SatCom For Net-Centric Warfare April 2012

MilsatMagazine

Advanced MILSATCOM

—Kratos' RT Logic...
On CyberSecurity
—Command Center...
Madden of SMC
Sears of Intelsat General
—Real-Time Optimization
—NG9-1-1
—*Gough, Heyman, Peeters*
—Structural Dynamics
—Satellite Interference
—Gen. *Kehler, Tip Osterthaler*

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SES Government Solutions

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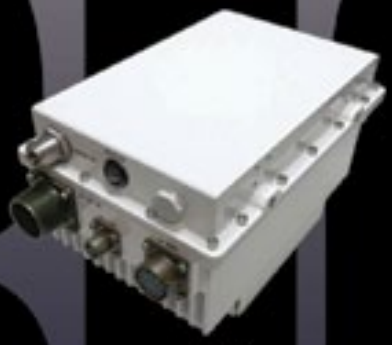

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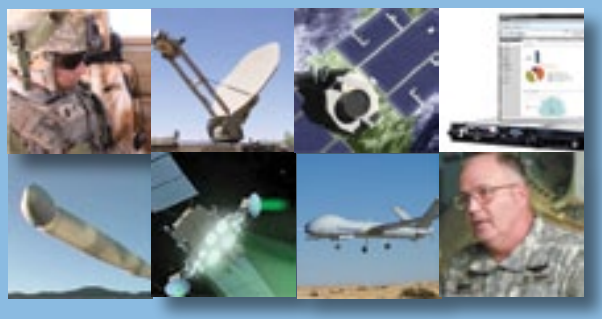

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PRIME: CYBERSECURITY RISK MANAGEMENT STRATEGIES FOR SATCOM NETWORKS

In recent months SATCOM-related cybersecurity events have taken center stage. Most visible was the additional background provided by the government about the orchestrated disruptions of the Landsat 7 and Terra imaging satellites. More recent was the Pentagon and NASA breach by Romanian hacker TinKode who allegedly posted to the Internet an image of files related to confidential satellite data from Goddard Space Flight Center. **Page 30**

INTEL: ANSF INTEROPERABILITY—LESSONS WELL LEARNED

With the Afghan National Security Force (ANSF) leading its first missions against the Taliban in Helmand, Giles Peeters considers the primary communications concerns for the departing NATO forces and the ongoing ANSF operation. Afghanistan highlighted the fact that NATO required allied forces to be able to communicate with each other over large distances, often at short notice, in mountainous conditions that didn't lend themselves to reliable radio communications. By *Giles Peeters*, Defense Sector Director, **TRACK24 Defence, *MILSATCOM Contributing Editor*** — **Page 36**

OPS: AND THE EARTH SHOOK...

Have you ever been in an earthquake? I have, once, and it's terrifying. Not a powerful earthquake, admittedly, and most California residents would probably have called it a tremor. However, it was enough to cause me to wake me up in the middle of the night, in the dark, and my first thoughts were, "Why does it feel like my head is spinning? Did I really drink that much vino rosso with my bistecca di manzo dinner at Umberto's Ristorante?" By *Bob Gough*, ***Asia-Pacific Contributing Editor*** — **Page 40**

RE:SOURCES...THE ROAD TO THE FUTURE—THE MILITARY ENIGMA

This issue's questions for Bert...

Our U.S. based company is supportive of the men and women who have made sacrifices serving in the military. What is your opinion on recruiting personnel from the Armed Forces?
by *Bert Sadtler*, President, **Boxwood Search**, ***Contributing Editor*** — **Page 46**

COMMAND CENTER: DAVE MADDEN, DIRECTOR, MILSATCOM SYSTEM WING, SPACE + MISSILE SYSTEMS CENTER

Mr. David W. Madden, a member of the Senior Executive Service, is the Director, Military Satellite Communications (MILSATCOM) Systems Wing, Space and Missile Systems Center, Air Force Space Command, Los Angeles Air Force Base, California. He is responsible for acquiring, deploying, and sustaining the $40B MILSATCOM portfolio of programs that consists of ACAT I and II programs, including the Defense Satellite Communications System (DSCS)... By *the editors of MilsatMagazine* — **Page 48**

FOCUS: A NEW ERA FOR POLAR-ORBITING SATELLITES

Three months after the launch of the Suomi NPP spacecraft, NASA unveiled a stunning high-definition image of Earth called, "Blue Marble 2012" snapped by one of the five remote-sensing instruments that comprise the satellite's instrument suite. The platform that enabled this image was built by Ball Aerospace & Technologies Corp., as the first of a new generation of satellites and a critical bridge to the future. By *Ball Aerospace & Technologies Corporation* — **Page 54**

COMMAND CENTER: KAY SEARS, INTELSAT GENERAL

Kay Sears, President of Intelsat General, is responsible for implementing the company's strategic and operational plans and for the overall mission of providing a range of sustainable, cost-effective and secure communications solutions to government and commercial customers. She has worked more than 22 years in the satellite communications industry, including extensive experience in rapid-response solutions for both military and civil agencies of the U.S. government. By *the editors of MilsatMagazine* — **Page 58**

OPS: DISAGGREGATION + DIVERSIFICATION OF U.S. MILSATCOM

The history of U.S. MILSATCOM has been one of aggregation of mission capabilities over time. The result has been today's limited number of large satellites of ever-increasing complexity. Core U.S. MILSATCOM will span just 14 satellites by 2020 [Advanced EHF (AEHF): 4, Wideband Global SATCOM (WGS): 6, Mobile User Objective System (MUOS): 4]. Though new capabilities have been fielded and proven valuable, the consequences of this approach have been profound... By *Ron Burch,* ***Advanced MILSATCOM, Boeing Space & Intelligence Systems*** — **Page 64**

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INTEL: IMPLEMENTING THE NATIONAL SECURITY SPACE STRATEGY

The U.S. approach to implementing its national space policy will determine its future course in space. Will our nation act as a collaborative partner that leads by example? Or will we try to move forward unilaterally in space? What steps should the United States take today to ensure security in space for the future?
By *C. Robert Kehler,* ***General, U.S.A.F.*** — **Page 72**

INTEL: SATELLITE INTERFERENCE—THE GOOD, THE BAD + THE UGLY

First: The Bad—There is no such thing as good satellite interferences, unless your intention is to try and knock someone else's traffic out of commission and you are good at completing such an act. That being said, there are two general categories of interferences: Intentional and Unintentional. The former is in the minority, the latter, the majority. "Bandwidth bandits," such as unauthorized accesses and jamming signals, are two examples of intentional interferences. By *Jeffrey C. Chu,* ***Co-Founder + CEO, Glowlink Communications Technology*** — **Page 78**

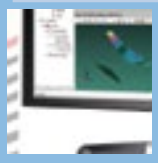
FOCUS: SATCOM IMPROVEMENTS ENHANCE MILITARY INTELLIGENCE + CAPABILITIES

Although military operations have officially ended in Iraq and are winding down in Afghanistan, there remains an even stronger need for military satellite communications (MILSATCOM), now and in the future. Why? Fewer boots on the ground mean a greater reliance on intelligence, surveillance and reconnaissance (ISR) missions, and ISR heavily relies on MILSATCOM technologies. By *Karl Fuchs,* ***iDirect Government Technologies*** — **Page 80**

RECON: A HISTORY OF SUCCESSFUL MISSIONS

In a world seemingly gone mad at times, our nation's and our allies' armed forces and government agencies are, nowadays, even more dependent upon the intelligence, surveillance and reconnaissance data beamed to them by various MILSATCOM satellites. Retasking flexibility, observation without detection, and the delivery of near-instant communication and data are just three reasons for the continuance of satellite build programs that result in saved lives and operational successes. By *the editors of MilsatMagazine* — **Page 82**

TECH OPS: UNITING STRUCTURAL DYNAMICS SIMULATION + TRAINING



Squeezed development and testing times for satellites call for intelligent solutions. Like other structural testing applications, satellites are subjected to exacting test procedures. But unlike other structural testing applications, satellites are so fragile that testing is typically carried out on a 'test model' that is identical to the real-life 'flight model', but will in fact never be used once the testing is completed. By *Noel Brown,* ***Brüel & Kjær*** — **Page 88**

FOCUS: DATA MANAGEMENT FOR FASTER + SMARTER INTELLIGENCE

On the battlefield and across the global security landscape, every second counts. The time it takes the warfighter to correlate their geospatial context and access intelligence is critical to the success of the mission. While the proliferation of space-to-ground sensors has enabled us to gather more intelligence than ever before, it has also made it more challenging... By *Michael Ehrlich,* ***ITT Exelis Geospatial Systems*** — **Page 90**

OPS: NG9-1-1 STATE OF THE UNION

The goal of NG9-1-1 is to improve public emergency communication services by adapting to this century's connected, multi-media-enabled, mobile society. In addition to connecting callers to 9-1-1, this program enables the public to transmit text, images, video and data to the 9-1-1 Public Safety Answering Point (PSAP). By *Thomas Ginter,* ***TeleCommunication Systems*** — **Page 92**

INSIGHT: THE IMPLICATIONS OF THE NEW FAA BILL REVIEWED

On February 14, 2012, President Barack Obama signed a new Federal Aviation Administration (FAA) reauthorization bill worth just over $63 billion, mostly intended for FAA funding to create a new national navigation system for both commercial aircraft, such as jetliners, as well as private aircraft. By *Jeff Allen + Ashish Sarma,* ***FreeWave Technologies*** — **Page 94**

DOWNLINK: FCSA—A YEAR IN REVIEW

In February 2012, the commercial satellite industry and the U.S. Government marked the one year anniversary of the first award under the Future Commercial SATCOM Services Acquisition, or FCSA. The initial intent of the joint GSA-DISA vehicle was to create a common marketplace for government customers to increase competition, opportunities and technologies, and ultimately, provide competitive pricing to the government. By *Tip Osterthaler,* ***SES Government Solutions*** — **Page 96**

ADVERTISER INDEX

U.S. Army's Tac Comms Upgrade Plans

The Army is preparing to field up to eight brigade combat teams with an advanced, integrated tactical communications network beginning early next year.

This was according to senior leaders during the Association of the United States Army (AUSA) Winter Symposium and Exhibition here this week.

The service is now synchronizing the production, fielding and training for Capability Set 13, which is composed of vehicles, network components, and associated equipment and software.

These technologies will, for the first time, deliver an integrated voice and data capability throughout the brigade combat team formation down to the tactical edge.

"It's not the individual products that we're delivering —we're putting together an integrated capability set for the brigade," said Col. Dan Hughes, director of the Army's System of Systems Integration Directorate. "This synchronized effort means that deploying units will receive integrated equipment and comprehensive training, so once in theater they can use the network to the maximum operational effect."

Capability Set 13 has taken shape through the Network Integration Evaluations, or NIEs, a series of semi-annual field exercises designed to quickly integrate and mature the Army's tactical communications network. The connectivity, architecture and components of the capability set will be validated and finalized at the NIE 12.2, which takes place in May at White Sands Missile Range, New Mexico, and Fort Bliss, Texas, involving 3,800 Soldiers of the 2nd Brigade, 1st Armored Division executing realistic operational scenarios.

The centerpiece of Capability Set 13 is the Warfighter Information Network-Tactical, known as WIN-T, Increment 2, a major upgrade to the tactical communications backbone that will enable mission command on-the-move and extend satellite communications to the company level. Integration and configuration of WIN-T, Increment 2, equipment on combat vehicles is now underway at Army facilities in preparation for production and synchronized fielding, Hughes said. The formal operational test for WIN-T, Increment 2, will take place in conjunction with NIE 12.2.

During presentations this week, Hughes and other Army acquisition officials stressed that the NIEs and Agile Process have accelerated the pace of network modernization by leveraging industry innovation to keep pace with technological advances. "The Army is now taking several steps to ensure small businesses are able to participate in the NIEs, including ways to evaluate prototype technologies in small quantities, and to minimize field support cost," Hughes said.

"Small businesses with less mature capabilities also have opportunities for technology insertion through the Army research and development community," said Marilyn Freeman, deputy assistant secretary of the Army for Research and Technology.

"We really want small business innovation to be part of this," Hughes said.

The Army is also working to formalize the precise mechanisms through which contracts can emerge from the NIE process. Earlier this week, in its first procurement action resulting from the NIEs and Agile Process, the Army issued a "sources sought" notice for a single-channel, vehicle-mounted radio. The radios, known as Soldier Radio Waveform, or SRW, Applique, will act as a conduit for voice and data between the dismounted Soldier, his unit and higher headquarters, increasing situational awareness and reducing fratricide.

This procurement, planned in time for Capability Set 13, illustrates how the NIEs and the Agile Process allow the Army and industry to work together to quickly fulfill network hardware and software capability gaps.

Synchronized fielding of capability sets every two years also will allow the Army to buy the right amount and type of gear for the brigades that need it first, then incrementally modernize it—instead of spending resources on technology that may be out of date by the time it is needed, leaders said.

Heidi Shyu, acting assistant secretary of the Army for Acquisition, Logistics and Technology, known as ASA (ALT), described the NIEs and Agile Process as a "pioneering effort that reflects adaptive thinking across the Army" at a time when the service must find fiscal efficiencies in today's more constrained budget environment.

"By bringing diverse equipment together for testing at Fort Bliss, the Army will have an unprecedented opportunity to assess equipment interoperability and address integration challenges much earlier," Shyu said. "The warfighter feedback will be helpful to industry in developing capabilities and will help inform the Army's requirements and Requests For Proposals, or RFPs. Moreover, the NIE provides an opportunity to work collaboratively with the requirements and testing communities early in the acquisition process."

That collaboration is necessary because the Army is using the NIEs to examine not only systems' technical merit, but also their impacts on doctrine, training, requirements, force structure and other key areas. Brigades fielded with Capability Set 13 through the ARFORGEN process will also receive the tactics, techniques and procedures, known as TTPs, necessary to leverage the new gear to its full potential.

"It is a combined, very large-scale effort, and we are moving forward," Hughes said.

A 2nd Brigade, 1st Armored Division Soldier uses the new chat feature of the Joint Capabilities Release of Force XXI Battle Command Brigade and Below/Blue Force Tracking during NIE 12.1 in November 2011. Joint Capabilities Release Chat works like an online chat room within FBCB2, allowing users to instant-message in real time over the BFT 2 satellite network. Joint Capabilities Release is part of Capability Set 13.

The Decision Has Been Made

Raytheon Company's U.S. Air Force satellite terminal system that provides protected communications to warfighters has received a successful Milestone C decision and subsequent production award.

Raytheon's AEHF SMART-T MILSATCOM System

The Minuteman Minimum Essential Emergency Communications Network Program Upgrade (MMPU) is Raytheon's first Advanced Extremely High Frequency (AEHF) terminal for the U.S. Air Force to enter into the production phase. In another achievement, it became the company's third AEHF terminal to interoperate with the on-orbit AEHF satellite, joining the U.S. Army's Secure Mobile Anti-Jam Reliable Transportable Terminal (SMART-T) and the U.S. Navy Multiband Terminal (NMT).

The first AEHF satellite, launched in August 2010, recently began an extensive set of operational tests. In this testing, MMPU, SMART-T and NMT demonstrated interoperable communications using the AEHF satellite's eXtended Data Rate (XDR) waveform, moving data more than five times faster than previous EHF systems. MMPU adds essential nuclear command and control capabilities to the Raytheon AEHF terminal product line established by SMART-T and NMT.

Raytheon is projected to deliver 67 MMPU AEHF terminals, including spares, to the U.S. Air Force. The MMPU AEHF systems incorporate Raytheon's XDR waveform hardware and software, including new cryptographic algorithms for protecting national command and control (NC2) networks, a complex technological breakthrough in protected communications. XDR and the cryptographic algorithms provide increased bandwidth, speed and significantly improved security within the NC2 communications architecture.

UAS Finds New Home In The Americas

Elbit Systems Ltd. has been awarded a contract, valued at approximately $50 million, to supply Hermes 900® Unmanned Aircraft Systems (UAS) to a governmental office of a country in the Americas.

The UAS will be operated in a variety of perimeter security missions. The project will be performed over approximately one year. The UAS will also include systems such as the Universal Ground Control Stations (UGCS), Elbit Systems Electro-Optics Elop's highly advanced DCoMPASS™ payload systems, as well as satellite communication systems.

The Hermes® 900 UAS builds on the vast operational experience accumulated by the Hermes® 450, the backbone of the Israel Defense Forces' UAS operations. Hermes® 900

offers a range of enhanced capabilities, from higher flight altitude (up to 30,000 ft.) to longer endurance and larger payload capacity. The system's unique structure enables it to carry a variety of payloads in different shapes and sizes for quick "conversion" between payload configurations.

Elad Aharonson, General Manager, Elbit Systems UAS Division, said, "We are very proud that yet another customer has selected the Hermes® 900, following orders by the Israeli Defense Forces and Chile. Hermes® 900 is establishing its position as a world-leading UAS for intelligence missions, as well as perimeter and security missions.

Moving Results For Customers

Last year, SES announced the integration of their two satellite operating companies and the creation of a truly unified global fleet.

With this integration, their U.S. Government business was realigned to better leverage SES' fleet of 50 satellites to serve the unique needs of their customer base.

Tip Osterthaler, President and CEO of SES Government Solutions noted, "This integration and the new alignment of SES Government Solutions within the company, has enabled us to react faster to the changing needs of our customers worldwide—including our government customers.

In February of this year, global commercial satellite operator SES announced the relocation of the SES-3 satellite from its former location over North America to Asia, an area of increasing great demand for state-of-the-art, reliable satellite capacity.

The SES-3 satellite was relocated to 108.2° East to provide coverage of the Middle East and South Asia regions, where SES is experiencing growing customer demand. The drift began in mid-December 2011 and the satellite arrived at its new orbital location on February 6, 2012.

"The relocation of the SES-3 satellite is a result of continued engagement and dialogue with our customers and in response to the growing demand for bandwidth to support critical communications capabilities. This move is a confirmation of our commitment to provide affordable and vital capability for our government customer," Osterthaler said.

SES-3 is a young satellite as it was just launched in July of 2011. Once reaching 108.2° East, the planned coverage is capable of supporting such applications as video, voice, data, and end-to-end communications networks. With MAC-1 compliance and encrypted tracking, telemetry and control, the satellite is also well positioned to meet the secure communications needs of government customers.

In a recent press release, Romain Bausch, President and CEO of SES, stated: "With a fleet of 50 spacecraft in orbit around the globe, SES has the operational flexibility to swiftly respond to shifting customer demand by re-deploying in-orbit capacity without affecting existing services."

The SES-3 satellite undergoing final checks, photo courtesy of Orbital Sciences Corporation.

Hastening HX

Hughes Network Systems, LLC has announced the planned release of its HX System 4.0, bringing a host of technology enhancements to the HX product family which will enable higher performance, higher efficiency, and a number of significant new features.

Hughes HX2x0 satellite terminal

Summarized next, these enhancements further strengthen the HX System in specialty markets such as IP trunking, 3G/4G cellular backhaul, Virtual Network Operator (VNO) hosting, and Comms On-The-Move (COTM) for airborne/maritime/land, including defense and Intelligence, Surveillance, and Reconnaissance (ISR) solutions.

IPv6/IPv4 Support: A major element of HX System 4.0 is a dual stack IPv6/IPv4 design which will enable the simultaneous support of both protocols. The ability to implement IPv6 is fast becoming a critical issue for every telecommunications service provider as the availability of new IPv4 address space is quickly disappearing. HX System 4.0 will enable operators to smoothly transition to IPv6 while continuing to support their installed base of IPv4 customers and devices

HX90 Satellite Broadband Router: The new HX 90 features higher efficiency and lower operational costs on satellite links through a new optimized encapsulation scheme on the outroute, and through LDPC coding on the inroute, the same coding scheme as used in the DVB-S2 standard. Combined with a major performance boost across the entire HX System

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family of routers, in sum these enhancements provide operators with best-in-class throughputs and efficiencies

Defense & Mobility Support: HX System 4.0 brings to market key functionality and specific operational frequencies in support of the Wideband Global SATCOM (WGS) system for military and defense organizations. In addition, HX System 4.0 encompasses a comprehensive set of enhanced mobility features including integrated Doppler correction, automatic beam switching, and enhanced return channel spreading for even the most demanding COTM applications

Network Management Enhancements: The industry leading HX ExpertNMS™ (Network Management System) has been upgraded in HX System 4.0 to provide enhanced management capabilities for VNOs. This new capability enables a VNO to monitor and control elements within their operational service domain, allowing a wholesale network operator to effectively partition their network and provide complete control to private users of these partitions.

HX System 4.0 will be available for delivery later in 2012. Hughes product info link:

http://www.hughes.com/ProductsAndTechnology/BroadbandSatelliteSystems/HXSystem/Pages/HXSystem40.aspx

Argus One UAV Demo Video Approved

World Surveillance Group Inc., a developer of lighter-than-air (LTA) unmanned aerial vehicles (UAVs) and related technologies, has posted approved video footage and images taken at the recently completed Government testing and demonstration of the Argus One UAV in Nevada.

In preparation for subsequent coordinated flights and demonstrations, the Argus One UAV has been re-stationed at facilities in Nevada where

the airship remains inflated inside a hangar facility, pending favorable weather conditions and scheduling permits.

The Argus One is a mid-altitude, unmanned, LTA airship designed to hover above the Earth's surface for extended periods of time.

The uniquely constructed low observable airship is designed to cope with winds in a more efficient manner than traditional "blimp-like" airships, while delivering a cost-effective solution based on minimal ground and human infrastructure. Link for additional info:

http://wsgi.com/argus

Kudos To CloudSat Ops Team

Retired Lieutenant General Gene Tattini, former commander of the Space and Missile Systems Center and currently the Deputy Director at NASA's Jet Propulsion Laboratory in Pasadena, California, paid a visit to the Space Development and Test Directorate recently to offer his personal congratulations to the CloudSat Operations team for a ground-breaking recovery from a six-month long anomalous condition.

CloudSat is a one-of-a-kind weather radar satellite that was launched in 2006 and is one of a five-satellite Earth-observing weather science constellation called the A-Train.

Selected as part of NASA's Pathfinder program, CloudSat flies a radar more than 1,000 times more sensitive than existing weather radars, providing detection of smaller ice and water particles within clouds than ever before, enhancing our understanding of weather patterns around the world.

In April 2011, the satellite experienced a crippling battery anomaly that shut down its payload and forced the satellite to drop out of the A-Train for safety reasons.

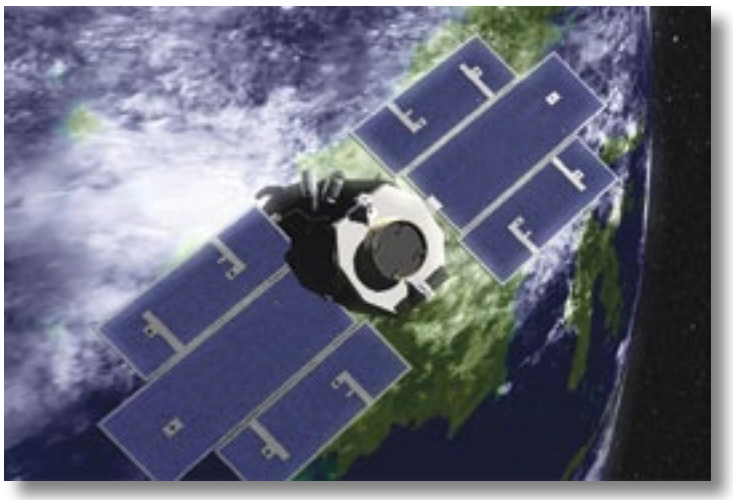
Since launch, the satellite has been operated out of the Research, Development, Test and Evaluation Support Complex at Kirtland Air Force Base, the Air Force's only R&D satellite operations center. The operations team, consisting of Air Force Space Command officers and LinQuest contractors, maintained the satellite in seamless operations for two years past its expected lifespan. Therefore, when the undervoltage condition onboard persisted, many believed that CloudSat had seen its last days.

However, due to the irreplaceable nature and uniqueness of the payload radar, the relevance of the satellite's data to cutting-edge weather modeling around the world (including to the Air Force Weather Service), as well as its complementary nature to the data from the other A-Train satellites run by allied mission partners such as Centre National d'Etudes Spatiales (France) and the Canadian Space Agency, members scrambled to beat the odds. A joint team was formed between the Air Force, LinQuest, the satellite manufacturer; Ball Aerospace and NASA JPL to investigate and attempt to restore CloudSat.

Four hundred plus operation memograms, 150 anomaly resolution meetings, 30 training sessions and six months later, the team had designed, tested and responsively adapted a ground-breaking new concept of operations they called DO-OP: Daylight Only Operations. Re-working risk management strategies and exploiting the momentum caused by Earth's magnetic field, the team cycled the payload and satellite sub-systems between being in the sunlight and being in the shadow of the Earth.

Through critical commanding over several nights and weeks, the team engineered positive thermal and power profiles in tune with the satellite's entry and exit from sunshine above the Earth. By October 2011, CloudSat's unique cloud-imaging radar was functioning during 96 percent of the sunlit orbit. The team had brought the 'left-for-dead' satellite back to life.

Gen. Tattini presented the operations team with a NASA Certificate of Appreciation, as well as individual congratulatory certificates. He also expressed his gratitude to SD for their dedication and pursuit of excellence in refusing to give up on CloudSat. "Cowboy operators are frowned upon," the certificate reads, "but operators that cowboy up are greatly appreciated."



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Early Ops Capabilities Witnessed

Marines witnessed the first flight of the service's newest small unmanned aircraft January 22nd at the Marine Corps Air Ground Combat Center in Twentynine Palms, California.

As part of the RQ-21A Small Tactical Unmanned Aircraft System (STUAS) Early Operational Capability (EOC), personnel from Marine Unmanned Aerial Vehicle Squadron (VMU) 2 and 3 and Insitu operators exercised the current configuration of Insitu's Integrator for the two-hour maiden flight.

"The lessons learned from this flight and all operations that will be conducted at Twentynine Palms are invaluable," said Lt. Col. John Allee, STUAS integrated product team co-lead at Pax River. "It will help our Marines fully understand how to operate the system when in theater."

Insitu delivered one EOC system, which is the current configuration of the company's Integrator to Twentynine Palms early in January. The EOC contract option allows for up to 30 months of contractor-provided training and logistics services for the Integrator system. The team at Pax River received the second EOC system January 12th. "This is a substantial achievement for the team" said Heather Bromley, the STUAS IPT co-lead. "To go from contract award to an operable system in 16 months is a testament to the responsiveness of the government and contractor personnel."

A CONUS-based deployment for EOC allows the Navy and Marine Corps to train operators, collect additional performance data, and support development for Initial Operational Capability (IOC). The government-industry team will continue to develop the RQ-21A configuration for initial and full operational capability while the EOC system is deployed with VMU-3.

RQ-21A will have payload capacity to support multi missions in a single sortie. Its sensor package will include Electro-Optic, mid-wave infrared cameras with an infrared marker and laser rangefinder.

"We are very excited to deploy an asset that has a greater performance capability with a significantly larger payload, mass, volume and power than intelligence, surveillance and reconnaissance services available in theater today," said Marine Col. Jim Rector, Navy and Marine Corps Small Tactical UAS program manager. RQ-21A will eventually replace the Navy and Marine ISR services contract in which current ISR missions are conducted in Iraq, Afghanistan and shipboard. The system will provide battlefield commanders with an organic capability 24/7, for real-time, actionable intelligence, surveillance and reconnaissance.

"The appetite for ISR has been insatiable," Rector said. "There is an increased demand for ISR capability in theater; and with fewer boots on the ground, we need this asset more than ever."

RQ-21A Small Tactical Unmanned Aircraft System (STUAS) Early Operational Capability (EOC) testing.

Space Capabilities Rank High

As the Department of Defense and the Army look for ways to reduce forces while increasing strategic capabilities, the leader of the Space and Missile Defense Command/Army Forces Strategic Command is confident his organization will continue to provide capabilities essential to the Army's core strength.

Lt. Gen. Richard Formica told more than 500 industry, government and technology leaders at the Air, Space and Missile Defense Association's annual membership luncheon on January 26 at the U.S. Space & Rocket Center that space and cyberspace defense capabilities are crucial to combatant commanders and their troops.

"If the Army wants to be able to shoot, move and communicate—it needs space. If the nation wants to be protected from rogue nations' ability to launch ballistic missiles—it needs missile defense," Formica said. "If joint forces want to fight in domains without geographic boundaries—they will need space and missile defense.

"I believe exploiting the potential of space and missile defense capabilities become even more important in an era where conflicts may take place in domains without boundaries and where forward presence may be reduced."

Although there will be "efficiency drills" across the entire Department of Defense, Formica said the space and missile defense capabilities that SMDC/ARSTRAT and the U.S. Strategic Command's Joint Functional Component Command for Integrated Missile Defense provide become more relevant as the Army focuses on being leaner and more effective.

"You are well aware of the fiscal challenges we face. These will lead to force reductions and program changes, and will mean a different future for all of us," Formica said.

"The recently published strategic defense guidance—

Lt. Gen. Richard Formica speaks about the accomplishments of the Space and Missile Defense Command/Army Forces Strategic Command during the annual membership luncheon of the Air, Space and Missile Defense Association.

'Priorities for the 21st Century'—reminds us that we need to ensure we can operate in anti-access/area denial scenarios. We must have cross-domain synergy with assurances that our forces can operate effectively in space and cyberspace. And as the STRATCOM commander emphasized recently—we must be able to fight in domains without geographic boundaries. Space and missile defense capabilities are critical to the Army as a decisive force and the Army's ability to execute unified land operations."

Last year, as the new commander of SMDC/ARSTRAT, Formica used the platform of the Air, Space and Missile Defense Association's annual meeting to announce the three core tasks of his organization—the operations function of providing trained and ready space and missile defense forces and capabilities in service to the war fighter and the nation; the capability development function of building future space and missile defense forces; and the materiel development function of researching, testing and integrating space, missile defense, cyber, directed energy and related technologies.

As the organization enters 2012, SMDC/ARSTRAT will "remain focused on accomplishing our three core tasks while being disciplined stewards of our nation's resources," Formica said.

He went on to say that SMDC/ARSTRAT "is uniquely organized and geographically well-positioned" at Redstone Arsenal and in Colorado Springs, Colorado.

"We are well positioned here in Huntsville because we are co-located with MDA, MSIC, PEO Missiles and Space, PEO Aviation, AMC, AMCOM, NASA, and the strong tech base here in the Tennessee Valley," he said. The lieutenant general reviewed a long list of SMDC/ARSTRAT's accomplishments for 2011, including streamlining the command, synchronizing SMDC/ARSTRAT with the Joint Functional Component Command for Integrated Missile Defense, sustaining collaborative relationships with the Missile Defense Agency, seeking out opportunities to integrate activities within the Army enterprise, and improving relationships with both Department of Defense and industry stakeholders.

Formica noted the deployment of 12 space support teams to theater, bringing to 70 the number of teams deployed since the beginning of combat operations in Afghanistan and Iraq; providing space and missile defense capabilities to 15 combatant commanders, war fighters and mission rehearsal exercises; activating the Forward Based Mode Radar Missile Defense Detachment in Japan and Turkey; providing Friendly Force Tracking data to armed forces around the world; providing geospatial intelligence and tailored satellite imagery products in support of Operation Odyssey Dawn and Operation Tomodachi; providing the High Altitude Test Bed Aerostat to support the Army's Network Integration Evaluation; leading the Army's effort to draft an Army Space Operations White Paper for determining future space capabilities for the Army; orbiting the Army's first nanosatellite; and conducting the first flight of the Advanced Hypersonic Weapon.

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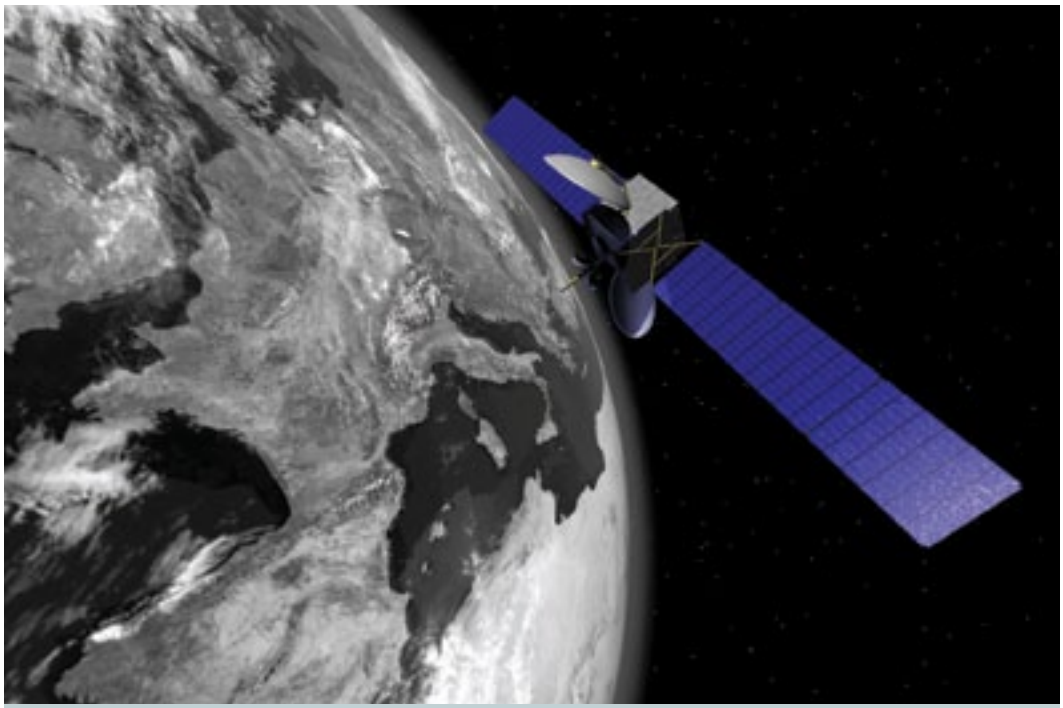

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In 2012, SMDC/ARSTRT will continue to provide space and missile defense forces and capabilities in support of the geographic commandant commands and war fighters, Formica said. "On any given day, we have approximately 850 operational forces supporting ballistic missile defense systems and space operations around the world—CONUS-based, forward-stationed or deployed. That includes five space support and commercial imagery teams currently deployed, and we will deploy another eight teams in 2012 as part of the Army's nine-month deployment cycle," Formica said. "We will provide space and missile defense forces in support of 11 combatant commands, war fighters and mission rehearsal exercises, to include the Strategic Command's Global Thunder and Global Lightning. These provide an opportunity to train the way we plan to fight in all our mission areas, and ensure we are prepared for crisis operations."

The command will also prepare for the deployment of the Long Endurance Multi Intelligence Vehicle to theater, launch the first flight of the low cost ballistic missile target alternative, the Economical Target-1; prepare for the initial High Power Demonstration of the High Energy Laser Mobile Demonstrator with a 10 kW laser; and progress toward nanosatellite demonstrations in 2012, among a long list of other tasks.

"To accomplish everything we do, we must continue to recruit, retain and support our high-performing team of Soldiers, civilians, contractors and the families that support them," Formica said.

"We are all about providing capabilities and developing public servants. SMDC/ARSTRAT is a diverse, complex and global command that provides critical capabilities to the Army, USSTRATCOM, the geographic combatant commanders and the war fighter. I am very proud of the Soldiers, civilians and contractors at SMDC/ARSTRAT on our team—focused on accomplishing our mission, in concert with our partners in industry, academia and the other federal agencies."

U.S. Military Pivot Strategy

Northern Sky Research (NSR) informs all that, amidst the trends of military budget cuts and troop withdrawals, one region is unquestionably on the rise for military SATCOM demand: Asia.

With China as the lead player and with numerous potential flashpoints on the horizon, this region is now the focus of a new "pivot strategy" from the U.S. Military.

China's continued spending patterns, which have been at double-digit levels over the past two decades, will likely ***lead to a rise in space-based capabilities, specifically satellite assets*** and services from the U.S. and its allies despite the tightening fiscal landscape.

China plans to boost its official defense budget by 11.2 percent, an increase to 670.247 billion RMB (Renminbi) ($110 billion U.S. dollars) in 2012. However, the Stockholm Institute for Peace Research (SIPRI) puts China's official figure at about 60 percent of its actual total military spending, while Al Jazeera reported that China wants to double the current budget by 2015.

China's current levels can, therefore, be pegged at roughly $200 billion based on SIPRI's estimates, and a doubling of the budget amounts to some $400 billion. Compare this to the U.S.' annual military budget of roughly $700 billion (and declining), and the spending gap with China will narrow significantly in the next two to three years.

Individual countries in Asia cannot outspend China for military purposes. Rather, a smarter, more cost-effective approach will likely be undertaken as part of an emerging containment strategy.

In the area of SATCOMS, procurement models are likely to change where bulk leasing will see a drop in demand as more specific applications take-up capacity. In particular, UAV, aeronautical and maritime demand should see significant growth given the need for ISR missions and coverage of airspace and ocean regions in preparation for potential flashpoints. It is worth noting that the above forecasts are NSR's Baseline demand projections and, depending on how events develop in the region, bandwidth demand can easily breach the 900 TPE mark by 2020.

