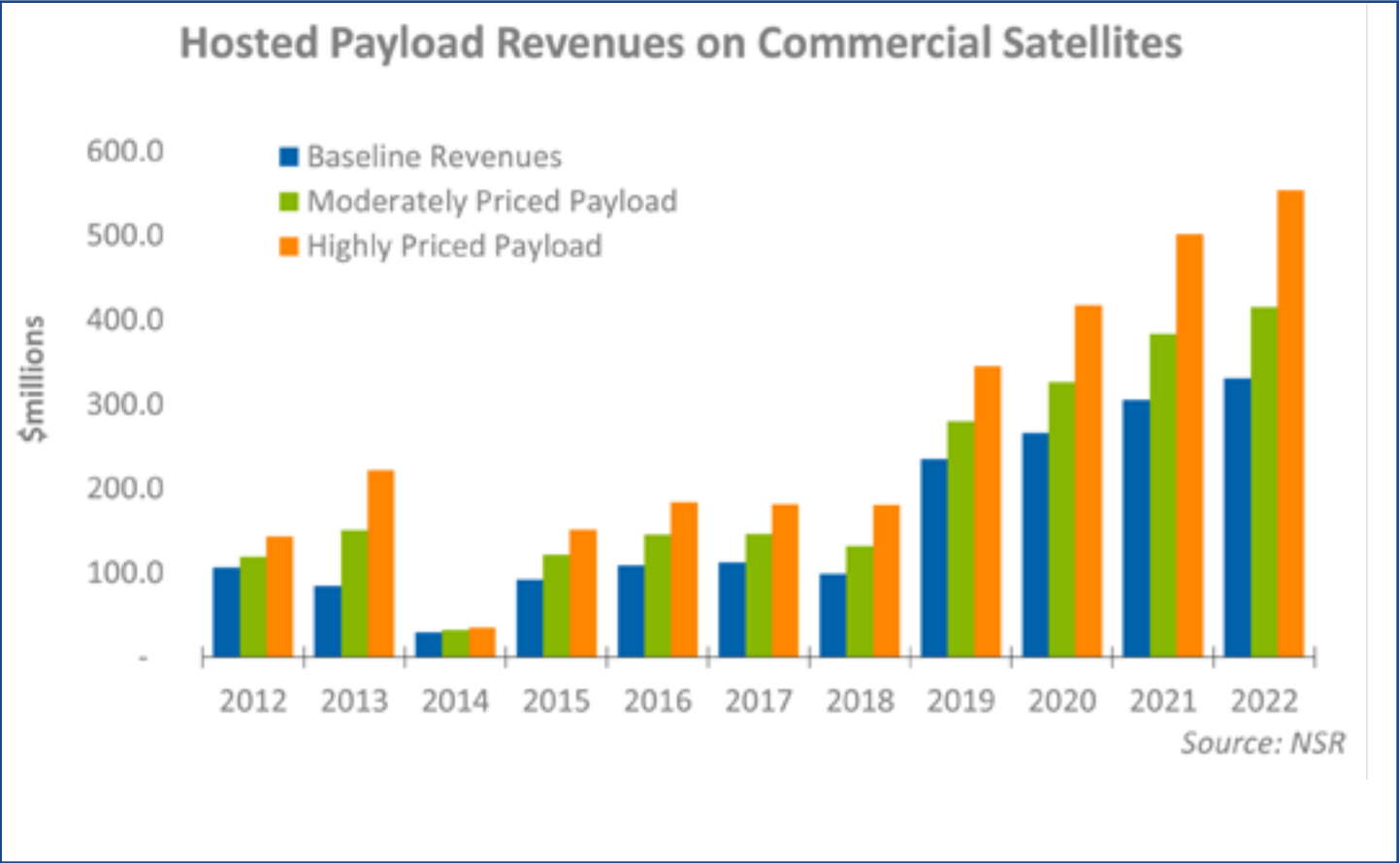
The revenue flows, when taken from a cumulative perspective, do suggest increased streams and thus opportunities in this given market. The specific annual revenue flows could be erratic; however, the overall trend of market opportunity is expected to increase within the forecast period.

