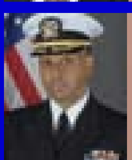
SatCom For Net-Centric Warfare January 2009

MilsatMagazine

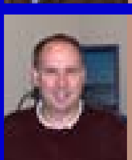
ISR — EYES IN THE SKY


Lieutenant General John T. Sheridan, SMC


Rick VanderMeulen, ViaSat


Commander Joseph A. Smith, NGA


Dan Losada, Hughes


Terry Benson, Overwatch Tactical Operations

Paul Scardino, Globecomm

Columnists Chris Forrester and Jos Heyman

Robert Demers, Howard Stevens, Brian Watson, AGS

Steve Gardner, Enerdyne

José Prieto, GMV

Prashant Butani, NSR

Jeffrey Weaver, XipLink

The Height Of Surveillance

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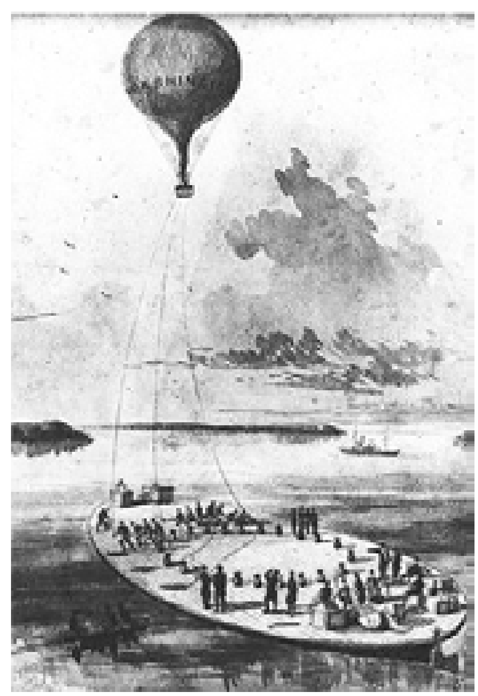
Viable intelligence requires surveillance of the highest caliber. To attain such, altitude is one of the mandatory tools required for mission success.

From the earliest days of humankind's history, intelligence regarding enemy positions and activities required some form of surveillance and reconnaissance to aid in determining the proper positioning of force, and counter force, to best effect. In early June of 1783, *Joseph-Michel* and *Jacques-Etienne Montgolfier* launched their first altitude balloon, sans habitant, with the first human ascent in the buoyant craft just five months later. (Image, right) Balloonists could finally relish, observe and record an entirely new perspective of the world around them.

The French, in 1794, established the first balloon reconnaissance unit with use throughout the Napoleonic wars. So effective was the intelligence received from such surveillance other countries adopted this tactic during the mid-19th century with aplomb. The Austrians found balloons at height became unique platforms for bombing the enemy. They engaged the Venetians in 1849 with 200, unpiloted balloons, which performed the first aerial bombardment in history. Unfortunately, weather prognostication was rather poor at that time, and the bomb-laden balloons were blown back into the Austrian lines due to inconsiderate, poorly timed winds.



With height comes useful reconnaissance. The most successful American Civil War proponent of such use for balloons was *Thaddeus Lowe* who, with a telegraph officer, rose to a height of 500 feet (152 meters) in a Union balloon to view Confederate efforts. Running from the balloon rigging were telegraph wires, which enabled direct (albeit rather slow) communication to the White House and the Union War Office. With brothers *Ezra* and *James Allen*, *Lowe* built the aeronautic service for the Union and developed other leading technologies for the time — how to avoid trees while gaining altitude being one of the foremost. They also developed a complete system for ground to air signaling. As the Confederates noted the effectiveness of the Union balloons during the waning years of the Civil War, they, too, manufactured a balloon constructed of silk dresses. During its maiden voyage, however, the Union immediately captured their reconnaissance craft. The image at the bottom of the preceding page shows a balloon being launched from a coal barge during the Civil War.

Other historical successes for balloons included another win-win for the French. During the Parisian siege in 1870, through the use of balloons, the French were able to move two million pieces of mail and 102 people over German emplacements. In 1880, Britain initiated a training regimen for balloons and Russia initiated aeronautic training near St. Petersburg. The reason for all of this balloon activity was to ensure one's military had the latest intelligence gleaned from the reports of those who had a heightened view of conditions — such reconnaissance was crucial to battlefield success.

Airships, also known as blimps, improved upon the basic balloon gondola and the U.S. Navy found them to be highly useful throughout World War II, becoming the only service to use them during this conflict. Following the Pearl Harbor attack, the U.S. Congress authorized 200 airships to be constructed. The navy used them for a variety of tasks, from search and rescue to scouting and reconnaissance.

Little known is that some 89,000 ships were escorted by airships that, although slower than aircraft, could remain at altitude for up to 60 hours — not a single ship so escorted was lost during the war. The photo at the bottom of the left hand column is of L-class airships on a training flight near the Naval Air Station at Moffet Field in California in February of 1944.

Balloons at altitude, even when used strictly for defensive purposes, helped win the day. During WWII, the British used balloons to force German planes on bombing runs higher into the sky during the Battle of Britain — the aircraft either had to climb or become entangled with the guide wires anchoring the balloons to the ground. The higher in altitude the bomber, the more accurate the AA fire.

During *Eisenhower's* presidential administration during the Cold War, a project known as ***GENETRIX*** launched 516 balloons carrying cameras over the Iron and Bamboo Curtains. Some balloons gained altitudes of 45,800 feet Only seven percent managed to survive their missions, but those photographs provided the best reconnaissance content available at that time. The balloons also recorded wind current data, which was used in helping to determine the U-2 spy plane's flight paths when that extremely high altitude aircraft made its debut.

For governments, the military, NGOs, and first responders, today's satellites are the link to control a variety of resources. From determining where to establish defensive lines when battling a wild fire, from tracking enemy combatants and equipment and UAV flight routes to destroy hostile capabilities, to determining weather conditions, satellites play a surveillance and intelligence role that is without equal. With pinpoint accuracy, many of today's military satellites possess capabilities that remain highly secretive in order to play their roles in future force planning and national defense.

The technologies involved are simply astounding and would read as intriguing, futuristic sciencefiction plots — save for the fact that today they are doing their work and ensuring life, liberty, and the pursuit of happiness. Getting high is the key to success.

We are delighted to present a number of subject matter experts and their views on intelligence and surveillance, as well as other topics of interest in this issue of ***MilsatMagazine.*** MSM

In combination with satellites, ***Umanned Aerial Vehicles*** (**UAVs**) now provide highly detailed surveillance for use by field commanders and first repsonders. Who better to discuss such intelligence and surveillance issues with than subject matter experts Robert Demers, Senior Vice President, Howard Stevens and Brian Watson, Sales Directors, at Americom Government Services (AGS) as well as Jose Prieto, the Business Development Manager for the I&S Business Unit within GMV?

A Conversation With AGS

AGS was formed on November 9, 2001 as an independent corporation, and a wholly owned subsidiary of **SES AMERICOM**. The Company offers satellite bandwidth and custom satcom network solutions to U.S. government agencies, including Defense, Civilian, State, Department of Homeland Security and Intelligence, as well as to commercial contractors who support government contracts. Prior to the formation of AGS, AMERICOM had continuously served the U.S. government satcom market since 1973, through custom network services and transponder leases. Today, AGS is the sole operating company within the SES family focused on meeting the satcom needs of the U.S. government. A mini round table discussion was conducted regarding this topic and the participants included:

- ***Robert Demers, Senior Vice President, AMERICOM Government Services***
- ***Howard Stevens, Sales Director***
- ***Brian Watson, Sales Director***

MilsatMagazine
What is AMERICOM Government Services doing to support current UAV intelligence missions? Has the demand for these missions increased or decreased in recent years? What do you anticipate the demand curve will create in the next several years?

Howard Stevens and Brian Watson
We are currently providing capacity to support the ***Predator***, ***Reaper,*** and ***Global Hawk*** training, research and development missions over the continental United States. In preparing the pilots to operate these vehicles, we supply the satellite bandwidth necessary to operate communications and surveillance systems onboard the aircraft.

Through our ***DSTS-G*** contract with both **Arrowhead** and **DRS** to support these missions, we've seen a rapid increase in demand for our satellite capacity for these activities. The initial requirement has doubled in size over the past two years and has increased by more than 50 percent over the past two months alone.

Because of the number of troop constraints and the increasing effort to better use technology to do more for them, and

Top to bottom: Predator, Reaper, Global Hawk UAVs

to keep them out of harms way, it is very likely we will see the number of Predators, Reapers and Global Hawks quadruple over the next four years. With that steady increase is the requirement for the capacity to conduct even more training, research and development.

MilsatMagazine
With explosive growth in the use of UAV's in combat, and the corresponding need to connect the user with the vast amount of data collected by those UAV's, what is SES doing to prepare for this satellite communications demand?

Robert Demers
SES is routinely launching three to four broadband satellites per year operating in the C- and Ku-bands to areas of the world where we project the greatest need. Typically that demand is driven by our commercial customers, but increasingly, we are adding capacity in areas of the world where there is a history of military demand, as well. Further, given the abundance of our satellite capacity, and with extra fuel on board many of our satellites, it is possible to drift capacity to where it is needed. As the demand for **AISR** service grows, we anticipate doing more of this in the future.

MilsatMagazine
Transformational Satellite (TSAT) is a huge DoD satcom acquisition program. Recently, DoD decided to delay a contract award decision on TSAT until at least late in 2010. Many now argue that TSAT will never happen. Were that to be the case, what could SES offer that would rival the vast capacity planned for TSAT?

The Transformational Satellite Communications System Mission Operations System will provide network management for the TSAT system, providing network-centric interoperability between TSAT and the Department of Defense's Global Information Grid.

Robert Demers
With 40 broadband satellites currently on orbit, as well as several new satellites going up each year, SES is already in a position to offer vast and affordable capacity almost anywhere on the globe.

Working with DoD, it would be very doable for SES to build satellites at a greater rate, and even add features like anti-jam and intersatellite links (ISL's) to newly designed spacecraft. Further, it is possible, even being contemplated, to incorporate the very high capacity spectrum in the Ka-band, which is adjacent to the military's EHF, and where it would be possible to expand the family of DoD ground terminal for use in both bands.

MilsatMagazine
DoD requirements are often strict and unwieldy... do you have any thoughts as to how the milsatcom industry can address these issues, all the while ensuring products that meet those specs?

Robert Demers
DoD and the satellite operators need to have an unfiltered discussion on requirements for capacity planning and capabilities (*e.g.*, protection, information assurance, encryption, payload hosting etc.) and about the level of risk and investment the operators are willing to take to meet DoD requirements;

The commercial satellite industry provides a gamut of services to include bandwidth in land, sea and air operations. Increasingly, that bandwidth is required to be portable and mobile, and is often sought as part of a larger network. What we are seeing more of now is the fact that satellite operators are being asked to provide total solutions through combining bandwidth, terminals, teleports, back haul, etc. As requirements and defense programs continue to expand, and the defense budget continues to be stressed, the commercial satellite industry can offer existing government programs timely and affordable access to space through customized payloads, hosting of payloads, and the potential for smaller satellites with specific capabilities. MSM

A Conversation With GMV I&S

GMV is a privately owned technological business group with an international presence. Founded in 1984, GMV offers a variety of solutions, services, and products in very diverse sectors, including Space, Defense, Telecommunications, and Information Technology for Public Administration and large corporations, among others.

We talked with ***José Prieto***, the Business Development Manager for the **I&S Business Unit** within **GMV**

MilsatMagazine
What does "Intelligence & Surveillance" for the military entail in a broad, industry perspective?

Jose Prieto
Military commands from all over the world have already recognized a significant change in defense and security as we entered the 21st century. During the years of the Cold War, borders were closed, information technology was at its infancy and one of the main concerns in the military domain was invasion, which provides insight into the challenges at the time.

Currently, the threat has evolved to the so called "Asymmetric War" in which insurgents are driven by fundamentalism and new forms of attack (cyber terrorism, CBRNE attacks, IED, suicide bombers). In addition, modern terrorism cells have a complex organizational structure with many interconnected groups that create a global threat rather than isolated conflicts in each nation. However, the worst facet of this new threat is the fact that it is constantly changing, making it less visible and predictable.

In this context, in addition to enhancing the capabilities of the current and future weapon systems, military services have envisioned an urgent need to increase the capabilities of military intelligence, surveillance and reconnaissance in order to obtain information superiority, a key factor for the success against these new threats. Hence, these challenges have been forwarded to the industry in order to develop solutions in the intelligence, surveillance and reconnaissance domain through a great variety of related technologies, such as sensors, sensor networks, information management, data fusion and image processing.

MilsatMagazine
Why is Intelligence & Surveillance so important to the satellite industry within the military? Is it important to GMV? If so, why?

Jose Prieto
Satellite assets (and in consequence the satellite industry) play a major role in intelligence and surveillance. According to a white paper by the European Space Agency, "Space has a security dimension and security has a space dimension." And there are several solid arguments for this statement.

First, satellite technology provides weather-resistant, 24/7, unobtrusive access to denied areas, giving the warfighter the capability to survey wider zones with great attention to detail and feed intelligent analysts with vital information about situation awareness. In addition, the intelligence and surveillance capability heavily relies on a solid and reliable communications infrastructure. Again, the satellite industry provides high data rate communications satisfying the most challenging security requirements.

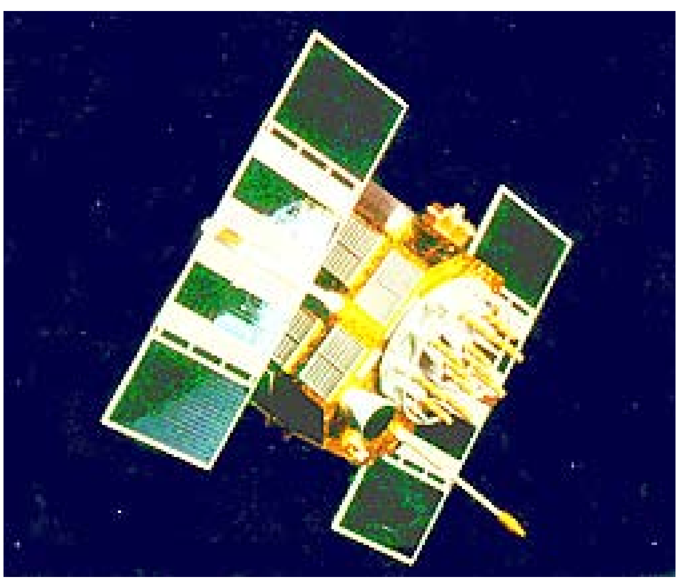
Intelligence and surveillance is indeed an important area to **GMV**. We have been providing innovative solutions in the space sector for more than 25 years and we confront the challenges posed by such Intelligence & Surveillance needs with great motivation and excitement. GMV holds a leading role in the space sector and as mentioned before, it is widely admitted that the satellite industry has the answer to many of the most pressing Intelligence & Surveillance problems. In this sense, we feel committed to this area and compelled to engage with our partners and customers in order to provide the capabilities that the new threats are demanding.

MilsatMagazine
What does GMV do to specifically support I&S? Can you provide some examples?

Jose Prieto
GMV provides intelligence and surveillance solutions through several initiatives.

Knowledge of multidisciplinary technologies for data processing, image treatment, algorithm development, visualization, storing, publication and data merging, as well as understanding the users and demanded applications, are essential to developing good quality I&S systems. After more than a decade of providing these solutions to a wide range of customers, GMV has acquired the experience, technology and equipment for supplying earth observation data processing solutions and systems.

GMV's presence in the space industry is demonstrated through our technologies, systems and services in the areas of remote sensing data processing and exploitation, and the development of ***Global Navigation Satellite Systems*** (**GNSS**) and applications. GMV is also present



GNSS system satellite

GMES satellite

in the telecommunications industry, providing innovative solutions through state-of-the-art platforms. Through its involvement in programs such as the ***Global Monitoring for Environment and Security*** (**GMES**) program, European Commission framework programs, and different projects and development of GNSS system applications, GMV provides a wide array of user segment systems and solutions.

In the particular field of **ISTAR** (***Intelligence, Surveillance, Target Acquisition and Reconnaissance***), GMV participates in the **MAJIIC** program (***Multisensor Aerospace-Ground Joint ISR Interoperability Coalition***) through the Spanish MoD for the development of two ISTAR exploitations posts.

Last, but not least, one should not forget that there are serious concerns due to the vulnerability of the space assets. This vulnerability has to be considered during the development, deployment and operation of space systems and GMV's portfolio of products include solutions such as physical security, encryption and access control.

MilsatMagazine
What Intelligence & Surveillance solutions are available to ensure the safety of our warfighters, government agency personnel, etc. in the military? Does GMV offer any of such solutions?

Jose Prieto
Today, there exists a huge variety of ISTAR systems ranging from strategic to tactical domains both at national and international level. Some examples are:

- ***Coalition Aerial Surveillance and Reconnaissance (CAESAR): The goals of the CAESAR project are to develop the concept of operations, tactics, techniques and procedures (TTPs) and the technology that will allow efficient and effective use of ground surveillance sensor platforms in a coalition environment.***
- ***Multi-sensor Aerospace Joint ISR Interoperability Coalition (MAJIIC): The main objective of MAJIIC is to maximize the military's use of surveillance and reconnaissance resources through the development and evaluation of operational and technical means for interoperability for a wide range of ISR assets.***
- ***Networked Interoperable Real-time Information Services (NIRIS): This is a system to use Internet technologies for the transmission and dissemination of a Recognized Air Picture (RAP) on a NATO classified network in near real-time.***
- ***Multi-Lateral Interoperability Program (MIP): This is a NATO program with the aim to achieve international interoperability of Command, Control and Communications Information Systems (C3IS) at all levels from corps to battalion, or lowest appropriate level, in order to support multinational (including NATO), combined and joint operations and the advancement of digitization in the international arena***
- ***Shared Tactical Ground Picture (STGP): The STGP was an initiative by seven NATO nations and NC3A to improve sharing of information in a coalition environment***

In addition, each country often has its own "national implementation" for such systems which is aligned with its own requirements. GMV has participated in some of the international programs (MAJIIC, MIP) and is also the main resource for the Spanish systems related to Field Artillery and Anti Aircraft Artillery. As mentioned earlier, GMV also provides a great variety of products and services related to intelligence and surveillance in the following areas: Earth Observation, data processing, data fusion, command and control and security.

MilsatMagazine
What will the current global financial doldrums mean to industries within the military environs?

Jose Prieto
The military is by no means isolated from the global financial crisis. In fact, it is often said that the armies are the first ones suffering the negative effects of the crisis once the economy goes south, and the last ones taking benefit from the eventual financial recovery.

However, even worse than the budgetary issues which are comparable with those from other industries, is the potential lack of confidence which comes into play in these situations. When facing the threats and challenges outlined above, international cooperation is key, and this cooperation is in inevitably based on trust. It is then essential to foster and enhance trust in the international arena, as a global threat requires a global response.

We at GMV feel optimistic about this topic since we are used to collaborating and competing in the international scenario as well as the military domain. GMV is in fact one of the most active companies in defense and security international programs such as the **European Defense Agency**, **NATO**, the **European Commission** and the **European Technology Acquisition Program**.