Southeast Asian countries welcome a stronger U.S. regional presence. The Philippines has been wooing the U.S. in its Spratly and Paracel Islands territorial dispute, and other neighbors such as Vietnam, Singapore, Thailand and Malaysia have boosted weapons purchases.

However, the most closely watched regional player apart from China is India. The 2012 Indian defense budget was set at $36 billion, an 11.6 percent rise compared to the previous year. Although still significantly lower than China, New Delhi is reportedly on the threshold of a huge military procurement, and it is estimated that its defense spending in the next five years will reach $100 billion.

Australia and New Zealand should further add to demand as well as South Korea, given tensions in the peninsula. Japan could be the biggest wildcard where spending on commercial SATCOMS may need to be boosted as part of not only a budget contributor, but as part of an emerging regional network architecture to contain China's capabilities.

The U.S. exit strategy in the Middle East has led to what has recently been referred to as the "U.S. pivot strategy to the Asia-Pacific," which many consider as a containment policy against a rising China.

In the area of commercial SATCOM demand, the U.S. via PACOM will unlikely account for the vast majority of spending similar to past missions in Iraq and Afghanistan. Rather, the U.S. can and will likely count on increased contributions from other countries. Here's why:

- *The perceived China threat "hits home," so to speak, where it is more tangible and real when compared to missions in Iraq and Afghanistan where many in the region consider it as a U.S. engagement*
- *Many countries have the financial wherewithal to contribute more significantly, and a cash-strapped and over-stretched U.S. does not have to (and probably will not) provide a large regional financial umbrella*
- *Most of all, a semblance of indigenous military strength and technological prowess has to be undertaken by individual countries*

As it is expensive for small countries to launch dedicated military satellites, commercial satcom demand and creative partnership schemes may be the way forward in enabling military and technological capabilities.

Analysis by
Jose Del Rosario, NSR

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Keynote To Military @ NAB

StratCorp Inc.'s CEO Robert Riegle will deliver a keynote address to the Military and Government Summit at the NAB Show on Wednesday April 18th in Las Vegas.

The Military and Government Summit at the NAB Show brings together military, government, and commercial interests to discuss new ideas and business relationships on

topics such as digital video acquisition, management and dissemination; video encryption and information assurance; the need for technical standards; and how the broadcast industry and government sector can work collaboratively.

Mr. Riegle, a highly regarded expert in domestic intelligence with more than 20 years of successful government, industry and active military service, will join speakers from the National Geospatial-Intelligence Agency, Microsoft Corp. and Associated Press to present case studies and discuss the latest convergent solutions. "Recent events surrounding the Arab Spring have illuminated the importance of understanding the atmospherics relating to uprisings and potential threats throughout the world," explains Mr. Riegle. "Central to this understanding is the ability to determine what information is broadcast by those exercising command and control and what modalities this occurs through."

Headquartered in Tampa, Florida, StratCorp Inc. supports customers around the globe.

Budget Restraints Don't Restrain U.S.M.C.'s Comms

As the Marine Corps' budget continues to shrink, more and more units will feel the pressure of conducting training with a limited amount of funds.

The effects were apparent for service members with Communications Company, Combat Logistics Regiment 27, 2nd Marine Logistics Group participating in a training exercise from, February 29th, through March 8th at Camp Lejeune, North Carolina.

"The [2nd MLG] got less money this year for the budget," explained 1st Lt. Brian L. Burger, the operations officer for Communications Company "We had to find ways to accomplish the training while remaining within our budget constraints."

The company scheduled the exercise to test their capabilities and readiness in a field environment, but the necessary funds to fuel the generators were not available.

Pfc. Jennifer M. Castillo (foreground), a field radio operator, and Lance Cpl. Francis G. Perdomo (background), a satellite communications operator-maintainer both with Communications Company, Combat Logistics Regiment 27, 2nd Marine Logistics Group, assemble an satellite dish during a training exercise aboard Camp Lejeune, North Carolina, February 29, 2012. During the exercise the participating Marines tested their capabilities in a simulated field environment in accordance with their training and readiness standards.

"It costs about $14,000 to fuel our generators for a week-long operation," Burger added. "We had to figure out a way to still accomplish the training without using generators."

Burger and his Marines determined a location aboard Camp Lejeune, which fulfilled the site requirements for the exercise."Here we can run our equipment using power from the base," Burger explained.

The Marines were also able to assemble their tents, antennas and transmitters in front of the company building to use as a secondary location to achieve their training goals.

"Although we are not in the field, this is what I call a real world experience," explained Sgt. Christopher T. Wehunt, the transmission site chief with the company. "All the Marines in the shop come out here and do their job. Here is where we get to see how proficient our shop is. This particular site might not be what we asked for, but it's better than nothing," Wehunt added. "Some of the new Marines in the shop have very limited experience and this is their opportunity to come out and train."

Cpl. Jonathan W. Barton, a digital multi-channel wideband transmission equipment operator with the company, expressed how important it is to go out to the field. "I think in the field is where we really get to test our skills," Barton said. "I think it's better when we get to work as if we were in a deployed environment.

"Regardless of the circumstances, we are Marines and we adapt to the situation," Barton added. "I'm glad that at least we still managed to come out and train."

Story and photo by Cpl. Bruno J. Bego, 2nd Marine Logistics Group

Polar Region SATCOM Experiment With TacSat-4

The U.S. Coast Guard Cutter HEALY (WAGB 20) successfully experimented with NRL's TacSat-4 communications satellite, January 24th, by communicating from the Bering Sea off the western coast of Alaska to Coast Guard Island, Alameda, California.

Returning from an escort and icebreaking mission to Nome, Alaska, assisting the Russian tanker Renda delivery of emergency fuel to the town,

The USCG Cutter HEALY escorts Russian fuel tanker Renda in Alaska's Bering Sea, January 11th, 2012. Photo courtesy of USCG.

USCGC HEALY—the Coast Guard's only polar icebreaker—was approximately 260 nautical miles south of the Arctic Circle at the time of the test.

Deployed into a unique, highly elliptical orbit with an apogee of 12,050 kilometers, TacSat-4 helps augment current geosynchronous satellite communication by including the high latitudes. The experiment was the first in a series of planned steps that aim to demonstrate TacSat-4's utility in the polar and arctic regions.

Also participating in communications with HEALY was the Army Space and Missile Defense Battle Lab (SMDBL) located in Colorado Springs, Colorado. The SMDBL team was conducting portions of the ongoing TacSat-4 Joint Military Utility Assessment (JMUA).

Managed by the U.S. Naval Research Laboratory, Naval Center for Space Technology, TacSat-4 is an experimental spacecraft that will test advances in several technologies and SATCOM techniques. It will augment the existing fleet with an additional space asset to provide communications to otherwise underserved users and areas that either do not have high enough priority or do not have satellite visibility. The Office of Naval Research (ONR) is funding the first year of TacSat-4 operations.

The Operationally Responsive Space (ORS) Office is leading and funding the JMUA of TacSat-4.

Flight Tests From Carrier Are Unmanned

Northrop Grumman Corporation and the U.S. Navy have successfully completed a series of flight tests to demonstrate technology that could help extend the operating range and flight duration of future carrier-based unmanned systems.

The flight tests, completed January 21st in St. Augustine, Florida, proved the functionality of the hardware and software that will enable the X-47B unmanned aircraft to demonstrate autonomous aerial refueling (AAR) in 2014. The AAR activity is part of the Navy's Unmanned Combat Air System Carrier Demonstration (UCAS-D) program. Northrop Grumman is the Navy's UCAS-D prime contractor. "These tests are a critical step toward proving that the X-47B can perform autonomous aerial refueling using either the Navy's probe-and-drogue refueling technique or the U.S. Air Force's boom/receptacle approach," said Carl Johnson, vice president and UCAS-D program manager for Northrop Grumman's Aerospace Systems sector. "Future unmanned systems will need to use both refueling techniques if they plan to conduct longer range surveillance or strike missions from the carrier."

The AAR tests were conducted by a Northrop Grumman/Navy team using Calspan Corporation's (Niagara Falls, N.Y.) Variable Stability Learjet as the X-47B surrogate aircraft, and a K707 tanker provided by Omega Air Refueling (Alexandria, Va.). The tests included simulated flight demonstrations of both boom/receptacle and probe-and-drogue aerial

Northrop Grumman's X-47B UCAS

refueling techniques. No fuel was exchanged between the aircraft during the test events.

The Learjet surrogate was equipped with real or functional equivalents of the navigation systems, flight control processor and vision system that the X-47B will use to conduct refueling operations. The aircraft contained no refueling receptacle or refueling probe. The K707, which is nearly identical in size and shape to an Air Force KC-135, was equipped with a Navy style refueling drogue only.

For each simulated refueling event, the Learjet/X-47B surrogate was piloted to a rendezvous position approximately one nautical mile from the tanker. Then the pilot transferred control of the aircraft to the X-47B's autonomous flight control processor, which controlled the Learjet during the test event.

During a typical refueling event, the tanker operator or a mission operator on the ground commanded the Learjet to fly, in sequence, to each of the major positions associated with aerial refueling: (1) the pre-tanking observation point off one wing of the tanker; (2) the refueling contact position behind the tanker; and (3) the post-tanking "reform" position off the other wing of the tanker. "These flights demonstrated empirically that an unmanned system can conduct aerial refueling operations with accuracy and precision," said Pablo Gonzalez, program manager for Northrop Grumman's UCAS-D AAR program. "The aircraft never gets tired, and it responds exactly the same way to operator commands every time."

"The X-47B will use a hybrid GPS/vision-based relative navigation system in conjunction with its autonomous flight control system to establish and maintain a precise distance between tanker and the receiver aircraft," he added.

The Northrop Grumman/Navy test team plans to conduct additional AAR surrogate testing using the same aircraft when flight-qualified versions of the relevant X-47B hardware and software become available.

The UCAS-D program plans to demonstrate in 2013 the ability of the tailless, autonomous, low-observable relevant X-47B demonstrator to safely operate from a Navy aircraft carrier, including launch, recovery, bolter and wave-off performance, followed by the autonomous aerial refueling in 2014. The program also plans to mature technologies required for potential future Navy unmanned air system programs.

For further information please visit:

http://www.as.northropgrumman.com/products/nucasx47b/

Connecting With Kodiak

Lockheed Martin has selected Alaska's Kodiak Launch Complex (KLC) as its dedicated West Coast launch facility for Athena rocket launches.

The company's decision will enable Alaska Aerospace Corporation to move ahead with plans to expand its space launch capabilities. Lockheed Martin has been working with the state of Alaska and Alaska Aerospace Corporation on expansion plans for the new medium-lift launch pad to support potential Athena III launches.

"Our nation needs affordable lift to meet current and projected demands at a time of declining budgets and economic pressures," said John Karas, vice president and general manager, Human Space Flight, Lockheed Martin Space Systems Company. "The leadership demonstrated by Governor Sean Parnell by investing in space launch infrastructure is a model for our nation and provides tremendous incentive to partner with the state and expand the aerospace industry in Alaska."

Last year, Lockheed Martin announced its intent to offer Athena II services with a ride-share launch from Kodiak in late 2013. The company is positioned to expand the Athena II program as it continues to evaluate the business case for Athena III launches from Alaska. The

Kodiak launch complex

Athena III would be capable of launching satellites weighing 4,600 kg (10,150 lbs) from the West Coast and 5,900 kg (13, 000 lbs) from the East Coast. Working with the Alaska Aerospace Corporation, Lockheed Martin will finalize its plans for Athena III over the next few months.

The new medium-lift capability from Kodiak will enable the company to engage Alaska businesses as future suppliers benefiting the state and the Athena launch program, as well as the opportunity to engage future generations of engineers and scientists through Science, Technology, Engineering and Math (STEM) outreach.

Army's Future Network For A Stronger Force

While the Army's newest generation of its tactical communications network backbone undergoes its operational test this spring, an upgraded version of its earlier counterpart will also participate in the test to ensure seamless connectivity and interoperability.

The combination of Warfighter Information Network-Tactical, known as WIN-T, Increment 2, which represents the next generation of on-the-move tactical communications, and Increment 1b, which will refresh the at-the-halt network that is currently used in theater, will be put to the test in realistic operational scenarios to gauge how it transmits and delivers essential information across the force. Because the Army will deliver these upgraded capabilities to deployed units on a staggered schedule, there will be "hybrid" network architectures on the battlefield

that must be fully integrated. "Every increment of the tactical network has its place in the force," said Col. Edward Swanson, project manager for WIN-T. "The key to success is to ensure the current and future increments can interoperate and deliver the critical data on the battlefield, whether it's the location of friendly forces, or a call for fire."

The WIN-T Increment 2 Initial Operational Test and Evaluation, or IOT&E, will be held in conjunction with the Network Integration Evaluation, or NIE, 12.2 at White Sands Missile Range, New Mexico, in May. As part of the test, the 1st Sustainment Brigade in Fort Riley, Kansas, will utilize Increment 1b for connectivity into the Increment 2 network to demonstrate and test the interoperability between the two versions. In preparation for the event, four weeks of WIN-T Increment 1b New Equipment Training, known as NET, began in early February for the 1st Sustainment Brigade.

Two weeks of NET Tactical Hub Node training is also scheduled for early March for the 101st Airborne Division, at Fort Campbell, Kentucky, which will serve as the division headquarters element for the IOT&E.

WIN-T Increment 2 is a major enhancement to the tactical communications backbone and a critical piece of Capability Set 13—the first integrated group of network technologies out of the NIE process that will be fielded to up to eight brigade combat teams starting in fiscal year 2013. The semi-annual NIEs leverage a full brigade combat team to assess new network capabilities in a realistic operational environment WIN-T Increments 1 and 2 have already successfully completed a number of other interoperability tests, both at the Joint Interoperability Test Command at Fort Huachuca, Arizona, and at the Central Technical Support Facility at Fort Hood, Texas, which conducts ongoing Army Interoperability Certifications, said Lt. Col. Robert Collins, product manager for WIN-T Increments 2 and 3.

Increments 1 and 2 were also integrated during the NIE 12.1 in October-November 2011, which gave the Army a unique opportunity to evaluate WIN-T Increment 2 in an operational environment and obtain initial Soldier feedback six months before its formal IOT&E.

"It was a useful exercise and probably one of the unique times that we will equip a single brigade with both WIN-T Increment 1 and Increment 2," Collins said. "They were able to interoperate relatively well in this construct."

Helping to ensure the interoperability of the different increments and network components of WIN-T is the Communications Systems Design Center, at Aberdeen Proving Ground, Maryland, which contains both WIN-T Increment 1 and Increment 2 technology to test operational requirements and interoperability within the network. Currently, it is conducting integration and pre-testing for WIN-T Increment 1 and Increment 2 interoperability for the upcoming IOT&E.

Similar to a home Internet connection, WIN-T Increment 1 establishes a network backbone that provides the full

Soldiers tested Warfighter Information Network-Tactical Increment 1 equipment at the Network Integration Evaluation 11.2. in June 2011. (U.S. Army photo)

Soldiers from the Alabama National Guard's 115th Expeditionary Signal Battalion trained on these Warfighter Information Network-Tactical Satellite Transportable Terminals at the North Alabama Fairgrounds in Muscle Shoals, Alabama, on April 12, 2011.

range of data, voice and video communications at battalion level and above, with Soldiers having only to pull over to the side of the road to communicate. WIN-T Increment 2 introduces additional capabilities including an initial on-the-move communications network that reaches down to the company echelon for the first time.

To date, WIN-T Increment 1 equipment has been fielded to roughly 200 units, or 96 percent of the units identified to receive Increment 1 equipment. But it is heading toward a big milestone in mid-spring when the Increment 1 fieldings will be 100 percent complete, providing for the first time a WIN-T Increment 1-equipped force across the entire Army.

In roughly the same timeframe, the WIN-T Increment 1a upgrades will also be completed, establishing a common baseline across the force. Army units originally fielded with the earliest version of the Army's network, the Joint Network Node that began fielding in 2004, are being upgraded to this common baseline. Increment 1a provides newer technology for increased capability, a longer equipment life cycle and more efficient technology refreshments.

Increment 1a units can communicate directly with one another with minimum lag and optimum results. However, if needed they can also operate with Increment 2 units. An Increment 1a unit can "talk" to an Increment 2 unit, but instead of using a direct link, it needs to take two "hops" instead of just one direct transmission. The signal is first sent from the Increment 1a location to a hub node, either to a Regional Hub Node or to a division headquarters Tactical Hub Node, and the node then sends it to the Increment 2 location.

The upcoming WIN-T Increment 1b upgrade provides increased interoperability with Increment 2 by taking advantage of the Network Centric Waveform, or NCW, through use of an NCW modem for satellite transmissions. The NCW is a more capable waveform and allows for increased efficiency of the existing bandwidth on satellites. WIN-T Increment 1b will add the Increment 2 NCW modem to all of its Satellite Transportable Terminals, acting as a bridge between Increment 1 and Increment 2.

Both of the two current modems will be retained in Increment 1b systems, but the addition of the NCW modem provides direct transmission between Increment 1 and Increment 2 nodes, said Shannon Jones, Operations and Special Projects chief for PdM WIN-T Increment 1.

To further increase interoperability, WIN-T Increment 1b will incorporate a "colorless core" security enclave, which will also be utilized by Increment 2. The colorless core increases capability by encrypting all data, both classified and unclassified, as it is transported over satellites and line-of-sight links, enabling Soldiers to send information across the battlefield more securely and efficiently than ever before. WIN-T Increment 1b and Increment 2 also share the same baseline set of Network Operations tools, although Increment 2 NetOps have additional capabilities. NetOps facilitate the planning, initialization, monitoring, management and response of the network.

Beginning in late summer, the Army will start to upgrade all WIN-T Increment 1a units to Increment 1b, with a projected completion date expected in fiscal year 2016. Due to the amount of time it will take to field Increment 1b across the force, over the next several years there will be some hybrid network architectures on the battlefield, Jones said.

"Potentially you could have Increments 1a, 1b and 2 all fighting in the same battlespace," Jones said. "We need to ensure that everything is interoperable and that all networks are healed at the hub node at a minimum.

"Going forward, Increment 1b will be fielded to all of the units that will not be receiving Increment 2. Proportionally one third of the Army's systems will

Capt. Charles G. Feher, communications officer for the 2nd Brigade, 1st Armored Division, works with a Warfighter Information Network-Tactical Increment 2 Tactical Communications Node, February 29, 2012, at Fort Bliss, Texas.

be fielded with Increment 2, while the remaining two-thirds will remain with Increment 1b. WIN-T Increment 2 will be fielded to division headquarters and brigade combat teams, known as BCTs, at the brigade and below level where the on-the-move capability is critical. All other units that are not BCTs will retain Increment 1b equipment, which operates at-the-halt," Jones said.

"A lot of the interoperability comes down to how you configure things," Jones said. "We have the right hardware in place. It's just a matter of making sure we configure things correctly to account for all of the differences out there, and not just with WIN-T capabilities, but with all other communications systems that participate in the tactical network."

Story by
Amy Walker, PEO C3T

A Rescue Story

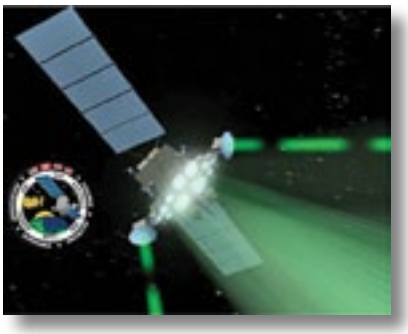
Fourteen months after human error stranded the U.S. military Advanced Extremely High Frequency communications satellite (AEHF-1) in the wrong orbit—and at risk of exploding—the satellite was finally placed in its correct orbit in October of 2011.

A successful test completed on February 29th prepared the AEHF-1 for operations, just two months before the second AEHF satellite is scheduled to launch. "This rescue effort was definitely a very sophisticated and highly technical masterpiece," said Col. Michael Lakos, chief of the Military Satellite Communications Division at Peterson Air Force Base, Colorado. It all started a couple days after AEHF-1's August 2010 launch aboard an Atlas V rocket. The satellite successfully reached it's parking orbit. But the main engines that are needed to circularize the satellite's orbit refused to work—they kept shutting off. The shut off is a safety feature instituted when a satellite detects a fault in the engines. The question was: what was the fault?

Experts determined that the fuel line had to have been blocked. But attempts to engage the engines had resulted in filling the lines with fuel, thereby putting the satellite at risk of explosion and making it hazardous to attempt another engine fire.

Luckily, AEHF-1 has two additional propulsion systems, albeit much less powerful, designed for use in stationkeeping adjustments, not major changes in trajectory. However, by applying small propulsive adjustments hundreds of times over 14 months, ground crews were able to slowly coax the satellite into its proper orbit.

The major challenge was keeping it intact in the interim. The satellite had to dodge space debris three or four times and deploy its solar shields much earlier than intended—putting them at risk of degradation from radiation exposure in the van Allen belts The fault for the blocked fuel line was eventually attributed to a piece of cloth that had been placed over the line during manufacturing to protect it from contamination,



Artistic rendition of the U.S.A.F.'s AEHF-1 satellite

but was never removed. "If I had to find the top 10 strange ones, that one would make my list," said defense analyst Marco Caceres, who tracks rocket and satellite failures as part of his work for the Teal group, an aerospace and defense analysis firm. The Air Force has now implemented additional checks for the remaining five satellites to be launched as part of the AEHF constellation and docked manufacturer Lockheed Martin $15 million for the mistake.

Story by Merryl Azrie
Space Safety Magazine

Security For SatNets

RT Logic, the subsidiary of Kratos Defense & Security Solutions (KTOS), has released the CyberC4™ family of cyber security products, which are designed especially for the satellite domain.

The four products address the increased vulnerabilities as satellite networks integrate with and become more IP interoperable.

The suite includes, CyberC4:Alert, the first Security Information Event Manager (SIEM) designed specifically for satellite network operations. CyberC4:Alert constantly monitors for cyber security threats by gathering event data from across the network, providing network administrators and information security officers with real-time, network-wide situational awareness for cyber security, incident response, and mission assurance.

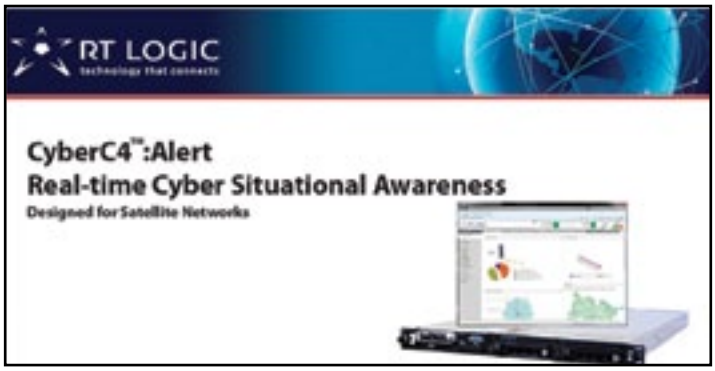
This all-in-one DIACAP (Department of Defense Information Assurance Certification and Accreditation Process) compliant application is designed for military, government, and commercial SATCOM environments. Currently more than 80 percent of military satellite communications engage commercial satellite infrastructure, making DIACAP compliance a critical necessity.

CyberC4's additional three products include:

- *CyberC4:Capture, a real-time monitoring and recording system with built-in alerting that deters and protects against insider threats. It captures and records instrumented user sessions (PC video-out and keystrokes), which are time-tagged and keyword search-able for incident response, forensics investigations, and playback training.*

- *CyberC4:Armor hardens RT Logic satcom modems, recorders, and other equipment to protect sensitive systems, particularly those deployed overseas. Using military grade, tactically proven system hardening technology, Armor protects from the most sophisticated reverse engineering, tampering, and cyber attacks, including zero-day exploits, execution of unauthorized code, and high-risk insider threats.*

- *CyberC4:Guard is a cost effective, low-risk, high-assurance Cross Domain Solution (CDS) that provides cross domain isolation at the PL3 and PL4 levels for control centers that use the Air Force Satellite Control Network (AFSCN) and/or dedicated remote tracking stations. Past approaches of segmented operations, firewalls, optical isolation, and data diodes are no longer viable; therefore, trusted guards are now required. CyberC4:Guard employs a single proven AFSCN Core Rule Set to exchange formatted message traffic between security domains for either application.*



RT Logic's CyberC4 solutions can retrofit existing critical national missions with no modifications to hardware, APIs, or Mission Software. Please see the feature article entitled *Cybersecurity Risk Management Strategies For SATCOM Networks* later in this issue...

SBIRS Satellite "Better Than Best" Report

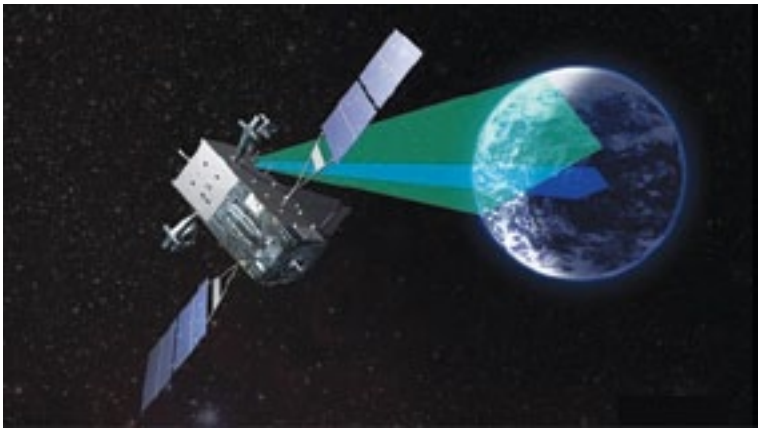
The satellite is currently undergoing rigorous certification processes, and is meeting or exceeding performance requirements.

The first Space Based Infrared Systems geosynchronous Earth orbit satellite, currently undergoing a rigorous operational certification process, is meeting or exceeding performance requirements, and on track to be delivered into operations. Within two months after launch, SBIRS began sharing initial GEO-1 satellite data with technical intelligence mission partners in order to enable early assessments of sensor performance.

On-orbit performance of the first GEO-1 satellite has proven superb. At the payload level, the GEO sensors are detecting targets 25 percent dimmer than requirements with an intensity measurement that is 60 percent more accurate than specifications. The payload pointing is nine times more precise than required, which is a key confidence measure for achieving a system level line-of-sight accuracy well within specification.

The SBIRS GEO-1 satellite includes sophisticated scanning and staring sensors that deliver improved infrared sensitivity and target area scan rates over the current constellation. The scanning sensor provides wide area surveillance of missile launches and infrared phenomena across the earth, while the staring sensor can be used to observe smaller areas of interest with superior sensitivity and revisit time.

While the satellite and its respective ground systems continue final system tuning through May of this year, interim mission performance results indicate that the system already demonstrates the ability to meet more than 90 percent of Air Force Space Command's performance requirements for operational use. The remaining performance refinements are on track to be completed prior to the formal testing campaign slated to begin in June.



"We've been extremely pleased with the performance of this first-of-its-kind spacecraft," said Col. James Planeaux, director of the Infrared Space Systems Directorate.

"We fully expect GEO-1 to enter services as an invaluable military asset that will help protect our nation and its allies for many years to come."

Live GEO-1 data will be included in the nation's missile warning and theater event networks during a trial period and operation utility evaluation this fall. This first GEO satellite is expected to be certified for operations by U.S. Strategic Command by the end of 2012.

As one of the nation's highest priority space programs, SBIRS delivers global, persistent, taskable infrared surveillance capabilities to meet 21st-century demands for early warning of missile launches and simultaneous support to other critical missions including missile defense, technical intelligence, and battlespace awareness. The SBIRS architecture features a mix of GEO satellites, payloads in highly elliptical Earth orbit, and associated ground hardware and software that provides a timely, accurate and clear infrared view of any region of interest around the globe during peacetime and all levels of conflict.

The GEO satellites replace and improve upon the legacy Defense Support Program satellites, offering enhanced sensor flexibility and sensitivity to provide global, taskable, 24/7 infrared surveillance capabilities to support the warfighter.

The SBIRS development team is led by the Infrared Space Systems Directorate at the U.S. Air Force Space and Missile Systems Center, Los Angeles Air Force Base, California. Lockheed Martin Space Systems Company, Sunnyvale, California, is the SBIRS prime contractor, with Northrop Grumman Electronic Systems, Azusa, California, as the payload integrator. The 14th Air Force operates the SBIRS system.

DoD's Rules Of Engagement For Cyberspace

Whether by land, sea or air, Defense Department leaders have long crafted rules of engagement to determine how, where and when forces can attack the enemy.

They expect soon to complete the same for their newest domain: cyberspace, the assistant secretary of defense for global strategic affairs said today.

"We are working closely with the Joint Staff on the implementation of a transitional command-and-control model for cyberspace operations" while reviewing existing rules of engagement, Madelyn R. Creedon told the House Armed Services Committee's subcommittee on emerging threats and capabilities.

Teresa M. Takai, DOD's chief information officer, and Army Gen. Keith Alexander, commander of U.S. Cyber Command, joined Creedon at the hearing.

"This interim framework," Creedon told the panel, "will standardize existing organizational structures and command relationships across the department for the application of the full spectrum of cyberspace capabilities."

Describing DOD's strategies for operating in cyberspace, Creedon said the department maintains more than 15,000 network enclaves and 7 million computing devices in installations around the globe.

"DOD continues to develop effective strategies for ensuring the United States is prepared for all cyber contingencies along the entire spectrum," she added, "from peace to crisis to war."

In times of fiscal constraint, Creedon said, DOD also is taking advantage of efficiencies provided by information technology advances.

"The department has been working around the clock, often in close cooperation with the Department of Homeland Security and other agencies," she said, to protect the nation from cyber threats that include the theft of intellectual property, as well as damage to the defense industrial base, the economy and national security.

The department hit a "significant milestone" last July with the release of its first strategy for operating in cyberspace, Creedon said. The document builds on President Barack Obama's International Strategy for Cyberspace and the DOD Quadrennial Defense Review, and guides the department's military, business and intelligence activities in cyberspace in support of national interests, she said.

The DOD works closely with colleagues in the departments of Homeland Security, Justice, State, Treasury, Commerce and other agencies, she added, and pursues bilateral and multilateral engagements to enhance security and develop norms of behavior in cyberspace.

Takai told the panel that DOD's $37 billion information technology budget request for fiscal year 2013 includes a range of IT investments, including $3.4 billion for cyber security efforts to protect information, information systems and networks against known cyber vulnerabilities.

It also includes $182 million for Cyber Command for cyber network defense, cryptographic systems, communications security, network resiliency, workforce development, and development of cyber security standards and technologies department-wide.

Among efforts to improve effectiveness and efficiency, Takai explained, "is consolidation of the department's IT infrastructure, networks, computing services, data centers, application and data services, while simultaneously improving the ability to defend that infrastructure against growing cyber threats."

Her office is leading the implementation of the initiatives, the chief information officer added, "but it is important that we work closely with the services, Joint Staff and U.S. Cyber Command to more aggressively modernize our overall information systems."

A pillar of that modernization is a move to a single, joint network architecture, Takai said, allowing DOD and Cyber Command better visibility into network activity and better defense against cyber attacks.

Individually, she said, the services and agencies have taken action to better position the information enterprise and security posture.

The department has made significant progress in several areas, Takai said. One effort involved deploying a modular system called a host-based security system that enhances situational awareness of the network and improves the ability to detect, diagnose and react to cyber intrusions.

"We've also taken the lead in assessing the risk of the global supply chain to our critical information and communications technology," Takai added, and has instituted a successful defense industrial base cyber security and information assurance program.

Alexander said cyber defense requires contributions not only from DOD, but from Homeland Security, the FBI, and the Defense Information Systems Agency—"all key partners in helping us do our cyber mission."

Cyber space is becoming more dangerous, he added.

"The intelligence community's worldwide threat brief to Congress in January raised cyber threats to just behind terrorism and [nuclear] proliferation in its list of the biggest challenges facing the nation."

The task of assuring cyberspace access, the general said, "has drawn the attention of our nation's most senior leaders over the last year and their decisions have helped to clarify what we can and must do about developments that greatly concern us."

Cyber Command is specifically charged with directing the security, operation and defense of DOD's information systems, he added, "but our work and actions are affected by threats well outside DOD networks … threats the nation cannot afford to ignore."

Dangers are not something new in cyberspace.

"Nation-state actors in cyberspace are riding a tide of criminality," the general said. "Several nations have turned their resources and power against us and foreign businesses and enterprises, even those that manage critical infrastructure in this country, and others."

For the panel, Alexander described five key areas Cyber Command is working on:

- *Building the enterprise and training the force*
- *Developing a defensible architecture*
- *Getting authorities needed to operate in cyberspace*
- *Setting the teamwork properly across U.S. government agencies*
- *Creating a concept of operations for operating in cyberspace*

"I think we're making progress," Alexander said, "but … the risks that face our country are growing faster than our progress and we have to work hard on that."

Story by Cheryl Pellerin, American Forces Press Service

Unblocking Oceanic Communications

Comtech EF Data's new Block Up Converter (BUC) enables an antenna to move freely, maintaining an optimal position towards the satellite, despite dramatic movements and wicked weather at sea.

C2SAT's 2.4m Stablizied VSAT Antenna

The Company announced the successful integration of its LPOD Block Up Converter with C2SAT's 2.4m C Stabilized VSAT Antenna. The integration of the innovative products will provide maritime users with a premier satellite-based broadband communication solution for oceanic vessels in motion.

The LPOD Block Up Converters were engineered with efficient thermal and mechanical packaging based on Comtech EF Data's extensive experience in outdoor RF transceivers. The LPOD eliminates the traditional requirement for the modem to supply a DC power source and a 10 MHz reference to the BUCs and LNBs. The optional internal reference and LNB bias T greatly simplify multi-carrier operation and provides cost-effective redundancy. The LPOD's compact size and weight make it ideally suited for installations with limited mounting space.

"The field-proven performance and reliability of Comtech's offering parallels our commitment to providing robust and reliable systems," commented Ulf Sundqvist, Head of Sales for C2SAT. "We now offer the LPOD as a standard catalog item."

The C2SAT 2.4m C is a 4-axes marine stabilized VSAT antenna compatible with C-Band satellites. The 4-axes antenna allows the RF equipment to move freely, maintaining an optimal position towards the satellite without large and sudden movements even during harsh conditions and heavy seas. The system does not experience dead angles or high elevation problems. The high reliability makes the antennas suitable for main connection points as they can carry large volumes of information without interruption.

"The combination of our BUCs and C2SAT's stabilized VSAT antenna provides a rugged, weatherproof and seaworthy solution," said Daniel Enns, Senior Vice President Strategic Marketing & Business Development for Comtech EF Data.

Comtech EF Data's LPOD-PS2 BUC/SSPA

A Network For Rapid Disaster Response

Hampshire based company Applied Satellite Technology Systems Limited (AST Systems Ltd) is to join a network of experts who can be called on by the British Government in times of international crisis, such as famine, floods and earthquakes.

The new facility will mobilize lifesaving support from Britain's best businesses and charities in the critical hours after a disaster strikes.

"Supplies, experts and vital aid are too often tied up with paperwork, rather than being deployed straight to the disaster zone," International Development Secretary Andrew Mitchell said.

The new facility allows organizations with experience in disaster response to access funding within hours, thereby reaching affected people faster and saving more lives. It will mean the best organizations from across the U.K. can be mobilized in the critical first 72 hours following a disaster.

AST Systems Ltd is one of an initial 34 non-government organizations (NGOs) which specialize in disaster response which has been invited by the U.K. Government to join the network.

AST Systems Ltd is a leading provider of satellite equipment and airtime from all major networks including Inmarsat, Iridium, Thuraya & Globalstar. AST Systems can provide satellite phone hire alongside supporting purchases of anything from a single satellite handset to a more complex tracking or military solution.

The new Rapid Response Fund will be activated in the event of a large scale crisis. The selected organizations will be approached within two hours and expected to take immediate action.

Andrew Mitchell said, "Clearly we need our best experts, equipment and aid on the scene as quickly as possible after a disaster, not tied up in red tape. AST Systems Ltd need to be able to do their job in that vital window of 72 hours, to save as many lives as possible.

"Only the professionals, with relevant skills and equipment will be approved. By working with a small pool of specialists, we will end the dangerous crush of aid organizations which often pour into a disaster zone.

"These organizations represent the very best performing disaster response agencies. This will allow them to focus on delivery. Make no mistake; however, qualification for the fund will be revoked at the first sign of poor performance."

Pauline Truckle, Managing Director of AST Systems Ltd said, "AST Systems Ltd has supported DFID for the past decade, supplying various communications equipment for projects including the devastating Boxing Day Tsunami in 2004, and the Haiti earthquake in 2010. As a result of working with DFID for a significant period of time, AST Systems Ltd has developed a great understanding of the flexibility required to support such a time-critical organization. With round-the-clock technical support and emergency activations, AST Systems Ltd can deliver the expertise, at times of greatest need."

Cybersecurity Risk Management Strategies For SATCOM Networks

In recent months SATCOM-related cybersecurity events have taken center stage. Most visible was the additional background provided by the government about the orchestrated disruptions of the *Landsat 7* and *Terra* imaging satellites. More recent was the Pentagon and NASA breach by Romanian hacker TinKode who allegedly posted to the Internet an image of files related to confidential satellite data from Goddard Space Flight Center.