Although long procurement processes are expected largely due to the inherently complex hosted payload arrangements as

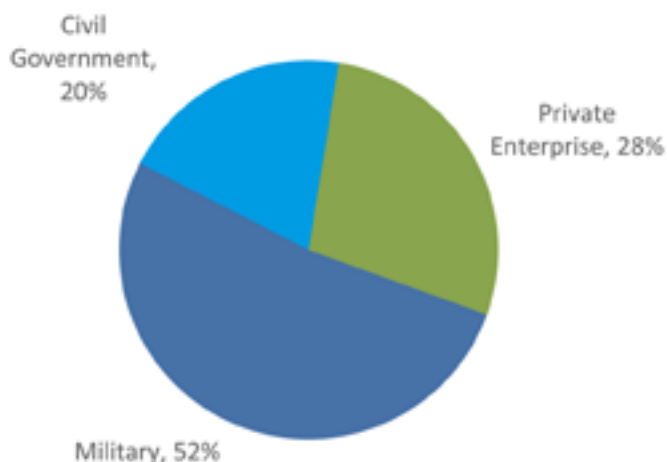## Military and Civil Government Hosted Payload Deployments

Source: NSR

well as associated fiscal and budget issues, the hosted payload proposition as a feasible capability-boosting instrument is expected to be exercised by a host of countries over the mid to long term. A sustainable and viable business model has emerged exemplified by the Australian program whereby risks associated with hosting complex military instruments can be justified by

Hosted Payload Revenues on Commercial Satellites

Source: NSR

Cumulative Revenues by Organization, 2012-2022

Civil Government, 20%

Private Enterprise, 28%

Military, 52%

Source: NSR

About the author

Mr. del Rosario covers the Asia Pacific region and is a senior member of the consulting team where he focuses his research on quantitative modeling, data verification, and market forecasting for the wireless industry and satellite communications sector. He conducts ongoing research with specialization in policy analysis, regional economic indicators, regulatory initiatives and end user demand trends.

commercial operators with the right compensation arrangements and risk-mitigating safeguards.
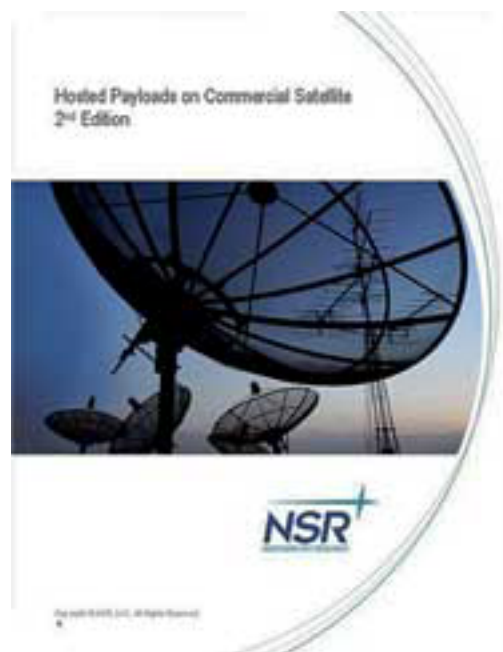
In Summary

- In terms of deployments:
  ◇ Private Enterprise communications missions are expected to be high, which represents a changing model where private sector absorbs risks.
  ◇ Opportunities for Military missions appear relatively few.
  ◇ In revenue terms:
  ◇ Military missions dominate despite the low number of deployments.
  ◇ Military missions represent higher contract values.
  ◇ Private Enterprise & Civil missions are expected to be almost equal

Bottom Line

The case for military, civil government and private enterprise risk taking is and will continue to remain viable over the long term. The market for hosted payloads is here to stay and will enjoy a greater role in terms of an option exercised by government entities and private enterprises around the globe. Private enterprise participation will be a tremendous boost to the market; however, the core market rests with military missions in revenue terms.

It should be noted that key market issues have to be resolved for the market to fully develop. It should be noted as well that in terms of revenue impact, hosted payloads are a niche offering where the percentage of market value is less than 1% of the entire satellite industry.

In addition to authoring numerous syndicated reports in his areas of focus, Mr. del Rosario has been involved in a wide range of strategic consulting projects. He has advised clients on market trends, implications, and strategies on such diverse topics as WiMAX, mobile communications, mobile video, 3G offerings, terrestrial microwave services, IPTV, IP telephony, multi-mission satellite programs, launch vehicles, broadband equipment and services, Internet trunking, and Enhanced IP Services.

Hosted Payloads on Commercial Satellite 2nd Edition

SATCOM For Morale, Welfare & Recreation (MWR)

Morale, Welfare and Recreation (MWR) programs are a key part of Government and Defense operations. MWR networks are designed to support remotely deployed defence personnel, civilian employees, ship crews and their families. Satellite communication plays an important role in MWR programs due to the fact that government and defence operations are mostly situated in remote locations or in areas suffering from man-made or natural disasters with no terrestrial connectivity.