MilsatMagazine

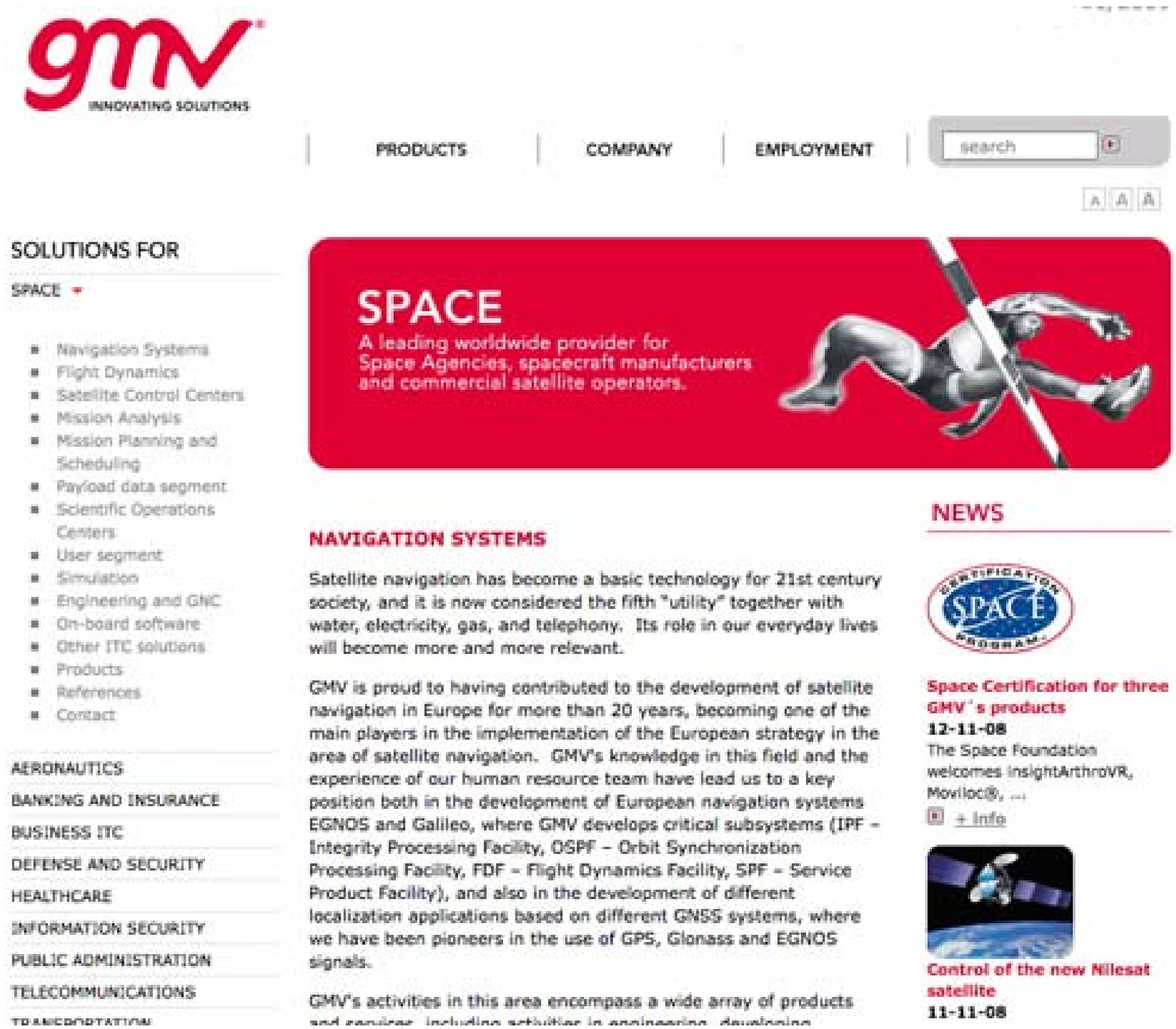
What does GMV see as important facets of the business for 2009/2010?

Jose Prieto

As already mentioned earlier, we feel that cooperation is essential given the current financial scenario. This situation has already started to create unconventional public-private partnerships in which it is possible to find private industries, research centers, final users and academia collaborating in common ventures. International defense agencies are growing, and each day it is more common to find governments spending money through those agencies in the form of international cooperation programs. As Mr. *Javier Solana*, *European Union High Representative for the Common Foreign and Security Policy* (**CFSP**), said in the *Economic Development Administration (EDA) European R&T Conference* held in 2006, "We should spend more, spend better and spend more together."

We at GMV are already starting to notice this trend and we feel that in 2009-2010, international defense cooperation programs will play a vital role. Our plans are to continue gaining the confidence of our partners and clients by maintaining excellence in our work and capitalizing on our significant international experience gained over more than two decades.

For further information, please email José at jprieto@gmv.com, *or call* + **34 91 807 21 27.**



As the Commander, Space and Missile Systems Center, Air Force Space Command, Los Angeles Air Force Base, California, Lt. Gen. John T. "Tom" Sheridan is responsible for managing the research, design, development, acquisition, and sustainment of space and missile systems, launch, command and control, and operational satellite systems. With more than 6,500 employees nationwide, General Sheridan is also responsible for an annual total budget ithat exceeds US$12 billion.

General Sheridan is the Air Force Program Executive Officer for Space and is responsible for the Air Force Satellite Control Network; space launch and range programs; the Space-Based Infrared System Program; military satellite communication programs; the Global Positioning System; intercontinental ballistic missile programs; Defense Meteorological Satellite Program; the space superiority system programs and other emerging transformational space programs. To say his day is rather "full" is an understatement of gigantic proportions, yet he managed to reserve some time to discuss his role with MilsatMagazine... a big thank you to the General and his staff.

MilsatMagazine
As the Commander of the Space and Missile Systems Center, you have an enormous responsibility in commanding a variety of wings responsible for the security of our nation and the improvement of warfighte communication. As the Program Executive Officer for Space and the Air Force Satellite Control Network, which projects do you feel will have the most positive impact for our country and those in service?

General Sheridan
I think all of our programs, once we deliver their capabilities to our users, will have a very positive impact. If you look at nation-wide (and even worldwide) impact, GPS is the best known and the most far-reaching of our programs. Nearly everyone in the U.S. is impacted in some way by GPS. Many use its navigation capabilities in their cars or while hiking, and almost everyone uses its timing capabilities when pumping gas using a credit card or using an ATM machine. The Air Force provides this incredible signal capability for free world-wide. Our Joint Forces use the military precision signals from GPS for most all of our operations.

Our MILSATCOM programs provide much of the wide-band communications in use by our deployed forces and almost all of the protected comms for strategic communications. Our DSP program, and soon our SBIRS program, provides state of the art global missile warning capability and contributes substantially to Missile Defense, Battlespace Awareness, and Technical Intelligence data.

Our EELV program is the backbone of un-manned launch capability for our nation. Our programs provide many other critical capabilities to our Joint warfighters too numerous to mention here.

MilsatMagazine
You follow the command of Lieutenant General Hamel at SMC... due to the importance of this command, do you know what criteria was used to spotlight you for this position? Do you have a broad depth of experience within the MILSATCOM environment?

General Sheridan
Spotlight may be too strong of a word, but I am truly privileged to be given the opportunity to command this extraordinary center which has a tremendously dedicated workforce. Of my 33 years on active duty, some 26 of them have been in Space or Space related assignments. I have worked in both the classified and unclassified worlds, and been responsible for both program management and operational leadership. These positions have afforded me a broad depth of experience in the overall space and acquisition environment.

MilsatMagazine
Your previous post was as the Deputy Director of the NRO — how different is your command at SMC?

General Sheridan
While at the NRO, I served as the first military Deputy Director. Given that over half of the NRO workforce is comprised of uniformed personnel, I think I was able

to help represent them personally to the DNRO. In addition, I was able to bring a military perspective to the NRO front office operations. The day-to-day work at the NRO and SMC is similar. Both organizations are responsible for design, development, production, delivery on orbit, and sustainment of major National Security Space system capabilities. Both organizations are at the cutting edge of NSS development. While mission focus differs, the challenges both face are equally complex. Both have highly technical workforces which must be trained, nurtured, mentored, and retained.

MilsatMagazine
General, you manage a huge budget for MILSATCOM. What should potential suppliers realize in order to become contenders in support of U.S.A.F. programs? What do you see as a common failing with submitted RFPs that drive a wedge between selection and non-selection?

General Sheridan
We follow the Federal Acquisition Regulations to the very best of our ability. We follow structured and disciplined process to ensure fairness in our evaluations. We attempt to communicate openly as often as possible with the prospective offerors. We encourage offerors to follow our RFP instructions to bidders and ask for clarification whenever needed.

MilsatMagazine
With a background and education in acquisition, resource strategies, and security, your career development has been intense — how do you successfully juggle your Air Force career and your personal life with family and friends?

General Sheridan
I believe it is important to maintain a healthy work-life balance. You are right — the demands of the job are steep. I balance that with regular running three to four times per week. I find running helps me work over issues in my mind without interruption, and it's just as equally important in maintaining a clear mind for decision-making. I have a very close and devoted family. My wife and I have been married more than 32 years, and we talk with each other every day, whether I'm away TDY or home. Good communication, whether at home or at work, is a key factor toward success.

MilsatMagazine
What environments moved you into an interest of military satellite communication and use?

General Sheridan
My first job in the Air Force was with the AWACS SPO at Hanscom AFB. From there, I transitioned to working with NATO AWACS in Europe. Satcom is crucial to the success of that aircraft's mission. My next assignment was to Sunnyvale, CA, where I began my career in space.

I eventually became A5 for AFSPC (Air Force Space Command), and was responsible for addressing the joint warfighter's need for protected and unprotected satellite communication. This varied from in-field requirements, open sea requirements, to UAV requirements. I am very pleased to be working as the PEO for Space and working to develop new modern systems for military satellite communication.

Air Force Space Command

MilsatMagazine
Your past role as the Commandant of Air Command and Staff College witnessed the training of new officers and personnel for the U.S.A.F. How do today's new officers stack up as competent individuals who add value to the service?

General Sheridan
We have an extraordinary cadre of men and women who make up the officer, enlisted, and civilian corps of the United States Air Force. General Bob Kehler, Commander of AFSPC, likes to say that one of his priorities is to make sure that the people coming up behind him are even better than the ones who came before. I couldn't agree more — each day, the nature of threats to the country changes and the Air Force must be continuously evolving to meet those threats.

Our men and women today are the best and the brightest. They have been called upon to deploy to war far more often than many more senior military members, and they are performing brilliantly. I am confident that they will lead us successfully into the future.

MilsatMagazine
You were promoted to Lieutenant General in May of 2008, a superb accomplishment. As a general officer, has the U.S.A.F. provided a suitable career environment others should consider?

General Sheridan
The Air Force offers everyone, from the most junior Airman Basic to the most senior four-star general, an incredible career environment, for so many reasons.

First, being an Airman of any grade or rank in the Air Force offers the opportunity to serve your country. We in the military have the special role of protecting and defending the nation.

Second, serving in the Air Force allows you to work on some incredible projects with some amazing individuals. In the Air Force, we develop some of the most technologically cutting-edge systems ever invented, and in doing so, work with the best and brightest.

Third, one of the hallmarks of the Air Force is professional development — in whatever your career field is. There are incredible opportunities for education, training, and mentoring to develop leadership and life skills that serve you well in whatever you do.

And finally, you have a unique opportunity to live in many locations and communities. I've served in Massachusetts, Virginia, California, England, The Netherlands, Colorado, Alabama, and Washington, D.C., and traveled to every continent but Antarctica.

MilsatMagazine
How do you select your staff officers for Wing command and project assignments?

General Sheridan
The process for selecting key staff varies depending on the assignment. For Wing/Group and Squadron commanders, we have a board who selects individuals competitively based on their record. There is a set process where they review previous assignments, performance evaluations, career, and other factors to choose from those who are qualified. For specific projects and key staff assignments at SMC, I get to select individuals. At lower levels within SMC, I trust my subordinate commanders and directors to choose the best individuals for the job at hand. Most important is living our Air Force Core Values — integrity first, service before self, and excellence in all we do.

MilsatMagazine
Lastly, what do you see as the most important role for MILSATCOM over the next year or so?

General Sheridan
MILSATCOM plays key role in supporting the joint warfighters in Iraq, Afghanistan, and really all around the world. We are critically dependent on both military and commercial assets to keep information flowing to and from deployed forces. MILSATCOM systems enable command and control of ground forces, equipment, and other space systems, and they provide critical support to the global information grid that supports warfighters and national decision-makers.

We at SMC have the critical role of delivering new MILSATCOM capabilities in the next two years. AEHF and WGS will be launched, and we must check out and begin integrating these capabilities with the warfighter. In addition, we are continuing the early development of TSAT to ensure we're on track for next generation of digital IP-based systems. MSM

SMC HQ at Los Angeles Aif Force Base

Ric VanderMeulen is the Vice President of Government Satcom at ViaSat Inc. and he leads the Company's efforts to transition commercial broadband network-centric satcom architectures and products to the government market. The group is developing the nexgen Government standard Satcom Modem and is integrating systems for DoD deployments in multiple theaters worldwide. Mr. VanderMeulen is working with the major DoD acquisition centers including the U.S. Army PEO EIS and PEO C3T, the U.S.A.F. ESC, the U.S. Navy PEO C4I & Space, DISA, and the OSD NII. He joined ViaSat in 2001. Previously, he served as Director, Business Development for Connexion by Boeing, where he led the venture development for this new high-speed Internet and Intranet data service for mobile travelers. In this role he also led the strategic planning for commercial new ventures for the Boeing Space and Communication Group.

MilsatMagazine
Thank you for your time, Mr. VanderMeulen... would you please give our readers a rundown of your background and what your responsibilities are as the vice president and general manager of ViaSat Government Satcom Systems as well as the areas of responsibility for your department?

Ric VanderMeulen
First, I would like to thank you for the opportunity to share our thoughts about military Satcom.

I've been with **ViaSat** since 2001, working with an extremely capable group of people. Our focus is on delivering mission critical utility to deployed users while minimizing the total system cost. The constantly growing user demand for ever-increasing communication capacity requires ever-increasing capacity at the lowest possible cost.

Our Government Satcom Systems group has been successful in transitioning ViaSat commercial broadband Satcom architectures and products to the government market. We've been pretty successful with that, beginning with our UHF and ***LinkwayS2*** networking systems and continuing with next-generation military standard Satcom and network Satcom developments such as the ***Enhanced Bandwidth Efficient Modem***, ***Joint IP Modem***, ***Blue Force Tracking 2***, and new capabilities such as communications-on-the-move.

I have been quite fortunate in having the opportunity to be involved through the inception and evolution of military Satcom. I started my career as a design engineer at **Rockwell Collins** working on some of the first mobile Satcom systems for ***UHF AFSATCOM***, ***Milstar 1*** and ***2***, ***UHF Follow-on***, and ***FleetSat*** satellites. I was also able to work in various management, business, and corporate development positions in communication networking. These included commercial and military terrestrial and satellite communications. I also spent time at the **Boeing Company** where I led a team that defined the capability for new commercial ventures including what became ***Connexion by Boeing***, the first airborne broadband system for commercial airliners. Collectively, these experiences provided me exposure to a broad range of customer needs, technology, and market forces that I use now to position us to understand the ever-increasing demand for communication capacity and the continual need to find ever-more efficient ways to deliver it.

MilsatMagazine
Are you working with other government entities outside of the United States, given ViaSat's commercial global responsibilities? Are you are also engaged in developing business with NGOs, agencies, and military organizations?

Ric VanderMeulen
The need to be able to access networks is universal. You clearly see it in the business environment as well at the park or coffee house. The need for deployed work forces to have broadband access while deployed or in transit expands into non-military United States Government agencies, NGOs, and entities outside the United States. We are working on many of these opportunities.

MilsatMagazine
What are your lead projects for ViaSat? Please outline those projects and what is to be accomplished?

Ric VanderMeulen
The commonality of our projects is communication and network communication efficiency. Sometimes the word efficiency gets over used, but if we can deliver almost limitless connectivity, where and whenever it is needed, at a cost basis that is equivalent to terrestrial services, we will have accomplished that goal.

Our lead projects include creating new levels of Satcom throughput, capacity, and connectivity, including tactical mesh (any-to-any) networking, the joint IP net-centric open standard system, the next generation of mobile Satcom technology, and improvements in Battle Command systems such as ***Blue Force Tracking***.

MilsatMagazine
How is your division involved with such programs as C-MNF, FHRN, SNAP, SWAN and WIN-T? Could you tell us a little bit about each of these programs and why they are beneficial to the warfighter?

Ric VanderMeulen
All of these programs are part of the rapid transition from pre-positioned telephony-based communication systems to "everything-over-IP" always-on network communications. The concept is to get access to the ***Global Information Grid*** (**GIG**) or fiber world as quickly as possible. Teleport and FHRN entry points get the deployed systems integrated into the ***SIPRNET*** and ***NIPRNET*** as soon as they pause, and, in some cases, while they are on the move.

We are one of the many technology partners making these programs happen. The transition to network-centric IP-based communication, from the user baseband, through the security devices, through the satellite network, and into the GIG, has happened at an unprecedented rate. Such could not occur without the cooperation of the technology partners.

We (the U.S. Army, U.S.N, and U.S.M.C. acquisition centers, R&D centers, and battle labs; other Government organizations such as DISA and OSD NII; and then industry participants, including the integrators and technology partners) have deployed and are operating four to five times more Satcom deployable terminals in the past four years than where deployed and operated in the preceding 20-30 years.

MilsatMagazine
One of the applications of the GPS system being used by the U.S. military is known as Blue Force Tracking — how do ViaSat products aid in transmitting the information upon which military commanders can make trusted, in-theater decisions, based upon the data they receive?

Ric VanderMeulen
We are working with the ***Army FBCB2 Program Office*** and their lead system contractor **Northrop Grumman Missions Systems** on the 2G communication architecture for Blue Force Tracking. We are leading the design of the satellite upgrade networking part of ***BFT2*** for Northrop Grumman Mission Systems. One of the things we do best is increasing the capacity of satellite channels at the lowest possible cost. In this case, we are using our ***ArcLight*** spread spectrum technology to enable the capacity increase, which translates to much faster location updates and throughput for eight times as many messages at any one time. One recent demo showed 45 times faster data transfer and information update intervals cut to about 2 seconds compared to 10 minutes for the first generation system. Imagine how much more accurate the system will be in showing locations of everyone in a battlespace.

MilsatMagazine
When considering ViaSat's LinkWay system for milcom projects, one of the terms used in describing the LinkwayS2 sat modem is full mesh — would you describe this technology and why it is so important to the military? How does the modem offer or include the critical need for secure communications?

Ric VanderMeulen
Imagine a piece is important data, maybe a live feed from a UAV. If that information is sent to a centralized location and then it is redistributed into the theater, you get twice the delay. In addition, you use the

ArcLight terminal system for Blue Force Tracking (courtesy: ViaSat)

LinkWay System

satellite twice. The satellite is by far the most expensive capital infrastructure element in this communication path. Using it twice and delaying the data does not help the military. Instead, sending it with a mesh (any-to-any) satellite network modem, the military gains the time advantage of a single satellite hop and they gain the ability to use the satellite capacity for more missions.

There are two major transponder-based satellite network architectures. One has a central hub or gateway that all traffic in the network must pass through. In this architecture, traffic returning to the theater requires two satellite "hops"; up and down from the sending terminal to the hub and a second hop from the hub to the receiving terminal. The second architecture uses a mesh system, in which all terminals can communicate directly with any other terminal in the network. That is an advantage when you have a large amount of traffic staying with the theater. That is the advantage for the ***Joint Network Node*** (**JNN**), ***WIN-T Increment 1***, and ***SWAN*** programs.

MilsatMagazine
Is the LinkWayS2 also backwards compatible with previous modem series? Why is the LinkWayS2 system such an improvement over previous models?

Ric VanderMeulen
Yes, the new ***LinkWayS2*** includes an operating mode that makes it backwards compatible with ***LinkWay 2100*** terminals.

Many of the improvement comes from the DVB standard. The ***DVB-S2 ACM*** feature reduces satellite bandwidth requirements by as much as 63 percent for the downstream (hub to remotes) traffic. But we also implement several new technologies that improve performance beyond the standard. For example, our ViaSat-proprietary ***Dynamic Link Adaptation*** reduces required bandwidth for the upstream by up to 18 percent. And we focus just as much on the performance of specific applications. That's what customers want. So we've added technology that enables those familiar applications and networking features to perform just as they would on a terrestrial network.

MilsatMagazine
What is the future of DAMA technology on UHF satellites? How does ViaSat play into this arena?

Ric VanderMeulen
There's still an important role for ***UHF DAMA***. It is one of the only true global networks available to the military. With its constellation of satellites and four network control sites, you can reach virtually anywhere on the planet. That's not the case with X-, Ku- or Ka-band, where you can connect only to another user under the same satellite beam. Simultaneously, every military user wants more bandwidth and throughput. ViaSat is at work on enhancements to UHF that will enable more users to access the system, access it more easily, and gain higher throughput for new applications that require better performance. That program is the ***Integrated Waveform*** (**IW**), part of the **Department of Defense** (**DoD**) *Standardization Program*. IW is designed to prolong the life of UHF DAMA satcom through a series of network upgrades.

MilsatMagazine
How is ViaSat involved in communications-on-the-

ViaSat's ANPSC 14 BGAN Terminal

move (COTM)? Are there any current in-theater operations using the ViaSat equipment? Do you see COTM as a major service push with new projects potential over the next year or two?

Ric VanderMeulen
The ***Arclight*** system we've been talking about is also an ideal system for COTM. On the commercial side, ViaSat has the first FCC approved Ku-band system for mobile satellite communications. It's already flying on over 75 business aircraft and has logged over 100,000 hours of flight time. It's also being sold by our partner **KVH Industries** for maritime applications, and we're working with KVH to expand that network to near global coverage by the end of 2009.

How does that relate to the military? They can tap into the same global network for comms on-the-move. All the same advantages — small antennas, lower cost, higher speed, reliable mobile access — apply to DoD applications too. We've already demonstrated it on military vehicles with great results. And a number of systems are being used on C-130 aircraft for Special Operations forces.

The other part of the question is more complicated. There's no doubt it works and Ku-band bandwidth is far less costly and higher capacity than other mobile broadband systems. But we have yet to see great demand for COTM by the military. They aren't certain how much they really need it. Is there major potential? Absolutely. Will it happen? We don't really know.