There have been numerous similar news reports from across government and industry.

Satellites, cybersecurity and related forms of service disruption are converging. A report from the conference on ***Securing Space Assets for Peace and Future Conflict*** at the National Defense University in November 2011 reported, "There was a consensus among participants that an attack on space capabilities will almost certainly be preceded by a Cyber attack."

The Evolving SATCOM Cyber Threat Environment

Historically, satellite networks largely have been spared the brunt of the cybersecurity attacks that plague terrestrial networks, due in part to their use of non-IP communications technologies. It is no secret, however, that satellite missions are increasingly moving toward an end-to-end IP environment. In fact, the forward trend in SATCOM ground system architectures is to create multi-mission SATCOM systems that are interoperable.

As *Stuart Daughtridge,* Vice President of Advanced Technology at **Kratos Integral Systems** notes, "Satellite ground networks are migrating away from stovepipe serial interconnections to lower cost, interoperable IP-based technologies. Though this migration satisfies cost, performance and interoperability requirements, the newer systems bring with them additional cybersecurity risks."

Cyber defense company **FireEye** has said that, based on its detection methods, more than 95 percent of all enterprises have had malicious infections somewhere in their networks each week—80 percent averaged an infection rate of more than 75 per week. The numbers may be higher in organizations dealing with highly sensitive or highly competitive information, as evidenced by the recent wave of targeted attacks against U.S. defense contractors.

Net-centric SATCOM systems with their increased connectivity to commercial IT infrastructure create additional "surface area" for cybersecurity attacks on SATCOM networks. In fact, according to a 2008 **NASA** report, satellites from certain U.S. space programs use commercially operated satellite ground stations, some of which rely on the public Internet for "data access and file transfers." Increasingly, cost-sensitive satellite operators are leasing commercial telecommunication lines for long-haul communications. The trend from dedicated to shared lines for communications also expands the surface area for cyber attack.

A new era of cyber threats is emerging for IP-based systems at the same time SATCOM dependence on IP networks is increasing. Complicating the challenge is that many SATCOM professionals are not well versed in IP technologies, let alone the additional issues involved in IP cybersecurity; understandable given their technological focus on RF. Luckily, it is changing, however, yet there is still a distance to go as mission needs lead to a merger of communities and SATCOM operations increasingly encounter the vulnerabilities in both IP and RF technologies.

A Risk Management Framework For SATCOM Cyber Defense

The **National Institute of Standards & Technology** (**NIST**), which is in the process of standing up a *National Cybersecurity Center of Excellence* with the goal of improving responsiveness, has recommended that: "Implementation of a cyber-security strategy requires the development of an overall cybersecurity risk management framework."

By focusing on the management of risk, the security framework for a satellite ground network starts with implementation and verification of appropriate security controls based on industry best practices. NIST has published several Special Publications under the *NIST SP 800-xx* series of documents that provides a basis for documenting a security strategy that identifies, mitigates and monitors risks.

Today, many security practitioners are accepting the idea that boundary protection alone is no longer sufficient against high-end threats that are capable of launching sophisticated cyber-attacks. This is due to several factors, including the increasing complexity of the systems and undisciplined behavior by users, especially those with authorized access.

Even the best security policies can be rendered ineffective if they are not consistently followed. Continuous monitoring of the security controls is the first line of defense against attacks and ensures that operational risks are kept to an acceptable level in light of the inevitable changes in the environment. Strong situational awareness of the cybersecurity infrastructure can be a powerful tool for enabling that monitoring and responding quickly.

A Clear View OF Cyber Situational Awareness

When most people consider cybersecurity they think of firewalls, *intrusion detection systems* (**IDS**), virus scanners and similar devices and applications. Modern threats often present themselves across multiple devices, however, making them

difficult to recognize while the attack is under way and even harder to respond to.

Cyber situational awareness is about being informed of events related to *information assurance* (**IA**) and security across operational networks in near real-time. The more timely the information, the more likely the threats are to be countered, or at least the impact minimized. As General *William Shelton*, commander of **Air Force Space Command**, recently noted in emphasizing the importance of cybersecurity situational awareness, "we can't defend [against] what we can't see."

An important foundation for cybersecurity situational awareness is implementation of a *Security Information Event Manager* (**SIEM**) that monitors and consolidates data from the independent security devices such as firewalls and IDSs into a single dashboard. While relatively common in commercial enterprise networks, they are less so in the satellite industry.

While nearly all SIEMs provide compliance monitoring as part of their core functionality, some have features that are especially helpful for the satellite industry, such as compliance with specific NIST or DoD policies for SATCOM. With this capability, non-compliance is immediately flagged and made known to security personnel. This will become a broader need as even commercial vendors are increasingly being governed by these compliance regulations when doing business with U.S. defense or other federal agencies. The *Future COMSATCOM Services Acquisition* (**FCSA**) contract vehicle, for example, requires service providers to comply with NIST's **Information Assurance 800-53** and **DOD Instruction 8500.2** controls.

SIEM contenders for the satellite industry tailor themselves to unique SATCOM devices such as modems and TT&C servers and can also offer features such as file integrity monitoring, vulnerability assessment, endpoint control and IDS capabilities.

For broader situational awareness, the SIEM should be integrated into the larger management systems if possible to provide stronger continuous monitoring and show the relationship between network events. For example, performance degradation in network devices can often be an early indicator of certain types of cyber attacks.

Capturing Forensics

Whether or not they use SIEMs or other tools for real-time situational awareness, all network operators can mine log files after an incident has occurred to piece together what happened. While reactive rather than proactive, logs are nonetheless critical tools for preventing recurrences, discovering root causes and gathering evidence for prosecution.

Today's systems have built-in logging related to security events and diagnostics. Often the root-cause analysis of security incidents is masked by inadequate logging information or gaps in logging caused by systems going down or sophisticated malware that is designed to cover its tracks. Missing forensic data can make the difference between identifying the smoking gun and an unsolved mystery.

An additional tool that can be used to protect against the loss of critical forensic data due to log file gaps is one that is already well known in the satellite world for other uses, the IP recorder. Cyber-focused recorders can supplement system logging by independently capturing IP network traffic and other key data sources in the system and securely storing this information for forensic analysis.

System logs and recorders can also be part of a defensive plan against one of the more difficult cyber risks to manage—the insider threat, whether intentional or accidental.

Defending Against Insider Threats

Although many SATCOM systems are physically isolated from the outside world and, therefore, may be relatively uncontested by external entities, the Achilles heel can be insider threats ranging from inadvertent errors to intentional malicious actions by trusted persons who have full access.

A recent *Cybersecurity Watch Survey* conducted by *CSO* magazine found that 21 percent of security breaches were caused by insiders. The study found that 33 percent of CSOs viewed the insider attacks to be more costly (up from 25 percent in 2010), and that insider attacks are becoming more sophisticated, with some 22 percent of insiders using rootkits or hacker tools (compared to 9 percent in 2010). Sometimes, the threat is as simple, and unintended, as picking up and using a stray memory stick that has been salted with malware, one of the reasons removable media is increasingly being banned in many organizations, both government and commercial.

According to a study by the *CERT Insider Threat Center* of the **Carnegie Mellon University**'s **Software Engineering Institute**, the fundamentals of combating insider threats are real-time alerting, continuous logging and targeted monitoring. For example, in their analysis of intellectual property theft cases, CERT found that 54 percent of data exfiltration events they studied occurred over the network and could be observed through proper network instrumentation.

As part of a thorough IA process, periodic audits should include: Remote access accounts, login accounts, DBA accounts, customer and company accounts. Physical and logical access controls can aid with user accountability for actions and protects system logs from attempts to conceal activities or identities.

Here is another area where recording systems can provide a more thorough defensive position by capturing data about user behavior inside the network as well as outside. By recording operator actions on the console, they build a far stronger obstacle to system and data compromise. What's more, making it known that such systems are in place can potentially deter bad behaviors.

To further strengthen defense, both against sophisticated insiders and determined outsiders, experts recommend hardening the network components themselves. Under normal circumstances certain operating systems become targets for malware, especially when left unpatched. Hardware-assisted system hardening and anti-tamper technology can help protect these systems by preventing unauthorized code from executing even if malware is installed by an authorized user.

Denial Of Service: From IP To RF

One of the most common forms of cyber attacks is *Denial of Service* (**DoS**) or *Distributed Denial of Service* (**DDoS**) which attempts to make a computer, network or service unavailable to legitimate users. Common techniques include flooding a website with traffic or disrupting connections between machines. While most satellite ground networks are secluded from this type of attack in IP form, they are subject to an RF version in the form of intentional jamming or accidental interference which can produce a similar result.

The RF link is just another connection between networked devices, much like an Ethernet cable. As systems become net-centric and more dependent on unimpeded RF signals, the rapidly emerging threat landscape extends traditional cybersecurity thinking to include protection of the radio signal links over which the network operates.

Radio signal interference can cause degraded SATCOM service quality, or a complete network outage, just as a traditional cyber threat can. Accidental interference or intentional jamming can be transmitted at the satellite or at the receiving site, and can be as simple as a disruptive signal that appears within the frequency range of the intended SATCOM signal.

RF sensors and automated RF signal monitoring, analysis and alerting tools are required for protecting SATCOM networks. Such tools allow SATCOM operators to detect and characterize interference and jamming, guiding them to efficiently resolving the resulting communications problems.

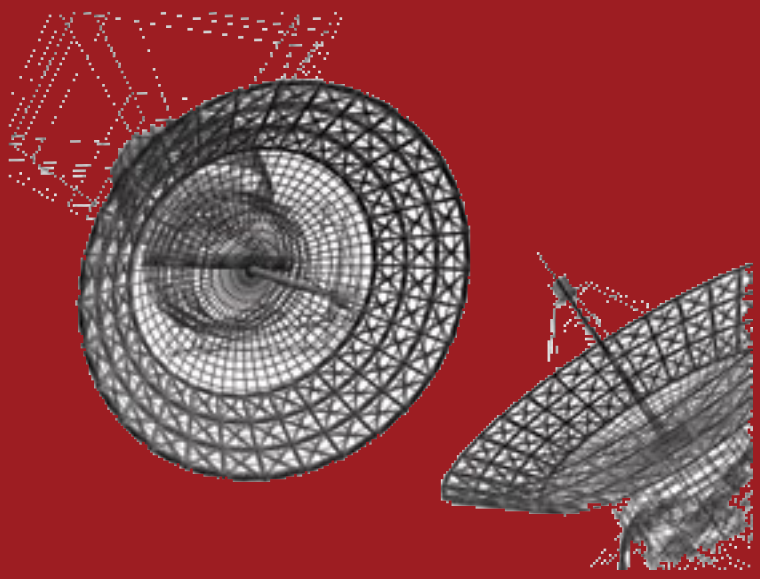
The Foundation For An Evolving Strategy

Cybersecurity is such a sweeping and evolving challenge that the techniques presented here represent only highlights of an effective program. According to *NIST Special Publication 800-137*, "... security is a dynamic process that must be effectively and proactively managed for an organization to identify and respond to new vulnerabilities, evolving threats, and an organization's constantly changing enterprise architecture and operational environment."

With cybersecurity threats continuing to morph, mutate and increase in stealth and sophistication, breaches will happen. The key is a framework that mitigates risk as much as possible and has the resiliency to adapt.

At the highest level, two tactics seem to be critical for a successful cybersecurity framework. One is formulating and implementing a continuous monitoring program that can be integrated with other technology management and situational awareness goals. The second is implementation of policies on the human side that train personnel in proper procedures.

As Lt. General *William Lord*, CIO of the U.S. Air Force told **Federal News Radio** in March, "There are things we expect every airman—whether that's an officer, whether that's a civilian, whether that's a contractor on our network or whether that's an airman basic who's getting ready to go to tech school—on cyber hygiene, on how you behave when your fingers touch a government keyboard."



Phil Carrai, the President of the Technology & Training Solutions Division of Kratos Defense and Security Solutions, answered a few questions regarding the Krato's acquisition of Integral Systems. Phil has decades of experience in IT and telecom and has held executive management and board positions in public, private, and early-stage companies.

***Q**—What was the Kratos acquisition of Integral Systems is about six months old now. How are things going?*

Phil Carrai—It has been simply incredible for me as a technology industry person. I have been able to meet a great many people in the Integral Systems family of companies and each time I come away consistently more impressed. Companies such as RT Logic, SAT Corporation, CVG-Avtec, Lumistar and Newpoint, and of course the original Integral Systems team who run the Epoch product line, brought together some of the best engineering minds in their fields.

That brain trust is already paying off in numerous projects we're cooking up to cross-fertilize our solution sets, including integrating our Compass™ and NeuralStar® products in the Situational Awareness and Network Monitoring domains, strong crossovers with our Herley microwave-based solutions, and some very exciting ideas in the cyber security space, such as the recent introduction of our CyberC4 products from RT Logic.

***Q**—What was the thinking behind the Integral Systems acquisition?*

Phil Carrai—Well, let me give you some background for that. Kratos is a specialized national security technology company working in a number of areas, particularly C5ISR applications. People may not realize, however, that we are very oriented toward products with approximately a 60-40 split between products and services today. That separates us from many defense contractors—in fact we view ourselves in large part as a supplier to the companies building the military's critical platforms.

Another thing that distinguishes us is that our emphasis on products means that we are deeply immersed in commercial markets, not just defense. The NeuralStar product I mentioned earlier, for example, had its origins in managing telecom provider networks, and our Public Safety division is one of the nation's leading suppliers of physical security solutions in cities around the country.

The Integral Systems' companies fit right into that mix. They are a balanced products/services provider— especially services that are highly attuned to the intellectual property in their products. They are equally well regarded in commercial circles as they are in the defense sector. And they are absolute leaders in one of the key C5ISR technology domains—satellites, especially SATCOM and satellite ground systems.

The fit couldn't be better, and it has direct synergies with some of our other recent acquisitions, including Herley, Gichner and SecureInfo.

***Q**—Yes, we read about your acquisition of SecureInfo at the end of last year. How does that fit?*

Phil Carrai—Even if you haven't followed it closely you can't miss the fact that cyber security is one of the most critical challenges facing defense, government, industry, even individuals. The more ubiquitous networks become and the more we rely upon them, the more the risk grows. Kratos provides specialized services and solutions in that area, and SecureInfo brings us greater depth, especially in the key areas of Cloud Security and Continuous Monitoring for situational awareness. The SecureInfo folks also have considerable expertise in satellite ground networks and Information Assurance as applied in satellite networks. That is going to be a huge opportunity for combined solutions with the Integral Systems folks.

So you see this as a combining principle?

Absolutely. Just look inside the Integral Systems family at SAT Corporation for example. They specialize in RF Interference monitoring, identification and geolocation. Historically most interference issues have been inadvertent, but the opportunities for intentional and criminal events are growing. This is a growing problem for everyone in the SATCOM arena, including the smaller players who may not be able to afford—or may not have the desire—to operate, complete NOCs with those capabilities. So SAT is expanding its solution portfolio to offer their industry-leading Monics, satID® and SigMon products as managed services.

Additionally, we are integrating these products with NeuralStar, just as we are with Compass, to give the broadest possible situational awareness for satellite operators, broadcasters and others who need the complete picture across RF and IP, such as the work we are doing with DISA, the Air Force and Army PM DCATS.

***Q**—Interest in service assurance ties into the recent announcement out of RT Logic about a new line of cybersecurity products as well?*

Phil Carrai—We are very excited about the new CyberC4 product family which we see as a practical, economical and fundamental first line of cybersecurity defense for the satellite industry. Satellite networks are not radically different from other networks, but there are important differences, such as the unique devices, protocols and special DIACAP regulations. The RT Logic team has been immersed in traditional and IP-based ground stations for many years—over 80 percent of missions around the globe use RT Logic products—so they know those differences and have engineered solutions to address them.

RT Logic also recently announced an ongoing program to offer "Armored" versions of many of its core ground system products that will harden them for increased resistance to cyber attack. I think that's a great move. Look, cybersecurity may not have been a big problem in the past for satellite providers, but there seems to be little doubt that over time that fact is likely to change. When that occurs, companies and government agencies will need to be prepared.

END-TO-END SITUATIONAL AWARENESS ACROSS SATELLITE + TERRESTRIAL NETWORKS

With their networks growing in complexity and frequently under attack, industry and government agencies are seeking every way possible to bolster their ability to monitor, protect and respond to challenges in real-time.

The military in particular has declared its need for increased network situational awareness in the form of a sharable Common Operating Picture (COP) across its environment to help overcome management stovepipes. Historically, different tools have been used to manage IT, satellite and hybrid networks; and within those lanes multiple tools manage servers, network, cybersecurity and other specialized systems.

This patchwork is a constant challenge to any real-time picture of infrastructure availability and security. Kratos Defense & Security Solutions is working to deliver true end-to-end situational awareness for satellite ground networks and others by integrating its NeuralStar® "manager of managers" with Newpoint COMPASS™, and SAT Monics as well as other satellite-oriented management products acquired through Integral Systems. COMPASS specializes in monitoring and controlling RF equipment and operational technology for satellite Earth stations, microwave towers, remote sites, and a range of other hybrid networks. SAT Corporation's Monics provides satellite carrier monitoring and interference detection.

In addition, SAT's satID product geolocates the source of that interference. Kratos has integrated the three products to provide a unified management dashboard able to collect data from the NOC to the network's edge and across the integrated terrestrial and satellite ground networks.

NeuralStar Consolidated Dashboard

In the combined solution, NeuralStar seamlessly aggregates data from COMPASS-managed sites as well as Monics-monitored interference data from the carriers based upon the spectrum plan; integrating it all with management data from other systems, including network devices, servers, applications, cybersecurity and IA, ancillary systems (such as UPS and generators), and even physical security equipment. Event sources can include anything from cryptographic devices and video surveillance feeds to virtually any device that can be connected to the network.

Concept image of the DoD GIG, courtesy of Air Force Space Command

Tailored applications such as SAT's One Touch Recovery sit alongside using correlation techniques to mitigate against RF interference with the touch of a button and further enhance mission assurance.

Deployed in some of the world's most rigorous and security-conscious enterprises, including DISA where it is used as the core network management solution inside the Integrated Network Management System (INMS) to oversee the DoD's Global Information Grid (GIG), NeuralStar provides a platform for collecting and fusing specialized data into a common end-to-end operational picture that can be customized for each command level.

The combination of the three products provides situational awareness for the complex terrestrial/SATCOM/microwave environment.

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Photo courtesy of U.S. Air Force

ANSF Interoperability—Lessons Well Learned

by Giles Peeters, Defense Sector Director, Track24 Defence + MILSATCOM Contributing Editor

With the Afghan National Security Force (ANSF) leading its first missions against the Taliban in Helmand, Giles Peeters considers the primary communications concerns for the departing NATO forces and the ongoing ANSF operation.

Afghanistan highlighted the fact that NATO required allied forces to be able to communicate with each other over large distances, often at short notice, in mountainous conditions that didn't lend themselves to reliable radio communications. Prior conflicts in Kuwait and Bosnia were fought either as industrial warfare, in which NATO owned the communications ground, or were small enough for radio and cellular coverage to suffice as an effective communications medium.

At the start of the Afghan conflict in 2001, NATO had limited military satellite capability that could be dedicated to the forces under the organization's control. This beyond-line-of-sight (BLOS) capability gap soon became an urgent operational requirement (UOR) that led to the introduction of AN/PRC-117 multiband radios with SATCOM antennae and channels. These were designed to transmit on tactical satellite as well as VHF and UHF frequencies. As progress through the country was made and radio relays were setup and maintained, the problem became manageable and the 117s fulfilled their purpose. However, the ongoing BLOS challenge is now being experienced by ANSF as it starts to lead operations against the Taliban.

It isn't feasible to equip what is a very large army with high value communications devices such as the 117, which will need to be managed and maintained. A solution is, therefore, required that will turn a disparate force, tasked with fighting a war amongst the people over a terrain spanning thousands of miles, into an effective, organized power. The ANSF needs to be able to communicate over large distances and routes near real-time information into an Afghan/NATO common operational picture (COP).

Vehicles on patrol.

One of the major developments made by the *International Security Assistance Force* (**ISAF**) during its time in Afghan has been the introduction of the *ISAF Friendly Tracking System* (**IFTS**) in 2008. This system was based on the U.S.' *Force XXI Battle Command Brigade and Below* (**FBCB2**) system, designed to provide situational awareness and limited *command and control* (**C2**) at the tactical level. This led to the adoption of the *NATO Friendly Force Information* (**NFFI**) standard. This 'open source' standard was introduced to provide full interoperability so all in-country allies could route data into a COP. Prior to this, different technologies and data types restricted coalition partners' abilities to converge data and, therefore, contribute with real-time intelligence to the strategic picture.

The IFTS model will stand the ANSF in good stead. It means that secure *commercial-off-the-shelf* (**COTS**) solutions running on commercial satellites can be easily integrated with the military technology already in place, to give the ANSF the BLOS capability it'll need to continue the war and contribute to the COP.

One of the initial problems experienced by NATO included satellite exclusion—if one of the limited channels it had was being used for voice data, then it couldn't be used for anything else. This meant there was a high premium on tactical satellites and it couldn't be used for important capabilities such as Blue Force tracking and C2—essential strategic components when fighting intra-community warfare in an austere, expansive landscape, often with limited reaction time.

My duration in the MoD included comms responsibility for British assets entering Afghan during *Helmand 1*. It was soon clear from the BLOS capability gap why the U.S. used commercial SATCOM extensively (indeed, 80 percent of U.S. SATCOM capability is provided this way).

Attaching a 117 to every vehicle leaving base camp would be expensive and impractical. The aerials are often cumbersome and aren't designed for constant on the move use. However, small satellite devices capable of sending regular short burst data signals, encrypted to a **Suite B** equivalent (**AES256**), are ideal, and a perfect solution for the ANSF. However, shipping thousands of devices to an army that's only recently come under a centralised command would be a mistake.

An interview with a British ISAF spokesperson recently revealed that it's the background operations (he specifically cited logistics and communications) that are causing the ANSF the greatest problem as its coalition partners slowly disband and the transition of military power takes place. It is, therefore, vitally important that NATO and the U.S. educate ANSF internally on the overall concept of operations. If you're in control of 1,000 troops, then the answer isn't necessarily to buy 1,000 radios.

Operational capability should never be technology led. Instead the whole communications picture needs to be strategically considered against a valid and current concept of operations.

The best way to develop a multinational intelligent COP is to consider the need on the ground—preferably from brigade level downwards. The beauty of a COTS approach is that equipment can rapidly be developed and deployed for UOR, once a standard such as NFFI is set, all coalition partners can benefit from interoperability and the COTS solutions can be integrated with existing military technology. If the strategic direction is clear, then the appropriate procurement can rapidly take place, and the ANSF will quickly have significant levels of cost effective capability.

The ANSF's ability to effectively operate once the final ISAF support has left the area is vitally important to the future stability of the country. This is about much more than the cost of a few devices. Coalition partners have invested billions in the region and suffered significant losses in personnel. If the ANSF cannot operate effectively once total control is handed over to them, then everything the U.S. and NATO have poured into the project may be jeopardized. It is imperative that NATO maintains an advisory presence in the country and strategically consider the ANSF's operational requirements. I'd like to think we've learned a lot during this conflict—now we need to ensure they weren't wasted lessons.

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 organizations 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).

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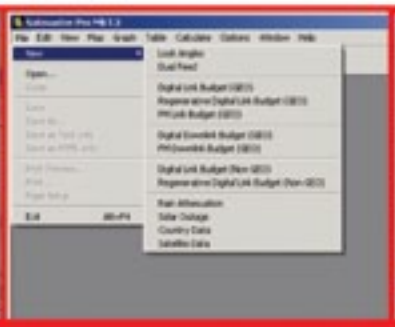
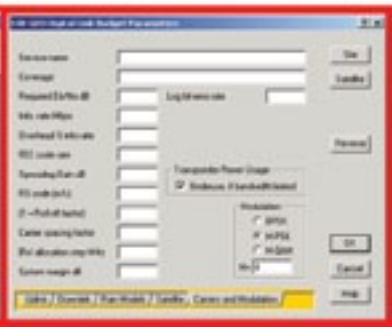




http://www.satnews.com/satfinder

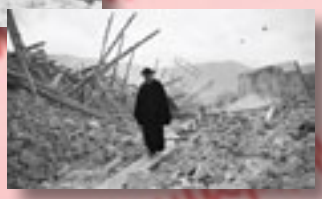
And The Earth Shook...

by Bob Gough, Asia-Pacific Contributing Editor

Have you ever been in an earthquake? I have, once, and it's terrifying. Not a powerful earthquake, admittedly, and most California residents would probably have called it a tremor. However, it was enough to cause me to wake me up in the middle of the night, in the dark, and my first thoughts were, "Why does it feel like my head is spinning? Did I really drink that much vino rosso with my bistecca di manzo dinner at Umberto's Ristorante?"

Only after turning on the bedside light in the hotel did I realise that it was my head that was spinning, as was the chandelier in the center of the ceiling. That's when the fear hit me...

I was in the town of Avezzano in the Abruzzi region of the Apennine Mountains in Italy, some 120km east of Rome. That in itself was no cause for concern, but remembering that Avezzano was totally destroyed by an earthquake on January 13th, 1915, with 32,610 deaths (96 percent of the population) had me shooting out of the bed, flying down the stairs, and out into the street.



Panoramic view of the Telespazio Fucino Earth station.

Artistic rendition of the OTS satellite.

I wasn't the only person exiting the Hotel Principe half-dressed and half-asleep, so perhaps what was experienced was more than a simply a mere tremor.

This happened in the late 1970s while I was working for the **European Space Agency** (**ESA**). At that time I was responsible for the in-orbit testing of the transponders of the ***OTS*** satellite—the satellite control and test station (SCTS) was hosted by Telespazio at their Fucino Earth station complex. Avezzano was the nearest town to the Earth station and about 16km northwest—I spent most of a two year period in Italy at this location.

I can't remember whether I returned immediately back into the hotel to grab car keys, a shirt and trousers, but it wasn't long before I drove to the Fucino Earth station to see if all was well. I was concerned because the Conca del Fucino used to be a very large lake—in fact, in Roman times, sea battles involving large ships, sacrificial slaves, and gladiators were played out on the lake to entertain the populace and the Emperor of that time.

The OTS satellite during testing.

Over the centuries, numerous attempts were made to drain the lake (hundreds of slaves drowned in the early attempts)—eventually, the Dutch succeeded and completed the job.

The reason I mention this (fascinating in itself) history is because the pancake-flat Conca del Fucino (now the largest potato growing area in Italy—the patchwork of fields is clearly visible on the map on the next page) is made up of silt; to a depth of heaven knows how many metres. Anyone who's watched Nat Geo or Discovery Channel on TV will know that earthquakes and silt soil do not go well together!

When I arrived at the Earth station everything looked normal, so at least the antennas hadn't disappeared into the depths of liquefaction! I thought I'd better check the telemetry to see how the spacecraft was doing and everything looked normal, including the **AOCS** (*Attitude & Orbit Control System*). My next check was the Earth station antenna tracking status and this is where a bit of technical background is needed. Don't get put off, because this is where the story gets interesting.

OTS was one of the first 3-axis stabilised geostationary satellites (***ATS-6*** was the first) and was the first satellite to carry 6 Ku-band (12/14GHz) transponders. The main **SCTS** Earth station antenna we were using at Fucino was a custom-built 13 metre ***Cassegrain*** dish, and **AEG Telefunken** was the prime contractor. This had a 3dB beamwidth of 0.15 degrees at 11GHz, but we needed a real-time tracking accuracy of much better than +/-0.005 degrees.

There are basically three types of tracking systems one can use; program track, step track, or monopulse. For a testing application where accuracy is paramount, SCTS was equipped with a monopulse system. This technology is used for extremely accurate tracking of fast moving objects, be they missiles or satellites. In essence, it's an extremely sensitive closed-loop control system so the pointing of the Earth station antenna in **Az** (*azimuth*) and **El** (*elevation*) immediately follows even the slightest movement of the spacecraft.

I looked at the tracking log file for OTS for the previous few hours. The graph of the Earth station's Az & El pointing angles should have been gentle sinusoids of +/-x degrees, with a 24 hour period reflecting the satellite's daily figure-of-eight movement within its 50km cube station-keeping box.

What I saw stopped me dead in my tracks; the Az and El plots looked like the output of a seismograph. Both Az and El exhibited massive positive and negative spikes around their nominal

Terrain map of Conca del Fucino, courtesy of Google Earth, copyright Cnes/Spot Image

values; first one burst of them, then another, then another. Only then did it dawn on me that what I was witnessing wasn't the satellite movement at all, it was the movement of the antenna's foundations in the lake-bed silt during the earthquake. The rapid response monopulse tracking system was compensating for the movement of the foundations and was trying to keep the pencil-thin antenna beam locked onto the satellite in its geostationary position some 36,000km above the equator. I had just stumbled upon the ultimate seismograph!

First Responders

Can you imagine what it must have been like in Avezzano on that fateful morning in 1915? Rome was many hours away by horse, as was Pescara on the Adriatic coast. What were the communications like—telegraph, perhaps? The earthquake was felt in Rome but how long did it take to send help and assistance to the few survivors of the quake?

Now travel 45km north of Avezzano and wind the clock forward to 3:23 a.m. on April 6, 2009. This is the moment when the town of *L'Aquila* was struck by a 6.3 magnitude earthquake which killed more than 300 people and destroyed thousands of buildings. This whole area is earthquake prone, but what sets the L'Aquila earthquake apart from most others is the recrimination which ensued over the warnings (or lack of them) issued by authorities. The deputy head of the technical division of Italy's *Civil Protection Agency* and six other Italian earthquake experts, including the then-president of the **National Institute of Geophysics & Vulcanology,** as well as the director of the **National Earthquake Centre**, now find themselves on trial for manslaughter!

The **American Geophysical Union** has warned that the trial will have long-term consequences for seismology, harming international efforts to understand natural disasters and mitigate associated risk.

Another major earthquake caused massive devastation in *Sichuan*, China, in 2008. It killed an estimated 68,000 people and left more than five million people homeless. Approximately 375,000 people were injured and more than 18,000 people were listed as missing. The epicentre of this magnitude 7.9 earthquake was 80km west northwest of *Chengdu*, the capital of Sichuan province.

It is pure coincidence that I happen to know someone who was in Chengdu with her husband when the earthquake struck at 2:28 p.m. on Monday May 12, 2008. She is the well-known writer *Junying Kirk*, author of *The Same Moon* and *Trials of Life*. Her husband, John, was one of the few western eye-witnesses—his testimonies were to appear in various U.K. newspapers, and his voice was broadcast via radio.

Initially, the mobile phone system was down and it was not until the next day the phone calls started coming in from Fox News, CNN, and others. When the inevitable questions about the effectiveness of the first response came in, here is his verbatim response..."I think the Chinese government have reacted promptly and efficiently. Their Prime Minister was on the scene already, and as I speak, I can see Army lorries passing by

our hotel window, no doubt heading towards the disaster area, doing rescue work. Compared to what happened when Hurricane Katrina hit New Orleans, I'd say that the Chinese are doing a good job…"

The Ring Of Fire

There are many earthquake-prone regions of the Earth but one of the most widely known is the Pacific Ring of Fire, associated with the subduction zone of two tectonic plates and stretching thousands of kilometres from Alaska to New Zealand.

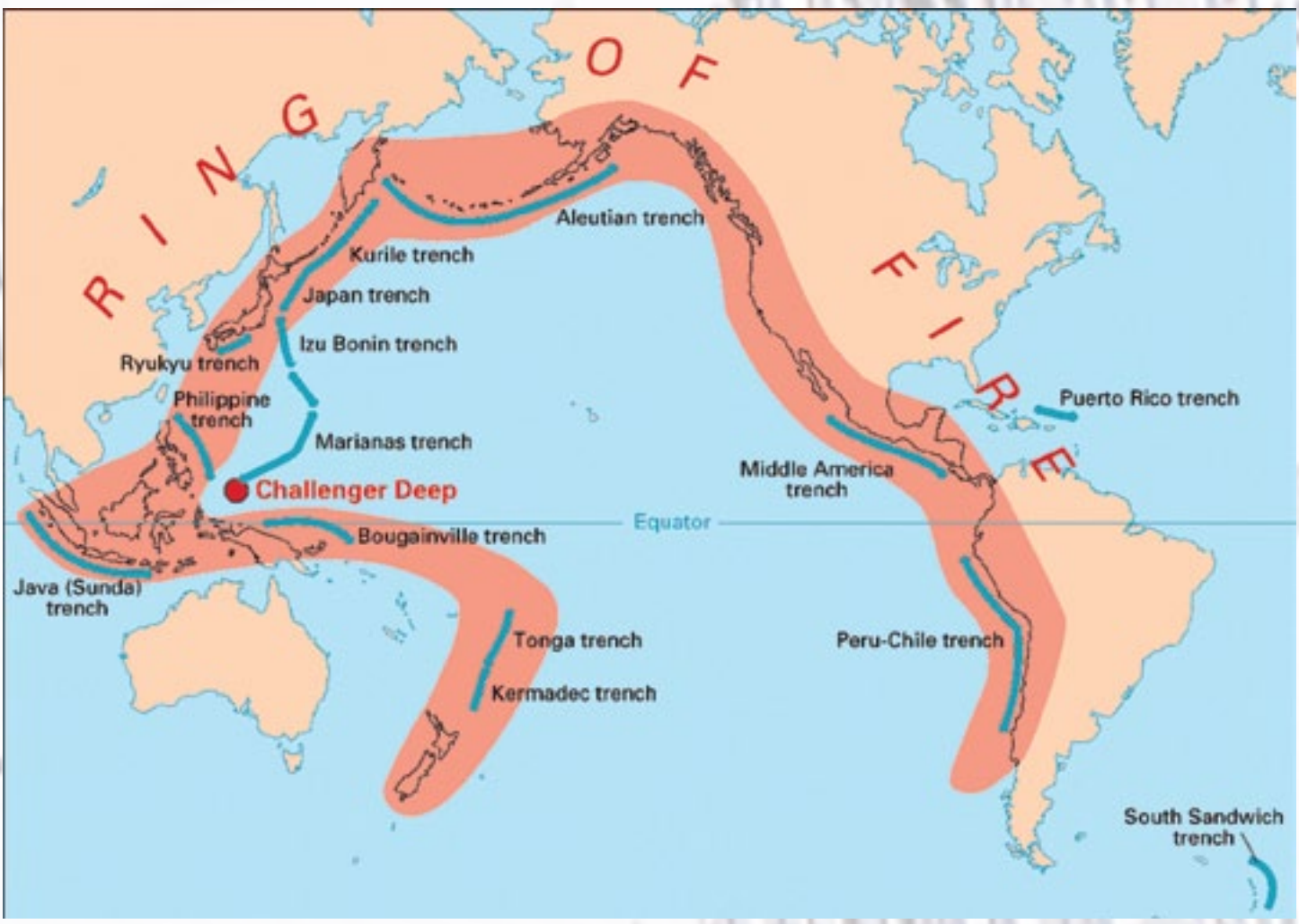
I hardly need mention the Fukushima earthquake and resulting tsunami. Earthquakes are occurring continually all along and close to this highly unstable geological band. For example, as I was writing this column, I noted a Twitter alert that a magnitude 7.1 earthquake had occurred under the ocean 124km west of Port Vila, the capital of Vanuatu, on February 2nd. Vanuatu, like most of these Pacific islands, are volcanic and exist only as a consequence of their location on the ring of fire.

As we go to press, news is filtering out regarding a magnitude 6.7 killer earthquake which hit the central Philippines on February 6, 2012.

Sometimes, though, even the most quiescent locations receive a totally unexpected shock, with devastating consequences. I'm thinking in particular of Christchurch, New Zealand. In terms of first responders and how such a crisis is addressed in those first critical hours, who better to comment than Mr. *John Hamilton*, Director, *Civil Defence and Emergency Management*, Government of New Zealand. Here are John's own words as he communicated them to me.

"The earthquake struck Christchurch at 12:51 hours on February 22, 2011. It was the lunch hour on a fine and warm afternoon, with many people in the CBD at work and children at school. Initially, the cellphone networks were overloaded, probably through a combination of high traffic and some sites being damaged. In addition, electricity was disrupted across the city, which also impacted telecommunications. As reports of the scale of damage and number of casualties became available to the Government and officials in Wellington, it was clear the impact of this earthquake was something we had not experienced in New Zealand since the 1931 Hawke's Bay earthquake. On the morning of February 23rd, the Government declared a state of national emergency which put in place a National Controller with the authority to co-ordinate and control national resources assigned to the response. In those first few hours New Zealand received generous offers of assistance from Australia, the U.S., Singapore, China, the United Kingdom, Japan and Taiwan, and many others.

"Surprisingly, the cellphone networks were re-established very quickly after the shock, albeit with a reduced capacity and, while electricity distribution took much longer to come back on, the use of back-up batteries and portable generators greatly assisted the telecommunications system. The lesson seems to be to encourage telecommunications providers to invest in redundancy, alternate power supplies and facilities that will better withstand the impact of a large earthquake.



The power of the Christchurch, New Zealand, earthquake can be readily understood by viewing these railroad tracks.