The amount of data, voice and video exchanged in MWR networks has grown substantially, along with the wide number of leisure and support services that are being offered.

Government and defence customers continuously seek new technologies to drive down bandwidth requirements and are looking for ways to lower satellite bandwidth costs. Through efficient satellite communication technology, such as is offered by Newtec's *FlexACM®*, *Cross-Layer-Optimization*™ and datacasting solutions, this objective can be achieved in relatively little time.

MWR Programs Via Satellite

Morale, Welfare and Recreation programs are established in order to enhance the quality of life for defense personnel, civilians, ship crews as well as their families.

- **Connectivity to families and friends to increase resilience under unusually distant locations**

- **Enroll new recruits or employees to participate in remote missions on land and sea**

- **Motivate remotely deployed personnel**

- **Provide leisure during times of low activity**

- **Implement training and education to improve readiness and skills for upcoming missions**

- **Relieve stress to stay mentally and physically fit**

Such programs often depend on SATCOM due to the remote nature of government and defense operations. Satellite MWR networks combine a set of varying services available for personnel serving on both land and sea. They can include such features as...

- **Internet Café Access**
- **TV & Radio Broadcast**
- **VoIP**
- **Training & Education**
- **Digital Cinema**
- **Mobile/Portable Access**
- **Intranet Access**
- **Social Media**
- **Travel/Sport/News/Dining Information**

Humanitarian missions into disaster areas, duty at sea, and peacekeeping operations take government and defense personnel to remote locations where, often, terrestrial communication infrastructure is unavailable, or has actually been destroyed.

A satellite link can be established quickly—anywhere in the world, regardless of the location on land or sea. Once the network is in place, extra remotes can be activated at any time.

Support of Video, Voice + Data

MWR services are a combination of voice (calling the home front), video (news, sports, entertainment, TV and radio broadcast, training movies) and data (social media, email). Most of these streaming and file-transfer based services have converged towards IP.

Through a multiservice platform, the various MWR services over IP can be combined either in the hub or via the remote into a single carrier for efficient transfer over satellite at optimal availability.

All Newtec equipment and technology individually contributes to optimising the satellite IP link. However, once combined, they bring the satellite link to full efficiency.

The Newtec modulators, demodulators and modems that are implemented for MWR are based on **DVB-S2,** the adopted standard for communication over satellite for data, video and voice allowing full interoperability.

Easy Integration

Newtec equipment and software have successfully been integrated in MWR networks over satellite worldwide—hub equipment, modems, modulators and demodulators fit perfectly into rack space at the MWR headquarters or at the remote sites. Video, data and voice (file-based or streaming) are transmitted through one modem in the same satellite carrier in the most efficient way.