MilsatMagazine
Is ViaSat involved in the UAV/UAS communication sectors? If not, are there any plans to enter this arena?

Ric VanderMeulen
In 2006, we acquired a dynamic small company named **Enerdyne** that is bringing new digital video links to this market. That ***EnerLinks*** digital technology, plus a number of other Enerdyne technology improvements, greatly increases the video quality and operational range for the UAS market. Enerdyne already had a great core business in classified applications and is now establishing itself as a key player for all UAS video links.

MilsatMagazine
What do you see as among the most important technological considerations for our military and government organizations over the next few years? How will ViaSat address those areas? Looking forward, what do you see as ViaSat's major thrusts for 2009 in the government and military communication environments?

Ric VanderMeulen
Fundamentally, ViaSat competes by applying advanced new technologies that are more cost effective than those used by competitors — who are more often than not much more established players. We've been fortunate enough to be successful several times with this approach, notably in our original defense markets for UHF-band satellite terminals, complex communication environment simulation, then with MIDS, and again in the Information Assurance market for Type 1 Internet Protocol security. Each of those has been an enduring and profitable "franchise" type market segment. We're now working to extend our reach in defense communications to information assurance in space, and video data links for small tactical UAVs.

There seem to be several procurement trends that play to our strengths. First is the military implementation of commercial products to save costs and shorten acquisition cycles, rather than funding major new R&D programs. The second is Navy, Marine, and Army communication and information system upgrades. And, finally, an increased emphasis on Special Operations. We think all of these elements are nicely targeted within ViaSat's sweet spot.

MSM

by Jos Heyman, Tiros Space Information

In this presentation, we will look at military early warning satellites, electronic intelligence gathering satellites, and ocean surveillance satellites launched by the United States military forces. Information about these satellites is invariably secret and the satellites are not given a name at the time of launch, or, in recent years, are grouped in a series of diverse military satellites simply identified as USA, without any further indication as to the objective.

Historians/analysts can often determine the objective of a satellite from the small bits of information that are available, including the launch site and the launch vehicle, but some of the information only arrives years after the launch. It is for this reason that the interpretation of this information by individual historians/analysts may sometimes result in different identifications. Until the programs concerned are declassified, these differences will occur.

Early warning satellites provide an advance warning of missile attacks through the detection of missile exhaust plumes. Electronic intelligence (elint) satellites pick up and record radio transmissions and radar transmissions while over foreign territory and then play back this information once over friendly territory. The information gained in this manner gives an insight into the strategy of the opposing powers and also reveals the location of the radar sites. Ocean surveillance satellites locate and monitor the movements of naval vessels by means of electronic equipment.

Early Warning Satellites

Midas series

The primary objective of the early warning satellite development was to fill the gaps in the coverage provided by the land based **Ballistic Missile Early Warning System** used by the United States to provide an early detection of a missile attack. This system initially consisted of a chain of large radar stations, which observed the USSR.

Name	Int. Des.	Launch	Notes
Midas-1	—	February 26, 1960	Failed to orbit
Midas-2	1960 1	May 24, 1960	
Midas-3	1961 1	July 12, 1961	
Midas-4	1961 1	October 21, 1961	Used in Project Westford
Midas-5	1962 1	April 9, 1962	
Midas-6	—	December 17, 1962	AKA Ops-5201; failed to orbit
Midas-7	1963 014A	May 9, 1963	Used in Project Westford
Midas-8	—	June 12, 1963	AKA Ops 1240; failed to orbit
Midas-9	1963 030A	July 19, 1963	Failed to separate from ERS-10

Table 1 - Midas launch dates

The ***Missile Detection and Surveillance*** (**Midas**) series of satellites was initiated in 1960 and appeared in two generations. The initial Midas spacecraft, which had a mass of about 2000 kg, were launched by ***Atlas Agena A*** launch vehicles. The combination of the mass and the limited capabilities of the launch vehicle allowed the spacecraft to achieve only a low near-equatorial orbit of about 540 km altitude. The introduction of the ***Atlas Agena B*** version and the reduction of the mass of the spacecraft to 1600 kg through the use of solar cells allowed a higher orbit of 3500 km, commencing with ***Midas-3***.

The satellites were equipped with infrared sensors developed by **IT&T**, which could detect missiles as soon as they would be launched. It is believed the program was only partially successful due to the limited capability of the sensors that were carried.

The sensor development undertaken as part of the Midas program led briefly to a satellite proposal identified as **Code 461**. This program was cancelled in favor of the **Code 266** program, which the author has labeled as Improved Midas. The three satellites in this series are believed to have tested the use of television cameras in conjunction with the infrared detectors, but may not have been successful.

Name	Int. Des.	Launch	Notes
I. Midas-1	1966 051A	June 9, 1966	AKA Ops-1960 and FTV-1351
I. Midas-2	1966 077A	August 19, 1966	AKA Ops-0856 and FTV-1352
I. Midas-3	1966 089A	October 5, 1966	AKA Ops-1920 and FTV-1353

Table 2 - Improved Midas launch dates

Name	Int. Des.	Launch	Real identity
BMEWS-1	1968 063A	August 6, 1968	Canyon-1
BMEWS-2	1969 036A	April 13, 1969	Canyon-2
BMEWS-3	1970 046A	June 19, 1970	Rhyolite (RH)-1
BMEWS-4	—	December 4, 1971	Canyon-4
BMEWS-5	1972 101A	December 20, 1972	Canyon-5

Table 3 - BMEWS launch dates

BMEWS

The BMEWS series of satellites is the prime example where historians/analysts, at the time of the launch, deduced an objective from the little bit of information that was available and which, with the passing of time, proved to be incorrect.

The ***Ballistic Missile Early Warning System*** (**BMEWS**) satellites were to have followed in the footsteps of the Midas series as an experimental early warning system. Also referred to as **Program 949**, the satellites were believed to have been built by **TRW** and were to have been equipped with infrared sensors developed by **Aerojet** and a television system developed by **RCA**.

Six satellites were earmarked as such and the first satellite in the series was placed in a near-geostationary orbit with an inclination of 10°, giving it a figure 8 orbit with an apogee over the USSR. This type of orbit gave the satellite an extended time over the western part of the USSR. The second satellite in the series was placed in a geostationary orbit, while the third failed to achieve a correct orbit. Following the failure of fourth satellite, the fifth achieves the desired geostationary orbit. The final satellite was believed to have been an experimental flight. Subsequent information has led to the revision of the objectives of the satellites concerned, as shown in the table. Ironically, none of the satellites were associated with early warning efforts.

IMEWS series

The ***Integrated Missile Early Warning System*** (**IMEWS**) satellites were the first early warning satellites of an operational nature. Also referred to as **Code 647**, **program 266**, **AFP-949**, ***Defence Satellite Program*** (**DSP**) and **LS-3A**, the system was inaugurated in 1970 and three operational satellites were placed in geostationary orbits over the Atlantic, Indian, and Pacific Oceans to provide a global surveillance capability. In addition, the system had two satellites as in-orbit spares. The satellites, built by **TRW**, were equipped with television cameras and infrared sensors operating through a ***Schmidt*** telescope, which was offset from the main axis of the satellite by 7.5° so that, with the satellite spinning at 6 rpm, a conical scanning pattern was achieved. Over several scans, this allowed observers to distinguish between a stationary heat source (for instance, a forest fire) and a moving heat source (a missile). In addition, the satellites were equipped with thrusters for station keeping and at the end of their operational life they were boosted into a higher orbit.

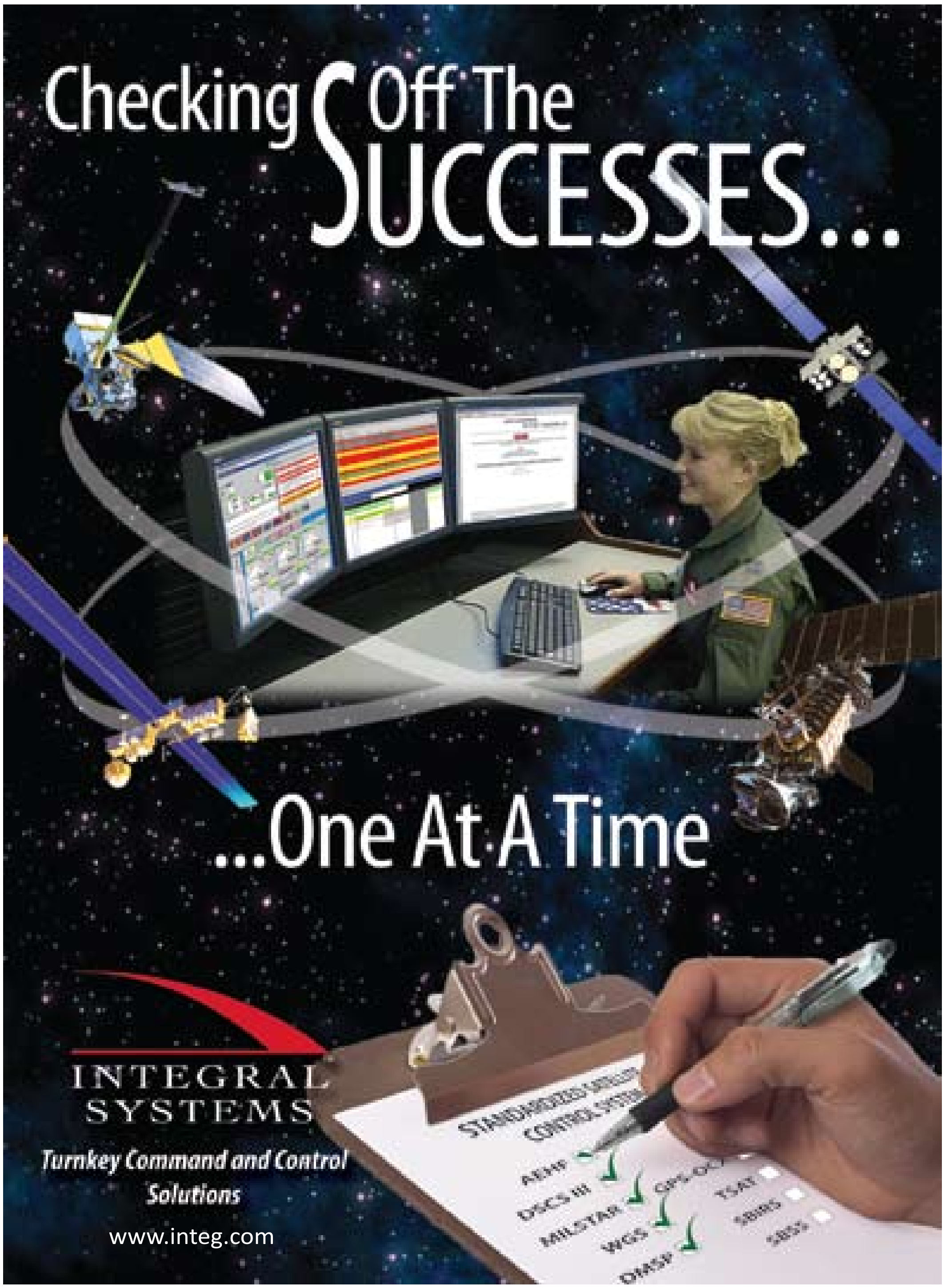
The first generation consisted of ***IMEWS-1 to -4*** and it is believed the satellites carried an array of 2000 infrared sensors. The satellites reportedly had a length of 7 m and a diameter of 2.78 m with a mass of 1100 kg.

The second generation commenced with ***IMEWS-5*** and incorporated several improvements as well as some additional instrument packages, although the main sensor payload remained essentially the same.

Commencing with ***IMEWS-8*** the ***Multi-Orbit Satellite/Performance Improvement Modification*** (**MOS/PIM**) was introduced, which allowed multiple targets to be accessed. The extra electronic packages increased the mass to 1170 kg.

IMEWS-12 introduced an improved resolution as well as better polar/global coverage. The main sensor payload, known as ***Sensor Evolutionary Development***, had increased to 6000 detectors while an ***Above the Horizon*** (**ATH**) capability provided improved polar coverage. The mass of the satellites had increased to 1674 kg.

The third generation, commencing with ***IMEWS-14***, was equipped with an improved telescope and 6000 infrared sensors. The satellites in this generation had a length of 10 m, a diameter of 4.15 m, and a mass of 2500 kg. Some, or all, of the satellites in the series also carried a magnetospheric plasma analyser to measure low-energy ions and plasma, as well as a particle analyser, to measure energetic particles. Following the launch of ***IMEWS-23***, the remaining two satellites, ***IMEWS-24*** and ***-25***, were cancelled.



Name	Int. Des.	Launch	Notes
IMEWS-1	1970 093A	November 6, 1970	AKA Ops-5960; did not reach correct orbit
IMEWS-2	1971 039A	May 5, 1971	AKA Ops-3811
IMEWS-3	1972 010A	March 1, 1972	AKA Ops-1570
IMEWS-4	1973 040A	June 12, 1973	AKA Ops-6157
IMEWS-5	1975 118A	December 14, 1975	AKA Ops-3165
IMEWS-6	1976 059A	June 26, 1976	AKA Ops-2112
IMEWS-7	1977 007A	February 6, 1977	AKA Ops-3151
IMEWS-8	1979 053A	June 10, 1979	AKA Ops-7484
IMEWS-9	1981 025A	March 16, 1981	AKA Ops-7350
IMEWS-10	1982 019A	March 6, 1982	AKA Ops-8701
IMEWS-11	1984 037A	April 14, 1984	AKA Ops-7641
IMEWS-12	1984 129A	December 22, 1984	AKA USA-7
IMEWS-13	1987 097A	November 29, 1987	AKA USA-28
IMEWS-14	1989 046A	June 14, 1989	AKA USA-39
IMEWS-15	1990 095A	November 13, 1990	AKA USA-65
IMEWS-16	1991 080B	November 25, 1991	AKA USA-74
IMEWS-17	1994 084A	December 22, 1994	AKA USA-107
IMEWS-18	1997 008A	February 24, 1997	AKA USA-130
IMEWS-19	1999 017A	April 9, 1999	AKA USA-142; did not reach correct orbit
IMEWS-20	2000 024A	May 8, 2000	AKA USA-149
IMEWS-21	2001 033A	Augusst 6, 2001	AKA USA-159
IMEWS-22	2004 004A	February 14, 2004	AKA USA-176
IMEWS-23	2007 054A	November 11, 2007	AKA USA-197
IMEWS-24	—	—	Cancelled
IMEWS-25	—	—	Cancelled

Table 4 — IMEWS launch dates

BSTS

In the mid-1990's, the United States hoped to establish the ***Boost Surveillance Tracking System*** (**BSTS**) series to monitor the launching of enemy missiles as well as cue the weapons deployed against such a threat. These satellites, to be designated by the U.S. Air Force as ***LS-6A***, were to be equipped with a large telescope with a wide field of view infrared mosaic sensor as well as a narrow field of view camera and some secondary instruments. Unlike the IMEWS series of satellites, which operated from geostationary orbits, the BSTS series would also have covered the Polar Regions. **Rockwell** and **Grumman** undertook initial studies, but the changing political climate as well as the escalating costs caused the cancellation of this series of satellites.

SBIRS

In the early 1990s, proposals to replace the IMEWS system were investigated as the ***Alert Locate and Report Missile*** (**ALARM**) satellite system and the ***Follow-on Early Warning System***. Both systems were abandoned due to insufficient technological capabilities to meet the requirements as well as too high cost. By 1996, these proposals evolved into the ***Space Based Infrared Systems*** (**SBIRS**), which initially envisaged...

- *Four SBIRS High GEO satellites which were to be placed in a geosynchronous Earth orbit*
- *Two SBIRS High HEO satellites which were to be placed in a highly eccentric Earth orbit*

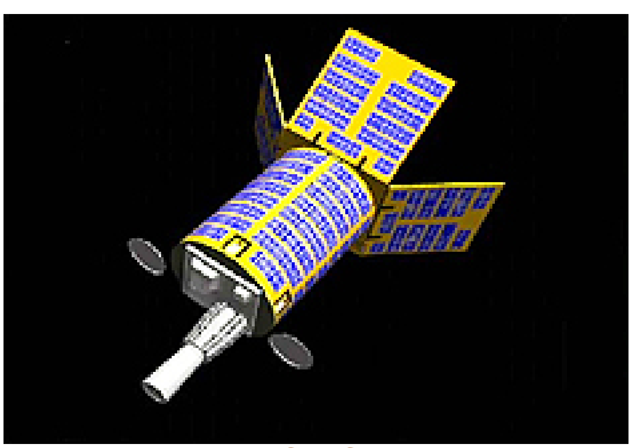
- ***24 to 30 SBIRS Low satellites which were to carry radar to track hostile ballistic missiles and discriminate between the warheads and other objects, such as decoys, that would separate from the missile bodies throughout the middle portion of their flights***

The first of four ***SBIRS High GEO*** satellites is scheduled for launch in 2009, with the second one scheduled for 2010. No launch date has been set for the third satellites and it is quite likely the fourth has been cancelled. The satellites, developed by **Lockheed Martin** and **Northrop Grumman** (originally TRW) will carry sensors that will cover short-wave infrared, expanded mid-wave infrared, and see-to-the-ground bands allowing it to perform a broader set of missions as compared to IMEWS.

The two SBIRS High HEO satellites turned out to be payloads on other satellites with ***SBIRS HEO-1*** launched on June 28, 2006, as a payload on the ***Prowler-1*** elint satellite and ***SBIRS HEO-2*** as a payload on the ***Prowler-2*** satellite that was launched on March 13, 2008.

The ***SBIRS Low*** satellites were scheduled to be launched in 2010, but the program, undertaken by TRW, was cancelled around 2001. By then, TRW had built two ***SBIRS-Low Flight Demonstration System*** (**FDS**) satellites to test some of the hardware. These satellites were scheduled to be launched in late 1999 aboard a single ***Delta 7420-10C*** launch vehicle.

The cancellation of SBIRS Low did not do away with the military need for a constellation of low-Earth orbit tracking satellites. A new program called ***Space Tracking and Surveillance System*** (**STSS**) (designated as ***LS-9A*** by the U.S. Air Force) replaced SBIRS Low. The two SBIRS Low FDS satellites are being re-used as the basis for the ***STSS Cycle 1*** mission, which are to be launched by ***Delta 7920*** launch vehicles from Cape Canaveral in April 2009 and which will test technology for operational SSTS satellites.



SBIRS

STSS series

Elint satellites

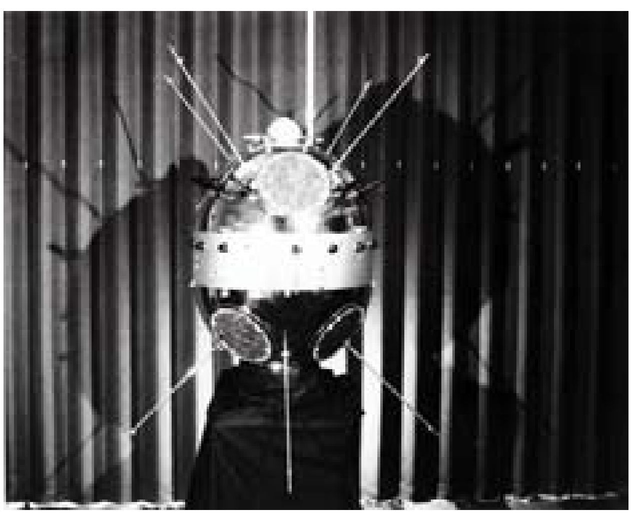
Ferret

The United States has launched several types of elint satellites. The first series is commonly referred to as ***Ferret***, but no formal names are known. Several sub-series appear to have been built. **Lockheed** built one series, while a second series was built by **Hughes** as **Program 711**. They may have been cylindrical in shape with a length of 8 m, a diameter of 1.5 m and a mass of 2250 kg. Another series, of which 15 were launched, has been identified as ***Saint***, ***Samos F-2***, ***Samos F-3***, ***Program 102***, ***Program 698***, ***Program 706***, ***Program 770***, and ***Program 704***. They had a mass of 1500 kg, a length of 11.75 m and a diameter of 1.5 m. They usually operated in 500 km orbits.

Other ferret satellites have been launched as ancillary payloads to various military satellites. These have been referred to as Pickaback and Hitchiker, but there is evidence that the use of these satellites also extends to small scientific and technology payloads.