"On reflection it could be argued we were lucky in Christchurch. The central business district was hit hard with many collapsed buildings, injuries, and casualties. The eastern suburban areas were hit hard by liquefaction, and the southern suburban areas suffered significant rockfalls. And yet, large parts of the city suffered comparatively minor damage. Access to the city by air, road and sea was quickly restored and critical supply lines were open. It could have been much worse. Satellite communications were held by the emergency services and the city's civil defence emergency management office. But, it seems, satellite communications were for the most part held as the alternative means of communications and the primary means of communications used was the more traditional radio networks and cellphones.

"As the National Controller for the emergency, I found that in the early stages of the response it was difficult to establish situational awareness, which in turn impacted our ability to set operational priorities. I attribute this to the combined effect of the highly valuable "all hands to the pump" initiative in those first critical hours, difficulties for first responders to then re-assign units, communications difficulties and demand for assistance across the city exceeding supply available. A formal review process is underway to draw out lessons which should improve readiness and the response and recovery to a future event."

Organizational Order

There are many international, national and local organisations that are focused on the planning and execution of first response efforts, too many to do them all justice in this short article. Having said that, there are two international organisations that do warrant mention here. One is the **International Atomic Energy Agency**'s (**IAEA**) **RANET** (*Response and Assistance Network*). The other is the **United Nations**' *UN-SPIDER Platform for Space-based Information for Disaster Management and Emergency Response.*

A PDF file describing RANET can be found here:
http://www-pub.iaea.org/MTCD/publications/PDF/ranet2010_web.pdf

UN-SPIDER (***http://www.un-spider.org***) has developed a *Space Application Matrix* which allows users to explore the possibilities of using space technologies for disaster management in all phases of the disaster cycle: mitigation, preparedness, response and recovery. This is an interactive, online portal with a very easy-to-use, intuitive method of finding the right documents from a large library of information.

With this tool you can access case studies and the *Space Applications Guides*, authored by experts and practitioners. These describe experiences from the application of space technology, and address benefits, lessons learned, and much more. Use the live tool at ***http://www.un-spider.org/space-application-matrix*** to see how powerful it is.

The CTV site after the Christchurch earthquake.

A crushed vehicle in Christchurch—the yellow lettering on the truck states "CLEAR," having been checked out by emergency personnel.

Total destruction of a church in Christchurch following the devastating earthquake.

What To Do In The Event Of An Earthquake?

I started this article with a description of a personal experience, so it is fitting to end in the same vein. What should one do when the swaying starts and the shock hits? The conventional wisdom would appear to be "Duck, cover and hold".

However, in recent years a different approach has been proposed by a Mr. *Doug Copp*, a veteran of a number of first line response rescues. His approach is quite different and gave rise to the term *The Triangle of Life*."

This has caused enormous concern and controversy and is hotly debated by various experts, experienced people, and organisations. Personally, I have no idea what is best, but for those readers who are interested, I suggest that you undertake an Internet search for "Doug Copp" and follow the numerous links to form your own view. ***Wikipedia*** also offers a good insight into this approach.

References and Citations

There's an amazing collection of 34 photos of the aftermath of the 1915 Avezzano earthquake which can be found by a search in the U.S. Geological Survey (***http://www.usgs.gov***) archive. These were donated by family members of the late Admiral J. Lansing Callan, **U.S. Navy Reserve**. The monochrome photos included in this article are his and are copyright©.

Courtesy and copyright© Telespazio for the Fucino Earth station photo.

Courtesy and copyright© European Space Agency (ESA) for the OTS pictures.

Thanks to Junying & John Kirk (http://www.facebook.com/pages/Junying-Kirk/180846635299025) for permission to share their Chengdu experiences.

Courtesy and copyright© New Zealand Government Civil Defence & Emergency Management website for the Christchurch photographs: ***http://www.civildefence.govt.nz/memwebsite.nsf***.

About the author

Bob Gough has spent more than 35 years in the satellite communications business and has experience in most aspects of SATCOM, which also happens to include seven years with the European Space Agency (ESA) in a number of roles, from end-to-end communication system design to work on the OTS, ECS, and OLYMPUS satellites. Upon leaving 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. Bob was instrumental in opening up the U.S. market for the company. He then founded a successful satellite communications equipment manufacturing company, Communication Systems Research (CSR), which had an international customer base and specialized in antenna tracking systems, UPPC systems, digital modems, spread spectrum and CDMA systems, VSAT systems and Earth stations operating up to Ka-Band. Bob founded Carrick Communications Ltd in 1990 and the company offers consultancy, training and software applications for satellite communications. More detail regarding Bob's specific experience can be found on the "Experience" pages of his personal website: http://www.satellitespy.net, or at http://www.carrickcom.com.

The Road To The Future—The Military Enigma

by Bert Sadtler, President, Boxwood Executive Search + Contributing Editor

These are interesting times for employers who need to acquire top-level talent as well as for those seeking a career change. Today, companies' economics compel them to re-assess their talent needs in order to remain competitive and drive growth. The Military communications industry is ripe with challenges and opportunities. One of the challenges faced by employers is the challenge of making a "great hire."

To assist with the recruitment of critical talent, we asked ***Bert Sadtler*** of Boxwood Executive Search to respond to readers' questions regarding the processes of recruitment and hiring as well as how Companies can retain crucially-needed talent. Boxwood is located in the Washington DC region and has success in senior level recruitment in communications, government contracting, and within the intelligence community. Bert was recently interviewed by Federal News Radio to discuss the acquisition and retention of critical talent. If you would like to submit a question for Bert to answer, please send an email to ***BertSadtler@BoxwoodSearch.com***.

Dear Bert,

Our U.S. based company is supportive of the men and women who have made sacrifices serving in the military. What is your opinion on recruiting personnel from the Armed Forces?

Steve N
President
SATCOM Sector Manufacturing Company

Dear Steve,

Members transitioning out of our military can offer the business community an incredible value. They have faced and overcome obstacles. They have made sacrifices personally and professionally. They are mission focused. They have developed a strong lifetime bond with their fellow military members.

Statistically, it is estimated that approximately 100,000 service members leave the military annually—either through retirement or just discharged, according to Hope for the Warriors, based in New York City. Today's military represents a diverse group ranging in age and leadership seniority. Many are eager to join the civilian workforce.

Hiring a vet is a great way to say "Thank you for your service". But, in today's competitive business climate, hiring critical talent is driven by the need to solve a problem. As in any recruitment, the first step is for the employer to define their challenge and then define the requirements needed when recruiting the talent.

For the employer that has decided to target candidates who are leaving the armed forces, they should also ask themself:

- *Is our goal to hire talent who will deliver long-term value and enjoy working for us?*

or...

- *Do we want to leverage the active armed forces contacts of the military veteran in the short term to open doors through business development?*

It would be intuitive to think that entering the business community would be easy for someone with accomplishments in the armed forces. All of my friends who have left the military and joined the business community describe it as a difficult transition.

For employers seeking to hire someone transitioning from the military to join their organization for long-term value, they will need to develop a post-hire integration process. This is the time when all efforts should be made to assure a successful hire.

It is strongly recommended that the employer implement a six to 12 month on-boarding/mentoring program. A structured program will be easy for the

veteran to relate to. A structured mentoring program will also assist the veteran as he or she embraces and understands the culture of the employer. This also helps the veteran to understand the business related objectives versus military mission related goals.

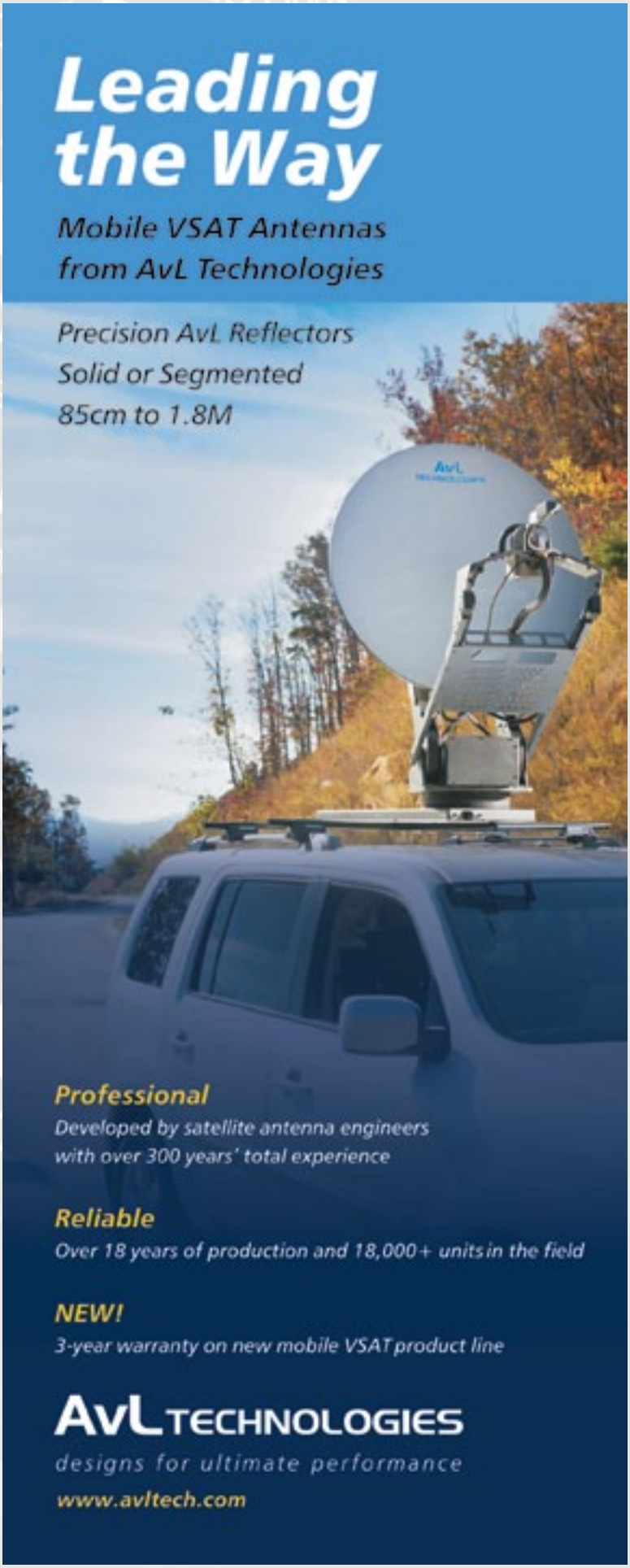
As an alternative, there are employers who recognize that people leaving the military have developed relationships that are regarded as immediately valuable by the business community. These relationships can translate to lucrative business opportunities. With time moving on, contacts become weaker as those military members are given different assignments, or retire themselves.

If the employer's goal is to leverage contacts that have a limited shelf life, we suggest avoiding a formal employment, which will likely end as soon as the contacts dry-up. This does the employee a disservice and can hurt the reputation of the employer.

An alternative might be to hire the veteran as a contractor with a defined role and defined timeline to leverage relevant connections. As part of this program, specific objectives—including number of meetings, introductions, new business opportunities, and so on, can be defined and measured to be rewarded as part of a performance based incentive compensation plan. In addition, when the period of the contract reaches its end, the veteran can now be regarded as having "experience" in the workforce.

Steve, I hope you have found this helpful.

Sincerely,
Bert Sadtler



Dave Madden, Director, MILSATCOM Systems, Space + Missile Systems Center, Air Force Space Command

Mr. Madden entered the Air Force in 1980 after graduating from Virginia Military Institute. He has gained vast experience in systems engineering, technical intelligence, command and control and space systems requirements, development, fielding and operations. In addition, he has commanded a Space Operations Squadron, a Material Acquisition Group, and most recently, the Global Positioning Systems Wing. He retired from active duty in the rank of colonel and entered civil service in 2010.

MilsatMagazine (MSM)
Given your U.S. Air Force career, and your civilian career, would you please tell our audience how you came to be interested in satellite communications? How did that transition into the military segment of this crucial technology?

Dave Madden
I actually became interested in satellite communications while I was at Virginia Military Institute (VMI) obtaining my degree in electrical engineering. I received many opportunities while I was on active duty in the U.S. Air Force to work in acquisition, requirements, and in operations associated with satellite communication systems and hosted payloads. The toughest challenge associated with the transition from GPS to MILSATCOM was in getting acquainted, and in some cases, reacquainted with, key stakeholders and developers in the community. The good news is this is a great community (user, government, and contractor) and they have gone to great lengths to welcome my return into the community.

MSM
With the need for superbly trained technicians and communications professionals in both the commercial and military/government worlds to support critical projects, and the realization that finding such candidates is becoming more challenging, how can military/government organizations help to promote and support STEM learning? What methods would you recommend to both entice and encourage high school and college students to delve into SATCOM careers?

Dave Madden
MILSATCOM's involvement in satellite communications is developing state-of-the-art technology key to the ability to enable secure and highly reliable global military communications. Communication roles are ever increasing with today's vast need for information at locations spanning the entire globe. MILSATCOM saves lives and enables both military combat operations as well as humanitarian operations. When one combines the need to operate in the harsh environment of space with the technology advances being made every day in the communication environment, added to the demanding needs of the warfighter, this is one of the most exciting areas for opportunities for learning, contributing, and belonging to an elite group of individuals.

In addition, one gets the opportunity to work with and support local and national organizations such as *Armed Forces Communications & Electronics Association* (**AFCEA**), *Institute of Electrical and Electronics Engineers* (**IEEE**) and *Association for Computing Machinery* (**ACM**) to promote education and learning within the space and engineering careers. This exciting work provides for challenges and opportunities to students excited about the opportunities that are available to them and the resounding impact they can have.

MSM
As the Director of MILSATCOM at the Space and Missile Systems at Los Angeles Air Force Base, and with a $40 billion overall systems portfolio, could you tell us of your duties? How are you able to juggle all of the various programs under your purview?

Dave Madden
As the Director of MILSATCOM, I am responsible for seven divisions and one branch, all of which are focused on developing, acquiring, deploying and sustaining space-enabled, global communications capabilities to support peacetime, contingency, homeland defense, humanitarian assistance, and wartime operations. Our portfolio is wide-ranging and diverse. Our assets include protected SATCOM products that provide the **Department of Defense** (**DoD**) with survivable, global, secure, jam-resistant communications for

Artist's concept illustration of the AEF satellite. Image courtesy of Lockheed Martin.

WGS Block 1, image courtesy of Boeing

high-priority ground, sea and air assets. This division executes the ***AEHF*** program, and provides operations and sustainment support to the on-orbit ***Milstar*** constellation. The **EPS** is a hosted payload that is the polar adjunct to the AEHF system.

Our ***Wideband SATCOM*** programs provide worldwide, high volume, voice and data communications. The **MILSATCOM Command and Control** branch directs the **CCS-C** program and is responsible for satellite command and control system development for all MILSATCOM systems. The **GBS** is a hosted payload that augments the wideband family of services. In addition, the program office acquires a family of receive suites (man-portable and in-garrison) that are fully rugged and designed for rapid deployment worldwide.

Our **Terminal Program Office** develops, acquires and operationally deploys communication terminals synchronized to support satellite weapon system operations and provides support for 16,000 aircraft, transportable and fixed site terminals.

We are also working toward the nation's future SATCOM needs. The **Advanced Concepts Division** is responsible for defining next generation SATCOM capabilities to meet warfighting needs for the **Joint Space Communications Layer**. The division is developing options to evolve the AEHF and WGS systems through capability insertion programs, as well as leveraging innovative commercial SATCOM opportunities to augment and expand military systems.

We have many priorities each day—a few deal with laying out the future for our current programs of record. The first happens to be on the Air Force's top five acquisitions for this year, the procurement of ***AEHF-5/6*** focused on lowering system costs while maintaining high system mission assurance.

The second is our ***WGS*** program, where demand continues to increase. We've laid out a few upgrades that increase the satellites capabilities with minimal investments and the program keeps expanding, with the recent addition of a Five-Nation International Partnership on WGS–9 and the addition of WGS-10.

There are a few others that we're working on as well, such as the follow-on to our current *Command and Control System —Consolidated* (**CCS-C**) and the *Control and Planning Segment* (**CAPS**) for our polar system, ***EPS***. A significant portion of work is also on the sustainment of the current constellations and capabilities. We find that our satellites are lasting longer than expected and the warfighter is really pleased about this news. However, the significant ground infrastructure involved on the terminals and command and control systems adds challenges as we deal with aging equipment on the ground and sustaining their operations.

In order to maintain the program offices focus on these activities, I find myself primarily dealing with the externals (**SMC**, **AFSPC**, **HAF**, and **OSD**) to keep the Divisions and programs of records focused on mission execution with my guidance. To accomplish all of this relies on experienced leadership in my Divisions—establishing their responsibilities and giving them the guidance to execute and trust in their abilities to get it done.

MSM
As of this writing, just this past week, the Department of Defense revealed to the public the massive number of cuts to our Nation's military, especially to the U.S. Army and U.S. Marine Corps. land-based forces. Prominently stated was that the offset for the lack of boots on the ground would be the finest technologies and equipment available to support the remaining forces. First, how will the budget cuts affect SMC and your command?

Dave Madden
SMC has taken the initiative to sustain critical capabilities by identifying and deriving efficiencies in the acquisition of programs of record such as AEHF and WGS. In addition, **Air Force Space Command** has formulated an investment plan based on national policy/strategy and two years of study and risk reduction efforts with traditional/non-traditional MILSATCOM contractors, the user community, DoD stakeholders, and FFRDC partners. The investment plan recommends targeted investments to enable a transition towards a more capable, resilient, and affordable MILSATCOM enterprise.

A key element of the investment plan is to focus on improving the affordability of protected communications for tactical forces across Services in a contested operational environment. The dissemination of such technology and capabilities to a larger base of tactical forces will be even more critical as changes occur in priorities and force structure.

MSM
Secondly, with MILSATCOM an advanced technology, and the statements from Defense Secretary Panetta, will this result in new funding and programs for your division to develop new and better communications and ISR capabilities?

Dave Madden
Air Force Space Command and the **MILSATCOM Systems Directorate** are currently supporting efforts within the Air Force and DoD to assess parts of the ISR architecture and options for addressing future communications needs.

MSM
How does your MILSATCOM organization work with Space Command? What is the project flow from inception to development to deployment?

Dave Madden
Space Command is the "*requirer*" and SMC is the "*acquirer*". In this capacity, Space Command leads the activities associated with capturing and documenting the warfighters' requirements, getting those requirements approved through the **Joint Capabilities Integration Development System**, and ensuring that necessary resources (money and personnel) are available to acquire, operate and maintain the systems.

SMC is responsible for translating those warfighter requirements into acquisition documents, conducting the competitions to select system developers, awarding and executing the contracts, and fielding and sustaining the new systems and capabilities. This connectivity is not only a giver-receiver relationship but also a collaborative one between what the warfighter needs and the fielding of the necessary assets to meet these needs. Therefore, SMC and Space Command maintain a robust dialog between the "requirers" and the "acquirers" throughout this process. In the Directorate, we interface directly with Colonel *Mike Lakos*, who leads the **MILSATCOM Capabilities Team** at Air Force Space Command—our staffs collaborate extensively.

MSM
Would you please tell us about some of SMC's most recent successes and their importance to our military and national defense?

Dave Madden
The ***Advanced Extremely High Frequency*** (**AEHF**) system is a joint service satellite communications system that provides survivable, global, secure, protect and jam-resistant communications for high-priority military ground, sea and air assets. AEHF enables the **National Security Council** and **Unified Combatant Commands** to control their tactical and strategic forces at all levels of conflict through general nuclear war, and supports the attainment of information superiority. Recent successes and upcoming milestones include...

When the action hits, iGT SATCOM keeps you connected on the ground, at sea and in the air.

FAST. Our networks operate on a shared TDMA bandwidth platform spanning multiple satellites, bands and transponders while supporting multiple topologies simultaneously, including SCPC for the fastest data rates available.

SECURE. iGT networks operate with the highest security using AES 256 TRANSEC for maximum data protection.

MOBILE. Our compact, lightweight powerful routers provide reliable communications over multiple mobile environments: on the ground, at sea and in the air.

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iGT

Stay connected. Stay informed. The mission depends on it.

- *AEHF-1 on-orbit and scheduled for turnover to operations*
- *AEHF-2 scheduled to launch 3Q, FY12*
- *AEHF-3 completes final integration and tests this summer and goes into storage awaiting launch*
- *AEHF-4 production contract awarded FY11*
- *AEHF 5/6 contract scheduled for award 3Q, FY12*
- *Upgraded ground system to support eXtended Data Rate (XDR) capability, 4Q, FY11*

The ***Wideband Global SATCOM*** (**WGS**) system provides flexible, high-capacity communications for the Nation's warfighters through procurement and operation of the satellite constellation and the associated control systems. With its first launch in October 2007, second launch in April 2009, and the third launch in December 2009, WGS Space Vehicles -1, -2, and -3 are the DoD's highest capacity communications satellites. Recent successes and upcoming milestones include...

- *WGS-4 operational 3Q, FY12*
- *WGS Block-II follow-on contract for WGS 7 – 9 awarded FY11. New firm fixed price contract strategy taking advantage of commercial business practices. Approach saved more than $350M*
- *WGS-9 international partnership agreements signed 2Q, FY12*
- *WGS-10 scheduled for award 3Q, FY12*

The **Terminal Program Office** deploys communication terminals synchronized to support satellite weapon system operations and provides support for 16,000 aircraft, transportable and fixed site terminals. Recent successes and upcoming milestones include...

- *Awarded Transportable Ground Receive Suites (TGRS) contract, 4Q, FY11*
- *Completed delivery of 126 GMTs, 1Q FY12*

MSM
What new satellites and launches are scheduled for the not-too-distant future?

Dave Madden
We have many commitments in 2012 we're looking forward to completing and it is more than just launching satellites.

- *Expand international cooperation, in accordance with National Space Policy, and award International Partners buy of WGS-9*
- *Turnover AEHF-1 to operations and deliver AEHF-2 for launch in April 2012*
- *Award AEHF-5/6 contract*
- *Award EPS Control and Planning Segment (CAPS) contract*
- *Award WGS-10 contract*
- *Purchase 4 AF Wideband Enterprise Terminals*
- *Ensure no lapse of CCS-C production & sustainment capabilities by awarding the follow-on CPASC (CCS-C Production and Sustainment Contract)*
- *Expand MILSATCOM capabilities by awarding upgrade to WGS providing an additional 25 percent throughput capacity*
- *Expand MILSATCOM capabilities by awarding development of non-proprietary and unclassified protected tactical waveforms*

MSM
Given your experience as a Colonel in the U.S.A.F., and as the MILSATCOM Director, where do you see MILSATCOM developing over the next year or two?

Dave Madden
The MILSATCOM Systems Directorate will continue to deliver needed capabilities by launching additional AEHF and WGS satellites as planned. In parallel, we will develop modest, cost-effective enhancements to AEHF and WGS. Additional notable activities include the EPS Control and Planning Segment (CAPS), a BAA focused on improving the affordability of protected MILSATCOM, and a BAA focused on hosted payloads.

MSM
How concerned are you regarding launch capacity scheduling for your satellites?

Dave Madden
Our #1 priority in MILSATCOM is to ensure we're delivering the capability our warfighters and decision makers need with respect to military satellite communications. We are also very mindful of the significant fiscal pressures our nation is under. We want

to ensure we deliver capability when needed but not break the bank doing it.

We have robust processes in place to determine which satellites should be launched when based on satellite constellation health and capability need. Therefore, when capabilities are needed, we're able to launch within the current launch capacity. We've worked hard to synchronize the delivery of satellites when they're needed and when launch opportunities are available. However, this is challenging across all of our DoD programs. In the end, we've been able to deliver capability when needed, focusing on our #1 priority.

MSM
There has already been an SMC-involved hosted payload launch... what are your thoughts about hosted payloads as one RESPONDER to reducing costs, obtaining launch capacity, and speeding up orbital placement?

Dave Madden
Hosted payloads represent another option to deliver capabilities. In fact, we currently have several systems that are, in fact, hosted payloads (***Interim Polar System***, **IPS**; ***Global Broadcast Service***, **GBS**; and ***Enhanced Polar System***, **EPS**). Looking toward the future, several studies have been conducted and have identified a few issues that must be addressed before this option can be used more routinely. These issues include acquisition practices, information assurance, and DoD policies on contracts, frequency/orbital slot filings, and launch platforms.

MSM
Are you looking at increased U.S.A.F. use of small satellites (nanos, micros, minis and so on)? If so, what are the main reasons for such?

Dave Madden
MILSATCOM Systems Directorate is supporting Air Force and DoD studies on a wide variety of options. We continue to support technical information exchanges with **DARPA** and **NASA** with respect to nano and micro satellites. Thus far, we have not found a good application for nano and micro satellites for MILSATCOM users.

MSM
As you recall all of your past duties, from your command of a Space Operations squadron, to your current command role, what programs and/or projects bring you the most satisfaction?

Dave Madden
I have to say I had an exciting 30 years as active duty in the Air Force. I got the opportunity to travel the world and learn and experience so much from many of our international allies, other services, and Air Force members. The Air Force gave me responsibility and the opportunity to succeed and to make a difference in saving lives and improving the quality of life for everyone on the planet (*e.g.*, GPS).

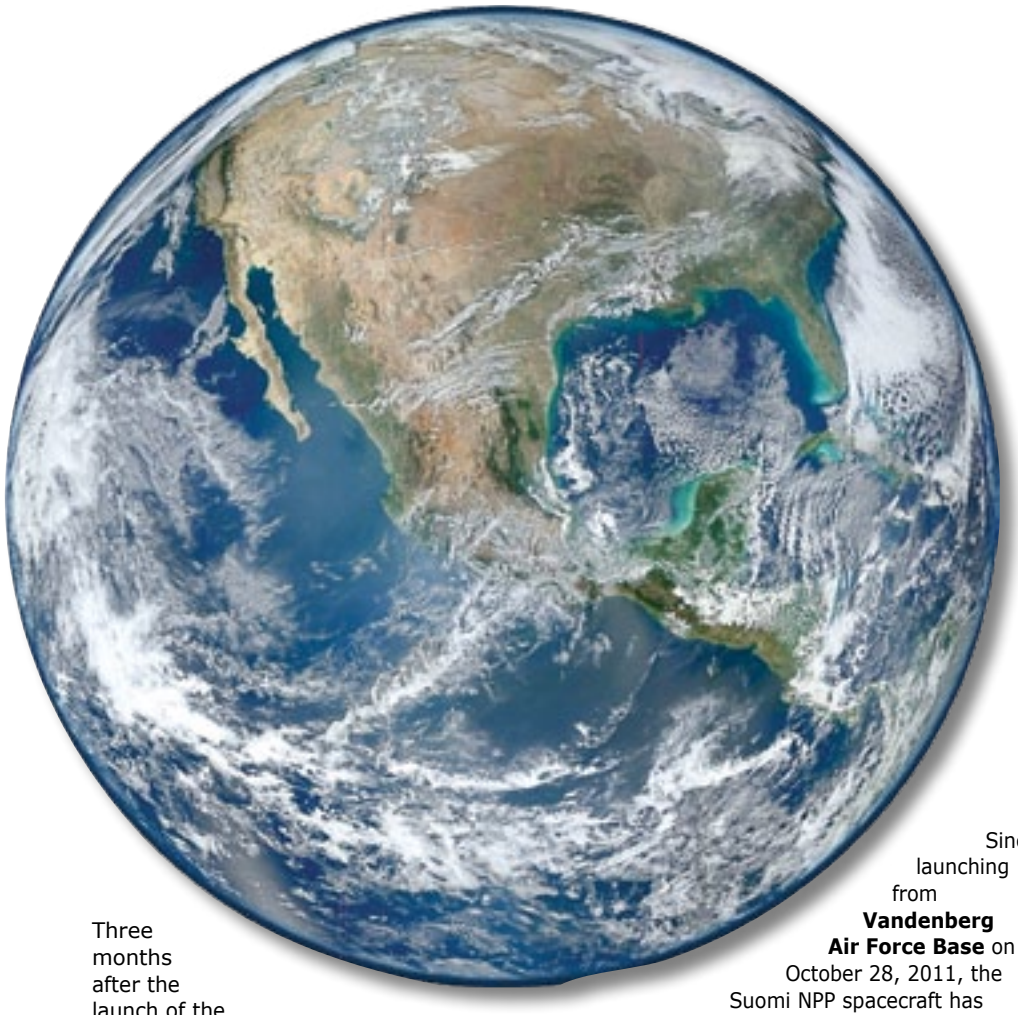
I am always looking forward, so the programs that bring me the most satisfaction are the ones I am currently working. The challenge associated with meeting critical warfighter needs in this highly technical and unforgiving space environment within schedule and budget, maintaining systems on orbit that far exceed the planned operational life, and developing and implementing new architectures strategies that are significantly improving future new capabilities make every day exciting.

When I add to that the opportunity of working daily with some of the greatest, smartest and most dedicated individuals in the world (**The Aerospace Corporation**, **MITRE Corporation**, U.S. Air Force (military and civilians), and our Prime and sub contractor partners), I am truly in Heaven.

MSM
Thank you, Mr. Madden, for taking time away from your crucial responsibilities to expand on some specific issues with MilsatMagazine readers.

A New Era For Polar-Orbiting Satellites

Three months after the launch of the *Suomi NPP* spacecraft, NASA unveiled a stunning high-definition image of Earth called, "Blue Marble 2012" snapped by one of the five remote-sensing instruments that comprise the satellite's instrument suite. The platform that enabled this image was built by Ball Aerospace & Technologies Corp., as the first of a new generation of satellites and a critical bridge to the future. It will observe many facets of our changing Earth leading to the launch of the Ball-built *JPSS-1*, the Joint Polar Satellite System, which is the first of NOAA's next generation polar orbiting weather satellites.



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The ***Suomi NPP National Polar-orbiting Partnership*** collects and distributes remotely-sensed land, ocean, and atmospheric data to the meteorological and global climate change communities as the responsibility for these measurements transitions from existing Earth-observing missions such as ***Aqua***, ***Terra*** and ***Aura***. It will provide atmospheric and sea surface temperatures, humidity sounding, land and ocean biological productivity, and cloud and aerosol properties.

Since launching from **Vandenberg Air Force Base** on October 28, 2011, the Suomi NPP spacecraft has completed commissioning and all five instruments are on, open, and processing science data at the expected rates. The NPP satellite was renamed ***Suomi NPP*** on January 24, 2012, to honor the late *Verner E. Suomi* of the **University of Wisconsin**. Traveling at 16,640 miles per hour (eight kilometers per second), 512 miles (824 kilometers) from Earth, NPP Suomi completes 14 orbits per day, 100 orbits per week.

Ball Configurable Platform

The Suomi NPP satellite is based on the *Ball Configurable Platform* (**BCP**) satellite design. The BCP can support a variety of payloads, including optical applications with sub-meter resolutions and synthetic aperture radar; and instruments that require precision pointing control, high data throughput and downlink and require a controlled re-entry.

The Suomi NPP redundant architecture extends its on-orbit life time design life to seven years, and the science mission duration to five years. It is the eighth of 11 spacecraft built by Ball Aerospace using the same core architecture. In total, this spacecraft design has logged more than 50 years of successful on-orbit operations.

BCP Family

The BCP is a family of spacecraft designed for cost-effective, remote sensing applications with a variety of options available including:

- Communication standards
- Power and propulsion capabilities
- Payload interfaces
- Onboard data storage

NPP undergoing testing at Ball Aerospace, the manufacturer of the spacecraft.

The BCP system can also include an on-orbit delivery package with the following:

- Launch vehicle & commissioning activities
- Mission control facilities and support
- Remote ground stations
- Image processing

Distinguishers of BCP design include:

- BCP 300/100 accommodates small launch class mission and ESPA compatible spacecraft and can be built in less than 24 months
- BCP 2000 accommodates medium launch class missions and offers quick re-targeting and greater agility for Earth remote-sensing payloads.
- BCP 5000 accommodates medium to large launch class missions and provides increased power, stability, agility, and data storage and transmission, as the demand for Earth remote sensing information becomes more comprehensive.

Data continuity can also be customized on the Ball platform. Data can be sent to the ground with only a few seconds delay, or stored for transmission at a later time. Built-in redundancy helps to create more reliability in the system. The architecture of the BCP is common across the spacecraft family, so migration to larger systems for future missions is easily accomplished.

Polar Orbiting Satellites

NOAA maintains two types of weather satellites: geostationary, which constantly monitor a fixed area on the Earth; and polar-orbiting, which circle the Earth and provide global information. Polar-orbiting satellites are the primary data source for civilian and military weather forecasts two to seven days in advance. The 24/7 global coverage they provide is crucial for military use in remote areas around the world.

Polar Orbiting Satellite Capabilities

- Support real-time assessments and short-to-medium range forecasts and warnings of environmental conditions that may endanger human health and safety, and dependable transportation
- Enable accurate predictions of hurricane intensity and track, severe thunderstorm outbreaks and floods
- Provide information on fire locations and burn areas
- Provide global cloud and ocean data critical to military operations and Intelligence, Surveillance and Reconnaissance missions
- Assess vegetation and forecast drought conditions
- Develop ocean products to enhance fisheries and coastal zone management, recreational boating, and the offshore oil/minerals industry

The JPSS Mission, image courtesy of Ball Aerospace & Technologies Corp.

Importance Of Polar Orbiting Satellites
Weather satellites help provide advance warnings for severe weather such as the deadly tornadoes, hurricanes, heat waves, floods, snowfall and wildfires that the weather service reports took the lives of nearly 1,000 Americans, injured more than 6,500, and led to a record 12 billion-dollar weather disasters in the USA in 2011. Satellite data returns are critical for but not limited to:

National Security—U.S. polar-orbiting satellites are the only assured source of satellite weather data for our warfighters globally. The JPSS-1 afternoon orbit observations will become the backbone of all weather forecasts beyond 48 hours and thus are crucial to military operations, mission planning, and disaster relief.

Public Safety—Severe weather forecasts allow state and local governments to warn their citizens; if forecast accuracy is degraded by one-to-two days it results in less time to react thus increasing risk to life and property.

Travel—Aviation forecasts and warnings directly impact the routing of commercial air and ground traffic, affecting millions of travelers daily. Commerce could also be curtailed due to the inability to predict storm course and severity with sufficient accuracy to ensure safe travel.

Search and Rescue—A gap in satellite coverage could mean longer hours for rescue operations—in some cases the time interval could mean life and death. Additionally, response time to emergency beacon signals could double if there are fewer polar-orbiting satellites receiving such signals. Nearly 300 lives were saved in 2010 through these beacons.

Agriculture—Crop production could be severely impacted without satellite information on drought, extreme temperatures, and length of growing seasons. Drought impacts alone are estimated to cost between six and eight billion annually in the U.S. and occur primarily in agriculture, transportation, recreation, tourism, forestry, and energy sectors.

Insurance Costs—The U.S. has more severe weather than any other country: 1,200 tornadoes; 5,000 floods; 10,000 thunderstorms each year; and, $14 billion in weather related losses. The majority of insured losses are from weather and climate events. Accurate weather forecasting is imperative to limit weather-related economic losses.

Electric Power—Weather factors are critical for electric power industry to forecast power grid loads accurately, efficiently manage start-up and shutdowns of generating plants, and plan future capital expenditures. Improved weather forecasts may save up to hundreds of millions of dollars in avoided costs per year.

Suomi NPP @ Ball Aerospace & Technologies Corporation

The Future Of Earth Observation & Weather Forecasting
The Suomi NPP satellite hosts a suite of advanced-technology remote sensing instruments that provide critical data for the nation to monitor the health of the Earth from space. The satellite will acquire a wide range of land, ocean and atmospheric measurements and provide both short-term weather forecasting and long-term climate monitoring.

Ball Aerospace is currently leading the design and development effort for NOAA's JPSS-1 satellite, the follow-on to Suomi NPP. As the next generation polar orbiting satellite, the Joint Polar Satellite System (JPSS) mission will provide essential data for civil and military weather-forecasting, storm tracking, and climate-monitoring. The data from JPSS-1 will be used by the National Weather Service in models for long-term weather forecasting and will allow scientists and forecasters to monitor and predict weather patterns with greater speed and accuracy. JPSS-1 is also a key contributor to long-standing climate measurement continuity.

The National Oceanic and Atmospheric Administration (NOAA) is responsible for the management of the satellites and instruments associated with the JPSS. NASA is the program's procurement agency and leads the acquisition for JPSS. Data and imagery obtained from the JPSS will increase timeliness, accuracy, and cost-effectiveness of public warnings and forecasts of climate and weather events, thus reducing the potential loss of human life and property and advancing the national economy. JPSS-1 will also fly a suite of advanced-technology remote sensing instruments similar to those on Suomi NPP.

Less than six months after launch, the Suomi NPP fixed-price satellite bus has solidified its role as the trail blazer for the next generation of polar operational satellites.

Kay Sears President Intelsat General

Kay Sears, President of Intelsat General, is responsible for implementing the company's strategic and operational plans and for the overall mission of providing a range of sustainable, cost-effective and secure communications solutions to government and commercial customers.