The network optimization software such as acceleration, shaping and data casting is available on Newtec IP equipment or as software clients which can be smoothly integrated into existing infrastructures.
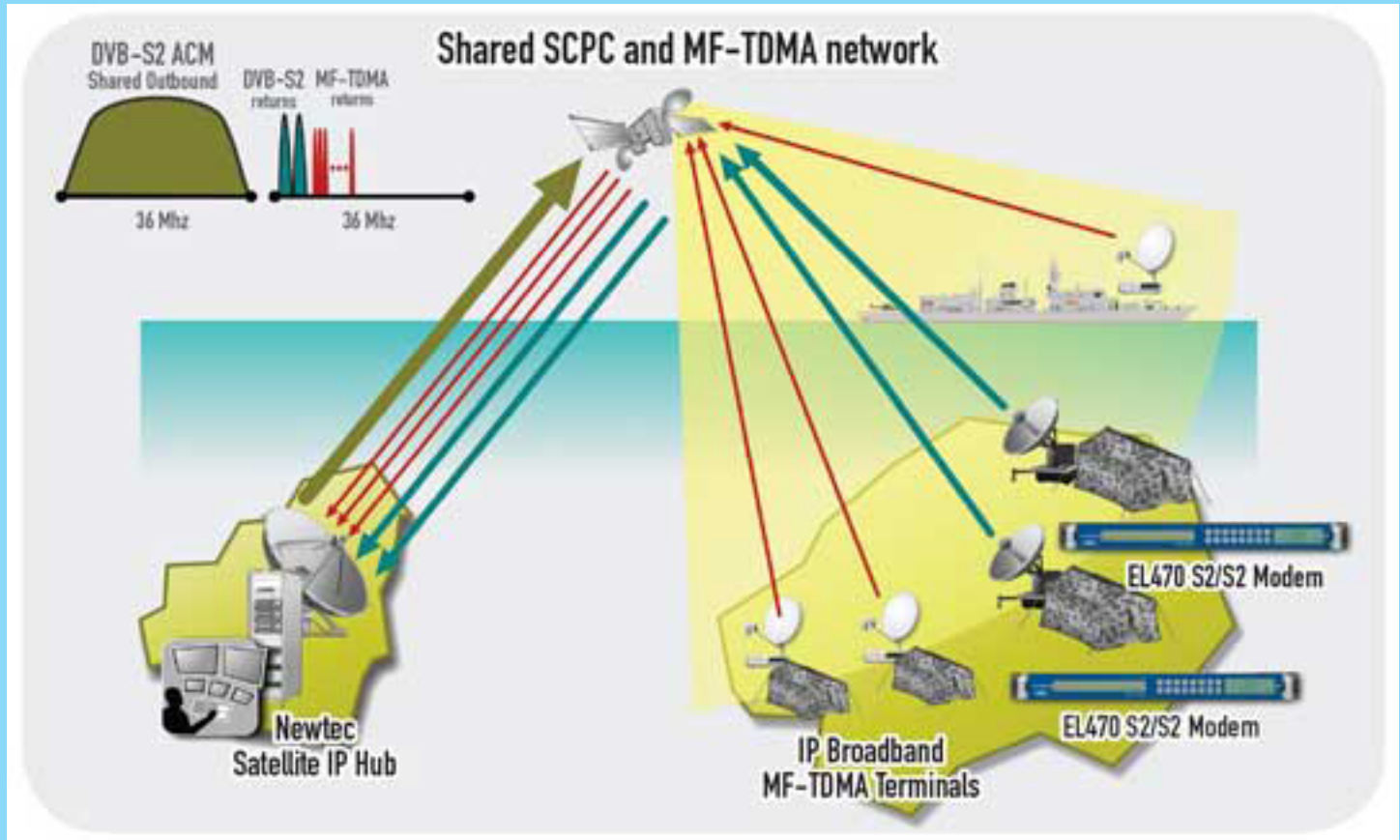
Newtec SATCOM equipment is based on DVB-S2, the adopted standard for interoperable communications over satellite.

Scalability

Through the Newtec hub, large camps, small sites or ships can be connected with a common forward satellite carrier. The return technology can be SCPC or MF-TDMA (or a combination of both technologies), depending on the return rates, size of the remote, or the configuration of the network (Point-to-Point, Point-to-MultiPoint).

Double Throughput, Same Bandwidth

Next to the increase in MWR networks over satellite, substantial growth has been experienced in data, video and voice traffic. Increased data rates need to be accounted for when such encounter a lack of satellite capacity in many operational locales.