Name	Int. Des.	Launch	Notes
Ferret-1	1962 1	February 21, 1962	AKA Ops-2301
Ferret-2	1962 1	June 18, 1962	AKA Ops-2312
Ferret-3	1962 1	December 13, 1962	AKA PL120 + Poppy-1A
Ferret-4	1963 003A	January 16, 1963	AKA Ops-2313
Ferret-5	1963 021E	June 15, 1963	AKA FTV-1292 + PL130
Ferret-6	1963 027A	June 29, 1963	AKA Ops-1440
Ferret-7	1964 001A	January 11, 1964	AKA Ops-001A
Ferret-8	1964 011A	February 28, 1964	AKA Ops-3722
Ferret-9	1964 035A	July 3, 1964	AKA Ops-3395
Ferret-10	1964 072A	November 4, 1964	AKA Ops-3062
Ferret-11	1964 087A	December 21, 1964	AKA Ops-3762
Ferret-12	1965 016A	March 9, 1965	AKA Ops-4988, Solrad-6B, PL142 + Poppy4
Ferret-13	1965 055A	July 17, 1965	AKA Ops-8411
Ferret-14	1966 009A	February 9, 1966	AKA Ops-1439
Ferret-15	1966 118A	December 29, 1966	AKA Ops-1584
Ferret-16	1967 053A	May 31, 1967	AKA Ops-5712 + PL160
Ferret-17	1967 071A	July 25, 1967	AKA Ops-1879
Ferret-18	1997 008A	February 24, 1997	AKA USA-130
Ferret-19	1999 017A	April 9, 1999	AKA USA-142; did not reach correct orbit
Ferret-20	2000 024A	May 8, 2000	AKA USA-149
Ferret-21	2001 033A	Augusst 6, 2001	AKA USA-159
Ferret-22	2004 004A	February 14, 2004	AKA USA-176
Ferret-23	2007 054A	November 11, 2007	AKA USA-197
Ferret-24	—	—	Cancelled
Ferret-25	—	—	Cancelled

Table 5 — Ferret launch dates



First generation Poppy satellite

Poppy

The U.S. Navy had its own series of elint satellites, which was not revealed until 2005. The ***Poppy*** series of satellites were developed and built by the **Naval Research Laboratory** to collect radar emissions of Soviet naval vessels. The program involved seven launches, some of them multiple satellites. However, apart from the launch dates, the statements associated with the de-classification of the information did not give details of the instruments. Also, as some Poppy satellites had been part of multiple satellite launches, there were no details as to which satellites were the Poppy satellites. It is, however, thought that the Poppy satellites were those previously identified as ***Ferret-3***, ***Calsphere-1***,

Name	Int. Des.	Launch	Notes
Poppy-1A	1962 1	December 13, 1962	Previously known as Ferret-3
Poppy-1B	1962 3	December 13, 1962	Previously known as Calsphere-1A
Poppy-2	1963 021D	June 15, 1963	Previously known as Radose
Poppy-3	1964 001E	January 10, 1964	Previously known as Solrad-5B
Poppy-4	1965 016A	March 9, 1965	Previously known as Solard-6B + Ferret-12
Poppy-5A	1967 053C	May 31, 1967	Previously known as GGSE-4
Poppy-5B	1967 053H	May 31, 1967	
Poppy-6A	1969 082D	September 30, 1969	
Poppy-6B	1969 082E	September 30, 1969	
Poppy-6C	1969 082F	September 30, 1969	
Poppy-6D	1969 082G	September 30, 1969	
Poppy-7A	1971 110A	December 14, 1971	Previously known as Ferret-24
Poppy-7B	1971 110C	December 14, 1971	
Poppy-7C	1971 110D	December 14, 1971	
Poppy-7D	1971 110B	December 14, 1971	

Table 6 — Poppy launch dates

Radose, ***Solrad-5B***, ***Solrad-6B*** or ***Ferret-12***, ***GGSE-4***, ***Ferret***-24 as well as a number of satellites that never previously received a name.

The extent to which the objectives of these satellites were suppressed is expressed in the use of the Solrad series for at least two of them. The ***Solrad*** series of scientific satellites were sponsored by the U.S. Navy. They were used to investigate solar X-rays and particle emissions which result in disturbances in the ionosphere and the assessment of the effects of those disturbances on satellite and ground based communications. The series was also referred to as ***Galactic Radiation Experiment Background*** (GREB).

Name	Int. Des.	Launch	Notes
Canyon-1	1968 063A	August 6, 1968	AKA Ops-3334 + Ops-222
Canyon-2	1969 036A	April 13, 1969	AKA Ops-3148
Canyon-3	1970 069A	September 1, 1970	AKA Ops-7329
Canyon-4	—	December 4, 1971	Failed to orbit
Canyon-5	1972 101A	December 20, 1972	AKA Ops-9390
Canyon-6	1975 055A	June 18, 1975	AKA Ops-4966 + Argus
Canyon-7	1977 038A	May 23, 1977	AKA Ops-9751
Chalet-1	1978 058A	June 10, 1978	AKA Ops-9454
Chalet-2	1979 086A	October 1, 1979	AKA Ops-1948
Chalet-3	1981 107A	October 31, 1981	AKA Ops-4029
Chalet-4	1984 009A	January 31, 1984	AKA Ops-0441
Vortex 2-1	1994 054A	August 27, 1994	AKA USA-105
Vortex 2-2	1996 026A	April 24, 1996	AKA USA-118
Vortex 2-3	—	August 12, 1998	Failed to orbit

Table 7 — Canyon, Chalet, and Vortex launch dates

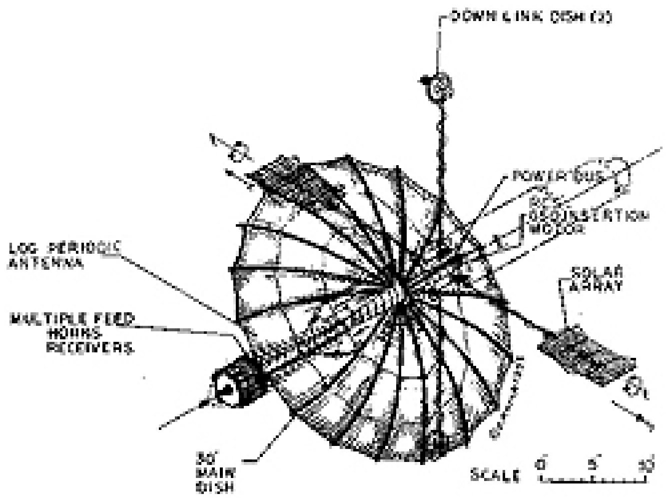


Diagram of Canyon SIGINT satellite. courtesy C. P. Vick, 1993

Canyon, Chalet and Vortex

The ***Canyon*** series of satellites were signals intelligence gathering satellites placed in so-called quasistationary orbits. These differ from a geostationary orbit in that they have an inclination of 3° to 10° with altitudes between 30,000 km and 42,000 km. With these parameters, the satellite does not remain stationary relative to the Earth, but moves in a complex elliptical trajectory, thereby providing a broad view in the course of a day. This orbit also allows the direction to radio emitters to be measured from various points of the orbit which allows the determination of the location of the emitters through triangulation.

The satellites were part of the **National Reconnaissance Office**'s **Program A**. The highly classified satellites were developed by the U.S. Air Force and were also known as **Program 827** or **AFP-827**. It is believed the satellites were 1.5 m in diameter and were fitted with one or more 3 m diameter antennas or a single 10 m antenna.

Successor programs to Canyon were known as ***Chalet*** and ***Vortex***, although these might be merely new cover names for upgrades to the same system. The Chalet series of satellite, which were also known as **Program 366** or **AFP-366,** are believed to have been with a large parabolic antennas of up to 45 m diameter, or even more, giving the spacecraft a mass of app. 1400 kg.

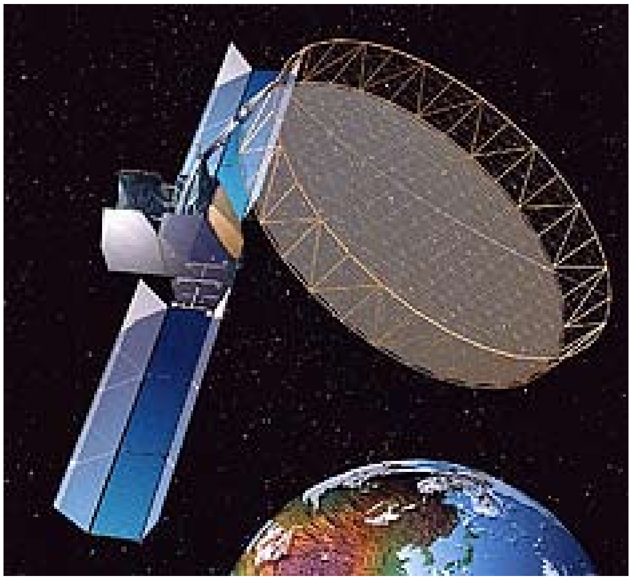
The ***Vortex*** satellites are believed to have been fitted a deployable antenna with a diameter of 80 m and have a mass of approximately 5000 kg. The Vortex series of satellites is also known as ***Mercury***.

Rhyolite, Magnum, Orion

The ***RH*** or ***Rhyolite*** series of satellites were placed in geostationary orbits for the interception of telemetry signals of missile test launches. The program has also been referred to as **Program 720** or **AFP-720**. Built by **TRW**, the 278 kg satellites were launched in a size of that of half a freight container. In orbit, the satellites unfolded into a 29 m diameter antenna with a framework grid to which large solar panels were attached. The operational system is believed to have

Name	Int. Des.	Launch	Notes
RH-1	1970 046A	June 19, 1970	AKA Ops-5346 + AFP-720; did not reach correct orbit
RH-2	1973 013A	March 6, 1973	AKA-Ops-6063
RH-3	1977 114A	December 11, 1977	AKA Ops 4258
RH-4	1978 038A	April 8, 1978	AKA BMEWS-II + Ops-8790
Magnum-1	1985 010B	January 24, 1985	AKA USA-8
Magnum-2	1988 077A	September 2, 1988	AKA USA-31; did not reach correct orbit
Magnum-3	1989 035A	May 10, 1989	AKA USA-37
Magnum-4	1989 090B	November 23, 1989	AKA USA-48
Orion-1	1995 022A	May 14, 1995	AKA USA-110
Orion-2	1998 029A	May 9, 1998	AKA USA-139
Orion-3	2003 041A	September 9, 2003	AKA USA-171

Table 8 — Rholite, Magnum, and Orion launch dates



PROWLER SIGINT satellite

consisted of two satellites monitoring the USSR and China. When the Rhyolite name became public, the system was renamed as *Aquacade*.

The successors to the Rhyolite series were named ***Magnum***. The satellites had a length of 10.84 m, a diameter of 3.55 m and a mass of 3600 kg and were fitted with large diameter antennas. The next generation was known as *Orion,* while the name ***Mentor*** has also been mentioned.

Jumpseat, Advanced Jumpseat, Trumpet, Prowler

The ***Jumpseat*** series of military electronic intelligence gathering satellites were placed in highly elliptical orbits to monitor transmissions to and from **USSR/Russian *Molniya*** communications satellites.

The satellites are believed to have been built by **Hughes** and may also have been known as **AFP-711**, **Code 711** or **Code 980**. Because of their orbit, the Jumpseat satellites are sometimes referred to as SDS military communications satellites.

The second generation of these satellites was known as ***Advanced Jumpseat***. This generation have carried anti-satellite alarm and avoidance systems as well as a manoeuvring capability.

The third generation of these satellites has been identified as ***Trumpet*** and ***Prowler***. It is believed these satellites had an antenna with a diameter of 90 m. As mentioned earlier, the Prowler satellites also had an early warning capability.

Ocean Surveillance

NOSS

As naval vessels operate under radio silence and maneuver to maintain positions under cloud cover whenever possible, an obvious application for space technology was an ocean surveillance system using

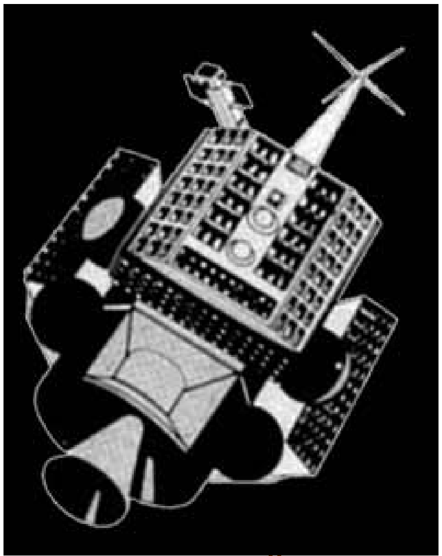
Name	Int. Des.	Launch	Notes
Jumpseat-1	1971 021A	March 21, 1971	AKA Ops-4788
Jumpseat-2	1973 056A	August 21, 1973	AKA Ops-7724
Jumpseat-3	1975 017A	March 10, 1975	AKA Ops-2439
Jumpseat-4	1978 021A	Febraury 25, 1978	AKA Ops-6031
Jumpseat-5	1980 100A	December 13, 1980	AKA Ops-5805
Jumpseat-6	1984 091A	August 28, 1984	AKA USA-4
A. Jumpseat-1	1989 061B	August 8, 1989	AKA USA-40
A. Jumpseat-2	1992 086B	December 2, 1992	AKA DoD-1
A. Jumpseat-3	1994 026A	May 3, 1994	AKA USA-103
A. Jumpseat-4	1995 034A	July 10, 1995	AKA USA-112
Trumpet-1	1997 068A	November 8, 1997	AKA USA-136
Prowler-1	2006 027A	June 28, 2006	AKA USA-184 + NROL-22

Table 9 — Jumpseat, Advanced Jumpseat, Trumpet, and Prowler launch dates

Name	Int. Des.	Launch	Notes
NOSS-1	1976 038A	April 30, 1976	AKA Ops-6431
NOSS-2	1977 112A	December 8, 1977	AKA Ops-8781
NOSS-3	1980 019A	March 3, 1980	AKA Ops-7245
NOSS	—	December 9, 1980	AKA Ops-3255; failed to orbit
NOSS-4	1983 008A	February 9, 1983	AKA Ops-0252
NOSS-5	1983 056A	June 9, 1983	AKA ops-6432
NOSS-6	1984 012A	February 5, 1984	AKA Ops-8737
NOSS-7	1986 014A	February 9, 1986	AKA USA-15
NOSS-8	1987 043A	May 15, 1987	AKA USA-22
NOSS-9	1988 078A	September 5, 1988	AKA USA-32
NOSS-10	1989 072A	September 6, 1989	AKA USA-45
NOSS-11	1992 023A	April 25, 1992	AKA Ops 4221 + USA-81
NOSS 2-1	1990 050A	June 8, 1990	AKA USA-59
NOSS 2-2	1991 076A	November 8, 1991	AKA USA-72
NOSS 2-3	—	August 2, 1993	Failed to orbit
NOSS 2-4	1996 029D	May 12,1996	AKA USA-122
NOSS 3-1	2001 040A	September 8, 2001	AKA USA-160
NOSS 3-2	2003 054A	December 2, 2003	AKA USA-173
NOSS 3-3	2005 004A	February 3, 2005	AKA USA-181
NOSS 3-4	2007 027A	June 15, 2007	AKA USA-194

Table 10 — NOSS launch dates

radar to penetrate the clouds and locate the naval vessels. The United States Navy initially used data generated by reconnaissance satellites but then embarked on the study of a dedicated ocean surveillance satellite under the designation of **Code 749**. Although no satellites were ever realized in this program, it eventually gave rise to the ***NOSS*** series.



NOSS satellite

The satellites in the ***Naval Ocean Surveillance System*** (NOSS), which are also referred to as ***Whitecloud***, were placed in orbits of 1600 km altitude with an inclination of 63° and a separation of 100°. It is believed the satellites carried side and forward looking radar, multi-spectral scanners and infra-red detectors and are said to have had the capability to detect warm water in the wake of a submerged nuclear submarine. To date, three separate generations have been identified, but the NOSS program remains highly classified.

The NOSS satellites were accompanied by sub-satellites, which are believed to have transmitted data to the main satellite. Cables to the main satellite connected some of these sub-satellites. They have been referred to as **SS**, **SSU**, **GB**, **EP,** or **JD**, although the meaning of such designations is not known.

Since 1986, they have been included in the USA series of satellites. With the introduction of the third generation of NOSS satellites, only one sub-satellite was launched, although official records do not catalogue these satellites. Instead, the objects visual observers believe to be the sub-satellites have been catalogued as debris.

Name	Int. Des.	Launch	Notes
SSU-A	1975 051C	June 8, 1975	
SSU-1	1976 038C	April 30, 1976	
SSU-2	1976 038D	April 30, 1976	
SSU-3	1976 038J	April 30, 1976	
SSU-4	1977 112D	December 8, 1977	
SSU-5	1977 112E	December 8, 1977	
SSU-6	1977 112F	December 8, 1977	
EP-1	1980 019C	March 3, 1980	
EP-2	1980 019G	March 3, 1980	
EP-3	1980 052C	June 18, 1980	AKA Ops-1292
SS-A	1983 008E	February 9, 1983	
SS-B	1983 008F	February 9, 1983	
SS-C	1983 008H	February 9, 1983	
SS-D	1983 008B	February 9, 1983	
GB-1	1983 056C	June 9, 1983	
GB-2	1983 056D	June 9, 1983	
GB-3	1983 056G	June 9, 1983	
JD-1	1984 012C	February 5, 1984	
JD-2	1984 012D	February 5, 1984	
JD-3	1984 012F	February 5, 1984	
USA-16	1986 014B	February 9, 1986	
USA-17	1986 014F	February 9, 1986	
USA-18	1986 014H	February 9, 1986	
USA-23	1987 043E	May 15, 1987	
USA-24	1987 043F	May 15, 1987	
USA-25	1987 043H	May 15, 1987	
USA-60	1990 050C	June 8, 1990	
USA-61	1990 050D	June 8, 1990	
USA-62	1990 050E	June 8, 1990	
USA-74	1991 076C	November 8, 1991	
USA-76	1991 076D	November 8, 1991	
USA-77	1991 076B	November 8, 1991	
—	—	August 2, 1993	Three satellites failed to reach orbit
USA-119	1996 029A	May 12, 1996	
USA-120	1996 029B	May 12, 1996	
USA-121	1996 029C	May 12, 1996	

Table 11 — SSU series launch dates

Name	Int. Des.	Launch	Notes
Vela-1	1963 039A	October 17, 1963	
Vela-2	1963 039C	October 17, 1963	
Vela-3	1964 040A	July 17, 1964	AKA Ops-3662
Vela-4	1964 040B	July 17, 1964	AKA Ops-3674
Vela-5	1965 058A	July 20, 1965	AKA Ops-6577
Vela-6	1965 058B	July 20, 1965	AKA Ops-6564
Vela-7	1967 040A	April 28, 1967	AKA Ops-6638
Vela-8	1967 040B	April 28, 1967	AKA ops-6679
Vela-9	1969 046D	May 23, 1969	AKA Ops-6909
Vela-10	1969 046E	May 23, 1969	AKA Ops-6911
Vela-11	1970 027A	April 8, 1970	AKA Ops-7033
Vela-12	1970 027B	April 8, 1970	AKA Ops-7044

Table 12 — Vela launch dates

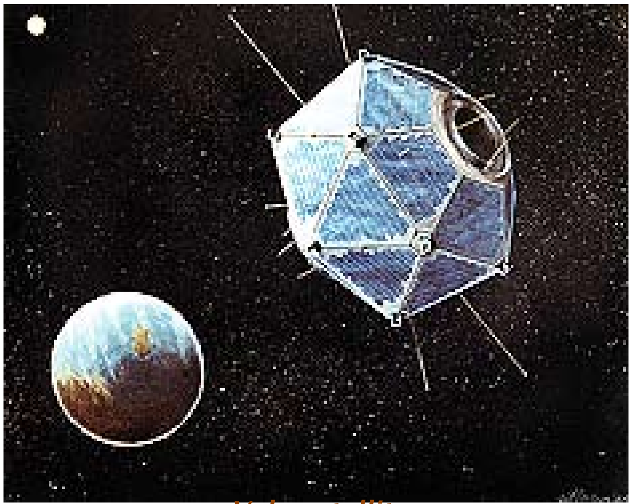
Vela

In a class of its own, the ***Vela*** series of highly sophisticated satellites were launched in pairs between 1963 and 1970 to detect nuclear detonations in the Earth's atmosphere.

Being part of an overall system consisting of ***Vela Uniform***, to detect underground detonations, and ***Vela Sierra***, to detect surface detonations (neither of which used satellite technology), the system is also known as ***Vela Hotel***.

The satellites, which were built by **TRW**, were equipped with detectors to identify X-rays, gamma rays, and neutron emissions which were not only used to detect nuclear detonations, but were also effectively used to gather scientific data on solar flares and other solar radiation. The satellites were placed in orbits of 112,000 km altitude with an inclination of 35°. Pairs were separated by 180,.