She has worked more than 22 years in the satellite communications industry, including extensive experience in rapid-response solutions for both military and civil agencies of the U.S. government. Ms. Sears has spoken widely on how commercial satellites can be utilized by the military to solve mission-critical needs and she has worked over the past several years to advance the commercial / DoD partnership. In 2009, Ms. Sears was appointed to the President's National Security Telecommunications Advisory Committee (NSTAC) to provide information, technical expertise, advice and guidance regarding issues that may affect national security telecommunications capabilities.

Before joining Intelsat, Ms. Sears helped launch government services business units at both G2 Satellite Solutions and Verestar. She has also held sales and product development positions with Intelsat and Comsat World Systems. Ms. Sears has a Masters in Business Administration from George Washington University and a Bachelor of Science from the University of Richmond.

Ms. Sears is currently serving on the Board of the Space Foundation, an international non-profit organization and the foremost industry advocate for all sectors of the space community.

MilsatMagazine (MSM)
Thank you for taking the time to chat with our international audience, Ms. Sears. One point of conversation online in various blogs and mentioned when we are "out and about" at industry events is the sparsity of women in engineering and leadership roles throughout the SATCOM environs. Obviously, this "glass ceiling" has been totally destroyed by you in your leadership roles. This is a two part question: How did you manage to acquire your role with this important Company?

Kay Sears
I have been extremely fortunate in my career to work for excellent companies and, even more importantly, to have managers who were truly interested in developing my career. I did not experience the "glass ceiling" and always pushed myself to take on that next challenge or responsibility. I think for the most part, strong performance is rewarded. In today's market, companies can't afford not to.

MSM
In your opinion, what recommendations do you have for women to move forward into new and exciting roles in SATCOM?

Kay Sears
I think women tend to underestimate themselves, or maybe they experience stereotypes. It is critical that women make their objectives known and that they understand what it takes to get to that next level. Maybe it is additional education or a particular skill set or experience. When you know what it takes, you can set your plan in motion.

MSM
And what course work should women in school and college focus on to gain the education necessary for such roles as the industry moves forward?

Kay Sears
The killer combination in our business is a technical foundation in engineering with a business degree on top. I might add some IT expertise into the mix now given the "networked" world that we operate in and the growing importance of secure systems.

MSM
The preceding question is also part and parcel of a larger industry dilemma, that of locating and hiring the best trained professionals for positions within a company. With the sciences and technology schooling failing miserably throughout our nation's public school systems, how can our industry promote and encourage STEM training for our youngsters? And, how can we encourage youngsters to look to SATCOM and the space industry as exciting careers?

Kay Sears
It is incumbent upon all of us in the space industry to mentor young professionals and build awareness at early ages to the wonders of space, and the many ways in which it touches our lives, not to mention our freedoms. I suggest you look at what organizations like The Space Foundation are doing to expose young people to space and science, and to help teachers provide engaging lessons and experiments. Every company can help by introducing intern programs and scholarships, hosting family days and offering facility tours to local schools. It doesn't take much to get young people excited about space—space is cool.

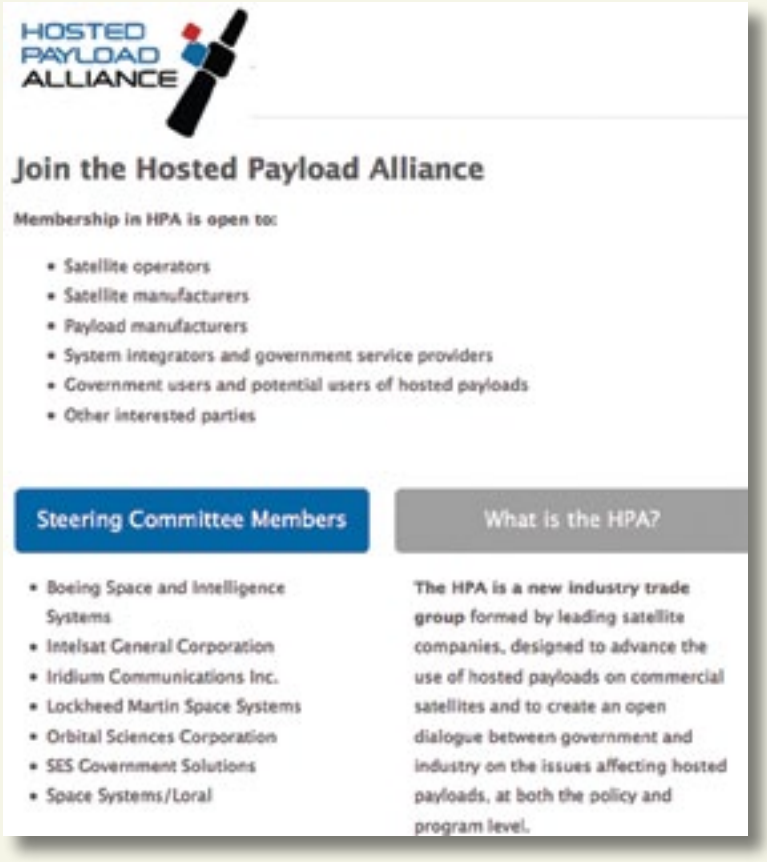
MSM
Would you please explain your responsibilities as the President of Intelsat General?

Kay Sears
As the President of Intelsat General, my main focus is to develop, along with my team, a vision for the company. I look at what direction we want to go in order to grow our company and provide the most advanced services and technologies possible to our customers. Specifically, my responsibilities are to run the day-to-day operations of the company, much like a General Manager. I am responsible for Engineering & Operations, Accounting & Finance, Sales & Marketing, Business Development, Procurement and Contracting, Legal and Human Resources. I have a fantastic management team that obviously is a big part of the success of IGC.

MSM
How did you develop the necessary experience to lead the Company? And what is your background in product development and customer relations?

Kay Sears
My career in the satellite industry started at the Department of Commerce where I was first exposed to satellites…weather satellites, but then I made the jump to COMSAT and entered the world of communication satellites. Despite always wanting to be an engineer (I couldn't pass the Math classes), I did develop a deep technical understanding early on. My personality led me to Sales and I worked on the commercial side for many years. When the Gulf War happened, we realized that the U.S. Government was a big potential customer and they had growing requirements. So I left the commercial side of the business and focused on the government market.

Listening to the customer is the first key for successful product development. Understanding their needs allows you to anticipate their future requirements and be ready with the services they want to buy. In satcom, this might be a particular coverage or feature like steerable beams. Developing a dialog and relationship with the many facets of the Government and military



has been challenging because we are not a major integrator with large programs of record. However, we have introduced concepts like hosted payloads and cost-effective space procurements that are enticing to this community and so there is a growing dialog and understanding of different business models. Customer relations takes time and trust and while we have earned our stripes in supporting the military in the current war efforts, there is so much more we can do for them.

MSM

The current cutbacks in military and government budgets by this administration in Washington DC must be a new and deeper wrinkle for commercial entities operating within these confines. How will Intelsat General, and Intelsat itself, manage these new variants, especially with future contracts?

Kay Sears

All of us in the government space market are in the vanguard of a challenging new era. Very difficult questions that haven't been relevant for over a decade will now need answers. What programs do we keep? Which do we cut? Are there better, more efficient ways to accomplish a particular mission?

Answering these questions represents a true culture change for many of our customers.

It's been well established that individuals work through stress and grief in phases—Denial, Anger, and eventually Acceptance. We're at the initial phase of the government's reaction to the new budget culture for space, which I'd call Hunkering Down. It's a natural impulse when faced with choices that have no easy answers. The walls come up, and the focus is on saving "our" programs.

It's understandable, but unfortunate. Not only does this impulse prevent reaching out for help, but it also becomes such a focus that executing on the mission suffers. Hunkering Down also prevents any coordination among branches of the military, hurting chances for a coordinated and strategic response to this country's space challenges, especially the balance of MILCOM vs. COMSATCOM.

There have been some encouraging signs of change. It was a major goal of the 2010 National Space Policy to make more and better use of commercial networks that are already operational, proven and ready for use today. How we're supporting the Navy through our CBSP program is a good example of that kind of approach.

Additionally, the DoD is sub-leasing UHF capacity on the Australian Defense Force's (ADF) hosted payload on board the soon-to-be launched Intelsat-22 spacecraft. This hosted payload is saving the ADF over $150 million and cutting years off deployment time. The U.S. Government could realize similar benefits by leasing hosted payloads directly from commercial operators, and indications are that they are slowly moving in that direction.

Programs like these are why I'm optimistic about the future, despite the tough budgetary climate.

MSM

There are many facets to Intelsat General...are there any particular areas that are the most appealing to you?

Kay Sears

Based on the changing relationship with the U.S. Government and the growing demand for satellite capacity, we see hosted payloads, and ISR, specifically UAVs, as key areas that we will support.

For hosted payloads, we see some very encouraging signs within the government. First, we are preparing to launch the UHF hosted payload for the ADF on IS-22. This is scheduled for late March and will give the Australians much needed UHF capacity to support tactical communications. This payload will also provide the U.S. DoD with additional capacity as part of their contract with the ADF. In addition, we see leadership in the U.S. Government moving in a positive direction. For instance, the addition of a hosted payload office within the U.S. Space and Missile Systems Center is sending a very clear signal to commercial operators. This needs to be followed by action, but it is clear that hosted payloads are becoming a central part of the dialog on how to affordably address space missions.

Increased UAV construction and use is a huge growth driver for the satellite communications industry right now. The withdrawal of troops doesn't mean that reconnaissance needs will decrease and we see some cases where they will even go up. As some DoD officials have recently said, fewer boots on the ground means more eyes in the sky.

At the same time, civilian use of UAVs is on the rise. And, with the increased budget pressures on the U.S. federal government, other governments may become more interested in financing their own UAV efforts, which will be good for the market as a whole.

We also see communications on the move as an important opportunity to support our government customer. They have come to depend on their ability to send and receive data from any location, and they need high data rates to do so as effectively as possible. We are looking at many ways to use our fleet of satellites to support this requirement.

MSM

How can the Department of Defense (DoD) more effectively use commercial satellite operators to meet the growing demands of UAVs/UAS communication and ops?

Kay Sears

Demand for UAVs and bandwidth to support them would be a good place for the DoD to start working with commercial operators more effectively. These platforms have changed the communications landscape dramatically over the last 10 years. They require large amounts of bandwidth to carry the data and video they collect and transmit to support intelligence gathering. The UAVs enable military users to see this information in real-time from the field. A good example has been the increased capability to monitor roadside bombs that were killing so many troops. Even as the troops are withdrawn from theater, use of UAVs will probably increase to ensure that reconnaissance can continue at the appropriate level.

The commercial satellite industry has enabled the DoD to achieve its missions since it entered Iraq and then Afghanistan, as their own satellite resources could not meet and still cannot meet their demand for satellite communications. On Intelsat alone, they use bandwidth on 11 satellites to support the growing number of drones as well as the sophisticated sensors on them. We are only one provider and, based on this demand, we all play a critical role. The U.S. Government needs to work more closely with commercial operators in supporting the warfighter. By doing so, we can better plan our future satellites to provide the most advanced capability and capacity available. This planning should

also include long-term funding in the budget so that the DoD can get the most cost-effective pricing for these resources.

MSM
There is nothing more important than the ability to save warfighter lives and ensure mission success for our nation and our allies. Where do you see SATCOM and its various related industries heading over the next year or so to cement such necessities in place for our security and defense?

Kay Sears
Satellites provide a critical capability for saving warfighters' lives as satellites send information from the field to military planners for analysis that enables critical decision making. They also send collaborative information from military leaders back to the commanders and the warfighter to enhance their situational awareness.

I see this requirement growing as satellites continue to play a vital role for military communications. There are clear trends that point to bandwidth demand growing even as American troops pull out of current engagements around the world. This will be due to the growing emphasis on special operations and more UAV flights. These kinds of operations demand a different kind of military and superior situational awareness, all of which require more satcom resources.

MSM
Another area of importance is that of hosted payloads... how can hosted payloads effectively address the USG budget constraints for satellite communications?

Kay Sears
Hosted payloads offer government customers an expedited method to access space on an economical basis as compared to stand-alone military satellite programs. By hosting a payload on a commercial satellite, customers share launch, insurance and construction costs. This dramatically decreases the overall cost for the same capability as you could have on a stand-alone bus. While this saves significant amounts of money, the government customer can still have complete control over the payload.

In addition, a hosted payload on a commercial satellite provides government planners with access to multiple launches each year in a variety of orbital locations, providing much needed flexibility in terms of timing, location and types of payloads. All of these factors make deployment of capability faster and more cost effective. The Australian Defence Forces recognized this cost issue and told us that they see a savings of $150M by acquiring a payload instead of building their own satellite.

MSM
Referring to the former question, what procurement changes must the U.S. Government make in order to more effectively, and efficiently, use the commercial satellite sector and subsequently save taxpayer dollars? Is there an example you can relate that shows how a government program's needs were more effectively met through commercial means and application?

Kay Sears
Since the wars began, SATCOM has been funded predominantly by supplemental funding, and often leased on a yearly vs long-term basis. Intelsat has argued for years that the government could realize substantial savings by planning ahead and leasing capacity on a long-term basis. As I mentioned before regarding the savings cited by the ADF, this may seem like small numbers based on the needs to cut billions of dollars from the budget, but every dollar counts and everything should be on the table as the government rethinks its procurement strategies.

The Navy's CBSP network is a great example of how Intelsat General can provide a more comprehensive solution. First, this network is global and operates at multiple frequencies. The Navy needs to add, move, change bandwidth based upon operating conditions—and they need coverage over a lot of blue water. The wideband military systems can, and do, provide some of the critical communications for the Navy, but CBSP offers them flexibility and worldwide coverage that they control. There is no queuing for access or waiting for circuit activations. This type of private, commercial network offers the Navy a robust solution to their needs, utilizing over 17 satellites in Ku-band, C-band and X-band and over seven different teleports.

MSM
There is always a lot of "explanation" necessary by a commercial entity when moving forward through the GSA process. How do you address the claims by the USG that commercial satellite services are more expensive than military satellite services?

Kay Sears
I know there have been many references to commercial satellite services being too expensive to serve the requirements of governments around the world. I believe that two issues are involved here. First, the DoD is buying the majority of commercial satcom on the spot market at short-term rates, which is inefficient and costly to the taxpayer. Since the DoD does not commit to industry for their future requirements, industry cannot customize solutions and the DoD gets what is available. We look forward to the opportunity to propose better pricing when the government gives us any kind of long-term commitment and works with us to plan for their future needs.

The second issue I see relates to how the DoD cites the costs for its military satellite systems. It is difficult to determine how much an overall system costs—end-to-end—when one agency is responsible for the platform and then another for the ground infrastructure, and so on. If these costs were combined with the launch price, on-going operations, and the costs for delay and failures, the costs for the military systems would be much higher. Commercial satellite operators like Intelsat quote prices for satellites that already include all of the elements named above.

I'm not sure if just comparing the costs of milsatcom vs commercial is the only debate. The Government needs their own satellites for certain mission sets, like nuclear command and control. For other requirements and missions, the U.S. Government should consider different procurement approaches. Commercial leasing may be good for a set of baseline communications networks, like the Navy's CBSP, and these should be leased long term because they are not likely to change dramatically over time. The more productive approach is to create an architecture that clearly differentiates what needs to be owned and operated by the Government for security reasons and what can be provided by commercial operators at substantial cost savings.

Commercial SATCOM—
Trusted Partner or Taken for Granted?
by Kay Sears

Commercial SATCOM providers can sometimes come off as being a little whiny. After all, the need for bandwidth by military users continues to surge, and the military has no choice but to rely on commercial SATCOM to support the warfighter. Why don't we all just pipe down, and appreciate the business?

Well, try to put yourself in our shoes. Imagine if you've been doing a job for over 20 years, and doing it very well. Yet you were never given a formal job offer, or even an exact job description of what your role was supposed to be. Plus, you were never given any kind of commitment, never told when you would no longer be needed.

That's the current situation for commercial SATCOM providers. Ever since Desert Storm in 1991 the U.S. military has relied on us to provide the bandwidth required by network-centric combat missions. Back then commercial SATCOM was considered a "last resort," to be used only as augmentation to military SATCOM. Then in 2004, the introduction of UAV flights really turbocharged the need for flexible, reliable SATCOM.

Fast forward to today, and the "last resort" has now become indispensable. But this dramatic reversal of roles has happened without any forthright conversation or planning. As I've previously written for this blog, commercial SATCOM provides the lion's share of ISR-related bandwidth needed by the military. And the need for that bandwidth is expected to double by 2018. So why is SATCOM still being purchased at spot market pricing, which is inefficient and more costly for the American taxpayer?

To be clear, there will always be a need for a partnership in space between commercial SATCOM and SATCOM the military owns and operates for themselves. But even the most optimistic forecasts for military satellite construction and launch have commercial SATCOM playing a major role for at least another decade. And those projections ignore the production delays and overruns that have plagued military satellite programs in recent years.

It's past time for commercial SATCOM to move from temp to perm. Let's have a healthy dialogue that will allow the commercial space industry to make the investments necessary to continue meeting the needs of the warfighter. As the military adjusts to a new budgetary culture, let's work together and realign priorities to match today's ISR realities and commensurate bandwidth requirements.

All we're looking for is some respect and a clear job description going forward. We've earned it.

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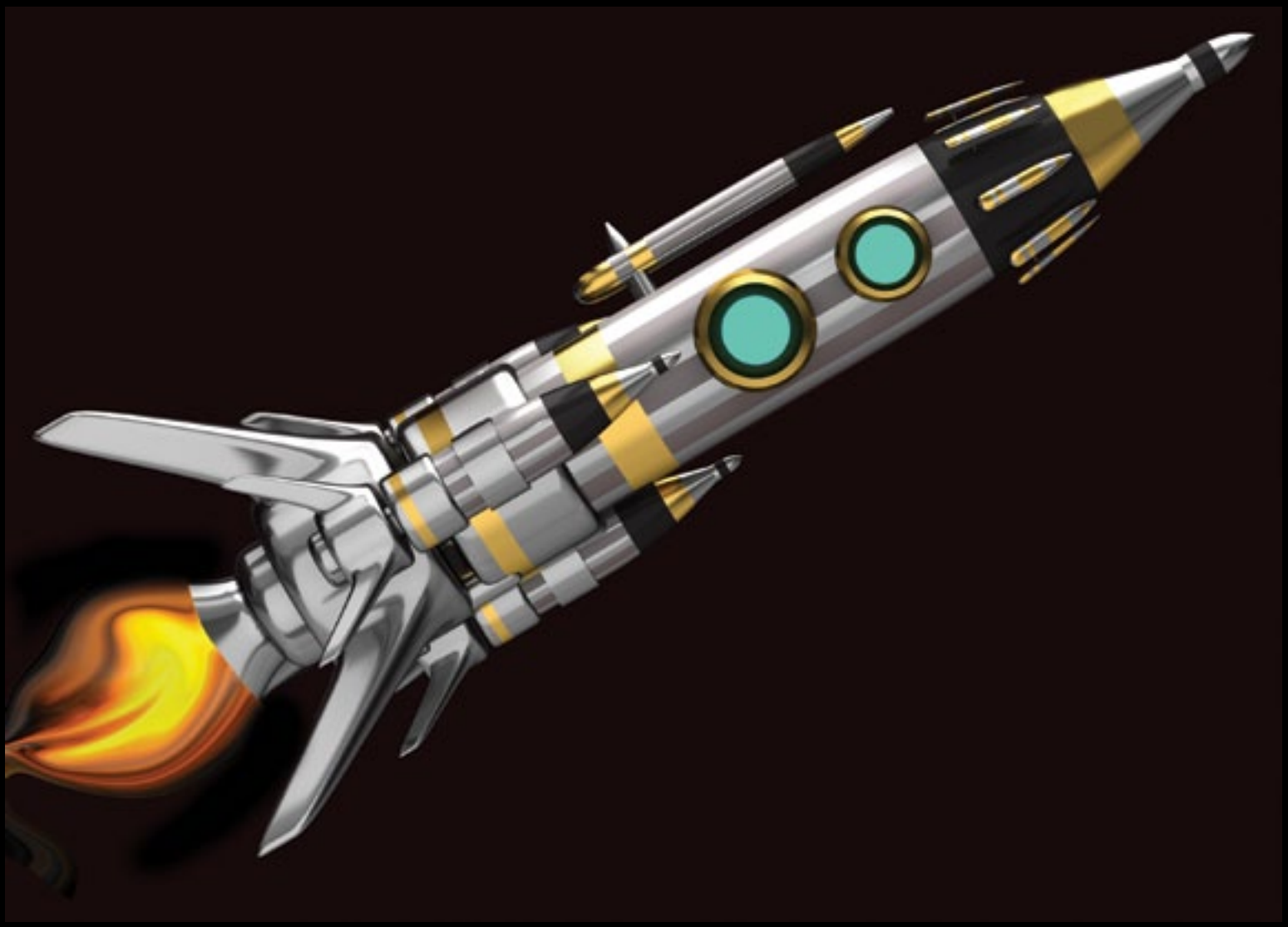
Disaggregation + Diversification Of U.S. MILSATCOM

by Ron Burch, Director, Advanced MILSATCOM, Boeing Space & Intelligence Systems

The history of U.S. MILSATCOM has been one of aggregation of mission capabilities over time. The result has been today's limited number of large satellites of ever-increasing complexity. Core U.S. MILSATCOM will span just 14 satellites by 2020 [Advanced EHF (AEHF): 4, Wideband Global SATCOM (WGS): 6, Mobile User Objective System (MUOS): 4]. Though new capabilities have been fielded and proven valuable, the consequences of this approach have been profound, resulting in fewer assets, increased cost and schedule uncertainties, and increasing delays in the fielding of new capabilities to support the warfighter. Recent budgetary constraints combined with program performance issues have forced a reevaluation of future requirements, procurement approaches, and technology roadmaps.

Additionally, these systems are not tiered, with the only augmentation being polar EHF payloads for protected communications, and leased commercial SATCOM transponders. While there are benefits to an aggregated approach, significant drawbacks have also become apparent in the form of program overruns and delays in the deployment of new capabilities. Long cycle times delay technology refresh and modernization, and this can cause the development of vulnerabilities over time. A disaggregated approach avoids many of these drawbacks by using shorter, focused missions to create a more cost-certain and incrementally deployed architecture to meet mission needs.



The Rise Of Complex Systems

Early MILSATCOM programs were largely single-mission in nature, providing somewhat specific services. Examples of these programs include ***Marisat*** and ***IDSCP*** (**DSCS Phase 1**). Missions were often created around frequency bands best suited for these particular services: UHF for narrowband services, X-band for wideband trunking, and so on. Individual satellites were neither particularly complex nor costly.

The next waves of MILSATCOM included larger, more complex, and more costly satellites: ***DSCS*** (**Phase II, III**), ***UHF Follow-on*** (**UFO**), and ***Milstar***. Capabilities expanded greatly. DSCS provided phased array antennas for robustness and Milstar added on-board processing, agile beam antennas, and nulling antennas, for example. As the satellites grew, so did the required launch vehicle size, and the cost to launch. While early satellites could be launched on small or medium launch vehicles, a highly aggregated satellite such as Milstar required a ***Titan IV***.

As satellite mass is a common metric often used in parametric *cost estimating relationships* (**CERs**) [1], it is useful to examine the evolution of the mass of U.S. MILSATCOM satellites over time. *Figure 1* is an illustration of the mass growth of core U.S. MILSATCOM systems [2] since their inception: narrowband, wideband, and protected EHF systems. Of note are the striking increases in moving between major program blocks, such as those in the late 1980s and early 1990s, a trend that continues today. Systems that increased in mass often added missions, in addition to improved performance and added functionality for the existing missions. ***WGS*** aggregated heritage wideband X-band missions and the Ka-band ***Global Broadcast System*** (**GBS**). ***MUOS*** includes a new *wideband code division multiple access* (**WCDMA**) payload to the legacy UHF payload, creating a hybrid UHF/Ka-band system.

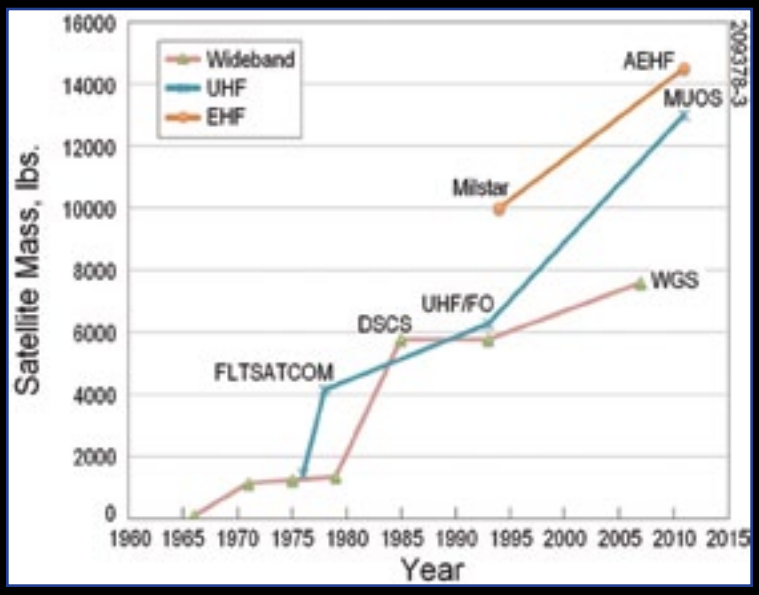


Figure 1. MILSATCOM Satellite Mass vs. Time

The latest wave of MILSATCOM programs began experiencing significant delays and cost overruns early in their development periods. *Figures 2* and *3* show a comparison of cost growth and schedule delay of U.S. space programs, including MILSATCOM programs, over a 15-year period. A conclusion is that with increased complexity, often brought on through the aggregation of mission requirements and resulting capabilities, has come difficulties in adequately assessing cost and schedule risk due to underestimation of the level of technical and programmatic effort required to meet the required milestones as planned.

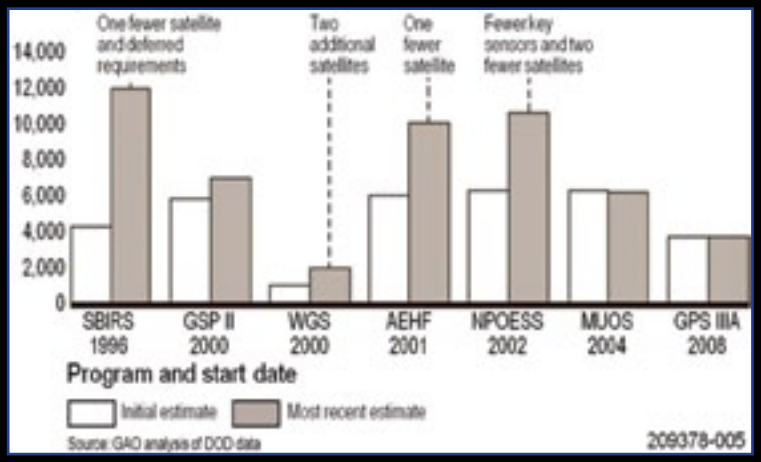


Figure 2. Cost Deltas For U.S. Space Programs (1996-2009) [4]

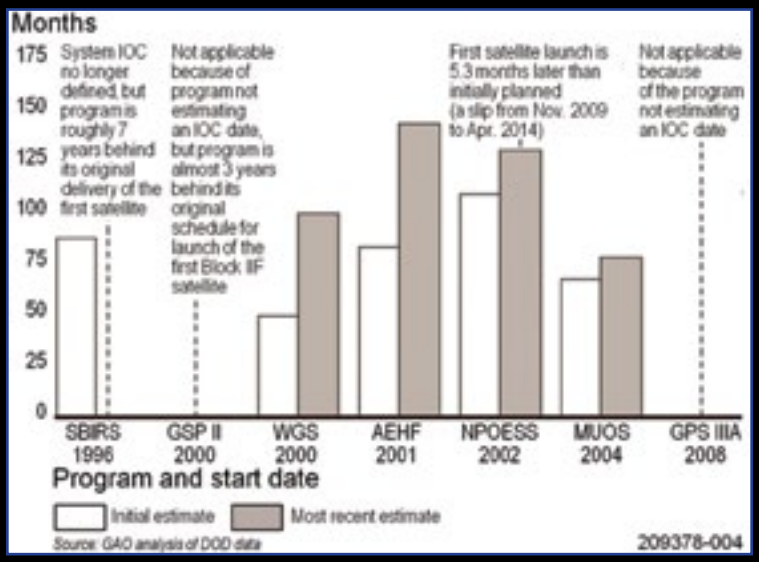


Figure 3. Schedule Deltas for U.S. Space Programs (1996-2009) [3]

In a **RAND Corporation** report to the U.S. Air Force in 2008, this dependence on complexity for space programs was noted as a driving factor in cost and schedule overruns of DoD space programs:

"*The much-increased complexity of military space systems netted together into larger systems of systems posed many new challenges for the space acquisition and cost-estimating communities. The so-called Young Report [5], a widely influential joint Air Force/DoD study published in 2003 on the growing challenges in the space acquisition process, pinpointed the system-of-systems concept involving multiple users and extensive user requirements as a major contributor to the causes of cost growth on military space systems. It noted that the proliferation of users and requirements led to increasingly complex systems of systems, which greatly increased the difficulty of managing cost, schedule, and risk. At the same time, the complexity of individual systems, subsystems and technologies was also increasing, as sensors and other payloads became technologically more sophisticated, and much more complex processing and software tasks migrated to space vehicles.*" [6]

Disaggregation

Alternative solutions and architectures should combat the growth of complexity seen to date. It should have the characteristic that allows growth to be better managed as well. One method of accomplishing this is to evolve more highly disaggregated architectures, in the process introducing greater diversity and flexibility for the Government. *Figure 4* shows an example of such a disaggregated architecture, one that is both distributed and tiered, with a clear hierarchy that is diverse and includes both core assets and augmentation assets.

There are two primary ways to disaggregate or diversify. The first is the decomposition of a large, aggregated system into smaller components. The second is to augment the core system by adding smaller components to create a more diverse and proliferated system of assets. In space terms, a system such as **Iridium**, a global commercial SATCOM service provider, represents the former, while a system such as ***SBIRS*** may be the first step towards the latter (with HEO payloads augmenting the large GEO satellites). Here we examine both, with an example for each: tiered augmentation of the WGS system and decomposition of the AEHF system.

The first case is illustrated in *Figure 5*, and shows the addition of smaller satellites and/or hosted payloads to supplement the capabilities of the core system. In this notional example, the new assets are tailored for specific military Ka-band missions, such as tactical (or intra-theater) **AISR**, **long-track AISR**, and *Communications on the Move* (**COTM**). Specific orbital locations are selected according to immediate COCOM needs and to ensure non-interference with the WGS constellation. The new assets are both hosted payloads and free flyers.

The second case, illustrated in *Figure 6*, shows disaggregation through the decomposition of the existing AEHF satellites into separate satellites or payloads to separately support both the strategic and tactical missions. In this case the resulting satellites are each significantly smaller and less complex than the original.

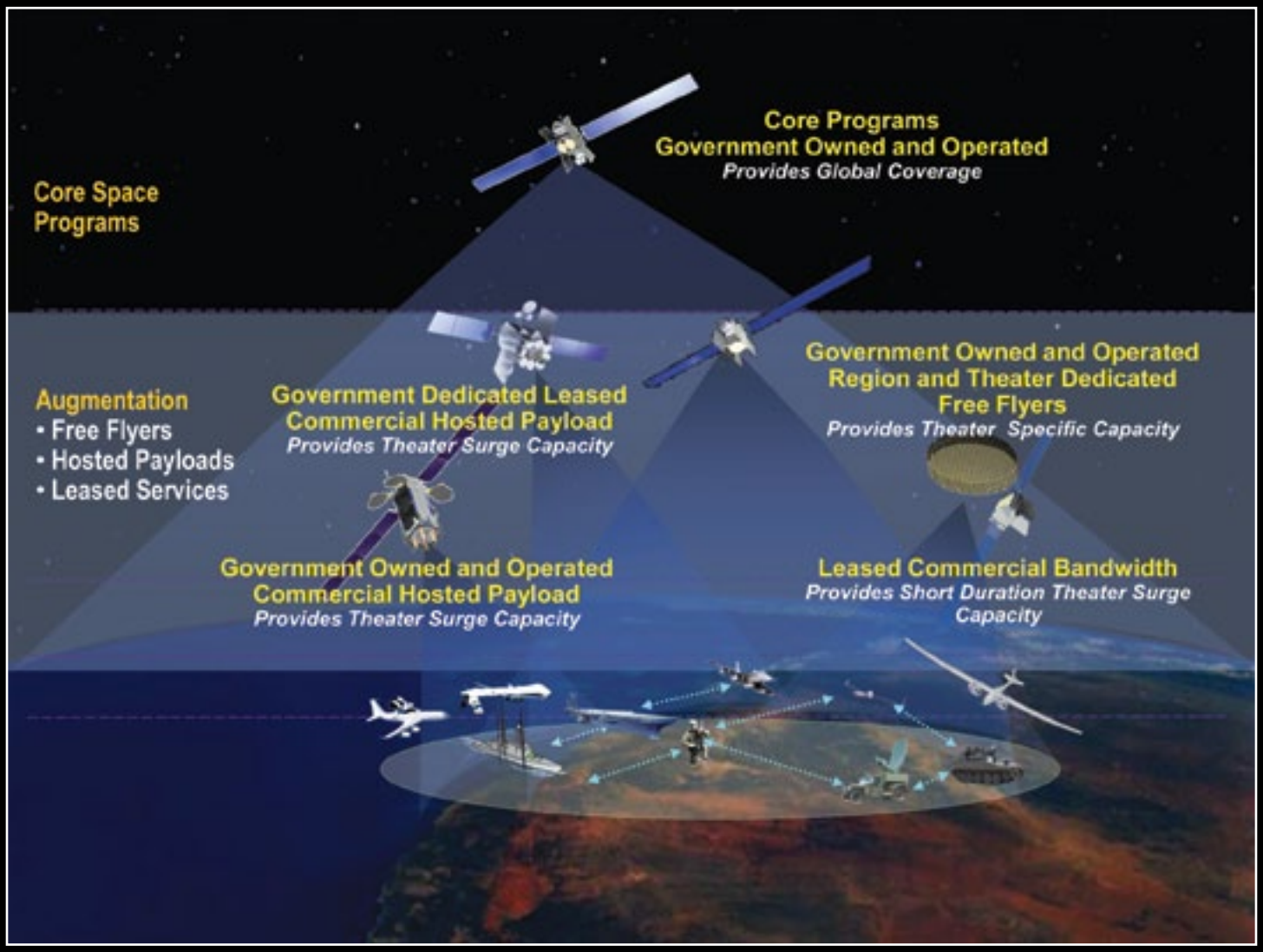


Figure 4. Future Disaggregated, Distributed MILSATCOM Architecture

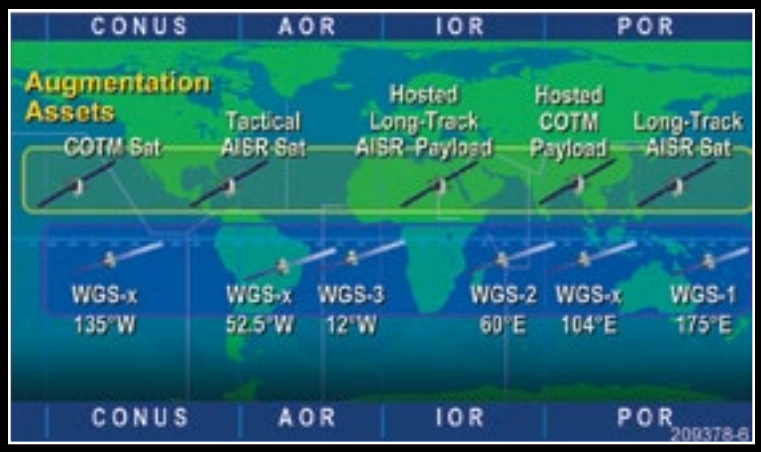


Figure 5. Example of Disaggregation Through Augmentation

Figure 6. Example of Disaggregation Trhough Decomposition

Benefits Of A Distributed, Disaggregated Architecture

Resiliency

Many methods can be employed to make a system more resilient. The Milstar system incorporates autonomous recovery in individual satellites to assure that strategic links are restored within a certain minimum time period following an attack. SATCOM service providers employ on-orbit hot sparing of their commercial satellites to recover from on-orbit failures. A third option is to maintain payloads or satellites in ground storage, available for quick call up for launch on demand to replace lost capability.

Using disaggregation to disperse mission capability among a larger population of satellites and thus limiting the impact of the loss of any single one through system-level redundancy provides a means of achieving resiliency. The level of similarity among satellites is a trade. If all possess the same basic capabilities, then system redundancy may be maximized, and there is less motivation by an adversary to target any specific satellite in the system. If the object is to customize the capability by geographic region, for example, then this benefit may outweigh the desire for strict commonality and associated cost savings.