Broadband Experience Away From Home

For true broadband experience over satellite, the modems and terminals from Newtec implement the most efficient technologies, such as DVB-S2 FlexACM® in the forward link, adaptive return technologies, and embedded IP traffic enhancement software (aka Cross-Layer-Optimization™) such as shaping, TCP acceleration, pre-fetching and compression. Adding to the improved end-user experience, considerable cost savings can also be achieved.
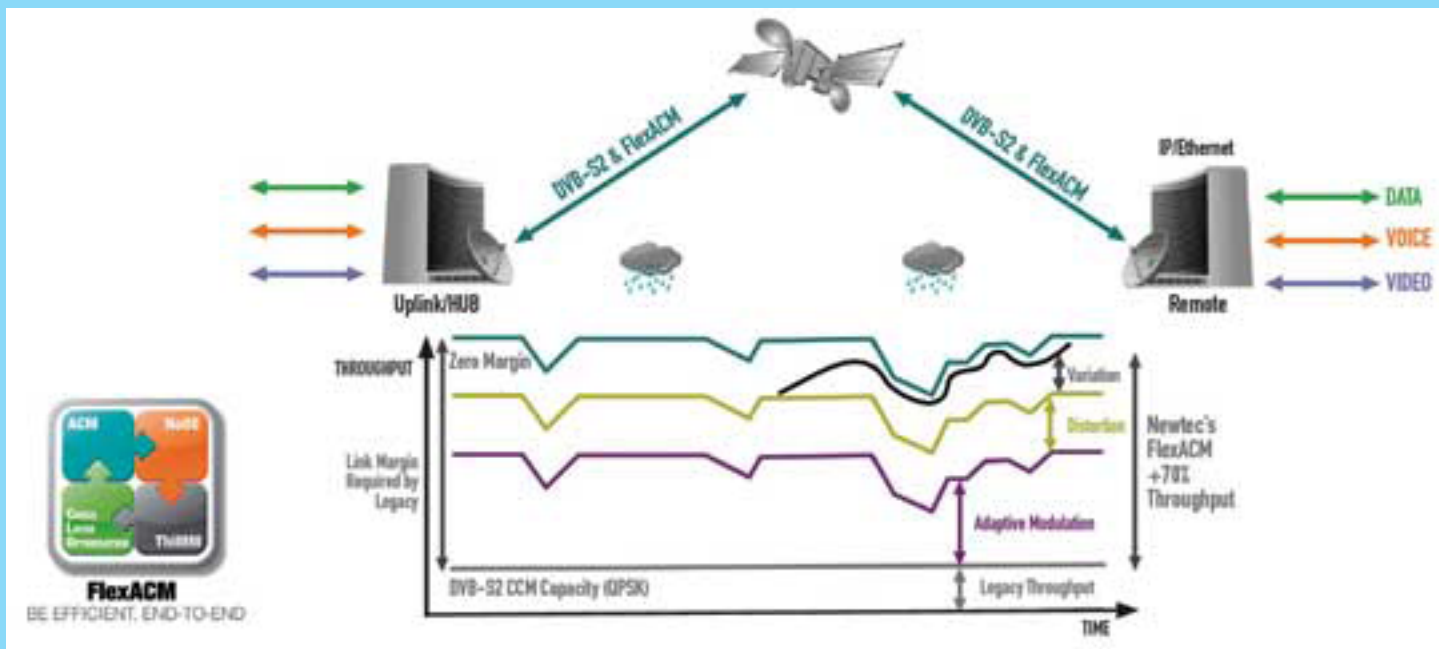
- Reduction of Webpage Load Time up to 60 percent
- Reduction of File Download up to 90 percent
- Up to 35 percent Bandwidth Reduction

The Newtec VSAT system provides reliable 2-way IP connectivity through a versatile, scalable hub and cost effective and low power consumption remote terminals. The networks contain management functions for monitoring and control, SLA Management, QoS and Fair Use Policy.

An answer is through the use of dedicated technologies such as FlexACM®, Bandwidth Cancellation, Clean Channel Technology™ and Equalink®—these are used in many MWR networks to achieve maximum throughput that is independent of the selected satellite. Simultaneously, important OPEX reductions can be achieved.

