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MilsatMagazine

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Boeing — GPS II-F
IvySys Technologies Command Center
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KVH Industries Vs. Piracy
Spacenet

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All About GPS IIF

courtesy of Boeing

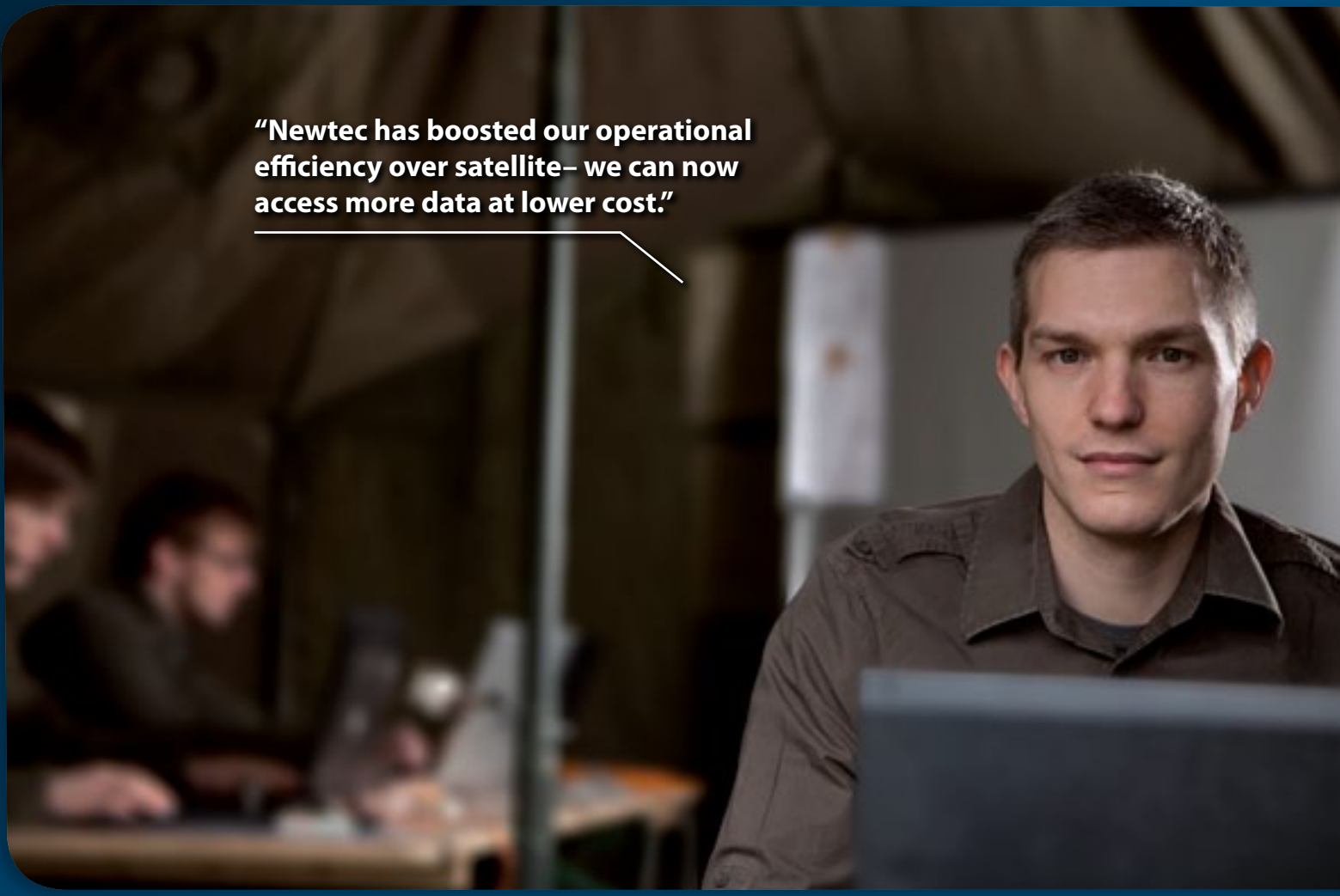
GPS is used to support land, sea, and airborne navigation, surveying, geophysical exploration, mapping and geodesy, vehicle location systems, aerial refueling and rendezvous, search and rescue operations, and a wide variety of additional applications. Civilian users range from commercial airlines, trucking fleets, and law enforcement agencies to farmers, fishermen and hikers. New applications are continually emerging.