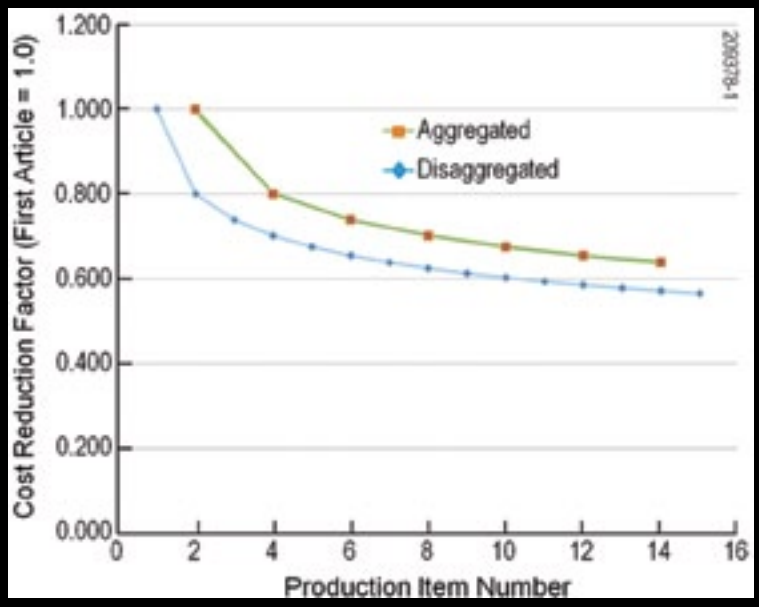


Figure 7. Comparison of Learning Curves

Cost

A distributed architecture should be cost competitive with existing systems to be attractive. When considering the benefits, cost must be considered; although in the end this may not be the most compelling factor in selecting the optimal degree of disaggregation. In addition, there is value in increased cost certainty for budgeting purposes, as well as overall cost.

Three major cost components dominate the space segment's total cost: the developmental (non-recurring) cost, the production (recurring) cost, and the launch cost. Each of these costs is highly correlated to the size and complexity of the satellite. These costs are also influenced by longer timelines for large, complex programs that have certain required fixed costs for large organizations such as program office, contracts, security, and other functions that do not directly affect the end product. As program timelines lengthen, these fixed costs increase proportionally. Thus it is always beneficial to execute in the shortest span possible.

Developmental costs: The *non-recurring engineering* (**NR**) costs in the developmental phase are usually much higher than the recurring cost of the first satellite (T1). Typical NR/T1 ratios for space programs are historically greater than 2:1. A number of recent studies have shown correlations between development costs and complexity for both software and hardware [7]. Generally this cost relationship is not linear, but becomes somewhat exponential at a certain level of complexity. Smaller, disaggregated payloads and satellites have the potential to maintain a complexity level below the knee of the curve. To attack developmental costs, we need to attack complexity, and its collateral impacts upon system development.

Production costs: The *recurring engineering* (**RE**) costs track more linearly with satellite size and complexity. As there are certain base costs associated with individual satellite builds, including program management and systems engineering, this cost element may favor the larger satellites, given similar technologies. On the other hand, the larger quantity of smaller satellites and payloads will yield some accelerated learning curve and greater block buy cost efficiencies.

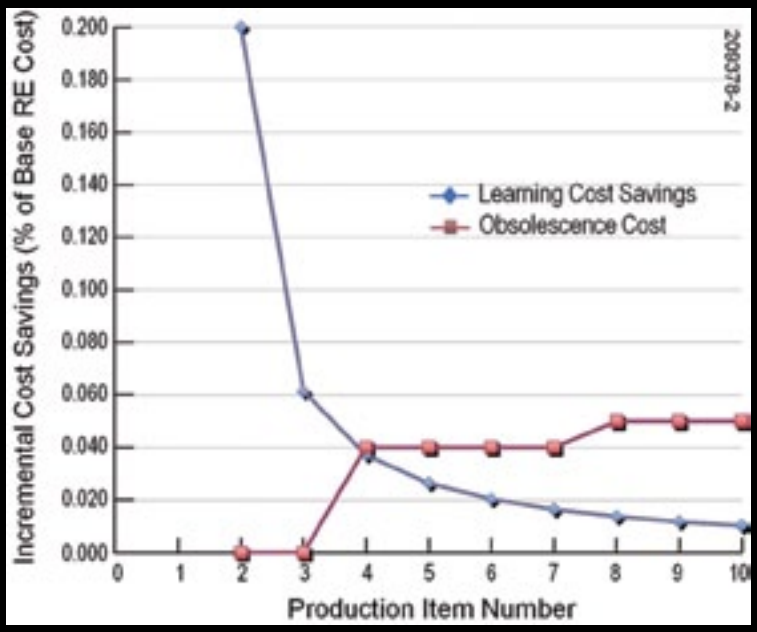


Figure 8. Learning Curve Savings vs. Obsolescence Cost

Consider a satellite with a recurring cost of $1B. If the satellite could be disaggregated into two identical satellites costing $500M each, and each built in half the cycle time, we can compare the effect of the learning curve as shown in *Figure 7*. It is common to use an 85 to 90 percent cumulative average learning curve for aerospace programs [8]. A 90 percent factor was used in this example. As we see, the learning benefits will be realized sooner with the smaller product.

In this case the smaller satellites' total cost is $3.5B for 10 items, while the larger five satellites would cost $3.9B, or about 11 percent more, due solely to fact that the higher volume of the smaller product takes greater advantage of the learning curve than for the shorter production run. And the functionality of the disaggregated satellites would be deployed more quickly than with the aggregated case, as half increments could be fielded twice as fast.

Eventually, learning curve savings and production efficiencies are offset by obsolescence costs during long-term production. Unless a lifetime buy is made for high-reliability and high value parts, obsolescence costs will increase the recurring cost over time and add some non-recurring costs for redesign as well. At some point the flattening of the learning curve may result in obsolescence costs overcoming any future learning curve savings. It can be argued that at this point the continued extension of the product is costing the program without returning value other than the immediate cost avoidance of non-recurring engineering to modernize the product design. The arrival of this cross-over point, notionally illustrated in *Figure 8*, is one indicator that the product may be past its useful life and requires a major redesign.

Maintenance of skill sets and material inventory is also more difficult with longer cycle times. If obsolescence can be contained, the larger satellite is more likely to enjoy a slight cost advantage for recurring costs. However, by that time, another evolutionary block upgrade is likely to have occurred, effectively resetting the learning curve again.

Launch Vehicle	Launch Price ($M)
Atlas 5/Delta 4 EELV	$200M [9]
Delta II	$95M [10]
Proton M	$85M [11]
Falcon 9	$60M [12]

Figure 9. Comparison of Approx. Launch Costs by Launch Vehicle

Launch costs: Launch costs represent a significant percentage of the total space segment cost for Government programs. Disaggregation results in a greater number of launches. If launch cost was directly proportional to lift capability, launching twice as many satellites of half the size and complexity at half the cost would be roughly equal to launching half of the number of aggregated satellites. However, launch vehicle cost is not proportional; there are a limited number of options with fixed capacities available. U.S. space policy further limits the allowable launch vehicles for MILSATCOM satellites to U.S. supplied items only.

Figure 9 shows a comparison of several medium and heavy launch vehicles (MLVs) suitable for launch to GEO. For the U.S. EELV launch vehicles, the launch cost is amortized over a large number of launches and thus there is little benefit in using a smaller vehicle. The ***Delta II*** is still available, though, at reduced cost for medium payloads. If non-U.S. launch vehicles can be considered, the number of alternatives for medium launch vehicles (MLVs) expands (*e.g.,* ***Proton M***), and lower prices can be found. In the future, new U.S. entrants such as the **SpaceX *Falcon 9***, with a price of $60M, could further encourage launches of smaller assets much more affordably. If smaller satellites could allow a dual-manifest launch, the cost for a single satellite could drop to $30M.

The introduction of hosted payloads can also significantly improve affordability. Hosted payloads are MILSATCOM payloads hosted as a secondary mission on either existing U.S. Government or commercial satellites. For smaller payloads, hosted payloads will in many cases prove to be a more affordable alternative, due to the cost sharing associated with fixed costs such as launch and accommodation costs and a hosting fee. These are balanced against the free flyer cost of the spacecraft bus and full cost of the launch vehicle. The reduced cost for hosted payloads will at least partially balance the greater number of assets in the disaggregated architecture.

Figure 10 illustrates the relationship between cost per capacity and payload size and capacity for both hosted payloads and free flyers. Actual cost values will be highly dependent upon the specific mission(s) and overall payload design and capacity. Free flyers can maximize affordability by more completely using available satellite and launch capacity at reduced cost per

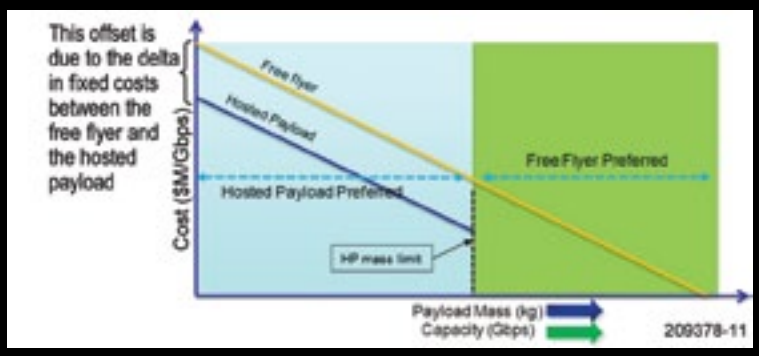


Figure 10. Cost Comparison for Hosted vs. Free Flyer

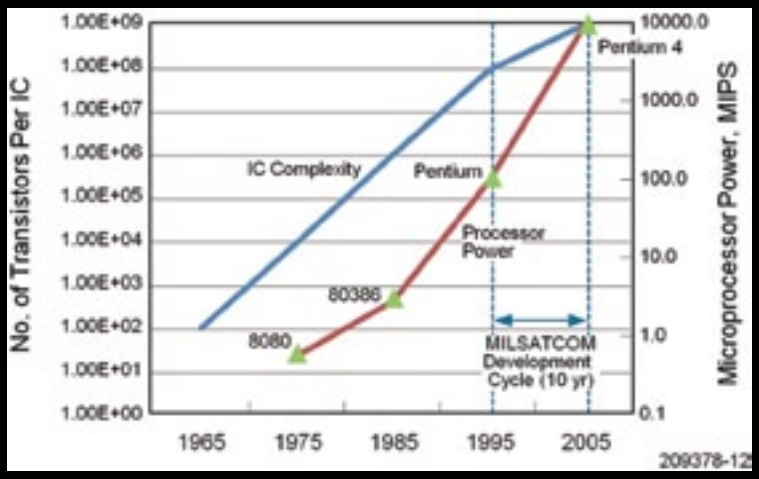


Figure 11. IC Complexity and Processing, Power vs. Time [13]

communications throughput (*e.g.,* $M/Gbps) but sacrificing some mission flexibility.

Other costs: Other cost advantages may be realized by disaggregating missions. In the case of nuclear hardened missions such as AEHF, disaggregation provides an additional cost reduction. The combination of strategic and tactical missions levies a survivability tax on shared hardware (including the bus) that must meet the more stringent nuclear requirements. Disaggregating frees the tactical payload of those requirements.

Though the focus here is the space segment, attendant ground segment and mission planning costs may also rise with a more disaggregated architecture. However ground assets are generally more scalable, and can often be shared among many spacecraft. In addition, today's highly networked terrestrial systems provide extensive interconnectivity to allow coordination of system management activities.

It is clear that many factors influence the system life cycle cost, some positively and some negatively. The challenge is to develop a solution that takes advantage of the more affordable aspects of a distributed architecture.

Security

Disaggregation also can respond to the need to be more agile by more rapidly fielding new capabilities in response to changing threats and environments. Programs with long cycle times effectively remove the option of rapidly making changes to counter the moves of an adversary if a new vulnerability appears.

One response to this concern has been to add flexibility to MILSATCOM payloads such that they can be reconfigured from the ground. Specific examples include the inclusion of more on-board digital processing and software, and configurable components such as phased array antennas. While these all provide flexibility, they do not necessarily add capabilities, and all represent cost and schedule drivers to the program, extending cycle times even further. Though software content in space continues to increase, a significant amount of functionality is determined by *application specific integrated circuits* (**ASICs**) and firmware, neither of which can be modified after launch. In the distributed world, smaller responsive payloads could be launched to augment the core missions with very specific capabilities in a much shorter

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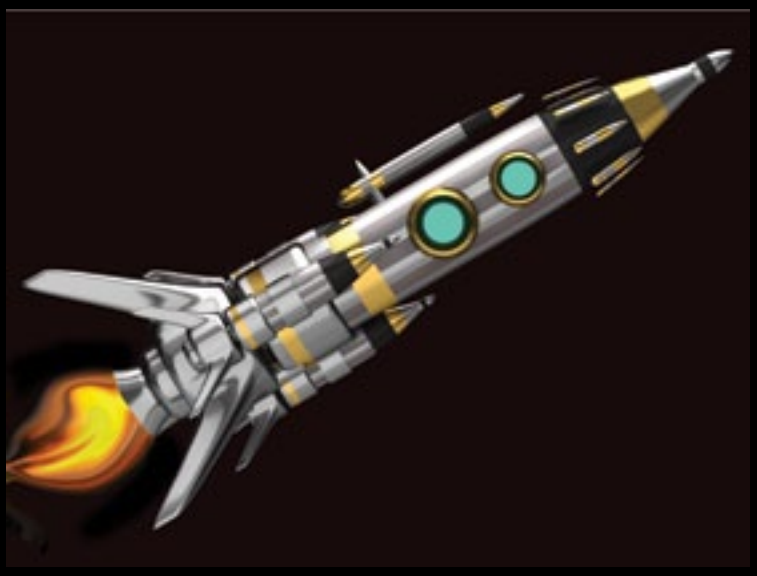
period of time, addressing new vulnerabilities in a time-critical manner, resulting in improved security. To borrow a term from the software world, this would effectively be a "security patch" at a system level.

Technology Refresh + Modernization
Disaggregation also provides more technology insertion opportunities with reduced risk for any single opportunity. With only a relatively small number of satellites, the opportunity to enhance the products are limited. In fact, as the number of assets shrinks, there is more conservatism, leading to upgrades only occurring as major block changes, which can take a decade to implement. With smaller satellites, there is a reduced risk of inserting new technologies for each, including demonstrations. The larger, core programs can be less disturbed, integrating new capabilities at a planned interval, after the viability of the technology has been proven. This allows technology development and demonstration to be effectively decoupled from larger, ongoing operational programs.

Examples of technology evolution applicable to space payloads are the increased speed and density of microprocessors, increases in power efficiency for a wide variety of semiconductors, and the higher capacity of solid-state memory. Cycle times for incremental improvements of these parameters are often between 12 and 24 months. *Figure 11* summarizes the rate of growth in *integrated circuit* (**IC**) complexity and processor power over the period 1965 through 2005. These gains are realized in the designs of spacecraft digital processors, digital storage units, encryptors, sensors, and other functional blocks, among others. The disaggregated architecture can also provide functionality and capabilities that are difficult to implement with more aggregated ones. In particular, modern networks, including the terrestrial and cellular systems, and the Internet, depend upon distributed architectures. These architectures allow for high levels of redundancy, yielding extremely high availability. A trait of these networks is a large number of nodes. Network utility increases in such networks proportional to the number of nodes [14]. If the future is to include space-based network extensions of the Global Information Grid (GIG) beyond simple transponded services, then an increased number of nodes will be highly desirable.



Challenges

System Management
Mission planning segments will need to be expanded to accommodate more payloads and satellites in the distributed world, encompassing core assets, hosted payloads, and smaller free flyers. Coordinated responses will still require a centralized mission planning element, but with potentially many more interfaces. Capabilities may be distributed so that command and control systems will have to be smarter to be aware of the inherent capabilities of each asset relative to the entire system. New or expanded planning tools may also be required. In certain cases, single-mission payloads may be operated independently, though, without substantial coordination with other existing systems.

Additional systems engineering will likely be required to develop the more detailed CONOPS for disaggregated MILSATCOM systems. This includes the work required to allocate mission capabilities among distributed assets, such as core and augmentation, to produce a requirements set for each, and support the tiered architecture concept. While not absolutely required, this process is more likely to ensure higher value to the Government by reducing duplication of capabilities among the various system elements.

Spectrum Management
Spectrum management is already challenging in many military and commercial frequency bands worldwide. Modern technologies and techniques have continued to allow satellites to be placed ever closer to one another in the GEO belt, but closer frequency coordination continues to be required to limit interference. Disaggregation will continue to complicate spectrum use, with more payloads in operation than ever before. One benefit of disaggregated systems is that they will inherently provide the opportunity for greater frequency reuse due to spatial isolation in the GEO belt allowing greater capacities in smaller theaters. It is also easier to plan and operate single-frequency systems at a single orbital location than multi-band systems.

SUMMARY
Full or partial disaggregation and diversification of existing MILSATCOM systems can provide significant benefits including increased cost and schedule certainty, reduced execution risk, improved security, increased resiliency and responsiveness, and the ability to more quickly integrate and demonstrate new technologies to avoid obsolescence. Challenges include providing effective mission planning and system management of a greater number of resources and coordinating their operation globally. While some key missions will always require a certain number of more exquisite satellites, a more diversified, disaggregated mixed architecture that prominently features less complex satellites and hosted payloads appears to have significant benefits to the U.S. Government.

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Implementing The National Security Space Strategy

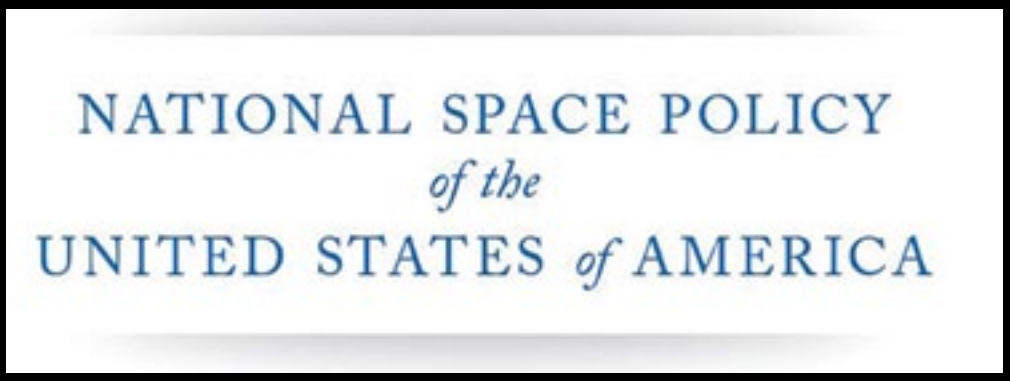
by C. Robert Kehler, General, U.S.A.F.

The *U.S. approach to implementing its national space policy will determine its future course in space. Will our nation act as a collaborative partner that leads by example? Or will we try to move forward unilaterally in space? What steps should the United States take today to ensure security in space for the future? General C. Robert Kehler, the commander of U.S. Strategic Command provides his perspective on the implementation of the National Security Space Strategy as a means to promote international cooperation, establish norms, and provide mission assurance for space-delivered assets vital to U.S. leadership.*

Leadership has been a defining hallmark of the U.S. space effort since the beginning of the Space Age. From *John F. Kennedy*'s bold challenge to put a man on the moon by the end of the 1960s, to our military's unprecedented use of space-based capabilities, to the evolution of the *global positioning system* (GPS) as a free global utility, the United States has aspired to—and attained—a leadership position in space, deriving significant benefits across the spectrum of scientific, military, commercial, and civil activities.

Our dependence on space has never been greater, yet our nation faces a new global security environment and strategic turning point that, if not addressed, will challenge our continued leadership and place increased stress on our ability to preserve the benefits we have come to rely on from our space capabilities.

Many of the challenges are obvious: an austere fiscal environment where we will likely be expected to do more with less; a congested space environment where more than 20,000 man-made orbital objects are increasing the demand for better situational awareness; a contested security environment where freedom of operations and access will be far from guaranteed; and a competitive international environment where our space industrial base—still the best in the world—will have to innovate and adapt to produce the capabilities we need in the future. Still other challenges may not be as obvious; therefore, we must also become more agile, flexible, ready, and technologically advanced to prepare for the possibility of strategic and operational surprise.



The reason for our concern is clear. Space capabilities offer the United States and its allies unprecedented advantages in national decision making, military operations, homeland security, economic strength, and scientific discovery. Space systems provide unfettered global access and are vital to monitoring strategic and military developments as well as supporting treaty monitoring and arms control verification. Space systems are also essential to our nation's ability to respond to natural and man-made disasters and to monitor environmental status and trends. When combined with other capabilities, space systems allow joint forces to see the battlefield with clarity, navigate with accuracy, strike with precision, communicate with certainty, and operate with assurance.[1]

Preserving the national security advantages we derive from space is critical to modern military operations and our future success and remains a key objective of the United States. The **Department of Defense** (**DoD**) recently reaffirmed this imperative. In his new strategic guidance, Secretary of Defense *Leon Panetta* emphasized the need to operate effectively "in cyberspace, space, and across all domains."[2] Similarly, the new guidance stresses the United States' intent both to "work with domestic and international allies and partners and invest in advanced capabilities to defend its networks, operational capability, and resiliency in cyberspace and space" and to continue to lead global efforts to "assure access to, and use of, the global commons" (including space).[3]

U.S. Strategic Command (**USSTRATCOM**) is one of the key organizations charged with preserving these advantages in the face of the changing strategic environment, and we are using the *National Security Space Strategy* (**NSSS**) as our guide. Although USSTRATCOM is not assigned a specific geographic *area of responsibility* (**AOR**), our scope of responsibility stretches from beneath the sea's surface (where our strategic ballistic missile submarines operate) to 22,000 miles above the Earth's surface.

USSTRATCOM's diverse responsibilities in space include:

- Planning and conducting military space operations
- Advocating for space capabilities
- Representing U.S. military space interests internationally
- Assisting human spaceflight operations
- Providing warning and assessment of any attacks on space assets
- Conducting space situational awareness operations that benefit the U.S. public and private sectors, human spaceflight, and—as appropriate—commercial and foreign space entities

These critical responsibilities are more important than ever, given the significance of space to our globally networked approach to deterrence and warfare. Future conflicts will, of necessity, be multidomain in nature and require more than one command's actions. Capabilities like space, which assure so many mission-critical capabilities, are powerful force multipliers. Space is essential to, and a great strength of, an interdependent joint force, assuring key missions and expanding the benefits derived from limited resources.

The Changing Strategic Environment + Space

The Space Age began in the context of the Cold War. Yet despite tensions that characterized their relations throughout the early days of the Space Age, the United States and the Soviet Union, in a surprisingly cooperative manner, signed the 1967 *Outer Space Treaty*. All parties to this treaty agreed outer space would be free for access, exploration, and use by all states; celestial bodies in space would be free from national appropriation or military bases, fortifications, exercises, and testing; that states would refrain from placing in-orbit around the Earth nuclear or other weapons of mass destruction.[4] These principles continue to serve as the foundation for our approach to the space domain.

Access to space and space capabilities during most of the Cold War, however, was limited to states with the technological and economic means to get there—namely, the two Cold War superpowers. The United States deliberately turned to space to meet some of the most difficult and unique security problems of the Cold War. As a result, it produced space capabilities that yielded unprecedented strategic advantages.

Space provided a "global perspective" to allow the United States "access to large areas of the Earth's surface," especially those areas denied to conventional terrestrial capabilities and forces.[5] In particular, space capabilities afforded U.S. decision makers with access to information, including force status and overall battlespace awareness, at a rate which most other states could not (and in most cases cannot yet) achieve. Along with assured command and control, these capabilities ensured senior U.S. leaders maintained a decision-making advantage over potential adversaries. Space also provided the primary means to warn of nuclear ballistic missile attack, monitor treaties, and connect the president to the nuclear retaliatory forces.

By the start of the 21st century, the de facto monopoly the United States and one other superpower shared disappeared. Advances in technology and commercial growth reduced the cost for nation-states and nonstate actors to gain access to space and space capabilities. Indeed, the National Security Space Strategy notes, "There are approximately 60 nations and government consortia that own and operate satellites in addition to numerous commercial and academic satellite operators."[6]

However, at the same time technological advances allowed friend and foe alike to develop capabilities to derive their own benefits and advantages from space, potential adversaries became keenly aware of the advantages space provided for the United States. The world watched as military operations such as **Desert Shield/Desert Storm** demonstrated the value of "strategic" space for operational and tactical use, and they became equally aware that America's reliance on space may also be a vulnerability to exploit. As a result, some seek to exploit a perceived overreliance by the United States on space by developing capabilities to prevent access to, and use of, space capabilities in order to deny or limit our overall military, economic, and technological advantage.[7]

As states continue to pursue benefits from space to enhance and secure their national interests, competition will only intensify,[8] and the United States may find it more difficult to guarantee its access to,

and use of, space capabilities. Unless we act, this may adversely affect our ability to secure our national security interests and maintain our economic, military, and technological leadership advantage. The National Space Policy (NSP) and the National Security Space Strategy outline objectives that are intended to ensure the United States continues to realize the significant national security benefits of space.

National Space Policy + National Security Space Strategy

The National Space Policy, released by President *Obama* on June 29, 2010, establishes the goals that the United States will pursue in its national space programs. They are "energize competitive domestic industries; expand international cooperation; strengthen stability in space; increase assurance and resilience of mission-essential functions; pursue human and robotic initiatives; and improve space-based Earth and solar observation."[9] The integrating fiber woven throughout the NSP is that the United States should "help to assure the use of space for all responsible parties."[10]

Building on the NSP, in January 2011, the secretary of defense and the *director of national intelligence* (**DNI**) promulgated the *National Security Space Strategy*, which "seeks to maintain and enhance the national security benefits" resulting from U.S. actions and capabilities in space. To achieve the tasks assigned by the NSP, the NSSS established specific objectives to "strengthen safety, stability, and security in space; maintain and enhance the strategic national security advantages afforded to the United States by space; and energize the space industrial base that supports U.S. national security."[11]

The Five Pillars Of The NSSS

The National Space Security Strategy provides the roadmap for implementing U.S. space policy and achieving our objectives in space. It consists of five core principles, or pillars, which prescribe the framework within which USSTRATCOM and others will act:

1. Promote the Responsible, Peaceful, and Safe Use of Space

The first pillar of the NSSS calls for the United States to "lead in the enhancement of security, stability, and responsible behavior in space" and to develop transparency and confidence-building measures that will "encourage responsible actions in, and the peaceful use of, space."[12] As outlined in the NSP, specific actions include domestic and international measures to promote safe and responsible operations in space; improved information collection and sharing for space object collision avoidance; protection of critical space systems and supporting infrastructures, with special attention to the critical interdependence of space and information systems; and strengthening measures to mitigate orbital debris.[13]

Central to this pillar is the opportunity to begin the necessary dialogue among international space-faring participants on the development of a foundational set of standards, norms of behavior, and best practices designed to promote the safe and responsible use of space. Defining responsible behavior could, over time, discourage destabilizing acts that threaten the overall safety, stability, security, and sustainability of the space environment. USSTRATCOM is actively engaged with the Office of the Secretary of Defense and the Joint Staff to examine and propose a variety of measures that could strengthen international stability and security as well

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as increase the safety and sustainability of space operations.

2. Provide Improved U.S. Space Capabilities

The second pillar of the NSSS calls for the United States to improve its capabilities in space and energize our space industrial base. Indeed, a stable, responsive, and innovative national industrial base is at the core of the new DoD strategic guidance and, combined with continued investment in science and technology and human capital, is vital to assuring continued U.S. leadership in space. A strong industrial base and supporting workforce is also one of our best insurance policies against surprise or other "shocks" in the strategic, operational, economic, and technological spheres mentioned in the new defense strategy.[14] But problems exist.

Since the Space Age began, we have rarely been so reliant on so few industrial suppliers. Many firms struggle to remain competitive as demand for highly specialized components and existing export controls reduce their customers to a niche government market.

Nevertheless, long-term, uninterrupted capability from space requires a capable industrial base dedicated to protection, resilience, augmentation, and reconstitution of assets in space, supported by timely design and development, cost-effective acquisition, and the ability to assure high-confidence space access. Any discussion of resiliency must also include consideration of new architectural approaches that leverage partnership opportunities with commercial entities and allies, and that use the full range of space and nonspace methods to deliver capabilities. Leased payloads, ride sharing, distributed capabilities, and new partnerships are among the means we need to pursue.

However, our resources are finite, and in the current fiscal environment, budgetary pressures are likely to constrain our operating and acquisition plans for some time. Accordingly, USSTRATCOM is working with our service components to ensure our requirements are realistic and achievable and that our actions fully reflect a culture of savings and efficiency that delivers essential services in support of military operations, serves as a force multiplier for global power projection, and maintains our technological edge. We are also working to help bring stability to our requirements, budgets, and programmatic approaches.

3. Partnering With Responsible Nations, International Organizations, + Commercial Firms

The third pillar calls for increased engagement and partnering with other space-faring nations, appropriate international organizations, and commercial actors. USSTRATCOM is actively committed to this pillar and is already engaging with many partners, having signed more than 29 agreements with commercial entities to share selected situational awareness information. We recently received the authority to negotiate similar agreements with non-U.S. governmental agencies and intergovernmental organizations and stand ready to work with responsible space actors by sharing and exchanging safety of spaceflight information.

USSTRATCOM is also actively seeking additional partners, especially those with

whom there has been little if any previous engagement. We already partner and engage with long-standing friends and allies like Australia, Canada, and the United Kingdom, as well as other NATO allies. And we are undertaking greater efforts to sustain those traditional partnerships while we seek new opportunities with potential partners in Europe, Asia Pacific, Latin America, South America, the Middle East, and Africa.

4. Prevent and Deter Aggression Against U.S. Space Infrastructure

USSTRATCOM's grand challenge is to protect and assure U.S. space capabilities for joint use and other national security purposes—defined in the fourth pillar as preventing and deterring aggression against U.S. space infrastructure. Space defense demands full understanding of the operating environment so we can recognize indications and warnings and operate effectively to protect our assets, provide resilience, and if challenged, employ alternatives as needed. This pillar includes operations to acquire and maintain an understanding of the location, activities, ownership, and intent of objects in the space operational area and to provide warning and assessment of attack in, from, and through space.

Space situational awareness (**SSA**) enables all of our operational activities. An important means to add capability and capacity to SSA would be to expand partnerships and increase international cooperation. To this end we are looking to transition the **Joint Space Operations Center** (**JSpOC**) in California into a **Combined Space Operations Center** (**CSpOC**).

Initially, in full collaboration with our closest partners, such a step would enable us to leverage our individual strengths and, consistent with national policies, provide a framework and environment that could help address common space security needs. Further, such a transition would be consistent with the mandate of the NSSS to "build coalitions of like-minded space-faring nations."[15] This partnership would allow us to act in a coordinated manner, synchronize our efforts, and, together with those partners, promote responsible behavior in space to ensure the long-term sustainability of space.

5. Prepare To Defeat Attacks + Operate In A Degraded Environment

The final pillar of the NSSS calls for the United States to prepare to defeat attacks in space and operate in a degraded environment. This approach is generally based on "mission assurance" concepts and includes activities to deliver mission-essential space capabilities to U.S. and coalition forces and to assure mission success via alternate architectures and means, as appropriate, through all conditions of conflict and stress.

Mission assurance involves the need to defend and protect critical U.S., allied, and partner space capabilities, to include enhancing the resiliency of critical space systems, improving the use of alternative means and domains to assure the mission, and demonstrating the ability to operate through a stressed environment if and when capabilities are degraded.

Beyond awareness in space we need robust, resilient architectures—both space-based constellations and terrestrial assets—to ensure today's essential space-based services are available to accomplish the mission.

Finally, to enhance deterrence we have committed ourselves to preparing our forces to "fight through" any possible degradations or disruptions to our space capabilities. Through regular

global and tabletop exercises, we are improving our operational concepts and tactics, techniques, and procedures to enhance both protection and resiliency. We also leverage commercial, civil, and partner capabilities to support our military operational needs and ensure we fully appreciate and understand the interdependencies between military operations and those capabilities. And, as stated by the NSSS, "The U.S. will retain the right and capabilities to respond in self-defense, should deterrence fail."[16] A U.S. response may include actions in other domains.

Conclusion

The space domain continues to grow more congested, contested, and competitive at the same time as nations rely increasingly on space and space-based capabilities for critical civil and national security activities. Space mission assurance—including access to, and use of, all space capabilities—is essential to current and future U.S. and allied civil life, economic strength, and military activities. Assuring continued U.S. and allied access to, and use of, space demands a broader strategic approach that protects our critical capabilities, leverages our partners, and promotes safe and responsible use of the domain.

As it has been throughout the space age, leadership remains the key to our success. Active U.S. leadership requires a whole-of-government approach that integrates all elements of national power, from technological prowess and industrial capacity to alliance building and diplomatic engagement. USSTRATCOM is taking concrete steps to contribute to that leadership, and we look forward to continuing this role as we assure our vital space missions.

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Editors' Note

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Satellite Interference: The Good, The Bad And The Ugly

by Jeffrey C. Chu, Co-Founder and CEO, Glowlink Communications Technology, Inc.

First: The Bad—There is no such thing as good satellite interferences, unless your intention is to try and knock someone else's traffic out of commission and you are good at completing such an act. That being said, there are two general categories of interferences: Intentional and Unintentional. The former is in the minority, the latter, the majority. "Bandwidth bandits," such as unauthorized accesses and jamming signals, are two examples of intentional interferences. These individuals may, or may not, be difficult to detect, depending on the interference techniques being used, and more importantly, how good the catcher's tools are in detecting such incursions.

Unintentional interferences come in all sizes and shapes: Sloppy antenna pointing, bad transmit polarization adjustment, incompetent satellite users, faulty equipment, and so on. For these types of interferences, no one likes to claim responsibility for such mistakes, which is quite natural. Once again, these types of interferences may be difficult or even, occasionally, impossible to catch.

Next: The Ugly

Some of the ugliest interferences are those that happen sporadically; Interferences that hop or skip around and, in general, are simply elusive and a true challenge to resolve. This type of interference can also be both intentional and unintentional.

Then, there are satellites that are, figuratively speaking,'loners', such as those in the X- and Ka-frequency bands. When interference happens to these 'loners,' they are often out of luck in terms of trying to identify and eliminate the interferences. These loners need a 'good neighbor' or adjacent satellite in order to track down the interferer with a 'Ghostbusters' equivalent for satellite interferences, via a process called geolocation.

Finally: The Good

Various people and organizations have been attempting to solve the satellite interference problem and, so far, there are mixed results. There is a group that promotes forcing communications signals on each carrier to imbed a unique identifier, or "ID," such that when interference occurs, you can trace its origin. This assumes, of course, that the transmitting equipment is where it is supposed to be and that it is functioning properly.

Neither of these conditions is, of course, guaranteed. In fact, it is utterly useless in preventing some of the 'bad' and 'ugly' interferences that are mentioned above. Nevertheless, this approach should be able to solve *some* interference location problems by extracting the ID and then cross-checking with a database of transmitting equipment and their locations. The challenge is, of course, that the database must be up to date, that the equipment has not been moving around such as would occur in a communication-on-the-move (COTM) scenario, and that the equipment is actually functioning correctly.

The other approach is technology. Here, the idea is to catch interferences without dependence on any externally imposed tip-offs, such as a carrier ID. The underlying technology is rather complex, and historically the needed equipment had been quite costly, if not cost-prohibitive, bulky, and often requires highly skilled operators.

Fortunately, the good news is that, as with all things innovation-driven, technology has decidedly improved over the last several years. As a result, interference detection and geolocation equipment has now become more affordable, less bulky in size, and far easier to use. Such technologies have become much better at catching and locating interferences.

Glowlink Model 8000
Integrated Geolocation and Interference Detection System
(Photo courtesy Glowlink Communications Technology, Inc.)

Advances in technology can now detect and locate challenging interferences that hop around, pop, sweep at high speeds, or pass through satellites with no "good neighbors", especially in the X- and Ka-bands. Overall, the good news is that real technology and innovation still trump other more parochial, hyped-up approaches. Perhaps more importantly, especially for the government and military markets, these capabilities can now be purchased completely off-the-shelf and are far easier to learn to use, operate, and maintain. The days of the having to absorb huge risks in developing product from scratch, often resulting in staggering cost overruns and schedule delays—are OVER. In the current, more austere defense spending environment, that indeed is the good news.

About the author

Jeffrey C. Chu co-founded Glowlink in 2000 to develop and market products aimed at resolving what at the time was pretty much a taboo subject of satellite communications: satellite interferences, a topic so embarrassing that no one providing the bandwidths or services in the satellite community really wanted to talk openly about it. Lately, of course, it has become such a hot topic that people are trampling over one another to promote, propagate and, naturally, benefit from. Which, of course, is pretty cool for Glowlink.

Mr. Chu obtained his BS in engineering from Harvey Mudd College and MS in electrical engineering from the University of California at Berkeley.

SATCOM Improvements Enhance Military Intelligence + Capabilities

by Karl Fuchs, Vice President of Technology, iDirect Government Technologies (iGT)

Although military operations have officially ended in Iraq and are winding down in Afghanistan, there remains an even stronger need for military satellite communications (MILSATCOM), now and in the future. Why? Fewer boots on the ground mean a greater reliance on intelligence, surveillance and reconnaissance (ISR) missions, and ISR heavily relies on MILSATCOM technologies.