The first six satellites had a mass of 231 kg and carried 18 detectors. Vela-5 and -6 also carried additional ultra-violet and visible light sensors. The next six satellites carried also optical and electro-magnetic pulse detectors and had a mass of 236 kg. Nuclear detection equipment was later incorporated in other satellites such as Magnum and the Navstar navigational satellites. MSM



Vela satellite

About the author

Jos Heyman is the Managing Director of [Tiros Space Information](), a Western Australian consultancy specializing in the dissemination of information on the scientific exploration and commercial application of space for use by educational as well as commercial organisations. An accountant by profession, Jos is the editor of the TSI News Bulletin and is also a regular contributor to the British Interplanetary Society's Spaceflight journal.

by Susan Sheppard, Consultant + Contributing Editor

The military deputy for the Sensor Assimilation Division in the Acquisition Directorate at the National Geospatial Intelligence Agency Headquarters (NGA) in Reston, Virginia, is Commander Joseph Smith. The NGA is a Department of Defense combat support agency and a member of the national Intelligence Community (IC). NGA develops imagery and map-based intelligence solutions for U.S. national defense, homeland security and safety of navigation and provides timely, relevant and accurate geospatial intelligence in support of national security objectives.

The term "geospatial intelligence" means the exploitation and analysis of imagery and geospatial information to describe, assess and visually depict physical features and geographically referenced activities on the Earth. Geospatial intelligence consists of imagery, imagery intelligence and geospatial (e.g., mapping, charting and geodesy) information. Information collected and processed by NGA is tailored for customer-specific solutions.

By giving customers ready access to geospatial intelligence, NGA provides support to civilian and military leaders and contributes to the state of readiness of U.S. military forces. NGA also contributes to humanitarian efforts, such as tracking floods and disaster support, and to peacekeeping.

MilsatMagazine
Commander, thank you for taking time out of your busy schedule for our readers. It's well understood that the NGA uses video from UAVs for C4ISR. But how do you use it? It seems like there must be thou-

sands of hours of video to look through before you find the content that is actionable.

Commander Smith
You're absolutely right. Recently, the NGA has been working with industry to identify ways to make video content actionable. To do that, we need to be able to retrieve video content using contextual content. We started looking at commercial off-the-shelf technologies (COTS) and working with industry to see how they tag their video in a broadcast application so we could take advantage of their capabilities.

MilsatMagazine
*The military uses any number of video types from unmanned vehicles such as **Predator** and **Global Hawk**, sensors and other devices. But isn't there a very limited set of metadata that can be searched?*

Commander Smith
Until we started using COTS applications, we could only search on time, location, date and, if we knew it, field name or mission name. Well, that doesn't make it easy to manage contextual type searches. You can't use the power of the ***Google*** search engine to find content in the millions of files you have from ***Predator*** data.

What we needed to do was search on phrases such as roadside bomb, or troops in contact in the context of the video clip. Until recently, that type of metadata or enhancement hadn't been done for the video that's being used in the government space.

The fact is there are so many types of sensors that transmit images that aren't truly full-motion video. This would include helmet cams on special operations forces, traffic cams, or pole cameras that are being used to monitor traffic flow in Afghanistan, and so on. We need to be able to retrieve and search for relevant data. Understanding how the broadcast industry tags data so it can be retrieved instantly is something the government is really interested in.

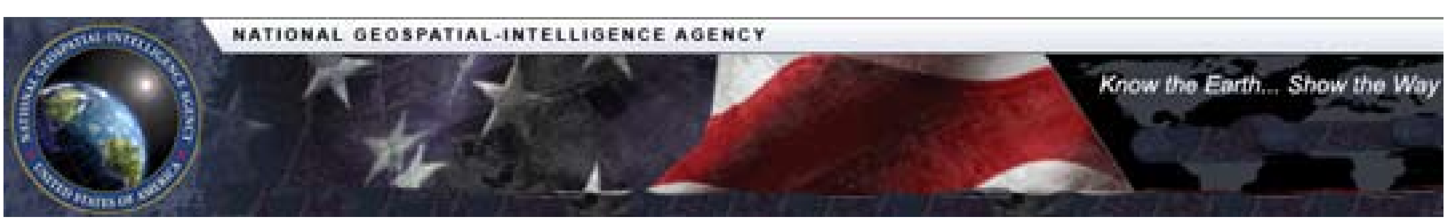
MilsatMagazine
What commercial technology has the most promise for intelligence agencies that use video? What kind of COTS applications are you using at the NGA to solve these contextual challenges in analyzing video?

Commander Smith
The commercial technology that I think has the most immediate promise and impact is digital asset management, because it truly allows *fusion* of military intelligence. The term *fusion*, in this context, means tying together dissimilar pieces of information — information that may be stored in different ways — so that the composite product is more insightful than any of the individual products themselves.

Any single piece of data can tell you something, but all of that data put together in context, and time sequenced together, gives you a different perspective on it than you would have received looking at any one of those pieces of data singularly.

The one biggest improvement we are making is development of a "proof-of-concept" prototype we call ***FAME***. FAME is an acronym we developed that describes the two processes we have to perform to improve our use of video.

The first phase, ***FAME I***, stands for ***Full-Motion Video*** **(FMV)** ***Archive Metadata Enhancement***. Phase two, or ***FAME II***, is called ***FMV Asset Management Engine***. Both use a broadcast industry technology called digital asset management. We developed this proof-of-concept system by adapting the digital asset management tool produced by **Harris Corporation**.



MilsatMagazine
How does it work, Commander?

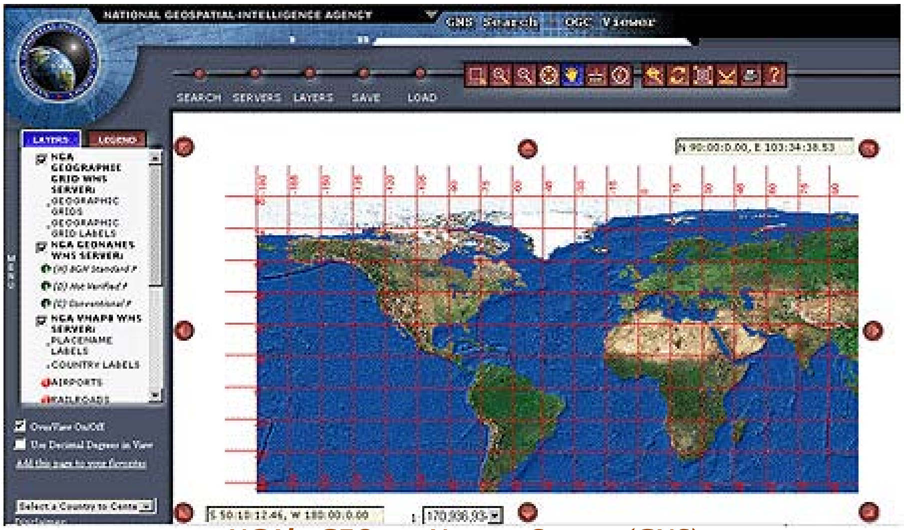
Commander Smith
To explain how digital asset management works, I like to use a football analogy. In sports, the broadcast announcers can inform the viewer of all kinds of details about the play: When was the last time that *Peyton Manning* threw a touchdown in a snowstorm? When was the last time he threw a touchdown against the *Patriots*? Sports broadcasters can display the path of the throw on the screen and compare that throw to past passes. They can accomplish that because they use digital asset management tools to find and tag those details that allow them to display the information in real time, or at a later date. That's exactly what we need to do in the government stage.

In military intelligence, where analysts are searching for a possible roadside bomb in a province, they need to know:

- ***When was the last time there was a roadside bomb at that location?***
- ***How many times have we had a roadside bomb at that location?***
- ***How often in a particular period?***
- ***What's the trend?***
- ***Can we look at the video in all the traffic cameras and figure out where that vehicle came from?***

If you have motion imagery and some ***Blue Force Tracking*** data and some sort of temporal information from a traffic analysis, any one of those pieces of data can tell you something. However, piece all of that data together and such can tell you more than looking at any single source. Being able to retrieve, track, and manage all those imagery assets is what we're interested in at the NGA and a capability that has value for any intelligence agency.

MilsatMagazine
You've talked about retrieving and managing video for future analysis, but how can digital asset management help with real-time video analysis?



NGA's GEOnet Names Server (GNS)

Commander Smith
If analysts were video taping at a checkpoint, and were able to have biometrics data in a crawl along the bottom of the video, we could identify a suspect immediately. We would know as soon as the biometrics comes across and says, "Hey, that matches this guy who is a part of this group we're investigating."

MilsatMagazine
Is it possible for digital asset management to be used in joint missions?

Commander Smith
Absolutely. We demonstrated this proof-of-concept system last summer at *Empire Challenge '08*. Having the digital asset management technology is often a catalyst in joint missions, because it creates a reason to tie together people with expertise in particular fields that you wouldn't have had before.

Say there is a joint mission that involves bringing a specialized vehicle with an explosive device down a particular route — the Commander needs to determine if it's feasible to do so. You may have people undertaking signals analysis, and another group handlingg imagery analysis, or terrain analysis, or traffic analysis, on that particular route. But until you can combine that analysis, the individual data pieces may not be able to tell you if the mission is feasible.

MilsatMagazine
Don't analysts already share data with multiviewers and other Command Center technology?

Commander Smith
Analysts may share data in a limited manner, but it is difficult to fuse the data in real time to make immediate decisions, unless you can add metadata tags and manage the assets. The digital asset management capability that allows you to portray all that data as a fused picture is probably the single most important broadcasting technology available, as it provides the most value in making sense of the volumes of data we have available. MSM

Editor's Note
Applications, such as the one described by Commander Smith in this article, will be the focus of the first ***Military and Government Summit****, at the annual meeting of the* ***National Association of Broadcasters*** *(***NAB***).* **SatNews Publishers** *is delighted to announce we are now a Media Sponsor for this important event. NAB holds the single largest event for the association each April in Las Vegas.* ***NAB Info is available at this direct link****.*

Leveraging the latest video technologies for defense and emergency response at the world's largest digital media show, the ***Summit*** *bridges the gap between military needs and cutting-edge commercial video applications and related technologies. Government and military attendees will learn how commercial applications can often provide the perfect solutions. Non-government attendees will learn about requirements of government programs and how to do business with the government.The program includes presentations by military, government, industry and academia, as well as workshops and technical paper presentations.*

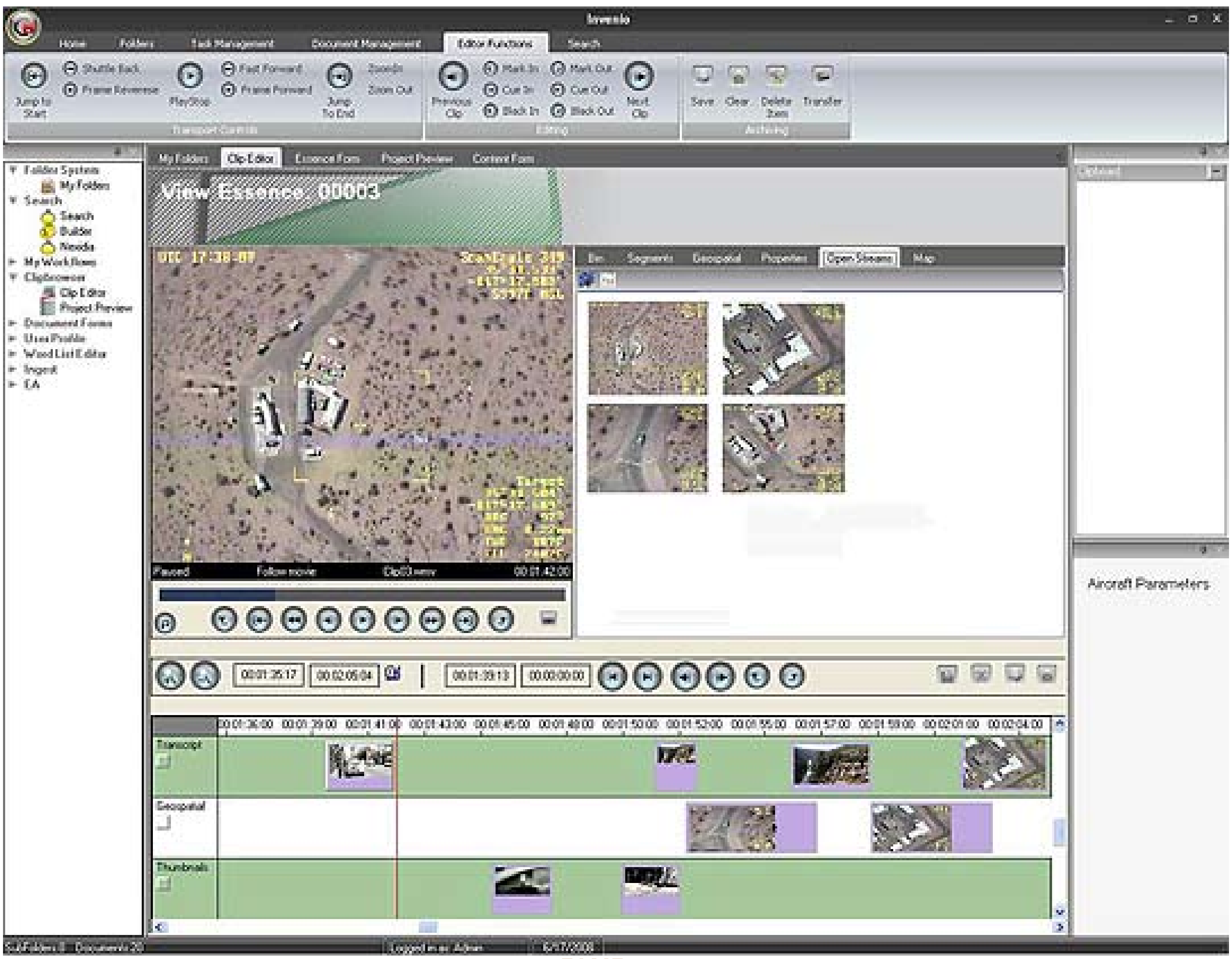
FAME SPEEDS UP SATIMAGERY USE

by Susan Sheppard

Editor's Note"
This article authored by Susan Sheppard is a follow-up to her previous interview conducted with Commander Smith of NGA to further examine the use of Harris' FAME technology.

One of the greatest challenges facing the military, intelligence community and other federal agencies is that of efficiently acquiring, managing and distributing satellite images in a multi-sensor environment. Massive volumes of intelligence information need to be processed for tactical analysis, surveillance, training, reporting and information-sharing missions. Adding to the challenge of volume is the fact that such data often arrive in multiple formats and from various intelligence, surveillance and reconnaissance satellites, sensors and networks. Satellite coverage accessibility enables communications in remote areas, further increasing the quantity of images and the speed at which they can be obtained and put to use — if the right tools are in place.

Harris Corporation provides systems that move, store, and manage broadcast video content from the time it is created to the time it is distributed — to the right place, at the right time, and in the right format. Today, Harris is applying its expertise in managing and distributing all types of rich media content to enable the **Department of Defense** and federal and



FAME screen

intelligence agencies to benefit from the same commercial off-the-shelf solutions that have been proven in demanding commercial broadcast applications around the world.

Specifically designed for intelligence applications by experts in the broadcasting field, ***FAME™*** features an open platform to integrate third-party and custom applications for use by military analysts.

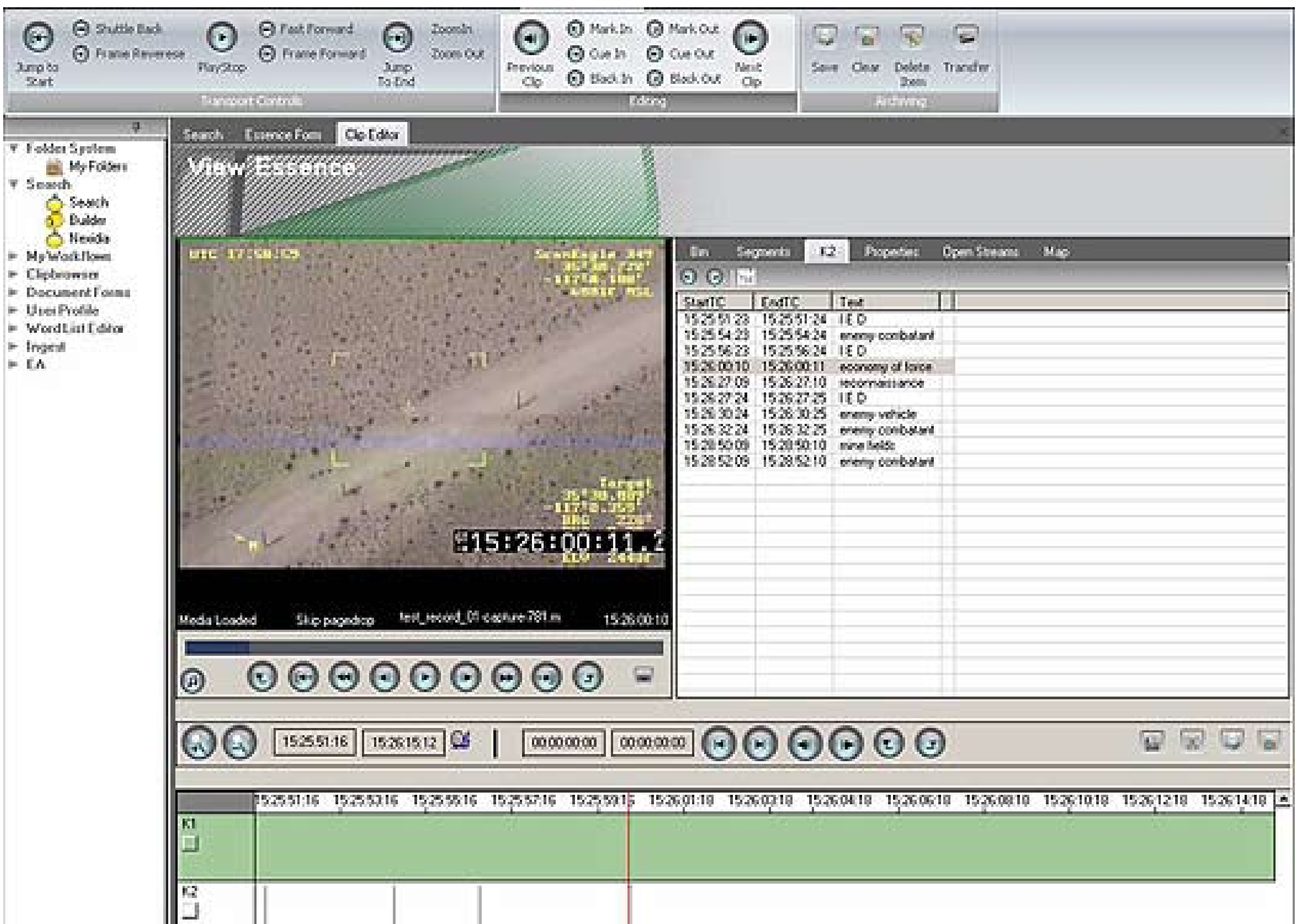
FAME

The ***Harris Full-Motion Video Asset Management Engine*** (FAME) system, developed with input from intelligence analysts, is a collaborative platform that provides video, audio and metadata coding, video analytics, and archive capabilities within a unified digital asset management solution.

Simultaneous motion imagery feeds from multiple sensor types, satellites, and ***Unmanned Aerial Vehicles*** (**UAVs**) can be ingested, annotated, and shared in real time.

Discovery and dissemination of motion imagery products within bandwidth-challenged networks are supported with a thin (remote) web-based client for at-distance access and collaboration.

"The efficient acquisition, storage, management and dissemination of situational awareness information — particularly full-motion video — are key challenges for defense and intelligence agencies," said *Lucius Stone*, director, *Government Solutions*, **Harris Broadcast Communications**. "FAME™ leverages our advanced commercial broadcast technology into the government space and dramatically reduces the time required to get multimedia, situational awareness



Fame Screen

information into the hands of military commanders and other decision-makers."

C4ISR Joint Operations Exercise

Successful exploitation of intelligence means providing battlefield commanders with real-time information that allows them to effectively respond to and neutralize enemy threats. Recently, the FAME system was demonstrated at *Empire Challenge 2008* to prove how the military can use new technologies to capture motion imagery data from satellites, UAVs and sensors for situational awareness.

Co-hosted by the **U.S. Joint Forces Command** and the **National Geospatial-Intelligence Agency**, the annual invitation-only exercise provides a platform for joint forces to test, evaluate and recommend situational awareness tools, including imagery and analysis tools for intelligence, surveillance and reconnaissance. These tools are designed to enable the integration of multiple dissimilar UAVs in a collaborative environment and are expected to provide high-resolution, highly accurate UAV intelligence, surveillance and reconnaissance imagery to tactical and operational-level warfighters, as well as exploitation cells.