Optimal Availability Over Variable Conditions

Even in the most harsh and hostile conditions, it is important to have MWR networks over satellite available for crew and personnel at all times. The auto-adaptive technology incorporated inside FlexACM® takes care of any fading condition in order to avoid link or data losses. Fading conditions due to choice of satellite (Inclined Orbit Satellite, Ku-, Ka-, X-band, HTS), environment (rain & dust) or interference (between two adjacent satellites) will no longer interrupt satellite transmissions. FlexACM® doubles the data throughput for fading sensitive satellites (X-, Ku-, Ka-band, HTS) and Inclined Orbit Satellites.
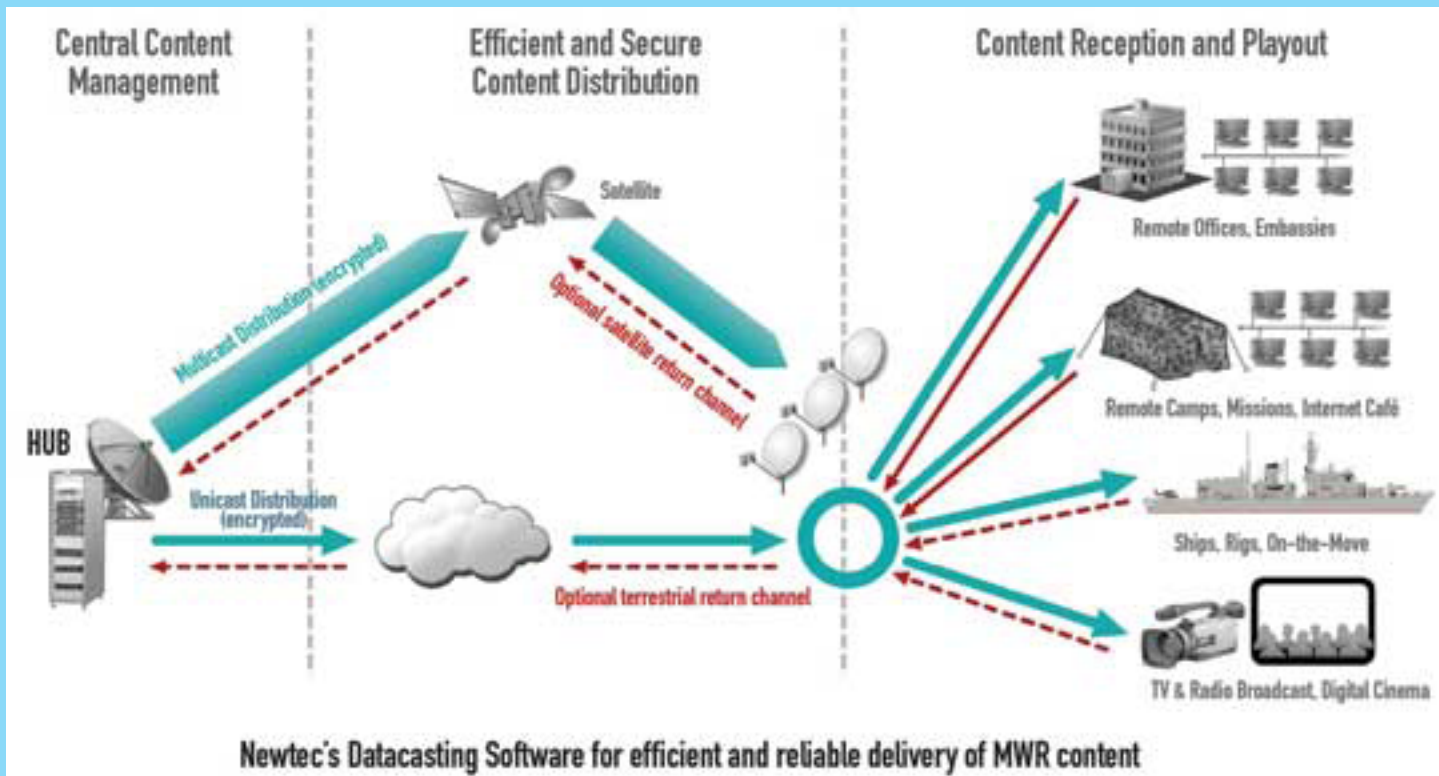
Reliable + Efficient Datacasting

Multicasting MWR content to remote sites and ships with the Newtec's datacasting software will immediately result in important use and cost efficiencies. The transmissions are aggregated in an efficient DVB-S2 FlexACM® forward over satellite. The content is stored on the server that is located at the remote site.

The reliability of datacasting (digital cinema, news, shows, etc.) is enhanced by the software's partial retransmission capabilities. Only the detected missing fragments are retransmitted. This, also, provides important OPEX gains for services on-the-move or those experiencing fading or interference conditions. Newtec's datacasting software also offers...

- **Dynamic Scheduling & Prioritisation**
- **Authentication, Authorisation & Accounting**
- **Automated Content Distribution via "hot folders"**
- **Monitoring & Control**

Newtec's Datacast solution provides efficient store & playback support over satellite and is robust against outages. More info is available at **Newtec's website**.

Newtec's Datacasting Software for efficient and reliable delivery of MWR content

Challenges = Innovation

Our nation's and our allies' armed forces and government agencies are highly dependent upon satellites tasked for MILSATCOM operations. Retasking flexibility, observation without detection, the delivery of near-instant communication and data, and critical reliance upon command and control of a satellite's resources are just some of the reasons for the continuance of mil/gov satellite build programs—the end results include saving warfighter's lives and mission successes.

The companies involved in such endeavors range from extremely large in size to those with just a few professionals staffing their efforts. Some company names we all are quite familiar with, as their satellite offerings are one segment of their overall manufacturing and technology offerings. Others you may not have heard of, yet they are equally as important in producing viable products to aid U.S. and Allied MILSATCOM efforts. This issue, we enter the world of *GMV USA*.

With a focus on the U.S. space market, **GMV USA** was established by **GMV** as a subsidiary company in Rockville, Maryland, and has built a solid reputation as a reliable supplier of technology to the U.S. Government and industry. GMV is the world's leading supplier of ground control systems for commercial telecommunications satellites, with 45 percent of the global market, and is a well-recognized authority in mission planning and scheduling for complex space missions and ground networks.