MILSATCOM provides a flexible, reliable and high-capacity service that can cover a large area such as Southwest Asia. The ability to quickly deploy and manage a network that can easily be scaled without the restrictions of an existing communications infrastructure is becoming increasingly critical to military operations. With MILSATCOM technologies, the military can uplink ISR imagery, maintain voice and data communications and make command assignments for more targeted situational awareness.

The use of military satellite communications improves the way soldiers, airmen, sailors and Marines conduct operations. A highly efficient *time division multiple access* (**TDMA**) network with appropriate *quality of service* (**QoS**) capabilities can allow for a variety of communications applications to run simultaneously on a single network without degradation of performance or throughput on the network.

And—all of this is about to get even better.

Enhancements in electronics including denser *Field Programmable Gate Array* (**FPGA**) implementations will reduce the *size weight and power* (**SWAP**) requirements of military satellite communications equipment. These enhancements will lead to terminals with smaller satellite dishes, more efficient *Block Up Converters* (**BUCS**), and longer battery life.

One of the key end-user requirements driving developments in SATCOM is airborne. Airborne SATCOM presents a number of technological challenges. One of the most daunting is the integration of the satellite modem, the aircraft *inertial reference unit* (**IRU**) and the *antenna control unit* (ACU). The integration of all three units is vital in providing a global airborne network and enabling a seamless transition of communications as an aircraft transitions from beam to beam.

In order to provide a standardized interface for all three components, the **Open AMIP** standard was developed. Open AMIP provides a common language for any vendor's modem, IRU, or ACU, for communication.

In order to achieve the goal of *Automatic Beam Switching* (**ABS**), in addition to a common language between the satellite routers, IRUs and ACUs, a remote must have an understanding of its location in relation to the footprint of the satellite's beam coverage. **iDirect**, parent company of **iDirect Government Technologies** (**iGT**), has developed geographic mapping software that contains *Effective Isotropic Radiated Power* (**EIRP**) contour maps, which enable the satellite router to make an intelligent decision on the optimal position to change satellite coverage.

Overlaying this entire architecture is the *global network management system* (**GNMS**). The GNMS allows for the provisioning of a single satellite router across a seamlessly integrated satellite network with global coverage.

The most critical application for airborne SATCOM is high-definition ISR video. High-definition ISR video pushes to the limits the data rate capabilities of standard satellite transmission equipment. ISR platforms are hampered by being limited to extremely small aperture antennas and yet demand satellite bandwidth in excess of 2Mbps. Enhancements in waveform technology, including the integration of highly efficient TDMA-based direct sequence spread spectrum, has made the transmission of high-definition ISR video in Ku-band a reality. By using ***Single Channel Per Carrier*** (**SCPC**), return channels, with their inherently more efficient in-route frame format, data rate of 14Mbps can be achieved on X-band where spread spectrum is not required.

During the past year, *Version 3.0* of iDirect software was released, featuring *Communications-on-the-Move* (**COTM**) for airborne platforms. iGT has also developed the ***e8000 AR***, a standard 19-inch rack-mount airborne router that meets all of the **MIL-STD EMI** and environmental specifications **810G** for aircraft. iGT is also developing a 4 MCU unit designed to fit in a commercial **ARINC** rack.

iGT's technology includes *Transmission Security* (**TRANSEC**), which uses *Federal Information Processing Standards* (**FIPS**) **140-2** certified *Advanced Encryption Standard* (**AES**), which guarantees the highest level of security for data communication. This technology is managed by **iVantage** and includes a global *Network Management, Monitoring and Maintenance System*, providing roaming remote management along with ABS and geographical mapping.

Today, military personnel deployed around the globe are turning to high-speed military satellite communications for voice, video and data connectivity out in the field. These technological advancements, performance increases, process improvements and lessons learned from other organizations are bolstering our military's capabilities, leaving them better equipped and prepared for tomorrow's fight.

About the author
Karl Fuchs serves as Vice President of Technology for iDirect Government Technologies (iGT); ***kfuchs@idirectgt.com***.

A vital component for any military organization is the ability to communicate, share information and provide support for large, mobile groups of personnel anytime, anywhere. COTM satellite technology with mission-critical connectivity is increasingly necessary for the military when they need to be mobile.

Recent COTM technology advances are bringing even greater advantages to the military. Soldiers can deploy a wireless broadband network on a moving ground vehicle, deep water fleet, military aircraft and even on an unmanned aerial vehicle (UAV). Portable systems that fit inside a soldier's rucksack are engineered to withstand harsher environments and can be activated at a moment's notice.

COTM systems traditionally were deployed in larger vehicles; however, significant advancements in satellite communications have brought the technology to the warfighter. New satellite router boards that are half the size of current products enable smaller, lighter-weight and lower-power portable terminals, providing COTM connectivity to on-the-foot warfighters.

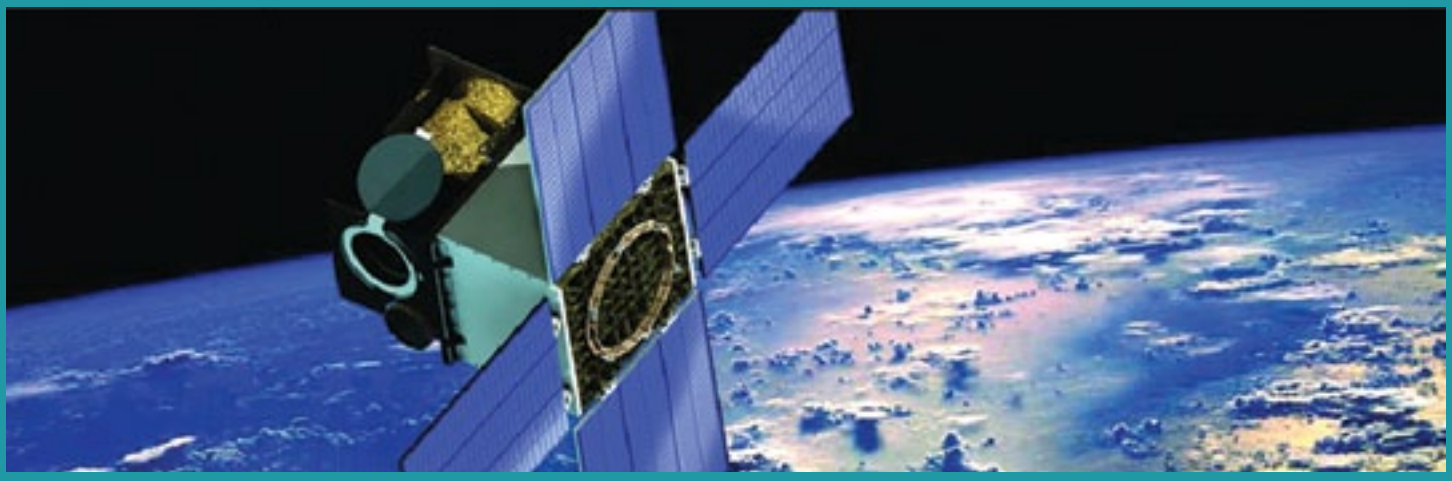
This new development in portable technology delivers several critical advantages. Soldiers can receive battlefield imagery that identifies potential threats, transmits situational video to base, receives command and control information, and even transmits X-rays and imagery of a wounded soldier to doctors who can interpret the injury and provide guidance on proper treatment.

COTM helps the warfighter achieve instant access to information in a mobile environment on the ground, at sea or in the air.

A Heritage Of Successful Missions

In a world seemingly gone mad at times, our nation's and our allies' armed forces and government agencies are, nowadays, even more dependent upon the intelligence, surveillance and reconnaissance data beamed to them by various MILSATCOM satellites. Retasking flexibility, observation without detection, and the delivery of near-instant communication and data are just three reasons for the continuance of satellite build programs that result in saved lives and operational successes.

The companies involved in such endeavors range from extremely large in size to those with just a few professionals staffing their efforts. Some are names we all are quite familiar with, as their satellite offerings are just one portion of their overall manufacturing and technology offerings. Others you may never have heard of, but they are as equally important in producing viable products to aid MILSATCOM efforts. This issue, we enter the environs of Comtech AeroAstro.



With locations in Ashburn, Virginia, and Littleton, Colorado, Comtech AeroAstro brings more than 20 years of experience in small satellite development to the marketplace. The Company has executed contracts for the development of seven complete spacecraft, from the ***ALEXIS*** spacecraft launched in 1993, to current work on the ***JMAPS*** spacecraft.

The end customers have included U.S. Government agencies and laboratories such as the Naval Research Laboratory, DoD Space Test Program, and Los Alamos National Laboratory, as well as universities conducting critical national research, such as at the Massachusetts Institute of Technology and Boston University. With continued investment into advanced technologies, such as plug-and-play, spacecraft capabilities are ever expanding into a broader set of product offerings, mission areas, and the acquisition of new customers.

It Takes Experience

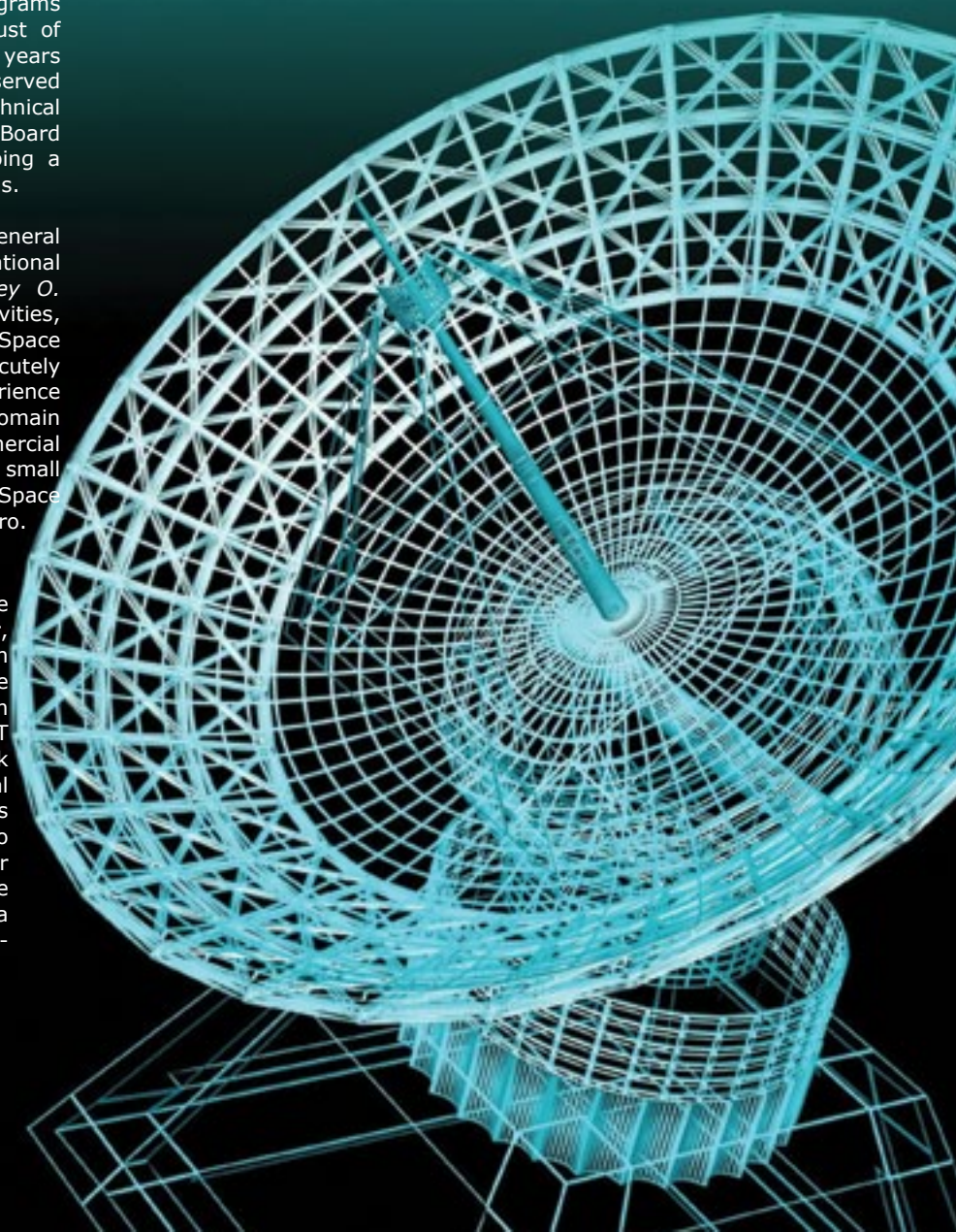
In 2008, *Paul Lithgow* was named President of Comtech AeroAstro, Inc. He was previously the Company's COO. Before joining AeroAstro, he served as the Director of Advanced Concepts at Radyne and led the Advanced Programs Division at Spectrum Astro until August of 2004. Mr. Lithgow has more than 25 years of management and technical experience and served in the U.S. Air Force in airlift, acquisition and technical intelligence positions. He is also a Member of the Board of Directors for Agape Youth Ministries, developing a program and building facilities to serve at-risk teens.

The Senior Vice President and General Manager, Commercial, Civil, International Programs for the Company is *Stanley O. Kennedy, Jr*. He executes all program activities, which include the Space Systems and Space Product development, to which he is acutely tuned with more than 26 years of experience in aerospace engineering that includes mission domain knowledge in military, intelligence, civil and commercial markets. He was the Senior Program Managerfor small satellite systems and concepts for Lockheed Martin Space Systems Company before joining Comtech AeroAstro.

Steven Schenk, the Senior Vice President and General Manager, Defense Programs, packs in more than 20 years of experience including the responsibility of being the Program Manager for the NASA Goddard GLAST space vehicle and DARPA Streak space vehicle programs during his time at General Dynamics. With Comtech AeroAstro, Steve executes on all emerging defense programs and has also functioned as the Company's Program Manager for the ORS Multi-mission Modular Space Vehicle Preliminary design phase program, developing a flexible spacecraft design that incorporated plug-and-play technologies.

Providing direction and oversight for the content and quality of the Company's engineering product, as well as design reviews, documentation and analysis, is *Dean Roukis*, the Vice President of Engineering. He joined the Company in 2005 as Chief Mechanical Engineer and brought more than 27 years of technical and management experience into the company. He previously had served as Principle Engineer in Satellite Operations at Intelsat where he was responsible for in-orbit power systems operations of 20+ geosynchronous satellites.

Rounding out the executive team is *Debra Latter*, Vice President, Finance and Contracts. With 32 years of financial management, she is responsible for Comtech AeroAstro's Sarbanes-Oxley implementation and government compliance. She is a member of the AICPA.

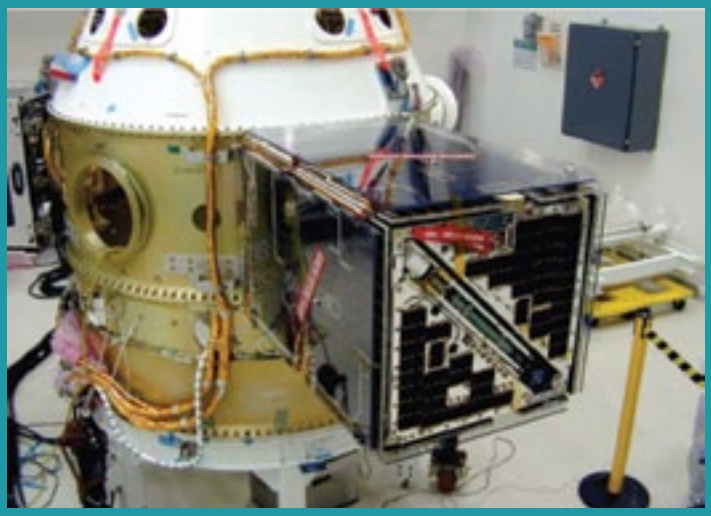


How's This For Heritage?

Bus Stops

There is not much one can do to produce a satellite without a viable bus. For Comtech AeroAstro, their ***Astro 200*** bus series handles configurations in the ~200kg total mass range, which can be accommodated by a variety of launch vehicles, including ***Minotaur I***, ***Minotaur IV***, ***Pegasus***, ***Falcon 1e***, ***Atlas V*** and ***Delta IV ESPA***. Payloads of up to 85kg in mass and 100W in power can fit into the standard interface of the Astro 200 without modification. The ***Astro 200AS*** is an enhanced performance version of the Astro 200 with improved attitude knowledge and control, jitter, additional X-band downlink capability, improved timing accuracy and a longer mission life. The enhanced version was initially developed for the U.S. Navy's ***Joint Milli-Arcsecond Pathfinder Survey*** (**JMAPS**) mission. ***STPSat-1*** and ***STPSat-2***, launched in March of 2007 and November of 2010, respectively, were based on the Astro 200 core design.

The Company's ***Antares*** bus offers a 500kg space vehicle mass range (spacecraft + payload) that's been designed to maximize payload accommodations by optimizing payload mass (up to 200kg), payload power (400W on-orbit average and 800W peak) and payload volume (Minotaur I 61-inch fairing). Antares meets the launch requirements for the same list of Astro bus compatible launch vehicles. The bus uses standard, open architecture, non-proprietary interfaces, a 100 percent *Space Plug-and-Play Avionics* (**SPA**) compliant network, and is 100 percent ***SPA-SpaceWire*** compatible that supports 200 Mbps data rates on orbit. Antares can operate in a variety of LEO and HEO orbits with a full range of altitudes and inclinations. No changes in transitioning from a low radiation LEO environment to a high radiation LEO environment are needed, thanks to the S-class quality parts and solid aluminum panels. The hinged hexagon structure allows for efficient, internal component access at all program states, all the while minimizing parts count. Propulsion is easily added for longer mission durations, orbit raise and maneuvering, as well as attitude control.



The Astro 200 bus

ALEXIS

Comtech AeroAstro's first spacecraft, ***Array of Low Energy X-ray Imaging Sensors*** (**ALEXIS**), was built for the **Los Alamos National Laboratory**. The satellite was launch-ready three-and-one-half years after concept and was launched in April 1993 on a ***Pegasus*** booster. The satellite operated on orbit for more than 12 years, far beyond its six-month design lifetime and surpassed all mission requirements and expectations until its final decommissioning in 2005.

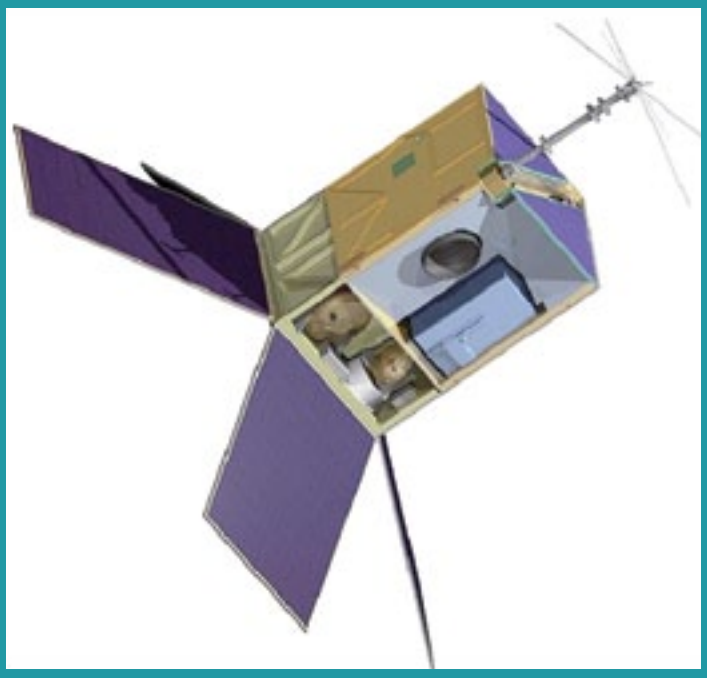
The ALEXIS spacecraft accommodated two payloads: 1) the soft X-ray experiment, also called ALEXIS, was a novel set of wide-angle, normal incidence telescopes, which scanned half the sky every satellite rotation; 2) ***BLACKBEARD***, an accompanying instrument, was a broadband receiver and digitizer designed to study ionospheric propagation in the 25-175 MHz band. The spin-stabilized spacecraft's bus comprised only 40 percent of the total satellite mass (45kg bus mass, 11 kg total mass). The bus provided 50 Watts of 28V power to the payload while consuming only 10 Watts of power itself. Attitude could be determined at any instant in post-processing to ±0.25 degrees.

ALEXIS spacecraft

Payload data were recorded in a Comtech AeroAstro-supplied 96MB spacecraft mass memory at mean rates of 10 kbits/second, with peak rates reaching in excess of 100 kbits/second. The ALEXIS system employed a "store-and-forward" architecture to pass tracking, telemetry, and control, and data between the spacecraft and a single ground station at Los Alamos. Commands were uplinked at 9600 bits/second and data were downlinked at 750 kbits/second via a steerable two-meter dish. Comtech AeroAstro designed and built the spacecraft bus and the ground station, as well as supported the launch and ground operations activities.

STPSat-1

Developed for the DoD's ***Space Test Program*** (**STP**), ***STPSat-1*** is the first STP satellite built specifically to exploit the ***Evolved Expendable Launch Vehicle*** (**EELV**) ***Secondary Payload Adapter*** (**ESPA**) launch capability. Comtech AeroAstro's role as prime contractor for the mission included spacecraft design, fabrication and assembly, payload integration, system test, launch vehicle integration, and post-launch support. This Class C single string spacecraft hosted two ***Space Experiment Review Board*** (**SERB**) experiments: the ***Spatial Heterodyne Imager for Mesospheric Radicals*** (**SHIMMER**); and the ***Computerized Ionospheric Tomography Receiver in Space*** (***CITRIS***), both provided by the **Naval Research Laboratory** (**NRL**).



STPSat-1

Successfully launched in March 2007 on the only ESPA launch to date, STPSat-1 was the first, and only, ESPA rideshare spacecraft developed by a U.S. contractor. STPSat-1 was designed for a one-year mission life, but operated successfully until its decommissioning in October 2009, providing valuable mission data for more than two-and-one-half years.

STPSat-1 is a highly capable, three-axis stabilized space platform that met the demanding technical requirements for the mission and launch environment. Packaged in the highly constrained ESPA envelope (~2 ft. × 2 ft. × 3 ft. in volume and ~180kg mass), STPSat-1 served as a pathfinder for developing a highly capable microsatellite supporting multiple space payloads as well as for the first ESPA integration cycle that included range safety approvals, coordination of multi-vehicle integrations, deployments and timelines, and multi-vehicle mission operations out of the **USAF RDT&E Support Complex** at **Kirtland AFB**.

STPSat-2 / STP-SIV

STPSat-2

The STP-SIV program supports the Space Test Program's goals to maximize space flight opportunities for Space Experiment Review Board (SERB) experiments. The ***STP-SIV*** bus design evolved from Comtech AeroAstro's experience as the prime contractor for STPSat-1, launched aboard the first ESPA (Atlas-V/STP-1) in March of 2007. Comtech AeroAstro simplified and enhanced the STPSat-1 design for the STP-SIV program to improve reliability, enhance mission flexibility and orbit range, and to provide the standard payload interface that is critical in supporting the maximum possible number of experiments. Also developed were high fidelity development and test plans, complete operating procedures including the bus content for the Payload User's Guide, and a detailed cost baseline. Such efforts will allow this bus design to be reproducible for a diverse set of mission options.

Each vehicle is designed to operate over a wide range of LEO orbits and to be compatible with a large variety of launch vehicles (see Bus Stop), including an EELV Secondary Payload Adaptor (ESPA) rideshare. Comtech AeroAstro's role was to design, build, and integrate the SIV bus under subcontract to prime integrator, Ball Aerospace. The first SIV bus, for the STPSat-2 mission, was delivered to Ball in December of 2008 for payload integration and was launched on a Minotaur IV from Kodiak, Alaska, in 2010.

ORS MMSV: Multi-Mission Space Vehicle

Under the ***Operationally Responsive Space*** (**ORS**) ***Multi-Mission Space Vehicle*** (**MMSV**) Preliminary Design study, executed from October 1, 2008, to February 1, 2009, Comtech AeroAstro designed a reconfigurable, multi-mission, rapid response space vehicle capable of hosting a variety of missions and payloads. The design focus was on *Electro-Optical, Space Situational Awareness* (**SSA**), and *Synthetic Aperture Radar* **(SAR)**. The "core" bus design evolved from a set of approximately 30 Design Reference Missions, in which cost, schedule, technical performance, and logistics footprint were all assessed against Key Performance Parameters, which were ranked in order of importance with government input and feedback.

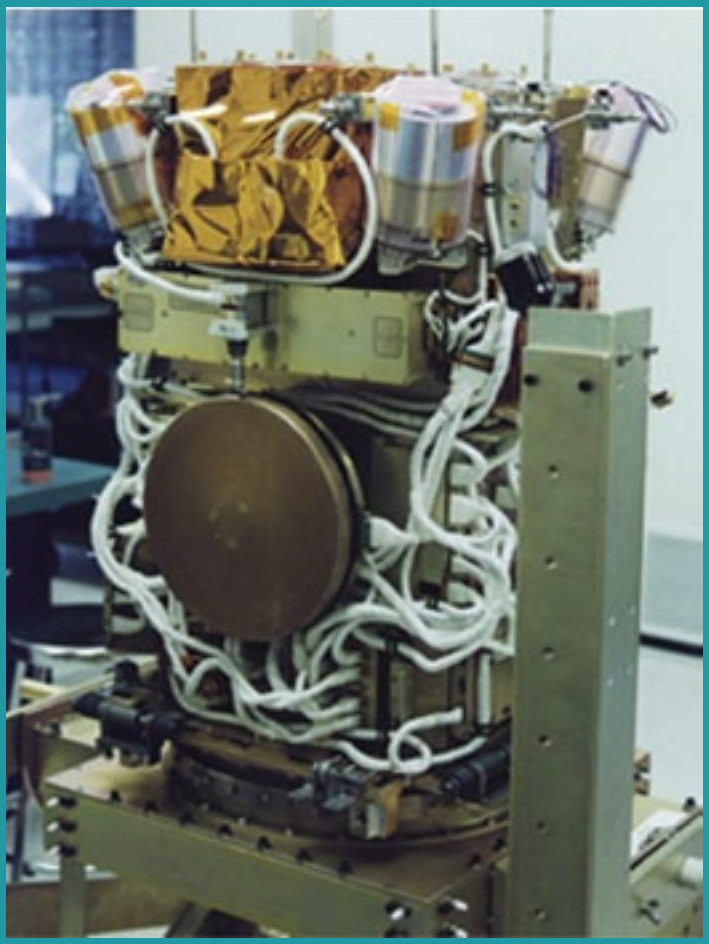
The final design met the stringent ORS cost ceiling (<$40M for recurring vehicles) and schedule goals by implementing space vehicle modularity at the component level. This required the implementation of plug-and-play architectures and used a non-exquisite technical performance philosophy that allowed new and advanced technologies to be fielded in a rapid timelines of less than six months, versus the typical 18 to 24 month timeframes.

The ORS MMSV design, which is an implementation of Comtech AeroAstro's Antares bus design, accommodates a wide variety of mission configurations / scenarios in the <460kg space vehicle (spacecraft + payload) mass range. The bus is designed to maximize payload accommodations by optimizing payload mass (up to 200kg), payload power (400W on-orbit average and 840W peak), and payload volume (Minotaur I 61-inch fairing) at LEO inclinations ranging from 30 to 97 degrees and altitudes from 350-800 km. The ORS MMSV design extensively uses standard, open architecture, non-proprietary interfaces, which allows for rapid reconfiguration, flexibility, and robustness for accommodating a large range of missions or payload types.

HETE

Comtech AeroAstro built the ***High Energy Transient Experiment*** (**HETE**) spacecraft for the **Massachusetts Institute of Technology** (**MIT**) with scientific cooperation from teams in the United States, France, and Japan. The mission for this spacecraft was the detection and observation of high-energy events in the gamma ray, X-ray, and UV spectra. ***HETE***, a pathfinder for the **NASA University Explorer** program, was launched on a ***Pegasus XL*** on November 4, 1996, with the ***SAC-B*** satellite. It was lost due to a launch failure and rebuilt as ***HETE-2*** (based on the original design), which was successfully launched in 2000.

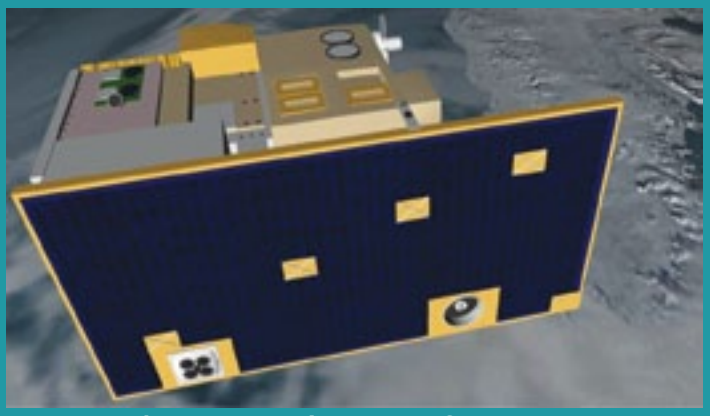
The Company supplied the spacecraft bus (55kg bus mass, 120kg total mass) and ground stations, and performed all payload integration and testing. In flight, the spacecraft oriented the fixed solar arrays toward the sun with instruments pointing in the anti-sun direction. Its communications system used a 230 kbit/second data downlink rate and a 7.5 kbit/second uplink rate. The power system supplied 67W average power at a nominal 28V to the payload.



HETE spacecraft for MIT

TERRIERS

Comtech AeroAstro supported **Boston University** on the design and fabrication of the spacecraft and ground station for the ***Tomographic Experiment using Radiative Recombinative Ionospheric Extreme ultraviolet and Radio Sources*** (**TERRIERS**) remote sensing spacecraft. This low-cost, fast-paced program was part of the *Student Explorer Demonstration Initiative*—sponsored by the *Universities Space Research Association*—and a precursor to NASA's University Explorer program. The TERRIERS' mission was to demonstrate global ionospheric tomography (imaging by sectioning) and to use the techniques to study ionospheric / thermospheric processes. The satellite was spin stabilized and had a mass of 121kg. The satellite bus provided 59W orbital average power. TERRIERS was launched on May 17, 1999.



The remote sensing spacecraft, TERRIERS

Current Endeavors

Comtech AeroAstro is deeply involved in the ***Joint Milli-Arcsecond Pathfinder Survey***, otherwise known as **JMAPS**, a **Department of the Navy** space-based, all-sky astrometric bright star survey. The satellite is scheduled to launch in 2015 and uses the Astro 200AS bus to host the instruments over the projected three-year mission life. Comtech AeroAstro has been a participant in the JMAPS mission development since 2005, building on work the Company originally conducted for the **Air Force Research Laboratory** (**AFRL**) and **DARPA**. Prior risk reduction efforts by Comtech AeroAstro have demonstrated that the demanding technical requirements for JMAPS can be met with a microsat-class space vehicle (<200kg). Work is being closely tied in with the NRL and the **U.S. Naval Observatory** (**USNO**) efforts to provide a proven bus that incorporates extraordinary jitter control, significant software reuse, and use of high-**TRL** (*Technology Readiness Level*) components.

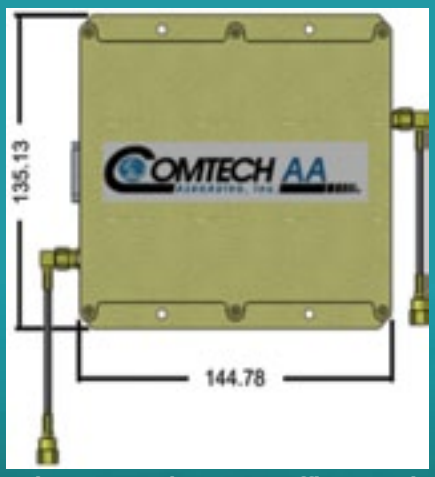
One of the Company's most recent developments is their new approach to support *Low-Earth Orbit* (**LEO**) *Space Traffic Control.* This approach is called the ***Payload Alert Communications System*** (**PACS**). PACS provides low-cost, low-size, weight and power (**SWAP**) position, velocity, time information along with low-data rate Host vehicle health and status reporting using the firm's patented *Code Phase Division Multiple Access* (**CPDMA**™) waveform. Comtech AeroAstro uses a unique tagging, tracking and locating device, along with the existing GPS system and Globalstar data-messaging infrastructure, to provide PACS services to users.

Department of the Navy's JMAPS satellite, set to launch in 2015

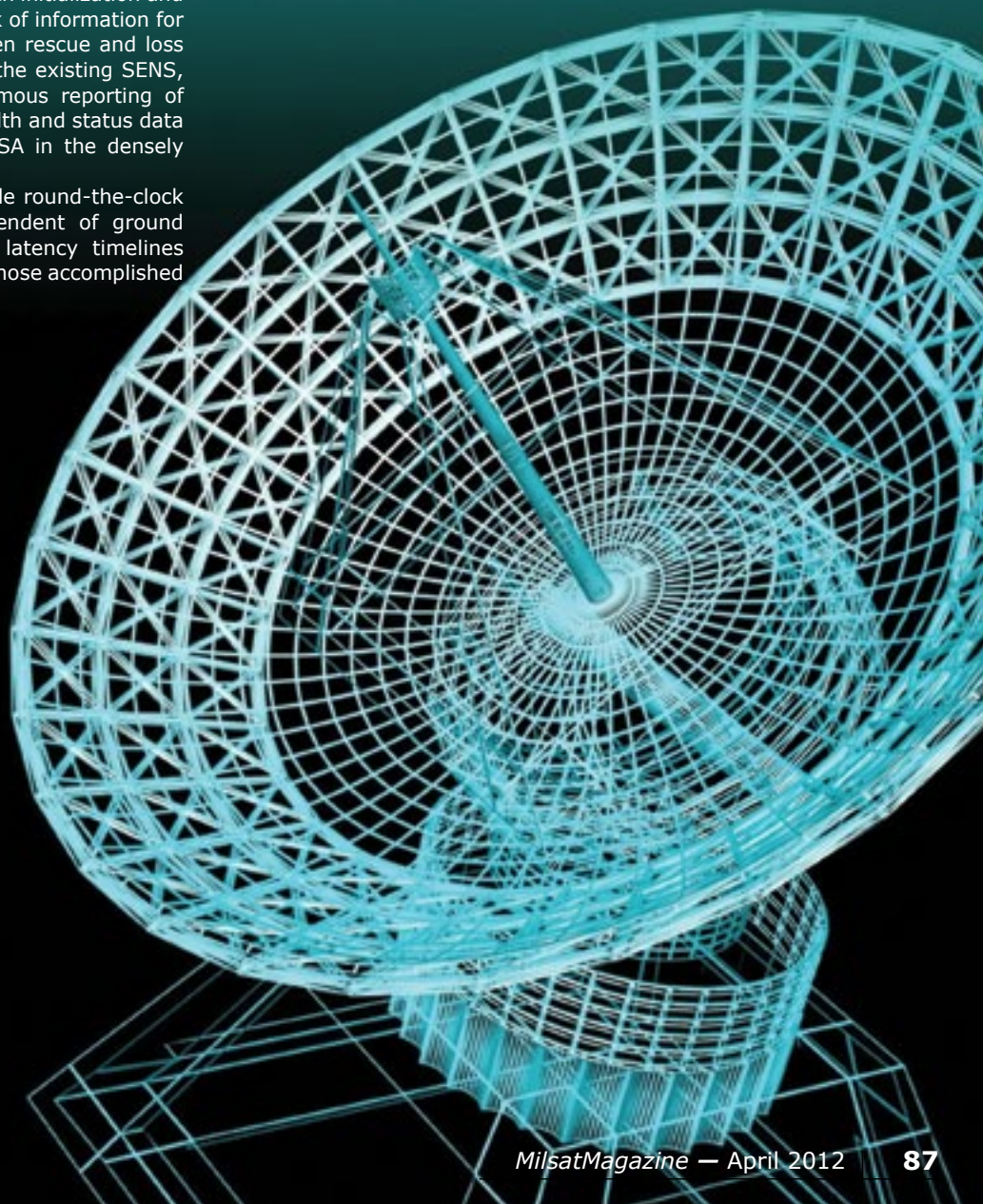
Comtech AeroAstro's PACS significantly reduces the manpower required to monitor and develop SSA associated with LEO spacecraft of all shapes and sizes. PACS leverages the Comtech AeroAstro-developed *Sensor Enabled Notification System* (**SENS**) technology developed for terrestrial tagging and tracking to provide the customer an easily integrated tool. This data availability can be critical during post-launch initialization and anomaly resolution, since the availability or lack of information for extended periods can be the difference between rescue and loss of an orbiting asset. PACS uniquely leverages the existing SENS, GPS and Globalstar infrastructure for autonomous reporting of position, velocity, spacecraft ID and limited health and status data messages to provide the customer assured SSA in the densely populated LEO environment.

The primary objective of PACS is to provide round-the-clock state-of-health and state-vector data, independent of ground system infrastructure and constraints. Data latency timelines (minutes) are orders of magnitude faster than those accomplished by existing ground assets (daily to weekly).

Spatial resolution of the data is substantially greater than commonly used radar or UHF / VHF communications system ranging methods. PACS also provides a valuable low data rate alternative communication path to the spacecraft owner, as the successful transmission probability with link closure (>90 percent) far exceeds traditional ground stations.