FAME also was one of a number of new technologies that was demonstrated and played a key role in the *Motion Imagery* (**MI**) *Pilot Initiative* at Empire Challenge '08. The objective of the Pilot was to address the efficiency and interoperability of the available platforms as a force multiplier, to improve MI efficiency, usefulness, and accessibility. The FAME system's primary mission was to add value to, and improve the discoverability of, motion imagery.

"FAME enabled analysts to select from among multiple, live Unmanned Aerial Systems (UAS) feeds or pre-recorded streams, and perform exploitation and dissemination in real time within a collaborative environment," continued *Stone*.

Analysts could collaborate simultaneously to annotate the video with mission text chat, telestration and audio. Annotations were then saved as rich metadata time-associated with the video for later search and retrieval and publication to the **DCGS** (***Distributed Common Ground System***) **Integration Backbone** (**DIB**).

FAME met all objectives of the pilot and demonstrated the benefits in leveraging commercial broadcast technologies for government tactical needs.

The FAME system's hardware is composed of leading-edge broadcast components that support standard- and high-definition formats and Internet Protocol Television, and are used by major commercial broadcasters around the world. The FAME software enables the collection, automation and addition of metadata; provides a platform for the fusion of metadata from *multiple intelligence* (**Multi-INT**) sources; and automates workflow processes, regardless of content source. Multi-INT content can be tagged with many types of metadata, including temporal, geospatial, video analytics, voice annotation and fusion with other metadata sources.

According to a report published by an analyst covering Empire Challenge, "The advantage (of FAME) over current tools is evident. A strong point is how quickly it allows the pertinent information to be passed from collection to analyst to customer, and the dissemination of information. This is easily a step up from current tools within the market."

The FAME initiative directly addresses the usability issue, allowing forensic use of MI that has, up until now, been stockpiled and generally forgotten. *Stone* adds that, "FAME can actually scale to thousands of streams of data, if required, and supports the search algorithms for analysts who want to use the stored MI as a forensic asset."

Future iterations of FAME may include the re-broadcast of the enhanced video stream, allowing users to choose one or several of the attached metadata streams for display as a crawler (typically used on CNN at the bottom of the screen) or in an embedded window. FAME layers metadata streams into a corresponding video stream. The resulting "enhanced" video stream is then stored and can later be searched on by the new metadata content. MSM

About the author
Susan Sheppard is the principal consultant for Rochester, NY-based Certa Cito Marketing Communications, and specializes in marketing, communications and media relations. Ms. Sheppard has 25 years experience in defense, government, communications and technology markets, and holds masters and bachelor degrees in Communications and Journalism. She can be contacted at smsheppard@frontiernet.net.

About Harris Corporation
Harris is an international communications and information technology company serving government and commercial markets in more than 150 countries. Headquartered in Melbourne, Florida, the company has annual revenue of $5.4 billion and 16,000 employees — including nearly 7,000 engineers and scientists. Harris is dedicated to developing best-in-class assured communications®; products, systems, and services. Additional information about Harris Corporation is available at www.harris.com.

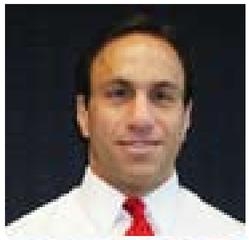
FAME lies at the core of tactical and strategic video workflows. Multi-INT fusion is the process by which media, data and video content are correlated and merged into one application, providing actionable intelligence. The FAME system performs this process, which is valuable to the warfighter on the ground, as well as commanding officers, in many ways:

- ***By automating processes that are currently performed manually, shorter product turn-around times can be achieved.***
- ***The ability to add or modify metadata allows users to tag critical content, allowing it to be discovered and used.***
- ***Users define what they need in terms of video length/content, and third-party integration allows for additional capabilities to be obtained as they emerge.***
- ***Leveraging broadcast industry technologies — IPTV, HD, SD — allows for content to be distributed regardless of platform or video viewer.***
- ***FAME extracts data from natural mission processes that are currently discarded and makes them part of the situational awareness picture.***

Glossary of Motion Imagary Terms

- ***MI.*** *Motion Imagery: Imagery that is collected at a frame capture rate of 1 Hz or greater that depicts objects spatially and temporally, as well as their relative movements through those four dimensions (the spatial "X, Y & Z" dimensions, and time).*
- ***Bit-rate.*** *The amount of compressed video data delivered into the decoding system. The higher the bit-rate, the higher the quality and/or the resolution of the video. For optical disk formats, this is usually measured in megabits per second (Mbps).*
- ***Clip***. *A portion of video that has been cut out of the larger MI stream, normally for exploitation, storage or transmission purposes. "I'm sending you a 2 minute clip of that Pred video for your analyst to look at."*
- ***Codec.*** *Contraction of "Compressor - Decompressor". This term is often used to refer to the compression scheme used for video processing.*
- ***Compression***. *The process of shrinking the size of data so that it uses less storage space and less transmission bandwidth. With video, sacrifices in video quality are almost always "traded off" against the resulting file size.*
- ***FMV***. *Full Motion Video: MI that is captured at a frame rate of 30 Hz or greater, which is the industry standard (OK, 29 point something) for the minimum rate needed to give the illusion of contiguous, fluid movement.*
- ***High Definition, Standard Definition (HD, SD)***. *Refers to the resolution or number of pixels used to represent a single video image frame. Standard Definition refers to having about 350,000 pixels per frame, and High Definition refers to having about 2,000,000 pixels per frame, (or about 6 times more than SD).*
- ***KLV***. *Key-Length-Value: is a data encoding standard used to embed information in video feeds. Items are encoded into Key-Length-Value triplets, where "key" identifies the data, "length" specifies the data's length, and "value" is the data itself.*

"Not Your Grandfather's Satellite Tech Company"



Paul Scardino is Vice President, Sales & Marketing for Globecomm Systems, and oversees sales and communications across all of the company's lines of business. We spoke to him last December about how the well-known systems integrator is changing to match a changing world.

MilsatMagazine
Globecomm has a long legacy in the satellite business, with the founders and lead engineers of the company going back to the early days of the industry. When people think of Globecomm, they probably think of Earth stations. Is that still what the company does?

Paul Scardino
We're proud of a legacy that goes back to the time when our founder and CEO, *Dave Hershberg*, helped install the presidential hotline that connected Washington and Moscow via satellite after the Cuban Missile Crisis. And we still sell a lot of earth stations, from custom-designed 11-meter uplinks to mobile auto-acquisition terminals. But the old satellite industry is now a hybrid industry, and Globecomm is a hybrid company. By that I mean, we're hybrid in terms of what we do. We custom-engineer systems from earth stations to media processing centers and multipoint next-generation networks, but we also operate teleport facilities and fiber circuits around the globe, and we provide lifecycle support for all of our systems. Our services unit is actually now the fastest-growing part of our business.

This year, we have even launched an information technology professional services company, Cachendo, to provide customers with expert, security-cleared staff on a project basis. And we're hybrid in terms of transmission. Two of our recent mobile service contracts — with Indigo Wireless in Pennsylvania and FIRST Networks in Canada - use fiber as the primary transmission path. So, no, Globecomm is not your grandfather's satellite technology company any more.

MilsatMagazine
Mobility is a key requirement for military solutions. What are you doing in that area?

Paul Scardino
We just introduced a new X-band version of our ***Auto-Explorer*** 1.2-meter auto-acquisition terminal. We have been selling record numbers of the Ku-band version, under the *Worldwide Satellite Systems Program*, for which we are one of six approved vendors. The demand is there from X-band users, and we want to meet it. But there are so many aspects of mobility. For NATO in Afghanistan, we developed a Blue Force tracking system based on a new Friendly Force Identifier standard they devised.

The vehicle-mounted systems allow all of the vehicles in a unit to see themselves and each other, to navigate regardless of conditions, and to communicate by text-based instant messaging. The command post has the same information in real-time and troops in the field or commanders can mark hazards like IEDs as they are found. It creates tremendous situational awareness while preventing friendly-fire casualties, and can be quickly swapped into and out of vehicles as needed.

There is also a commercial application that is generating a lot of interest from our military customers. Early in this decade, we had an opportunity to develop a solution to meet a customer requirement for running a mobile network in remote regions. We have since expanded that into a service offering called ***SatCell***. SatCell technology optimizes mobile signaling and backhaul traffic for transmission as IP, using a hybrid architecture customized to a network's traffic volumes and patterns. It significantly reduces the bandwidth required to connect base stations via satellite, which means high efficiency and the ability to support more base stations.

At our Mobile Service Center, we also operate a hosted switch that allows customers to activate a network on short notice, run it for as long as needed, and take it down again. Our military customers are interested in SatCell as a way to support the new counter-insurgency strategy issued by the Army and Marine Corps. That doctrine stresses the importance of safeguarding civilians, restoring essential services and supporting the rapid deployment of local security forces, instead of just targeting the enemy. From our work for the government of Afghanistan, we know how powerfully communications can contribute to those goals.

MilsatMagazine
How are the government and military's requirements evolving, and how is Globecomm adapting?

Paul Scardino
Whether the application is military or civilian, governments want more bang for the buck. There are a couple of examples I can share from the civilian side of the fence. We engineered and continue to provide lifecycle support for a mission-critical satellite network for the Federal Aviation Administration. That's part of a Harris project to upgrade the nation's air traffic control system, which is going to save taxpayers millions of dollars as well as ensuring safety and reliability.

We just completed another air traffic control project for a Middle Eastern nation that involved putting all ATC-related voice and data onto a TDMA frame-relay platform running over satellite. It is already saving a lot of money while bringing performance and reliability up to world-class standards. There's a constant need to innovate to slash costs and improve performance for our customers, and that's where we will continue to focus our efforts. MSM

MANAGING WIRELESS CAPACITY IN TACTICAL ENVIRONMENTS

by Jeffrey Weaver, Director, XipLink

Wherever emergencies happen, on a battlefield, across a disputed border, or as the result of hurricanes, floods, or fires, on-site communication managers face an immediate set of unnerving trade-offs.

Traditional spectrum management consists of frequency coordination that governs access to the available wireless capacity by strictly controlling all emitters in an area. However, when the number of satellites covering a small area limits the total available capacity, channel assignment is no longer enough and communication managers also want to establish dynamic use-policies that can be enforced in real-time.

The dispatch of tactical troops or civilian first responders relies on a high degree of confidence that no further harm or injury will occur to these responders.

Unmanned Aerial Vehicles **(UAVs)** are frequently used to survey an area to ensure no secondary explosions or attack are possible, followed quickly by tactical troops or civilian public safety officers to secure the area. Only then are recovery and medical teams allowed into the area to assist survivors.

During these events, the need for satellite communications capacity is insatiable. All UAVs demand downlink spectrum and data capacity for remote command and control, but today's sensor and target tracking packages can also consume every amount of available uplink capacity in the area of the incident for the duration of the flight.

Tactical first responders rely heavily on satellite capacity during intelligence and reconnaissance missions as well as to enhance command and control through robust audio and video communications during any secondary actions, but are often forced to wait for any UAV activity in the area to end. Additionally, battlefield surgeons and EMS personnel are trained to operate autonomously, but the demand for remote surgical support is high.

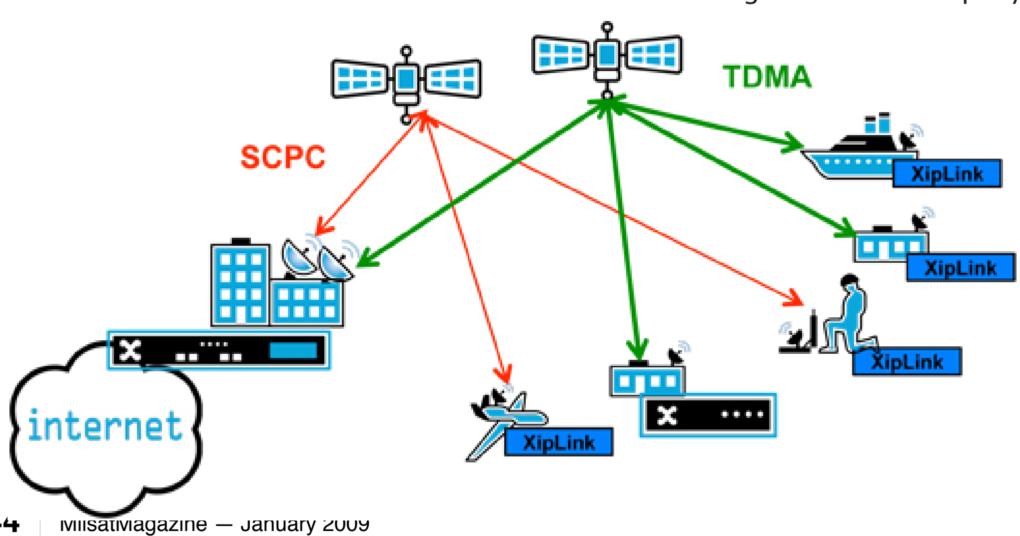
Given enough satellite data capacity, tele-surgery based on live audio and video is being used with great success from the scene of the injury, saving lives that might otherwise have been lost.

Ideally, there would be enough satellite coverage over every affected area to offer each of these complementary operations full access to all the bandwidth they might require. The challenge of having enough satellite capacity exactly where it is needed will always be with us — we have to plan on deployments to locations that may have limited coverage.

Military Use Of Satellite Capacity

The Joint Network Node (JNN) / Warfighter Information Network - Tactical (WIN-T) program describes a steady increase in the use of satellite and terrestrial wireless networking for the future and builds upon the TCP/IP networks being used today.

This strategic architecture evolves from communications on the halt, to a fully integrated mobile communications infrastructure that includes support of UAVs or other airborne platforms and satellites, while fully extending mobile communications from the Brigade to the Company level in Increments 2 and 3. Net Ops resources at the Brigade level promise unprecedented levels of coordination and real-time management of the available wireless capacity once these future Increments are deployed.



Using The Available Capacity

Today, as different operational units gain access to satellite capacity, they each investigate and specify methods to improve the performance of TCP/IP applications over satellite to serve their individual missions. Working with the tools originally established for enterprise customers, these users have rapidly adopted commercial VSAT solutions to their unique needs.

In many cases, the users have simply selected WAN or application accelerators and deployed them in a tactical environment. These legacy products help avoid application issues related to the low bandwidth and high delay of satellite links. In each case, the operational units consume as much of the available spectrum as the equipment can access, but these users remain subject to a complete spectrum outage when an unmanned aerial vehicle enters the airspace.

We have reached a critical tipping point in the use and management of satellite capacity in tactical scenarios. Ideally, we could partition the spectrum and avoid conflicting use of overlapping channels by different functional groups. However, today, there is simply never enough capacity in any one area.

The spectrum coordination function and the command authority to dynamically restrict and manage the use of the available spectrum to include UAVs is defined as a part of Net Ops in ***WIN-T***, but today, few devices in the wireless topology provide the functionality for dynamic policy enforcement.

Managing The Wireless Capacity

The immediate situation has resulted in a new class of equipment, the wireless optimizer, which is designed to optimize the performance of all applications using TCP/IP over the satellite network. These devices can also allow remote management of the wireless capacity in shared networking environments.

This device has many of the characteristics of traditional WAN or application accelerators as well as many distinct functions that have not evolved from the requirements of commercial enterprise users. These new functions come from the perspective of a wireless network operator. They relate to control and use of the spectrum and provide an immediate set of tools for military operators today.

A wireless optimizer must, first of all, be small and portable, ideally with a version of software that can be embedded in mobile terminals or handheld devices. The wireless optimizer must focus on very efficient algorithms for enhancing TCP/IP, often operating in very limited memory and CPU on mobile devices, unlike WAN optimizers that can always rely on substantial CPU, memory, and even disk storage in the devices where they operate.

Wireless optimization should be conceptually viewed as having a network based component as well as an edge device component and should be priced to address this wide variation in deployment models. Rate shaping and congestion control algorithms may be different on either end of a shared satellite space segment to fully maximize the data that can be sent over each link. Wireless optimizer software must accommodate different network types without sacrificing interoperability, the primary reason to continue to deploy products based on the ***Space Communications Protocol Specification*** (SCPS).

The other requirement for these network-deployed optimizers is one of policy enforcement. Remote programming interfaces (API's) must exist that enable the Network Operations (Net Ops) center to dynamically control the amount of data each device in the shared network is allowed to transmit. The fact that wireless optimizers sit in-line, closely bracketing each satellite link, makes them the ideal place for further managing the overall spectrum from a central location. Once informed of the available bandwidth (or the allowed bandwidth), the optimizer must quickly shape the user traffic to this new level using rate control algorithms.

Remotely controlling the raw bits per second of space capacity that a user or a LAN is allowed to access, by updating the rate control algorithm using API's, enables the Net Ops controllers to free up capacity for some users while locking down others, based on the tactical environment. The users of the network are assured their applications are operating at maximum capacity, even during periods when their bandwidth may be limited. Using embedded systems software, this function can be extended to ground based vehicles, UAVs, and man-portable systems.

By installing wireless optimizers across an organization, Net Ops can ensure that each operational unit is getting the maximum capacity from the bandwidth they are allocated while also using tools to balance the overall use of the available spectrum for the benefit of all users in the area. These techniques work hand in hand with operator based quality of service features. Additional wireless optimizer functions such as data compression, Internet caching, and pre-fetch ,all continue to operate over the programmable fixed rate control algorithm that is shaping the bandwidth to the configured data rate and are transparent to the end user.

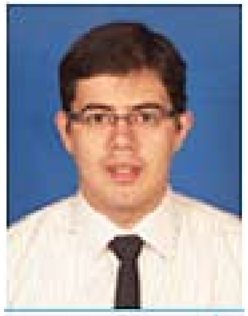
In the best of situations, there may be plenty of satellite capacity to support on-going operations, where users are simply optimizing their applications over the space segment. However, in situations where satellite capacity may be limited, the use of wireless optimizers that have intelligent programmable rate control algorithms delivers an element of control over spectrum usage that is highly desirable today.

About the author

Jeff is the Director of Technical Marketing at Montreal based XipLink, a leader in the development of wireless optimization products and software. Jeff has been active in the digital and RF data communications industry for over 25 years and acquired his engineering education from the U.S.A.F. as a Space Systems Specialist and can be reached at 954.415.0870 or jweaver@xiplink.com.

SATCOM IS CRITICAL FOR REAL-TIME, ACCURATE INFORMATION

by Prashant Butani, Satcom Analyst, NSR



The tragic terrorist attacks in Mumbai on the 27th of November killed nearly 200 people including a large number of Indians, as well as nationals from the U.S., Germany, Canada, Israel, Britain, Italy, Japan, China, Thailand, Australia and Singapore. This horrific incident has been suggested as a tactical shift in terms how terrorism will be carried out in future attacks. For one, terrorists can now call out and target specific nationals travelling to countries where security measures may not be as tight as measures back home. Americans or Britons may feel safer in their own countries, but Mumbai showed that an American, Briton, German and others can be easily, and more importantly, selectively targeted while on vacation in another land.

The other noteworthy change or shift was that the Mumbai operation, which was carried out in the heart of India's commercial capital, appears to be an emergence of a new kind of terror tactic. Prior to Mumbai, attacks on 9-11 in the U.S., bombings in Bali, 7-7 in the U.K. as well as continued attacks in Iraq and Afghanistan, involved suicide missions or vehicles armed with bombs that have been the common tactic thus far.

In Mumbai, a small army was dispatched in the center of an urban setting and turned it into a battlefield. From operations that have been purely carried out by bombings and suicide missions lasting a few seconds, this new brand of terrorism lasted days and took the form of urban guerilla warfare where the number of casualties could have increased by the minute had the situation not been contained. The disruption and paralysis of everyday life including economic activities also became uncertain in terms of the length of time, as well as the loss of life and damage to property the terrorist attack will ultimately achieve.

Greater Coordination Required

This new brand of terrorism requires more in terms of resources and capabilities out of counter-insurgency operations. In suicide attacks, emergency units, police and military personnel are dispatched to contain the situation and provide emergency support for the injured or for personnel trapped in the areas affected by the attack. In this new urban guerilla operation, emergency units, police and the military personnel have to stay engaged for prolonged periods of time, in not only fighting the insurgents but in protecting innocent lives in the line of fire including journalists in the field who are covering the scene while the situation develops.

In terms of equipment terrorists have access to, *The Statesman* reported on November 30th, "the tech-savvy terrorists used satellite phones to ensure there was no record of conversations between them and their handlers." This goes to show that in this urban guerilla battlefield, the enemy is just as well equipped in the area of satellite communications as the country's defense units. Moreover, security requirements for public places may now fall within the purview and domain of militaries where in the past, this was within the jurisdiction of the police. As terrorists can now target virtually any public place for prolonged periods of time such as hotels as in Mumbai, malls, coliseums, cinemas or even hospitals, security measures will have to be boosted where military-grade solutions may have to be implemented in order to secure public premises.