GMV is also the only company to sell ground software to space institutions around the world including **NASA**, **NOAA**, and **USGS**—in fact, 20 percent of all spacecraft, commercial, civilian and classified launched in 2010 use GMV technology. Currently, GMV has more than 285 operational systems installed on six continents in 25 countries. GMV is *CMMI Level 5 Capability Maturity Model* (**CMM**) and *ISO 9001* (**Quality Management Standard**) certified for software development.

GMV USA offers a suite of proven, flexible, and customizable *Commercial-Off-The-Shelf* (**COTS**) software solutions for *Flight Dynamics*, *Mission Planning and Scheduling*, *Real-Time Telemetry Tracking and Control* (**TT&C**), and *Payload Management and Configuration*.

GMV USA + MILSATCOM

MILSATCOM users operate in a dynamic environment that includes rapidly evolving technologies, policies and procedures, and adversary capabilities. MILSATCOM networks increasingly incorporate mobility from user and terminal perspectives.[1] User mobility may include user ability to change terminals and terminal types. Terminal mobility refers to terminals that change location while either offline or online. Mobility, including *Communications on The Move* (**COTM**) and *Remotely Piloted Aircraft* (**RPAs**), offers unprecedented challenges, and will require capabilities such as...

- Autonomous maintenance of connectivity as users move between beams within theater coverage areas, at times over unimproved terrain and under full weather

- Over-the-air rekeying and local mission key generation

- On-the-fly reconfiguration to restore lost capability following a failure

- Oncurrent acquisition and logon services to a large number of terminals

In addition, the demand for MILSATCOM will almost certainly grow, even as supporting budgets become increasingly constrained.

Seeing The Solutions

GMV's solutions are designed to provide agile, low cost, low risk solutions to optimize performance in a resource-constrained environment. GMV solutions are interoperable with *Service Oriented Architecture* (**SOA**) solutions and span multiple generations of hardware and software in space and on the ground to reduce lifecycle cost and enable affordable, flexible changes over the life of the mission to accommodate new assets,

changes in resource status, and an evolving user community. GMV incorporated *Information Assurance* (**IA**) and cyber threat protections into all of its software solutions. GMV's customizable COTS Mission Planning, Scheduling, and Management solutions offer highly specialized, customizable, integrated multi-mission, multi-user mission planning and bandwidth optimization and allocation capabilities to meet and surpass war fighter MILSATCOM requirements.

Planning Ahead

Initiating a new space mission is daunting... the intricacies are mind boggling when appraised as a whole event. This is when mission analysis comes into play, where the programs are studied for their viability, determining the optimal benchmarks to ensure maximum scientific return, new path propositions, space mission objectives identification and establishment, mission recovery as well as mission extension alternatives, and calculating constellation designs for optimal communications coverage.

GMV USA uses its years of experience and knowledge to successfully execute the task at hand. Their solutions are particularly well-heeled for telecommunications, Earth Observation (**EO**), interplanetary, scientific, orbital transport and infrastructure, and navigation missions. GMV solutions additionally incorporate the ability to provide launch mission analysis support and orbital debris tracking and monitoring.

Flying High

Flight dynamics' systems provide the necessary means to determine the position and the orientation of satellites and space systems, and also enable the planning and execution of required maneuvers. As a result, these systems are essential to ensure the perfect reception of satellite communications, or the attainment

of goals in any mission, whether scientific, exploration, or of any other nature.

GMV USA supplies flight dynamics systems to institutional and commercial customers around the world. Flight dynamics' systems provide support to various mission types such as telecommunications, military, EO, scientific, orbital transport and infrastructure, navigation, space exploration, and missions. GMV USA offers turnkey flight dynamics solutions based its focussuite product line and customized to meet customer-specific requirements.

focussuite is GMV's line of COTS flight dynamics multi-satellite and multi-mission products for satellite operations support of all types of missions and phase levels. The focussuite product line includes products such as *focusGEO* for GEO satellite support; *focusLEO* for LEO satellite support; *focusCn* for satellite constellation support; and *focusLEOP* for *Launch and Early Operations Phase* (**LEOP**) satellite support—all solutions are 100 percent flight-tested. Consulting and engineering support is also provided during any development phase of these systems.

As an independent supplier, GMV USA is able to tailor systems to the needs of customers and provide optimum solutions to satellite operators, while ensuring full data confidentiality for satellite manufacturers. The flight dynamics' tools incorporated within the focussuite product line component provide full flight dynamics automation using adapted operating procedures. These include...