The Company's Space Traffic Control product, PACS



Uniting Structural Dynamics Simulation + Testing

by Noel Brown, Brüel & Kjær

Squeezed development and testing times for satellites call for intelligent solutions. Like other structural testing applications, satellites are subjected to exacting test procedures. But unlike other structural testing applications, satellites are so fragile that testing is typically carried out on a 'test model' that is identical to the real-life 'flight model', but will in fact never be used once the testing is completed. Unsurprisingly, modelling on a scale like this is costly, so simulation is used wherever possible.

Simulated models allow an increasing amount of testing to be performed in the virtual realm, leaving final qualification tests for the expensive real-world. This virtual modelling or *Finite Element Analysis* (**FEA**) uses computer-based mathematical models to predict how a design will behave. FEA is a key tool for use with lighter structures, to ensure that the calculated eigenvalues (resonant frequencies) do not coincide with the excitation frequencies encountered by the actual structure.

Once the virtual *Finite Element Model* (**FEM**) has been approved, prototypes are developed in accordance with them, to carry out experimental modal tests. The results from these modal tests (resonant frequencies and mode shapes) should then agree with the results achieved from the FEM analysis, thus validating the theoretical model. These FEMs are then updated and improved by feeding data from actual tests back into them.

However, calculations and model updating have historically been long and slow processes that require a lot of time and effort. Responding to this, **Brüel & Kjær** has extended their structural testing solutions with advanced Test-to-FEA correlation in the latest version of their PULSE analysis software.

Brüel and Kjær's ***PULSE*** *Reflex Modal Analysis* software was developed by building on their extensive experience in the field of modal testing, and is now enhanced with a Correlation Module to compare the experimental and theoretical results achieved from FEM packages. Accurate correlation is quickly obtained by following an intuitive yet flexible workflow process that guides the user efficiently through geometry alignment, DOF mapping, comparison, vector comparison, mode pairing and reporting.

Thanks to an open data policy, data can be imported from various leading FEA programs such as **Nastran**, **Ansys**, or as *UFF* files.

To find out more about Brüel & Kjær's modal, vibration and acoustic systems for testing and development, visit ***www.bksv.com***. You can also catch their engineers at the Spacecraft Technology Expo, Los Angeles, May 8-10, 2012. Information regarding this event may be found at ***www.spacetechexpo.com***. By visiting Brüel & Kjær's booth and see its satellite mechanical qualification test system, plus its comprehensive range of vibration and acoustic sensors, shakers, data acquisition and analysis solutions.

About the company

Brüel & Kjær provides structural dynamics systems for modal analysis and verification of design models; vibration analysis for structures and rotating equipment; environmental qualification test systems for swept-sine, pyroshock and reverberant chamber testing, and acoustic test systems for interior and exterior noise mapping, noise certification, and acoustic material testing.

The new structural analysis software contains visual tools to assist with easy comparison between mathematical models and test data

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- EIRP Maps
- Uplink Facilities
- Buyer's Guide and Index

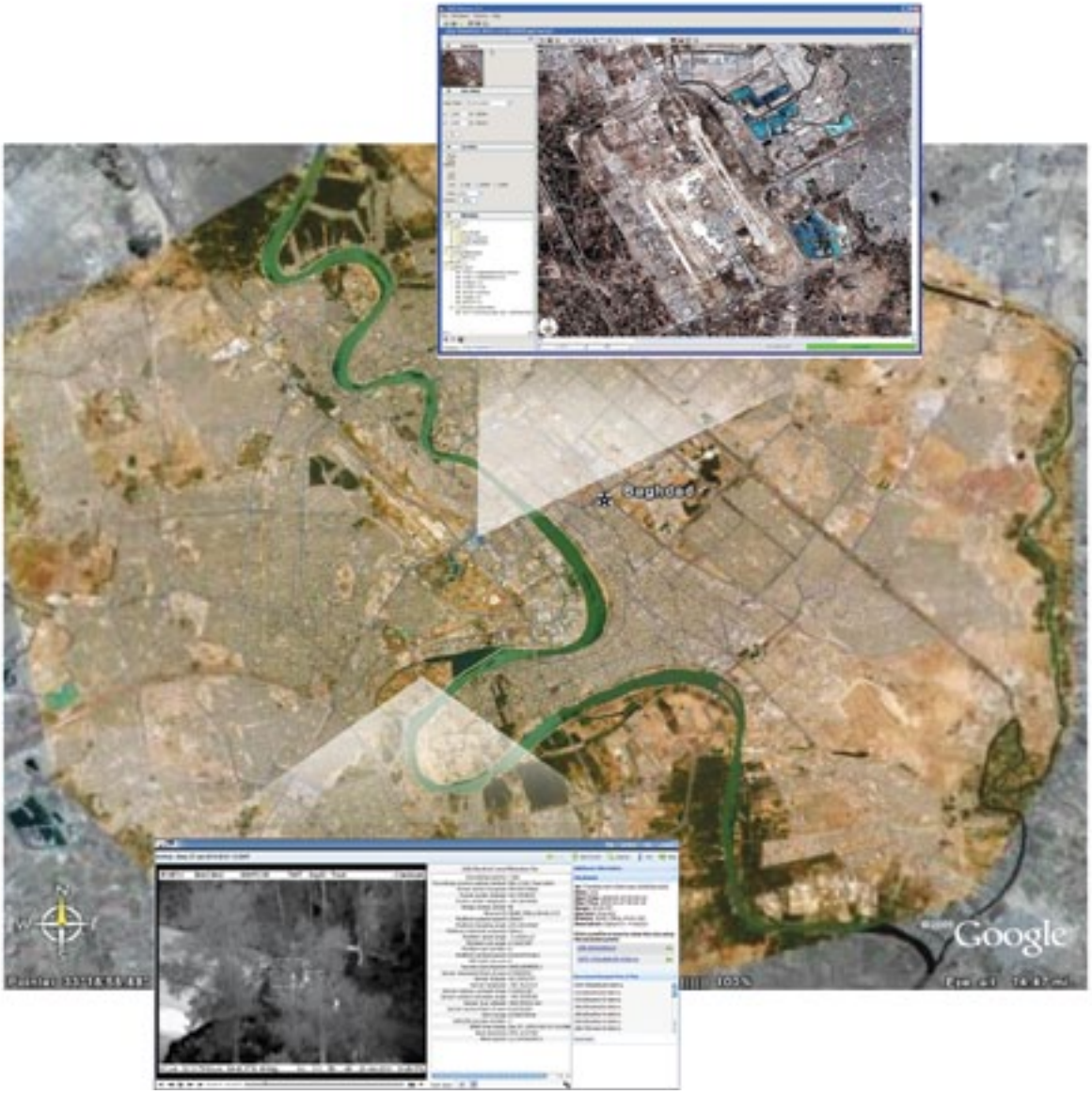
Data Management For Faster + Smarter Intelligence

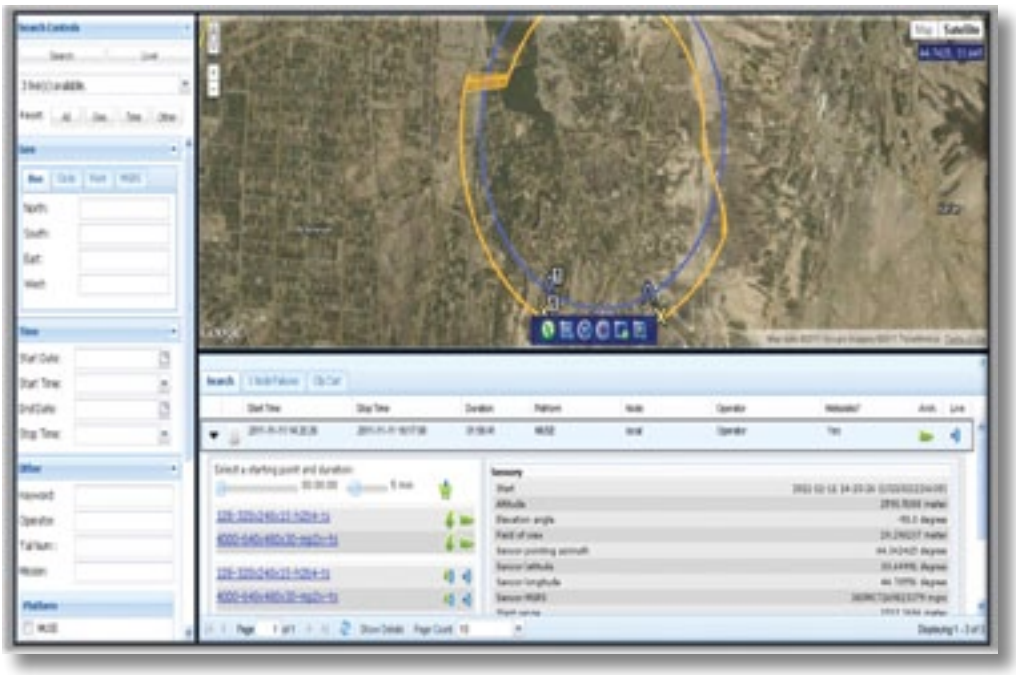
by Michael Ehrlich, Product Manager, GEOINT, ITT Exelis Geospatial Systems

On the battlefield and across the global security landscape, every second counts. The time it takes the warfighter to correlate their geospatial context and access intelligence is critical to the success of the mission.

While the proliferation of space-to-ground sensors has enabled us to gather more intelligence than ever before, it has also made it more challenging to convert the vast pool of data now available into actionable information. Research analysts have estimated that as much as 70 percent of military intelligence collected is "left on the cutting room floor" and does not benefit the end-user.

Traditional data management systems are increasingly overwhelmed by the growing flood of data and can't meet the demands of the individuals and organizations that rely on it. Current tools take minutes, hours or even days to provide the user with the information he or she needs. With many of the existing systems, users on the battlefield have to track down data or download images from multiple locations and sources.





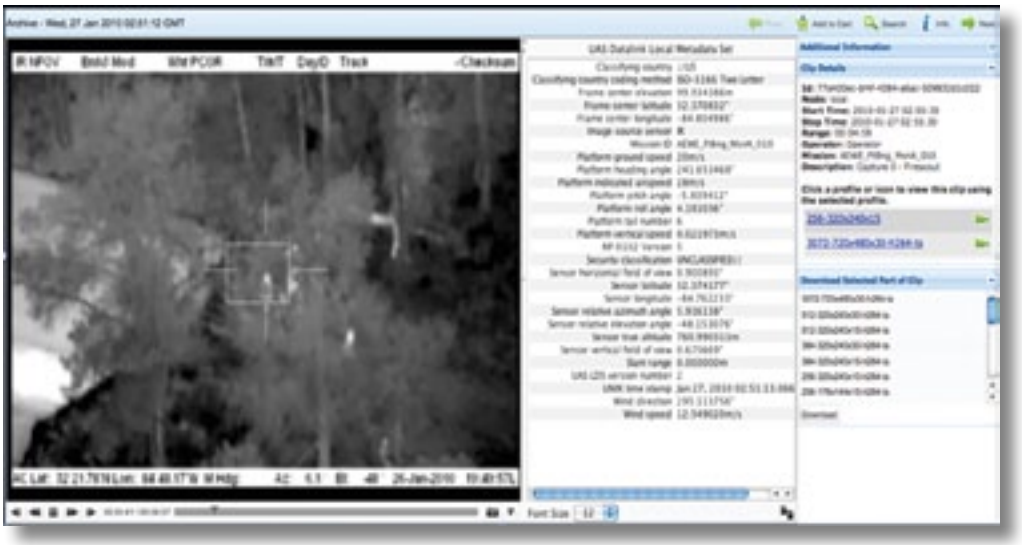
ITT Exelis Jagwire search feature.

Tracking down this information from disparate sources takes too long, especially if you are operating in a hostile environment. Today, soldiers and defense professionals need a system that allows them to quickly process the massive amounts of information ingested into the network to access the specific intelligence they are looking for.

To meet this pressing need, **ITT Exelis** developed ***Jagwire***, an enterprise to edge solution for the processing, management and dissemination of Still Imagery, Full Motion Video and Wide Area Motion Imagery. Jagwire manages unrelated types of content at an enterprise level, providing warfighters with one seamless user interface to search, discover and exploit this critical data.

In airborne wide-area surveillance sensors, Jagwire monitors surveillance over large areas of interest, including regions of a city. Surveillance information is fed into the enterprise, providing near-instant access to the data. Users can respond to events in real-time or carry out exploitative tasks and conduct forensic analysis into the past. The interface allows the user to determine exactly what he or she wants to see and enables DVR-like flexibility to stop and rewind streaming feeds. As a result, warfighters in the field and users in the intelligence community can now quickly find accurate geospatial data to make fast, effective decisions that impact mission success.

Equally important, Jagwire has the capabilities to operate efficiently across distressed networks. It can stream images and deliver information over low bandwidth, such as the austere environments forward users operate in, where networks often fail. Users in this space (particularly warfighters and first responders) can benefit from Jagwire by having accessibility to the intelligence they need, when and wherever they need it, almost regardless of bandwidth.



ITT Exelis Jagwire player.

Beyond supporting soldiers on the ground, Jagwire has implications for the broader security industry as well as civil markets. These are both areas where a growing number of individuals are looking to harness the vast amount of data and intelligence available today.

For instance, a significant issue in the maritime industry continues to be piracy, with companies in this market making significant investments to protect their cargo and people. In addition to potentially helping ships track severe weather events, technology like Jagwire can help ships detect and negotiate threats and ensure their route planning is updated accordingly. By alerting ships to potential danger out at sea, they can use this technology to gather more imagery, carry out analysis and make real-time decisions on how to respond.

A good example in the civil market is Hurricane Irene which hit the U.S. East Coast last year. During this event, an abundance of information was generated through a host of properties and sensors. Much of this user-generated information was fed into weather agencies, news organizations and agencies such as **FEMA**. From an intelligence perspective, this event showed that if you can take all this information out there and bring it into a content management environment where it could be correlated, it could improve the response to crises and disasters.

In the years ahead, ITT Exelis will continue to produce and collect more information than we know what to do with. This information will also continue to come in disparate formats. The question is how we can process and organize it for the individuals and organizations looking for rapid intelligence. That is where the value of Jagwire lies. ITT Exelis and the organizations the Company partners with can play a major role in addressing this fundamental challenge to create value for a diverse and growing range of customers.

NG9-1-1 State Of The Union

by Thomas Ginter, V.P., Product Management,TeleCommunication Systems

The goal of NG9-1-1 is to improve public emergency communication services by adapting to this century's connected, multi-media-enabled, mobile society. In addition to connecting callers to 9-1-1, this program enables the public to transmit text, images, video and data to the 9-1-1 *Public Safety Answering Point* (PSAP).

Planning for NG9-1-1 started in 2000 by the ***National Emergency Number Association*** (NENA). The NG9-1-1 Project began in 2003 and continues towards the ultimate goal of establishing national standards and implementation plans to accomplish advanced 9-1-1 systems and services by replacing the legacy narrowband, circuit switched 9-1-1 networks which carry only voice and very limited data. These legacy networks of limited capability are to be replaced with resilient IP networks and advanced systems capable of routing multimedia communications based on the location of the caller and capabilities of the final emergency services destination.

A significant hurdle has been how to implement solutions across municipal, county and state boundaries. Until recently, the technology did not exist to allow for the greater data handling capabilities required—the ability to route text, still picture or video data across jurisdictional boundaries simply did not exist. It was determined that a highly standardized system would be critical for the seamless support of communications and data transfer across county, state and even international borders. As well as across the multitude of emergency response professionals and agencies, including traditional *Public Safety Answering Points* (**PSAP**), *Poison Control Centers*, trauma centers, **Coast Guard** and disaster management centers.

NENA Requirements

Whether the distinct NG9-1-1 systems share local PSAP boundaries, or the systems are located across the country from one another, the NENA standards define how the NG9-1-1 systems can inter-operate. In these standards, the NG9-1-1 systems that route calls, validate locations and provide telecommunication operators access and the necessary security are collectively called an ***ESInet*** (*emergency services internet protocol network*). By implementing NENA's standards-based approach, it is possible for multiple ESInets of cooperating jurisdictions to share essential caller data, including location, for call routing and deployment of emergency services.

Elements Of ESInet

There are a number of defined functional "building blocks" within an NG9-1-1 ESInet, The most pertinent are described briefly below to provide a flavor of the functionality involved in deploying an advanced multi-media capable 9-1-1 system:

- **Emergency Services Routing Proxy (ESRP)**—The ESRP lives at the heart of the ESInet and receives VOIP 9-1-1 calls, checks where they are from, checks policies that can impact call treatment and then determines where the 9-1-1 call ultimately needs to be routed.

- **Policy Routing Function (PRF)**—The modern 9-1-1 system establishes many polices for what to do in the case of high call volume, overflow or system outage, as well as individual treatment of specific callers with physical disabilities or non-English language requirements, among many examples.

- **Location Information Server (LIS)**—Knowing where a caller is located is paramount to routing emergency services effectively. The LIS provides storage for location information of the caller drawn from many sources, including GPS systems.

- **Caller Information Database (CIDB)**—Traditional 9-1-1 systems store a "Class of Service" or "disability indicator" which contains limited enumerated information such as: "deaf" or "mute". The NG9-1-1 CIDB has the potential to go far beyond the traditional capabilities and include specific details from a caller's: critical allergies, identifying photo, guardian information or other caller-provisioned data, to be released in the case of an emergency. The CIDB represents the greatest single step forward in providing real-time potentially life-saving details to emergency personnel attempting to render assistance at the scene of an incident.

These components work in harmony to receive, assess and route the 9-1-1 calls. Unlike systems of the past, emergency responders of the future will be armed with life-saving, contextual information upon arrival to the location of an emergency caller. In fact, the use of the word "caller" becomes obsolete as NG9-1-1 systems enable the use of text or other non-voice communications media to be processed and delivered with equal ease to the PSAP.

Headway To Date

Few contracts and deployments for NG9-1-1 systems were made prior to 2009. However, from 2010 through to today, we have seen significant movement in the 9-1-1 market with NG9-1-1 deployments made in Iowa, Alabama and Maine on a statewide basis and with additional multi-county awards in Texas and elsewhere. These jurisdictions have much work ahead of them as they need to deploy, not only the next generation multi-media and location-based call processing equipment, but they also have to deploy or provision an underlying IP (broadband) network as well as upgrade equipment at the PSAP call taker positions.

Further, legacy systems need to be decommissioned and traffic routed to the new IP-based systems will require staff to be trained and numerous details handled for the conversion to a significantly more sophisticated method of serving the public. With the exception of small trials, including *Short Message Service* (**SMS**), no large scale NG9-1-1 systems have been commissioned or are processing calls with full multi-media capabilities. The good news is that significant progress has been made in the underlying location and GIS technology that enables NG9-1-1 systems to function. Despite restrictive government budgets, the next few years will see the increased deployment and commissioning of such systems.

Leveraging satellite technology has been particularly successful. Satellite communications can be used in two general ways in relation to emergency services: (1) providing the public with better access to the public safety and (2) allowing emergency responders to communicate better amongst themselves. The use of satellite communications as a backup facility for connectivity to PSAPs accomplishes both, in particular for remote or rural PSAP agencies.

For example, a PSAP serving a remote Federal or State park will often have limited wireless connectivity to the public network—often a single fiber or legacy DS0 to T1 connection. From a cost perspective, it is not pragmatic to install a redundant facility. A simplex line to the PSAP is vulnerable to being severed by an errant backhoe, tree-fall or, in the case of California, a wildfire. Having ready satellite back-up capabilities, which have a narrowband standby capability and rapid turn-up of high bandwidth, can be very attractive to the rural emergency responder community. Standby low bandwidth communications inform the remainder of the NG9-1-1 system to switch calls away from the disabled PSAP and, often within an hour, wideband communication via satellite can restore the PSAP to a fully functional mode.

As can be seen, much is changing in the world of emergency services. An evolving case in point is the NG9-1-1 implementation progress made by, the state of *Iowa Homeland Security Emergency Management Division* (**HSEMD**). The Iowa HSEMD is in the process of deploying an emergency services network, which complies with NENA **i3** standards. The solution will ultimately enable all 119 PSAPs in the state to accept incoming emergency requests from wireless, *Public Switched Telephone Network* (**PSTN**)-based and *Internet Protocol* (**IP**)-based end-users. The NENA i3-based solution enables the Iowa HSEMD to use the diverse and redundant IP networks owned and operated by the state. The initial rollout will enable legacy wireless calls to be delivered via the new Next Generation 9-1-1 solution; additional plans include support of emergency requests using text, images and video. This solution is expected to be the first NENA i3 compliant Next Generation 9-1-1 system in the United States to be deployed on a statewide basis.

Everyone agrees that Next Generation 9-1-1 will improve and enable Public Safety's ability to deliver on their mission statement in a rapidly changing world. Examples such as the Iowa implementation are only the beginning of improved public safety solutions that will ensure resources are best leveraged and lives are saved around the world. The challenge now is in the deployment of NG9-1-1 across the country today.

About the author

Thomas Ginter is VP Product Management, Service Bureau at TeleCommunication Systems.

The Implications Of The New FAA Bill Reviewed

by Jeff Allen, Marketing Manager for Government + Defense, and Ashish Sharma, CMO, FreeWave Technologies

On February 14, 2012, President Barack Obama signed a new Federal Aviation Administration (FAA) reauthorization bill worth just over $63 billion, mostly intended for FAA funding to create a new national navigation system for both commercial aircraft, such as jetliners, as well as private aircraft. The intended outcome is to switch the nation's air traffic control system from older radar systems to newer satellite-based Global Positioning Systems (GPS), enabling more efficiency and safety management procedures.

However, what is exciting to many technology vendors is that this new bill also paves the way for use of Unmanned Aircraft Systems (UAS) into commercial U.S. skies. For companies such as ***FreeWave Technologies*** that provide reliable, high-performance spread spectrum and licensed radios for mission-critical data transmission, the bill opens up significant new market opportunities to sell wireless communication technology into the new governmental and non-governmental markets.

Today there are proven wireless data communication technologies for unmanned systems in the government and defense markets. Some vendors, such as FreeWave, have mastered the requirements for military UAS applications, are already selling wireless data communication solutions into the government and defense markets, and offer technologies that can send and receive mission critical data reliably over long distances.

FreeWave's radios are used for a variety of military applications—from asset tracking to troop training, guided parachutes to chemical and biological sensing; and most especially, the command and control of unmanned systems, such as robotics, ground vehicles and unmanned aircraft systems. Just this past year, we announced a major company milestone regarding the current military UAS platforms that our solutions are embedded within.

Our military line of wireless radio transceivers have logged more than one million flight hours with some of the top military, government agencies and *Original Equipment Manufacturers* (**OEMs**) around the world. Take, for example, the ***MM2*** radio that is designed specifically for unmanned systems and weighs a mere 14 grams with a size of 1.4-inches high by 2.0 inches wide.

FreeWave is excited by the opportunity this new FAA bill offers. It opens up new opportunities for us, our partners and other technology vendors to expand our solutions and offerings into new commercial markets. Until now, there have been limits to selling these types of solutions to customers and partners in the defense and government markets only. For example, ways in which this new bill can positively impact organizations include:

- Police Departments and Emergency Responders
- Public Safety Organizations, Homeland Security and Border Patrol
- Agricultural business Companies and Farmers
- Oil, Gas and Energy Companies

We believe that the growth of components, systems and technologies that surround UAV/UAS will explode when the public airspace opens up for unmanned systems. This is because unmanned systems can be sold to many different end-users that never had the opportunity to take advantage of this technology before. It opens up new ideas and applications for ways in which unmanned systems in our commercial skies could be used.

In example, farmers now pay commercial pilots to fly over their crops to see if there are any health issues, *e.g.*, viruses, irregularities, insect problems, and so on. This type of application now can be managed by an unmanned system at a much lower price point.

Oil and gas or energy companies can use UAS platforms to monitor the health of pipelines and other infrastructures from the air covering large, remote areas that would otherwise take enormous amounts of time and manpower.

Local police departments can have a UAS in the trunk of their cruisers and use it for hostage situations to obtain better visuals as to what might be occurring

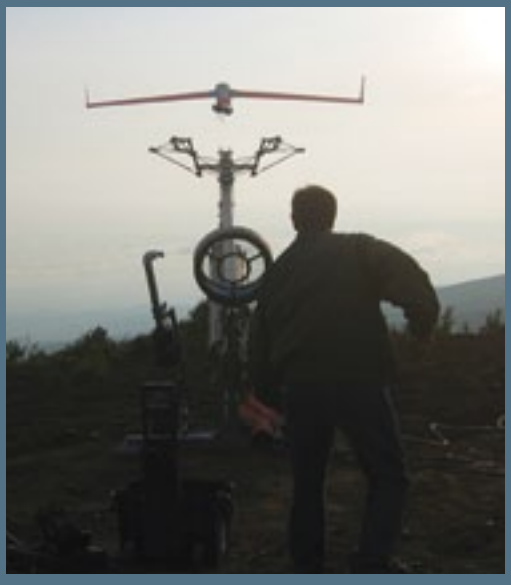
inside a building. A UAS can also be used to assist in tracking criminals from fleeing a crime scene.

Border patrol and homeland security officials can deploy unmanned systems along our nation's borders to monitor illegal immigration incursions and potential safety hazards arriving in U.S. ports.

Developing countries might use UAS to spray and control mosquito colonies using repellents and pesticides to help eliminate viruses that are detrimental to the health of any society.

These are just a few of the applications officials and companies have identified that could tap the benefits of UAS in commercial skies—clear evidence as to just how big the potential is for this new market for UAS. This, truly, is what the industry has been waiting for, while on the other hand one of the big challenges to face is addressing the way to properly manage the tens of thousands, potentially even hundreds of thousands, of new unmanned systems that will be accessing commercial airspace.

FreeWave sees some additional challenges ahead, as well. In particular, many new rules and regulations will be put in place to make certain piloted systems safely and effectively share the sky with unmanned systems. Proper protocols must be put into place to help govern the airspace in order to ensure unmanned systems don't inflict damage upon people, property, or any other manned (or unmanned) systems.



Dale Nash, chief operating officer of the Alaska Aerospace Development Corporation, stands behind the launcher as one of the University of Alaska Fairbanks' unmanned aerial systems takes flight back on June 22, 2007. The UAS was equipped to capture images of the vegetation growing in the Stewart Creek impact area, near Eielson Air Force Base. Photo originally presented at the University of Alaska's Fairbanks website.

With the number of helicopters, private planes and jetliners in the skies today, the question becomes, how can we, as a society, manage all of the new air traffic with the introduction of UAS platforms into the U.S. commercial skies? Currently, pilots and air traffic controllers manage the traffic control systems along the entire flight path to make sure everyone knows where any plane is, the latitude and longitude, the elevation it is flying at, and so on. We don't currently have that capability with a non-piloted system, therefore, how are we going to manage the airspace with unmanned systems joining piloted systems?

The answer is by implementing UAV sense-and-avoid techniques and/or collision avoidance capabilities. These techniques will require the use of many different systems, including sensors, analytics, evaluations and more. As sensing a target is only the first step to collision avoidance, effective maneuvering procedures and accounting for environmental factors also need to be incorporated. Collaboration on the development of UAS sense-and-avoid techniques must be conducted in a comprehensive systems approach and not concentrate on just one layer of functionality. These technologies can also be used by manned aircraft to further increase the safety of their operations as well.

On a different note, it becomes interesting to consider having very long range UHF or VHF radios that can broadcast hundreds of miles to talk to other unmanned systems. In a sense, you have established somewhat of a mesh network so these unmanned systems can sense what is in the immediate area. At some point, operators could put these radios on jetliners as well, so they also have these sensing capabilities for another layer of safety and communication.

In the future, this problem could potentially be solved by mandating transponders on all UAS platforms of a certain weight. Overall, the automation of the skies becomes a very real conversation now that unmanned systems will be making their way into the commercial sector. We expect this to be a hot topic in the coming years and expect a greater collaborative effort across many companies and industries.

The new bill also brings up the issue of applying rules and regulations to prohibit the unlawful use of unmanned systems, as well. As a society, we need to make sure these systems don't get in the hands of the wrong individuals. We, as a society, must also make certain these systems won't be used to infringe our personal privacy. In the past, there have been problems with people operating unmanned systems and flying them over people's backyards for spying purposes. The voyeuristic aspect of these systems can be frightening and the correct steps need to be taken to help ensure that our privacy isn't violated.

In addressing these issues, the new bill states that significant standards will be set for the proper licensing of UAS operators and that the FAA is the governing body that will review the causes of accidents involving UAS technology. As a technology vendor that contributes to the success of these UAS platforms, we will need to adapt our systems to support these new rules and regulations in order to ensure only approved user(s) of the UAS are in control of the platform while in flight. With radio frequency technology, implementing multiple layers of security are required to ensure the effective and reliable delivery of critical communication data.

Our frequency hopping spread spectrum technology, for example, provides one layer of security to ensure the proper safety measures are in place for unmanned flights. Furthermore, security measures such as 128 and 256 bit AES encryption over a variety of frequencies and data rates prevent unauthorized access to the signal as well.

Rules and regulations still need to be hammered out. However, we are excited to witness the passage of the new FAA bill. We expect many challenges, along with a variety of new applications and marketing opportunities as this technology moves forward.

Vendors, such as FreeWave, that also manufacture their UAS products will need to adapt to the increased numbers of radios being sold for the new commercial platforms. We look forward to the continued integration of our radio technology with existing OEM partners and expect new partnerships to form, as well. We will continue to help drive the successful implementation of unmanned aircraft systems in the commercial skies in a safe, practical, and valuable manner.

FCSA—A Year In Review

by Tip Osterthaler, President + CEO, SES Government Solutions

In February 2012, the commercial satellite industry and the U.S. Government marked the one year anniversary of the first award under the Future Commercial SATCOM Services Acquisition, or FCSA. The initial intent of the joint GSA-DISA vehicle was to create a common marketplace for government customers to increase competition, opportunities and technologies, and ultimately, provide competitive pricing to the government. As industry awaits the third tier of the FCSA suite, the custom satellite solutions or CS2 contract, *MilsatMagazine* spoke with SES Government Solutions President and CEO, Tip Osterthaler, to obtain his feedback on the Transponded Capacity and Subscription Services contracts released during this first year of FCSA.

MilSat Magazine (MSM)
Tip, from the perspective of a commercial satellite operator, how was the new FCSA model different from the previous way of doing business? What was this recent change intended to do?

Tip Osterthaler
For the past decade, the Department of Defense procured a large portion of their satellite communications capability through a procurement vehicle known as DSTS-G, which stands for the DISN Satellite Transmission Services—Global. When initially awarded to three small businesses in 2001, DSTS-G was the single largest small business set aside procurement of its kind in DoD history. In 2011, the FCSA vehicle opened the competitive landscape to include commercial satellite operators, integrators, equipment manufacturers, and service providers. This broadening of the participants in the GSA schedule enabled direct dialogue between the commercial satellite operators and the government end-users, and was intended to foster competition, increase options for the government, and reduce costs.

MSM
SES Government Solutions was one of the first satellite operators to receive the new FCSA vehicle under Schedule 70 in early 2011. How would you say SES-GS was positioned when the first opportunities came out for competition considering your foreign ownership?

Tip Osterthaler
We've been doing business with the U.S. Government for over 35 years, since signing our first contract with the Air Force in 1975 as RCA Americom, and even during the DSTS-G era, we provided satellite services and solutions directly to the government under a number of different contract vehicles.

As a U.S. proxy corporation and wholly owned subsidiary of the Luxembourg-based SES, we operate as an American company, so foreign ownership is not really an issue, particularly in light of the fact that there are no large American fixed satellite service companies. Having said all that, the DSTS-G contract limited our direct interaction with the Government and specifically some of the most important end-users of our services, so we are still in the process of rebuilding those relationships.

MSM
Following the first year of FCSA, do you believe the government is in a better position to receive the competitive pricing and common marketplace they initially were seeking? Do you support this new way of doing business with the government going forward?

Tip Osterthaler
At SES-GS, we continue to strongly support the Government's move toward a more open and inclusive procurement environment for commercial space products and we also strongly support the initial intent of the FCSA program. However, for more than 10 years, commercial satellite capacity was channeled through three small companies, and the traditions and relationships that developed over those years are deeply entrenched. I would have to say that, so far, FCSA has not lived up to its promise.

To truly take advantage of the competitive landscape now available to the government, it will take more than a new contracting vehicle. I regularly meet with DISA and other government officials, and I believe they are committed to making FCSA a success. However, as long as end-users are permitted to write requirements that can be met by only the incumbent solution or a single service provider, the benefits of competition promised by FCSA will not be realized by the government.

MSM
Are you suggesting the first year of FCSA was essentially, "business as usual" in terms of the previous DSTS-G program? If so, how?

Tip Osterthaler
We understand that a change this significant will take time to have its complete and intended impact. This is after all the largest SATCOM procurement program to date for the U.S. Government. However, since the first contracts were released in February of 2011, almost all of the awards have been made to the incumbents, either as a recompete on FCSA or as an extension of existing work on DSTS-G. Continuing in this fashion does not get the government in the position of increased competition and affordable solutions they were initially seeking. Unfortunately, early indications reveal similar results in year two of the procurement process.

MSM
Is there substantial risk to continuing to procure capacity in this fashion going forward? If so, what is the risk and what would you recommend the government do?

Tip Osterthaler
The U.S. Government and, particularly, troops deployed in the CENTCOM AOR will be dependent upon commercial satellite capacity for the foreseeable future, and this reality makes it very important that commercial owner-operators like SES remain engaged and focused on the needs of this customer.

I believe that DISA is doing what it can to create a level playing field for companies like ours who are reentering the direct market, but, so far, the expectations they have created over the past three years are simply not being met. We remain hopeful that, over time, the market will indeed be more open to new providers and solutions. However, every day that passes without real competition increases the risk that FCSA will not deliver more choices or lower costs, but instead cause companies such as ours to have to take a "wait and see" attitude rather than relying on what the government says it intends to do. This would be a very bad outcome for both the government and our company, because we simply do not have enough money in the DoD budget to buy the space capabilities we need if we continue to do business the way we have done it in the past.

About the author

Mr. Robert Tipton (Tip) Osterthaler joined SES in 2006 to become the President and CEO of AMERICOM Government Services. Since then, the wholly-owned subsidiary of SES SA has become SES Government Solutions (SES-GS). During his tenure at SES, the U.S. Government business has been transformed from a product-oriented sales channel into a solutions-focused independent subsidiary responsible for all aspects of SES's U.S. Government business, including planning for the next generation of satellites that will be needed by government users. Under his leadership, SES Government Solutions transitioned into a Proxy Corporation structure, allowing the company to broaden its business base to include a wider range of customers and technologies. In 2008, SES-GS entered into a groundbreaking contract with the U.S. Air Force to fly the Commercially Hosted Infra Red Payload (CHIRP), and in 2009, SES-GS conducted its first acquisition, enabling the company to better serve the intelligence community.

From 1997 until 2006, Tip was a Senior Vice President at Science Applications International Corporation (SAIC). His last assignment was Deputy General Manager of the Strategies, Simulation and Training Business Unit, a 2,300 person organization that provides government and commercial clients with advanced modeling, simulation and training solutions. Prior to joining SAIC, Tip served in the U.S. Air Force for 28 years, retiring as a Brigadier General and Deputy Assistant Secretary of Defense for European and NATO Policy. Earlier positions include Vice Commander of the Air Intelligence Agency and numerous command and senior staff assignments. Mr. Osterthaler is a Command Pilot with more than 3,200 hours of flying time in fighter aircraft including multiple models of the F-15 Eagle.

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ULTRA-LINEAR POWER CHART

HPA Model	Linear Power MIL-STD-188-164A (Watts)	Prime Power (Watts)	Peak Power (Watts)	HPA Weight (kg/lbs.)
Ka-Broadband 27.5 – 31.0 GHz				
MT2300L-175/70	**60**	550	150	15.0/33
MT2300L-250/150	**120**	645	215	
MT3600-175	**85**	620	150	23.4/47
MT3600L-250/175	**120**	750	215	
MT3600-250	**120**	805	215	
MT3300L-340/250	**160**	1000	280	29.5/65
MT3300L-500/250	**215**	1100	415	
MT3300L-500/350	**235**	1100	415	
MT3300-500	**235**	1100	415	
Ku-Band 12.75 – 14.5 GHz				
MT2300-200	**100**	830	175	15.0/33
MT3400-400	**200**	1265	360	29.5/65
MT4400-750	**375**	2035	665	38.0/84
MT4400L-1250/600	**500**	2610	1070	
X-Band 7.9 – 8.4 GHz				
MT2500-200	**100**	850	175	15.0/33
MT3400-400	**200**	1265	360	29.5/65
MT4400-750	**375**	2035	665	38.0/84
MT4400L-850/500	**425**	2085	760	
Q-Band 43.5 – 45.5 GHz				
MT3600-130	**55**	600	104	23.4/47
MT3600-180	**80**	650	144	

OTHER BANDS AND POWER LEVELS ARE AVAILABLE.

For additional information, please contact MCL Sales Department at (630) 759-9500 or sales@mcl.com

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