Here, the underlying change in terrorist tactics will now require greater cooperation and coordination between the military and civil agencies, including local authorities. Indeed, the **NSR** Analyst in Mumbai, *Prashant Butani*, who experienced first-hand events of the attack, believes that no longer are a country's borders the only regions that warrant protection. The new face of war is not aimed at drawing trained soldiers to the battlefield but taking the battlefield into the homes, offices and gathering places of the common man. Combating warfare of this genre requires training civilians in emergency response, collaboration of military and civil defense agencies and finally equipping them with the right training, technology and information.

Civilian Empowerment

Satellite communications equipment is in the hands of military entities, terrorist groups and other forces on both sides of the conflict. Those who are increasingly caught in the line of fire or are inadvertently forced to be engaged in terrorist conflicts may need satellite communications equipment themselves for safety measures as well as for helping fight the enemy in case of an attack.

In its latest market research report, ***Government & Military Demand on Commercial Satellites, 5th Edition***, NSR outlined the number of in-service units required to support government and military activities around the globe. Despite calls for troops to return from Iraq, growth of in-service units is expected to increase at a steady rate as other activities around the globe such as Afghanistan increase, as promised by President-elect *Barack Obama*. With the Mumbai bombings and the recent activities in Pakistan including bombings carried out by unmanned aerial vehicles (UAVs), activities within South Asia for both military and counter-terrorism measures should further boost demand for communications units to better address a situation that may continue to deteriorate and become protracted over the near term. And with the new phase of terrorism, requirements towards civilian empowerment could lead to development of new application suites. These applications could include at a minimum, back-up communications capabilities when terrestrial services become unavailable if or when terrorists strategically knock-off terrestrial communications facilities. A select group of civilians may also be called upon to alert military and civilian authorities that a terrorist activity may be unfolding where a special feature in a dual-mode terrestrial/satellite mobile phone with GPS capability could immediately alert authorities to send troops or civil agents to a potential hotspot.

In Mumbai, it was reported that paratroopers from Delhi were sent more than nine hours after the initial attacks took place, a situation that has angered many of India's citizens due to the slowness of its government's response. As civil groups continue to become frustrated with government response, proactive measures may indeed become necessary in preparing for the next attack. It was reported that many people around the globe and in and around the scene of attacks sent and received text messages, BLOGs and other forms of messages. The information relayed may not be 100 percent accurate but it was instant. In Mumbai, some put a premium over instantaneous information ahead of accuracy. In the future, accuracy and real-time information will be critical.

Dan Losada is the Senior Director of the Defense and Intelligence Systems division at Hughes where he manages the Company's Department of Defense (DoD) and intelligence-related programs. Dan is heavily involved in supporting C4ISR (Command, Control, Communications, Computers, and Intelligence, Surveillance and Reconnaissance) programs.

MilsatMagazine
Hi, Dan, it's nice to have the time to talk with you. Is Hughes involved in all branches of the military?

Dan Losada
That's correct. **Hughes** prides itself on the broad military and intelligence applications of our technologies. Our satellite broadband solutions support land mobile, maritime, or airborne in the U.S. Air Force, Navy, Army, and the Defense Information Systems Agency (DISA) to name a few. We support these customers in North America and across the globe.

MilsatMagazine
What does Hughes support?

Dan Losada
Hughes supports a range of strategic and tactical requirements. Some of our most exciting work involves our broadband communications on ambulances in the Middle East. We helped create a mobile telepresence to enable paramedics to communicate with specialists anywhere in the world.

The technology itself is impressive—but its importance really sinks in when you consider the "golden hour," when proper patient stabilization and care can greatly increase the chances of survival, recovery, and reuniting with families back home. In addition, this last year we participated in an interesting, multi-agency exercise simulating a fictional bio-terrorism attack.

Dan Losada, Hughes

MilsatMagazine
Simulations are a hot topic right now. What part did Hughes play in that effort?

Dan Losada
We demonstrated our ***SATCOM-On-The-Move*** (**SOTM**) terminal, receiving a satellite downlink displaying images, data, and video from an ***Unmanned Aerial Vehicle*** (**UAV**) into a mobile C2 van. The van, in turn, simultaneously sourced video that streamed to the command post while on-the-move.

MilsatMagazine
That's interesting, Dan... how does that work?

Dan Losada
The "pilot" of the UAV can be anywhere on the planet. The video is downlinked via satellite, but this is a huge advancement because, previously, pilots had to be at a fixed site and were unable to transmit images directly from the UAV to soldiers on the ground. The only path involved a central hub at a fixed location.

MilsatMagazine
That location would be where the UAV pilot was actually located?

Dan Losada
Yes, the pilot had to process it and then send it to the people on the ground through some other communication network. That takes valuable time. SOTM enables a more mobile mode of communications requiring far less transmission time.

MilsatMagazine
Was this effort was a success?

Dan Losada
Absolutely. As mentioned, this was a massive, complex operation that included federal, state, and local government decision-makers, as well as first responders; in other words, all the players that would be involved in a real crisis.

MilsatMagazine
Dan, would you please provide some insight into your background?

Dan Losada
I am an engineer at heart and by training, so I approach all of these projects from the technical side and then moved forward from there. I have handled a great deal of technical project management, focusing on things such as Ka- and Ku-Band SOTM capabilities, processed and transponded satellite networks, microwave point-to-multipoint, as well as cellular and Personal Communications Services.

MilsatMagazine
Where did you go to school?

Dan Losada
I earned my Bachelor's and Master's degrees from the *University of Illinois at Urbana-Champaign* and I also did some studying in Colombia, where I attended the *Universidad de los Andes* in Bogota. While there, I had the opportunity to serve as a technical consultant on the deployment of a point-to-multipoint network for the Universidad Antonio Nariño and worked on building a city-wide Wireless Local Area Network (WLAN). That is the great thing about this kind of technology — it's universal.

MilsatMagazine
A typical question coming up about your career — what is best about working at Hughes?

Dan Losada
That is a tough question! Hughes is very much a global company, and every day I work with some of the most advanced satellite communications technology on the planet. We are helping the military and government become more global, too, as well as conduct their business more efficiently. Sometimes that means working on a SOTM terminal and some-

times it means building the kind of system we just launched our own satellite called ***SPACEWAY-3***.

Our team has just been joined by *Rick Lober*, our new Vice President and General Manager. He came from **Cubic Defense Inc**. where he did a lot of work in high bandwidth links for UAVs. He wasalso with **Watkins-Johnson** in SIGINT and commercial telecom.

MilsatMagazine
Dan, can you tell us more about SPACEWAY-3?

Dan Losada
SPACEWAY-3 is a really unique solution. We know about routers and how they direct network traffic, whether on the Internet or via a closed network. Routers are really important, but in a crisis situation they jam up. SPACEWAY-3 is the world's first satellite system that functions as an IP router in space.

This means that if something knocks out communications on the ground, you have both back-up and functioning back-up with built-in networking capabilities. These closed, secure networks equal peace-of-mind — and that is hard to come by in an emergency response scenario or national security crisis.

MilsatMagazine
Is that where you see Hughes moving in the future?

Dan Losada
I hope it is where we see the world moving in the future. This is vital to national security, defense, intelligence, and emergency response communities, serving their mission-critical information requirements. It is important to continue broadening our capabilities and exploring the role that satellites will play in the future.

In fact, we recently announced a *Cooperative Research and Development Agreement* (**CRADA**) with **DISA** to study ***Network Centric Enterprise Architecture*** validation of IP networking with the ***Regenerative Satellite Mesh*** (**RSM-A**) standard and the SPACEWAY-3 system.

Under this agreement, Hughes and DISA will perform research and development that supports overall IP convergence as the basis for seamlessly integrating satcom networking and information needs with the ***Global Information Grid*** (**GIG**) — a worldwide set of information capabilities, associated processes, and personnel for collecting, processing, storing, disseminating, and managing information that was established by the DoD.

I am fortunate to be a part of such an exciting time at Hughes and part of the exciting future for satellite communications.

Terry Benson, Overwatch Tactical Operations

Terry Benson serves as the business area manager for communications systems at Overwatch Tactical Operations. In that role, Terry is responsible for program management, business planning, and new business development. He joined the company in 2005 to lead the SATCOM business area, and he's overseen program execution, business development, and strategic plan development.Terry has more than 24 years of industry experience, working in the military and commercial markets. He received a bachelor of science degree in electrical engineering from Texas A&M University in 1984 and a master of science degree in engineering management from Southern Methodist University in 1990. Terry is also a registered professional engineer in the state of Texas.

MilsatMagazine
Terry, there may be many readers who are unfamiliar with your company... what is Overwatch Tactical Operations and what makes the company unique in the industry?

Terry Benson
The company was founded in 1992 as **Austin Info Systems**, and was later renamed **Overwatch**. In 2005, it became an operating unit of **Textron Systems**, a Textron Inc. company. Textron Systems is the cornerstone of Textron's defense and intelligence business, which, apart from Overwatch Tactical Operations, includes aerospace and defense experts **AAI Corporation**, **HR Textron**, **Lycoming Engines**, **Overwatch Geospatial Operations**, **Textron Defense Systems** and **Textron Marine & Land Systems**. This breadth of experience serving military customers gives us greater insight into their needs, as well as a unique ability to meet those needs.

Overwatch Tactical Operations offers expertise in several areas, including command, control, communications and intelligence (C3I) systems, course-of-action development, knowledge-based discovery, data mining and intelligent searches, knowledge representation, software agent development, digital communications switching, and remote radio control hardware. We also are a proven provider of satellite communications (SATCOM) products and integration services.

A large part of what makes us unique is our level of experience. We've been designing, developing and fielding these solutions since the early 1990s. We are focused on delivering this technology with high quality, within cost and on schedule. Because of that, we have robust continuous improvement programs which have resulted in certifications including AS9100, ISO 9001-2000 and Capability Maturity Model Integration, or CMMI, Level 5.

MilsatMagazine
How long have you been with the company? Describe your position at Overwatch Tactical Operations, as well as previous industry background.

Terry Benson
Our SATCOM business unit is focused on providing military communication systems for a number of domestic and foreign applications.

In 1997, the company developed a unique tri-band feed and antenna system under a *Small Business Innovative Research* contract with the **U.S. Army Communications and Electronics Command**. The feed required no mechanical changes for operation in the C-, X-, and Ku-bands. We received the ***U.S. Army Phase II Quality Award*** for this development in 1999. Since then, Overwatch Tactical Operations has continued this development and the company has been granted two patents for its simultaneous multiband, single-feed technology.

Today, Overwatch Tactical Operations provides single-band (including L-, S-, C-, X-, Ku- and Ka-bands) and simultaneous multiband (including X/Ka, C/Ku, X/Ku, Ku/Ka, C/X/Ku, X/K/Q, L/S and S/X bands) SATCOM system solutions. Our fielded systems have been utilized by military customers for flyaway, transportable, fixed-site and shipboard applications.

We also are a full-service satellite communications solution integrator. Overwatch Tactical Operations has experience with all aspects of SATCOM system

design, integration, performance testing and certification (including Intelsat, Americom Government Services and Defense Satellite Communications System). In addition, we have designed, developed, certified and fielded low passive intermodulation, or low PIM, simultaneous X/Ka multiband shipboard antennas.

MilsatMagazine
Please describe the company's patented multiband feed technology. Why is it essential to your customers?

Terry Benson
The Overwatch Tactical Operations patented feed technology combines dual polarization with multiple frequency band coverage into a single feed that can be fitted onto new or existing antenna systems. This technology reduces footprint and minimizes life cycle cost, both of which are important considerations for our customers. This technology has been applied to a number of systems, including flyaway, fixed (or teleport) and shipborne, and is readily applicable to mobile applications.

The multiband feed design consists of coaxial, concentric waveguide cavities that operate in TE11 mode. Normally used in circular waveguide feed design, this mode also is suitable for use in coaxial waveguide.

The large, outermost cavity of the feed operates in the lower frequency band, while the innermost cavity operates at the higher frequency band. The antenna is fed with orthogonal waveguides for polarization diversity in all bands. The coaxial cavity feed is ideal for this application because the feed produces high-efficiency, near-optimum illumination patterns and coincident phase centers in both bands simultaneously. Because it is a waveguide design, the input power levels used in SATCOM systems do not present breakdown problems[1].

This feed has proved to be an ideal multiband illuminator for parabolic reflectors, and therefore could be used in many military and commercial applications that require multiband operation[1].

A dielectric lens on the aperture focuses the feed to match reflector optics. As a result, the feed design can be adapted to multiple reflector designs simply by changing the lens. Radiation patterns of the feed without the lens are fairly broad, limiting the antenna designs upon which the feed could be deployed successfully. The lens allows the radiation pattern to be tailored to the optics of an existing antenna system, expanding the available antenna uses. Since the lens acts as a broadband device, the radiation pattern is similar across both bands. As a result, similar efficiencies can be achieved in both bands. The lens concept is another Overwatch Tactical Operations patented technology that has been used successfully in antenna systems with multiband feeds.

MilsatMagazine
In what ways do Overwatch Tactical Operations military SATCOM technologies enable your military customers to better perform their missions?

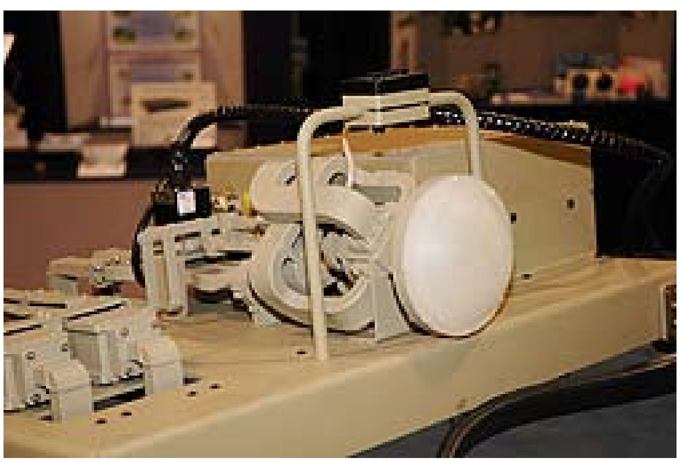
Terry Benson
By providing transmit and receive for two bands simultaneously, our customers can effectively double their communications throughput. This advantage allows them to more quickly and effectively adapt to evolving requirements in theater. Scenarios change quickly in forward environments, so flexibility is of vital importance to assessing a situation and responding to it quickly without the added concern of equipment capability.

For example, one possible scenario using Wideband Global SATCOM, or WGS, satellites would allow the same terminal to connect to assets within the continental United States in X band with a large data pipe, while also allowing connectivity to multiple tactical users on the battlefield utilizing Ka band.

MilsatMagazine
What are the benefits of dual-band systems for your military customers?

Terry Benson
These solutions offer three substantial benefits for our military customers — increased throughput and capacity for a single terminal, a smaller system footprint, and reduced life cycle costs. These represent increased functionality and maximized system value.

As Overwatch Tactical Operations has been on the forefront of this technology, many potential customers were not aware that this capability was available. As we have presented the possibilities and demonstrated the capabilities with working hardware, new applications continue to present themselves as customers realize all that they can accomplish with dual-band systems.



The company's patented feed technology can be used on new or existing antenna systems; this application required a quad-band antenna.

MilsatMagazine
The company's SATCOM antenna systems are offered in flyaway and shipboard configurations, as well as fixed. How are the non-fixed antennas designed to offer comparable performance compared to a fixed option?

Terry Benson
Fixed, or teleport, systems are typically large-aperture antennas that serve as direct communication links for a given satellite, whether in theater or here in the United States. Given that most of the newer satellites are multiband; for example, the WGS, simultaneous multiband capability at the teleport or fixed site allows them to match the capability of the satellites with which they're communicating using a single antenna. Multiband capability in a single terminal also saves users the additional real estate and life cycle costs associated with another large antenna.

The operational aspects of smaller terminals such as shipboard, flyaway, transportable, or very small aperture terminals require a different set of capabili-

Overwatch Tactical Operations developed this 2.4-meter quad-band antenna that can be used for combat vehicles or trailers. A multiband system allows customers to greatly expand the capacity provided by a single system.

ties. In the case of a shipboard system, multiband provides increased capability without increasing the impact on the deck's footprint. After all, space is typically at a premium aboard ships. Other shipboard applications address regulatory concerns where the ability to seamlessly switch frequency bands; for example, from C- to Ku-, is necessary when entering some ports of call without manually changing out a SATCOM feed.

For other transportable or flyaway systems, multiband provides the flexibility to seamlessly switch between two bands or to operate in both bands simultaneously. These capabilities are essential for military customers so they can meet the demands of emerging in-theater operational scenarios.

MilsatMagazine
Overwatch Tactical Operations also is a SATCOM system integrator. How do your military customers benefit from this experience? How is it to their advantage to have your company field their systems, as opposed to gathering and integrating the various components themselves?

Terry Benson
Overwatch Tactical Operations can provide anything from an integrated quad-band flyaway terminal to feed solutions for existing antennas. Different customers require different levels of integration and support, so we tailor our solution and approach to their unique requirements.

Some customers contract with Overwatch Tactical Operations for the complete antenna and feed assembly while others may request our feeds with the goal of creating their own reflectors or retrofitting an existing reflector. In the latter case, it is important that we act as a partner during the reflector modeling and testing process to ensure that the integrated antenna product will perform to specifications.

MilsatMagazine
How do you see SATCOM technologies maturing even further in the next several years? What are the new and vital military missions these products will need to perform?

Terry Benson

It's my belief that with the advent of WGS, military communications will continue to increase their reliance on both military and commercial satellite capacities. In the past, multiband terminals achieved that capability by swapping feeds.

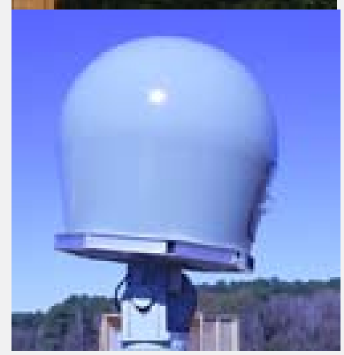
With an eye toward the future back in 1997, we believed that a more robust solution was necessary. As a result, the Overwatch Tactical Operations patented multiband technology was developed to provide maximum flexibility and increased operational capacity. This technology allows our customers, both military and commercial, to fully utilize the capability of satellites that are being launched.

For more information on Overwatch Tactical Operations products and services, visit www.overwatch.com. To learn about the larger Textron Systems organization, visit www.textronsystems.com.

1 – Cavalier, Mark D. and Don Shea, "Antenna System for Multiband Satellite Communications," MILCOM 97 PROCEEDINGS, November 1997.

Anchors Aweigh

Overwatch Tactical Operations delivered seven X/Ka band shipboard antennas to customer EADS Astrium for the Royal Australian Navy's ASTIS JP2008 program. The antenna and feed, which utilize the company's patented multi-band feed technology, enable the Royal Australian Navy's satellite to transmit and receive in both the X and Ka bands simultaneously for mission flexibility.



TRENDS IN COMMUNICATION SYSTEMS FOR ISR UAVS

by Steve Gardner, GM, Enerdyne Technologies, Inc.

During the past six years of combat in Afghanistan and Iraq, all doubts about the utility of Unmanned Aerial Vehicles (UAVs) in providing mission critical ISR (Intelligence, Surveillance, Reconnaissance) for war fighters have been erased. In 2002, UAV systems (a ground station supporting a number of aircraft) deployed totaled 16. In 2008 the number of systems in theatre exceeded 1,000, with nearly 6,000 aircraft fielded. In these few years the UAV industry has moved from a state of infancy to a condition that might be described as adolescence, since the technology has advanced sufficiently that its full potential can be envisioned, but there is a lot more growing up to do.

Although they are small and have very low cost compared to manned ISR platforms, good ISR UAVs are an impressive aggregation of technologies — the airframe, engine, autopilot, and navigation system, sensor package, and communication link each must excel for a UAV to achieve its mission goals.

As the principle purpose of these aircraft is to obtain quality, high bandwidth ISR data and move that information into the hands of its consumers as quickly as possible, the communication link is a key element of the UAV system. The requirements for these links vary as much as the types of missions and different UAV classes.

The general perception of UAVs tends to be driven by news articles featuring larger aircraft such as the ***Predator*** that are flown by pilots in climate-controlled rooms half-way around the world, and whose ISR output travels over Ku-band *Common Data Link* (**CDL**) satcom links. Those links allow viewing of data in real time by **CONUS** mission commands including **Creech Air Force Base** and the **Pentagon**. The reality is the role of the lion's share of UAVs is to provide ISR data to soldiers within 50 miles of the aircraft using line-of-sight air-to-ground links.

Today these links are predominantly analog FM links for standard definition video, but a change to

Predator UAV

sophisticated digital links is underway, driven by a range of factors. Tomorrow's needs include security, improved range, efficient use of spectrum, and support for a variety of complex sensors such as high definition video, laser designators, *synthetic aperture radar* (**SAR**), ground moving target indicators, and multi-spectral imagers.