- Close approach evaluation and collision avoidance

- Constellation multi-mission, multi-satellite operations

- Flight dynamics generic product infrastructure

- 2D/3D visualization engine for satellite operations

- Precise orbit determination (POD)

Artistic rendition of the GOES-R satellite

Artist concept illustration of the Landsat 7 satellite

The Controlling Factor

No matter how viable a satellite may be, data and service continuity and integrity are non-existent without reliable and robust ground systems to provide crucial control and tracking. GMV is well regarded in the satellite control center segment of our industry and, in fact, is the number one worldwide provider of *Ground Control Systems* (**GCS**) for commercial telecommunications operators.

Real-time telemetry and command processing systems provided by GMV and GMV USA offer support to different mission types such as tightly integrated military missions, EO, telecommunications, orbital transport and infrastructure, scientific, navigation, and space exploration.

GMV provides turnkey systems developed to meet customer-specific requirements for the telecommunications satellite market. These systems are based on the adaptation of *hifly*®/*archiva*, the company's COTS multi-satellite, multi-mission flight-proven product for integrated support of satellite operations. GMV additionally offers engineering and consulting support during any system development phase.

GMV's real-time telemetry command and control and offline telemetry and analysis software product has been selected by for the *Geostationary Operational Environmental Satellite – R Series* (*GOES-R*), **NASA**'s *Space Network Ground Segment Sustainment* (**SGSS**) *Project*, and **USGS**' *Landsat Data Continuity Mission*.

It is important to note that GMV USA's significant space experience over the years has led to solid relationships with major satellite manufacturers including **Boeing Satellite Systems**, **Space Systems / Loral**, **Orbital Sciences Corporation**, and **Lockheed Martin**. These relationships have enabled complete system tailoring to provide optimum solutions to satellite operators, all the while ensuring data confidentiality for satellite manufacturers. The entire control centers life cycle is covered by the firm's wide array of activities, ranging from requirements consulting and specification and design to on-call support and all-important education and training.

NASA's Space Network Ground Segment Sustainment Effort (SGSS) successfully completed its Key Decision Point B review in April of this year.

Artistic rendition of NASA's fisrt TDRSS spacecraft

Artist's rendering of the LRO spacecraft in orbit.

Mission Possible

Achievement of optimal mission performance requires highly complex scheduling of the ever evolving mission priorities, resource availabilities, and operational constraints that are an inherent part of operations. To accomplish this task, GMV USA developed flexplan, a highly customizable, innovative, COTS *Mission Planning and Scheduling* software product. **flexplan** is a highly configurable mission planning tool that can easily be expanded to add additional missions and resources, and for efficient reuse from one mission to the next. It is specifically designed to optimize the management of multiple missions with multiple spacecraft and complex ground networks, and allows users to quickly and easily adapt the system to their requirements.

flexplan has a modular architecture in which all components interact with each other via the system database. This enables different components to run at different times, or concurrently by different operators. All interactions with outside systems (*i.e.*, the Flight Dynamics system or the T&C system are carried out via the *External Interfaces* module, which is an easy-to-manage component that can be adapted to various mission types.

The software has been designed so that even non-experts can operate it and easily be used for any spacecraft platform and a wide variety of missions. GMV USA's flexplan software has been selected by NASA Space Network next generation **Ground Segment Sustainment** (**SGSS**) **Project** for the planning and scheduling of the full constellation of **Tracking and Data Relay Satellite System** (**TDRSS**) spacecraft and associate ground network, NASA's **Lunar Reconnaissance Orbiter** (**LRO**) mission, and the **USGS** L**andsat Data Continuity Mission** (**LDCM**).

About GMV USA

Theresa W. Beech is the President and Chair of the board of GMV USA, and Gonzalo Garcia is the Vice President. More than 285 space missions have used GMV technology, and the firm's operational systems are currently installed on six continents in 25 countries. Other areas of concentration not covered in this article include global satellite navigation systems, simulation expertise to assist in new concept and technologies validation, systems engineering, embedded software and more. GMV USA also achieved CMMI® level 5, the world's most prestigious business-process improvement model, in September of 2010.The parent company of GMV USA is the privately-held, family-owned GMV international technology conglomerate headquartered in Madrid, Spain. Founded in 1984 by a university professor, GMV offers its solutions, services and products in very diverse sectors: Aeronautics, Banking and Finance, Space, Defense, Healthcare, Security, Transportation, Telecommunications, and Information Technology.

As the Company's credo states, GMV USA has a "Passion For Challenges—An Opportunity For Innovation."