This article will offer some insight into how the variety of mission needs has resulted in a wide range of different UAVs, each filling a particular mission niche. The focus then moves on to how these needs drive the communication system design on the UAV, focusing especially on the need for a broad consideration of spectrum management, since this is the next major hurdle in the UAV maturation process.

UAVs for Intelligence, Surveillance and Reconnaissance

As there are many types of missions, there are also many types of UAVs. Each has a broad range of characteristics to allow it to satisfy the needs of a specific mission. Size (measured by payload capacity) and endurance (maximum flight time) are the biggest differentiators, but mode of flight also matters. Observers sometimes divide the UAV industry into three classes, called ***Tiers***. Although the armed services differ on how to define the tiers, the Army Tier concept is shown here:

- ***Tier I UAVs are highly portable and can be hand launched (many can be carried in a soldier backpack). They are intended to allow small troop units to find out what's happening behind the next building or*** *on the other side of a nearby hill. Tier I UAV payload capacity is typically less than three to four pounds and their endurance is an hour or less. They rarely carry more than a single standard definition EO camera. Examples of Tier I UAVs are the AeroVironment Raven and the Lockheed Martin Desert Hawk.*

Raven UAV

Desert Hawk UAV

- *Tier II UAVs can often be lifted by two men and might carry five to 30 pounds of payload, which could include several different types of sensors including EO, IR or SAR radar. These aircraft support larger troop formations with more wide-ranging missions and can operate out to the line-of-sight horizon, with endurance of as much as 12 hours or more. Examples of Tier II UAVs are the Insitu Scan Eagle, AAI Shadow, or DRS Sentry.*

Scan Eagle UAV

Shadow UAV

- ***Tier III UAVs rival small passenger aircraft in size and payload. They carry a wide range of sensors, including sophisticated on-board image and sensor data processing payloads. In recent years it is becoming increasingly commonplace that Tier III UAVs carry weapons so that they can fill a hunter/killer role, working in concert with ground warfighters to "find, fix and finish" a target. Examples of Tier III UAVs are the fixed wing General Atomics Predator and Northrop Grumman Global Hawk, or the rotary wing Boeing FireScout.***

Global Hawk UAV

Tier I and ***Tier II*** UAVs almost never use satellite links because they can't support the size and weight of high-gain tracking antennas, and they often change attitude too rapidly for a tracking antenna to stay locked on the satellite. Line-of-sight, air-to-ground links are the norm for both Tier I and Tier II. Tier III UAVs commonly have satellite links to allow for the rapid dissemination of their ISR content across the globe.

Within the Tiers, there are many additional differentiating factors. For example, some Tier II UAVs focus

Fire Scout UAV

on maximizing endurance. Endurance requires minimum aircraft weight and maximum flight efficiency, which can often best be achieved at the expense of greater complexity in the required ground equipment. For example, a Tier II UAV might use an RF transmitter with very low output power to minimize its power consumption (and thus conserve fuel). The range penalty resulting from the low power transmitter can be offset by use of a one to two meter parabolic reflector antenna at the ground site.

Larger ground-based launchers enable a lower peak-thrust engine design to save weight. Using ground-based in-flight retrieval devices, aircraft can be designed without landing gear. But such a large and complex ground segment can be an inviting target for an enemy, requiring a greater degree of security than might be needed with a smaller ground footprint.

On the other hand, if shorter endurance is acceptable, the aircraft can be designed to land without assistance from ground hardware. The engine can have sufficient power that the launcher can be very small (or be eliminated), and the aircraft transmitter power can be increased to the point that small ground antennas with relatively low gain work just fine. The resulting UAV and all its support equipment can conceivably be carried in the back of a ***HumVee*** while drawing minimal attention, but its endurance will not match the previous example.

Neither approach can be designated as "better" outside the context of the mission. For some missions, endurance is critical. For others, minimal ground equipment is vital. There are clear niches for both concepts. The UAV ecosystem has many other niches as well — for example, for surveillance between buildings in urban canyons, a fixed wing design that must fly in circular "orbits" is inappropriate and the ability to hover is key. Rotary wing UAVs include the aforementioned ***Boeing FireScout*** and the ***DragonFly***

Tailoring To Meet Mission Requirements

Communication systems often require some degree of tailoring for best performance on a given UAV platform. Descriptions of some of the design issues follow.

- ***Antenna Placement — With Tier II UAVs, the number of potential antenna mounting points is limited. "Shadowing" or blocking of the antenna is routinely a problem, as the single most common mission is flying in circles while monitoring a fixed or slowly moving point below. For many antenna locations, there will be some part of the orbit in which the antenna is shadowed by the aircraft fuselage, resulting in a link dropout. Use of antenna space diversity techniques in the aircraft can greatly improve shadowing performance.***
- ***Self Jamming— Almost every UAV has receivers for GPS and as well as for command and control for the payloads and the aircraft navigation systems. Care is required to ensure that the downlink transmitter does not de-sensitize these receivers, which typically involves analysis of transmitter emissions and receiver selectivity as well as care in antenna placement.***
- ***Asymmetric Transmissions — For most UAVs the downlink data transmission bit rate is typically much greater than the uplink rate. Coupled with the fact that aircraft power supply constraints limit the amount of transmitter power, this means that the downlink is substantially disadvantaged compared to the uplink. Techniques such as downlink antenna space diversity provide***

gain in multipath channels, and are one way to recover some of this disadvantage.

- ***Relay Capability** — It is easier to acquire good imagery when operating at low altitudes, since there is less atmospheric haze and shorter focal-length lenses are lighter and have less stringent stabilization requirements. Operational altitudes from 2,000-5,000 feet are commonplace, but these altitudes cut line-of-sight range to about 50-100 miles when the terrain is smooth, or even less in hilly or mountainous terrain. Using a second high-flying UAV to relay the ISR data can extend the range substantially.*

The relay configuration introduces additional complexity. If the data link uses the common technique of frequency division duplexing to separate the uplink and downlink, it is very difficult for the relay UAV to avoid self jamming unless it can reverse the frequency plan for the link back to the ground station. Moreover, antenna placement on the distant UAV must allow some visibility upward, which may require different antennas from those used when there is no relay. An important conclusion to be reached from this discussion is that a one-size-fits-all solution to the communication challenge is unlikely. However, a well conceived system approach can provide an interoperable system that can be tailored to a range of specific scenarios.

UAV "cockpit"

Spectrum Efficiency and Frequency Management is Vital

All branches of the U.S. armed forces and special operations units plan substantial increases in the number of fielded UAVs in the near future. Analog FM links used on the majority of fielded UAVs consume 20-25 MHz of bandwidth, and channel spacing often has to be even greater than that. It is very difficult to have more than three or four UAVs operating in a given region when bandwidth is consumed in such a wanton fashion.

Realizing the DoD vision of large numbers of UAVs operating simultaneously will require a very different approach. Many UAVs are in the process of the necessary first step: transitioning to digital transmission. But without a holistic view of the spectrum management problem, the industry is likely to find itself confronted by another retrofit cycle in five years.

To date, most of the thought about UAV spectrum efficiency with digital transmission has simplistically focused on the transmitted spectrum, but this is only one facet of a multi-dimensional problem. The UAV community needs to draw from the experiences of other wireless industries with bandwidth constraints, examining all the tools available for spectral efficiency including source coding, efficient modulation, receiver selectivity, antenna directivity, and transmit power control.

The cellular industry has a similar problem to the UAV industry. It is very constrained in bandwidth and needs to space channels as tightly as possible. Cellular engineers have long recognized that the fundamental problem caused by transmissions in the adjacent channel is that some amount of the energy of the unwanted adjacent channel signal makes its way through the receiver filters. This energy creates an effect comparable to additional receiver front end noise, thus degrading the minimum level of the desired signal that can be received with acceptable quality. A spectrally efficient system design uses every means possible to limit the amount of adjacent channel energy that makes its way through the receiver filters. The solution requires much more than just reducing out-of-band emissions in the transmitter spectrum, including these techniques:

- ***Maximizing receiver selectivity — that is, designing the receiver to reject energy outside of its intended passband to the greatest possible extent***
- ***Directional Antennas —- when the ground station antenna has most of its gain in the direction of the desired transmitter, a potential interferer that is not in the main lobe of the antenna experiences substantial attenuation before it reaches the receiver and thus interferes less***
- ***Power control —adaptively reducing the transmitted signal level to no more than what is needed to close the link, with acceptable margin, reduces the amount of interference that a given transmitter can cause***

The remaining tactic to minimize channel spacing is an obvious one: *the system should send as few bits as possible*. Fewer bits implies the use of the most effective compression techniques, but it also includes simple (but not always followed) concepts such as using a modem whose bit rate can be matched to the throughput demand of the mission, rather than running at only one or two rates chosen to grossly overbound the maximum rate required among a broad range of missions. With H.264 compression and a high performance turbo code for FEC, it is easy to transmit high quality 30 fps standard definition video with a 3 Mbps modem bit rate.

Frequency Band Choice

A related problem is the question of what frequency band or bands to use. While the ***Office of the Secretary of Defense*** has mandated the use of Ku-band CDL links for Tier II and Tier III UAVs, to date the Tier II UAVs have not made this transition, mainly because of the technical challenge of using Ku-band on an aircraft that demands minimal size, weight and power consumption.

While the OSD goal of providing data link interoperability has undeniable merit, a link budget problem results because steerable antennas are impractical in a small UAV and also because of the losses due to atmospheric effects. Range is extremely compromised at Ku-band compared to what is possible at lower RF frequencies. At L-band (1700-1850 MHz), for example, it is easy to close a 5-10 Mbps link at ranges up to 75 miles with a simple, manually pointed ground antenna. Even C-band (4-6 GHz) provides a far more favorable link budget than Ku-band. Thus many Tier II UAVs use links in L- or C-band as well as S-band. Although there is less bandwidth available at the lower frequencies, if the spectrum is used efficiently, a large number of UAVs can share it.

Data Security Also Driving UAV Data Link Design

FM analog links are easily intercepted by low cost off-the-shelf receivers, so they don't provide even rudimentary data privacy. Even without encryption, digital links provide a substantial step forward in privacy if they are not based on common standards. Commercial grade AES encryption is simple to add to a digital link, and maximum security is afforded by Type 1 military encryption.

The security issue also creates some conundrums that must be addressed. One of the most valuable ISR assets for the warfighter has been the remote video terminal (for example, the ROVER terminal), which is a single multi-band FM video receiver that allows soldiers on the ground to view video from a range of UAVs. RVTs turn the lack of security in the video into an advantage, since multiple users can exploit the ISR without the need to manage the distribution of encryption keys and passwords.

On the other hand, Type 1 encryption creates its own set of issues, since it carries with it a requirement to manage keying material with a level of care that often precludes its use by foreign nationals or contract

EnerLinks III equipment

employees who may be part of the mission team. Provisions for destruction of keying material in the event of compromise make equipment bigger, more power hungry, and more expensive — all of which are serious impediments to Type 1 use in Tier I and Tier II UAVs.

The use of commercial grade encryption with password-based keys seems to be a good compromise, but in many cases there are concerns about how secure such a system really is. Some of these concerns may be more cultural than real, but perception can be important in security. And any encryption system will reduce the ability of the RVT user to exploit the video. Ultimately, it seems likely that providing a range of security options will allow tailoring of security to meet the needs of the mission, but there is more work ahead to reach an industry consensus in this regard.

Converging Issues = Solutions

In the last six years, UAVs have demonstrated the ability to provide critical real-time ISR data to warfighters at a fraction of the cost of manned platforms, in spite of the relative immaturity of the systems. Timely and accurate ISR increases the effectiveness of our armed forces and also helps to greatly reduce casualties through improved situational awareness and shortened sensor to shooter chains.

The universal recognition of these benefits has brought the need for improvement in next generation UAV systems into sharp focus. An understanding of the different platforms supporting the range of DoD missions will drive the deployment of many varieties of aircraft, and it will be necessary for these aircraft to be able to cooperate spatially and spectrally while disseminating the ISR from platforms in standardized waveforms and formats that are spectrally very efficient and designed to coexist and interoperate. The user community is recognizing the need for interoperability, but recognition that existing systems may not provide the required spectrum efficiency is still to come. The next few years promise to be interesting as these issues converge to a solution. MSM

About the author

Steve Gardner became General Manager of Enerdyne in December 2007 after serving the company as Chief Technical Officer since May of 2003. Under his technical leadership, Enerdyne is a mainstream provider of digital data links for manned and unmanned applications in ISR. Steve was the architect of the EnerLinks™II family full-duplex data link, which has been deployed on a variety of manned and unmanned aircraft and surface vessel platforms. The EnerLinks™II family includes the EnerLinks™II DVA (Digital Video over Analog FM Links) system that converts legacy analog data links to digital systems using the existing sensors and RF equipment in both the aircraft and ground system. Drawing on nearly 30 years of experience in the field of communication system design, he restructured Enerdyne's engineering department to add best-in-class talent in RF hardware, modem design, signal processing and networking design.

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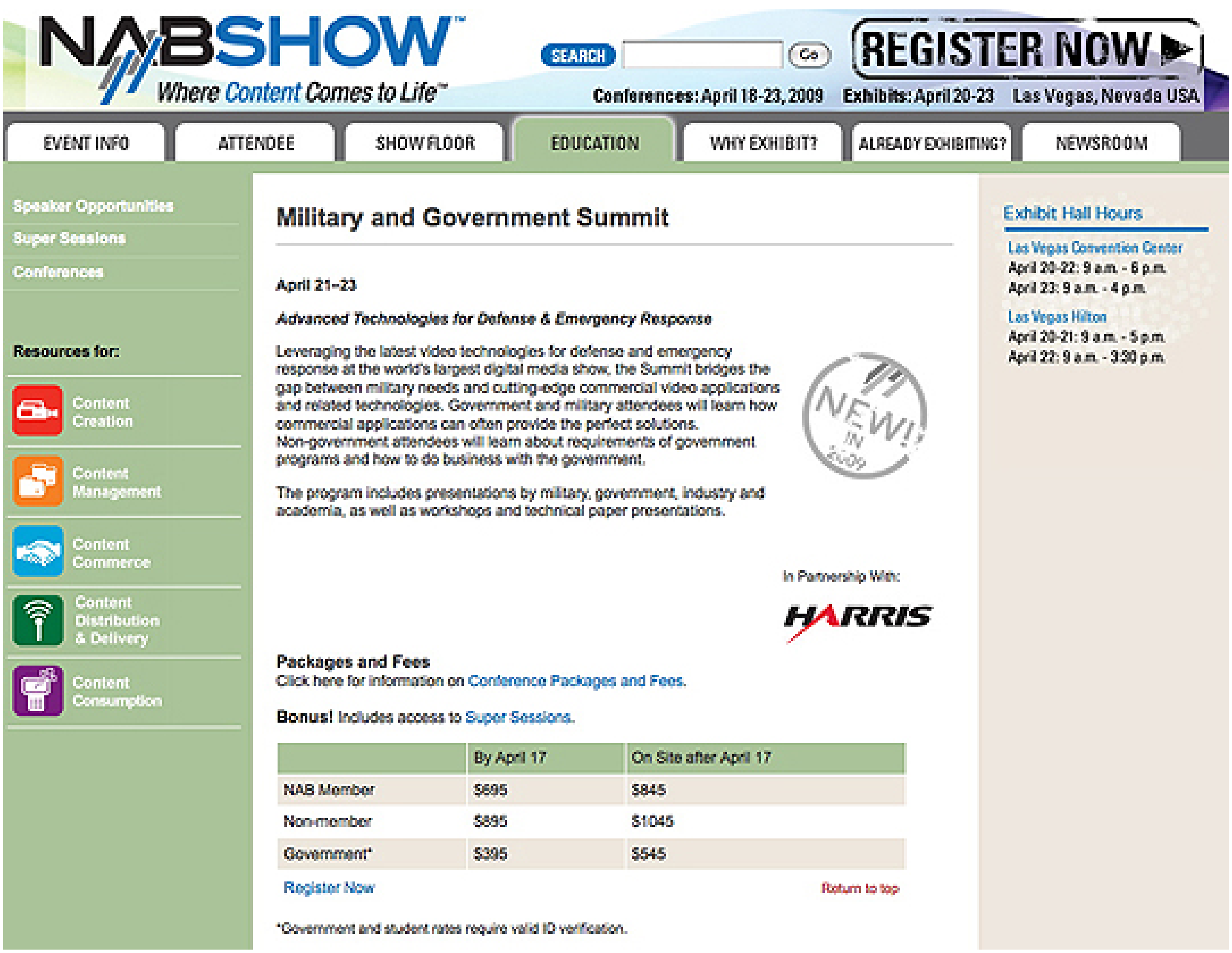
The ***Summit*** will identify ways in which government and military officials can use commercial video technologies for defense and emergency response applications. Plus, attendees will have access to the NAB Show floor — the world's largest video marketplace which opens on Monday, April 20th.

The ***Summit*** will feature an opening keynote by *Kevin P. Meiners* of the ***Office of the Under Secretary of Defense for Intelligence*** (**OUSD**). The ***Summit's*** education program will be led by conference chair Commander ***Joseph A. Smith***, **U.S. Navy**, ***Military Deputy Sensor Assimilation Division*** (**ASX**), **National Geospatial-Intelligence Agency**. (***Please see his interview with MilsatMagazine on Page 33.***)

"The Summit will unite government and non-government officials to examine the strong role video technology plays in military applications," said



Commander *Smith*. "As the world's largest digital media event, the NAB Show provides the perfect platform to examine this issue."

Additional presentations will be led by military, government, industry, and academia, as well as workshops, case studies and technical papers by leading defense companies. Other invited speakers include: Maj. Gen. *John M. Custer*, **U.S. Army**, Commander, **USAIC** and **Ft. Huachuca** and Vice Adm. *Robert B. Murrett*, **U.S. Navy**, Director, **NGA**

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Keynoter

Kevin Meiners, the opening keynote speaker, is a graduate of the **Virginia Polytechnic Institute and State University**, **Marymount University**, **Defense Systems Management College**, **Industrial College of the Armed Forces** and **Federal Executive Institute.** He holds a Masters of Science Degree in management information systems and national resource strategy. Prior to joining OUSD, Meiners served as an electronics engineer, program manager and director of intelligence strategies within the United States Navy and the Pentagon. MSM

About the 2009 NAB Show

The NAB Show will take place April 18 - 23, 2009 in Las Vegas (exhibits open April 20). It is the world's largest electronic media show covering filmed entertainment and the development, management and delivery of content across all mediums. Complete details are available at www.nabshow.com.

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2009 Editorial Calendar
SatMagazine + MilsatMagazine

SatMagazine + _MilsatMagazine_ are offered as online viewable magazines and also as downloadable ".pdf" versions — there is no charge for access. Some issues are also printed for distribution at various conferences, exhibitions, and trade shows, and they are so indicated in the list below. SM = *SatMagazine*, MSM=*MilsatMagazine* — SatNews *deadlines are 5:00 p.m. daily, California time.*

- ***JANUARY SM — Deadline: December 10 — Theme: The Microsatellite Market (Nanos, Picos, Minis, Micro)***
- ***JANUARY MSM — Deadline: December 10 — Theme: Intelligence/Surveillance (also UAV connection)***
- ***FEBRUARY SM — Deadline: January 10 — Theme: The U.S. Satellite Market***
- ***MARCH SM (PRINTED) — Deadline: February 10 — Theme: All Things Broadcast Related (300 dpi graphics minimum)***
- ***MARCH MSM (PRINTED) — Deadline: February 12 — Theme: Advanced Military Communications (300 dpi graphics minimum)***
- ***APRIL SM — Deadline: March 10 — Theme: New Applications***
- ***MAY SM — Deadline: April 5 — Theme: Imagery & Earth Observation***
- ***MAY MSM — Deadline: April 10 — Theme: New Technologies***
- ***JUNE SM (PRINTED) — Deadline: May 11 — Theme: Asia + pan-Pacific Market***
- ***JULY/AUGUST SM — Deadline: June 5 — Theme: MSS + Ground Stations | Teleports***
- ***JULY/AUGUST MSM — Deadline: June 10 — Theme: The Warfighter***
- ***SEPTEMBER SM — Deadline: August 5 — Theme: European Markets***
- ***SEPTEMBER MSM — Deadline: August 10 — Theme: Military Satellites***
- ***OCTOBER SM (PRINTED) — Deadline: September 12 — Theme: Satellite Launch Sector markets (300 dpi graphics minimum)***
- ***NOVEMBER SM — Deadline: October 5 — Theme: MENA + Latin American markets***
- ***NOVEMBER MSM (PRINTED) — Deadline: October 10 — Theme: COTS + Mobility (300 dpi graphics minimum)***
- ***DECEMBER SM — Deadline: November 10 — Theme: Year In Review***

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