These capabilities were put to the test during ***Operation Desert Shield*** and ***Desert Storm***. Coalition forces relied heavily on GPS to navigate the featureless Saudi Arabian desert. Forward air controllers, pilots, tank drivers and even cooks used the system so successfully that several U.S. defense officials cited GPS as a key to the Desert Storm victory. Recently, during ***Operation Enduring Freedom*** in Afghanistan and Operation Iraqi Freedom, GPS proved invaluable to coalition forces navigating in difficult conditions. These operations included the use of immensely successful GPS guided munitions, such as **JDAM** (***Joint Direct Attack Munition***), allowing pinpoint accuracy with minimum collateral damage.

GPS provides the following 24-hour navigation services: extremely accurate three-dimensional location (latitude, longitude and altitude), velocity and precise time; a worldwide common grid that is easily converted to any local grid; passive all-weather operations; continuous real-time information; unlimited support to worldwide users; and civilian user support at a slightly less accurate level. The GPS signals are so accurate that time can be calculated to within a millionth of a second, velocity within a fraction of a mile per hour and location to within feet.

GPS consists of three segments: space, control and user:

The Space Segment, consists of 24 operational satellites in six circular orbits 20,200 km (10,900 nm) above the Earth at an inclination angle of 55 degrees with a 12 hour period. The satellites are spaced in orbit so



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that at any time a minimum of six satellites will be in view to users anywhere in the world. The satellites continuously broadcast position and time data to users throughout the world. The satellites transmit signals on two different L-band frequencies.

The Control Segment consists of a master control station operated by the 50th Space Wing's 2nd Space Operations Squadron at Schriever Air Force Base, Colorado, with five monitor stations and three ground antennas located throughout the world. The monitor stations track all GPS satellites in view and collect ranging information from the satellite broadcasts. The monitor stations send the information they collect from each of the satellites back to the master control station, which computes extremely precise satellite orbits. The information is then formatted into updated navigation messages for each satellite. The updated information is transmitted to each satellite through the ground antennas, using an S-band signal. The ground antennas also transmit and receive satellite control and monitoring signals. The current ***Block IIF*** contract includes development of the Control Segment. In December 2003, a new **Boeing GPS Center** (**BGC**) was dedicated in Colorado Springs, Colorado. The center was created to develop, integrate, test and sustain the control segment hardware and software for the latest GPS IIF satellites. This facility will also have the capability to support evolutionary software development for GPS IIF and other versions of the GPS satellite.

The GPS IIF is pictured here in Boeing's's satellite integration and test complex in El Segundo, CA,

The User Segment consists of the signal receivers/processors, antennas and control/display units that allow land, sea, or airborne operators to receive the GPS satellite broadcasts and compute their precise latitude, longitude, altitude, velocity and precise time at any time, in any weather. The system can accommodate an unlimited number of users without revealing their positions.

The GPS concept of operation is based upon satellite ranging. Users figure their position on the Earth by measuring their distance from the group of satellites in space. The satellites act as precise reference points.

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Each GPS satellite transmits an accurate position and time signal. The user's receiver measures the time delay for the signal to reach the receiver, which is the direct measure of the apparent range to the satellite. Measurements collected simultaneously from four satellites are processed to solve for the three dimensions of position, velocity and time.

GPS receivers collect signals from satellites in view. They display the user's position, velocity, and time, as needed for their marine, terrestrial, or aeronautical applications. Some display additional data, such as distance and bearing to selected waypoints or digital charts.

Boeing technicians prepare the GPS IIF-2 satellite for shipment to Cape Canaveral. The satellite was transported in a Boeing-built C-17 Globemaster III airlifter. Photo is courtesy of Boeing.

GPS provides two levels of service — a ***Standard Positioning Service*** (**SPS**) for general public use and an encoded ***Precise Positioning Service*** (**PPS**) primarily intended for use by the **Department of Defense**. SPS signal accuracy is intentionally degraded to protect U.S. national security interests. This process, called ***Selective Availability*** (**SA**), controls the availability of the system's full capabilities. The SPS accuracy specifications, given below, include the effects of SA.

SPS provides accuracies of (for position, the accuracy with respect to geographic, or geodetic coordinates of the Earth) within:

- **100 meters (2 drms) horizontal**
- **156 meters (2 Sigma) vertical**
- **300 meters (99.99 percent probability) horizontal**
- **340 nanoseconds time (95 percent probability) time**

SPS coverage is continuous and worldwide, with a ***position dilution of precision*** (**PDOP**) of six or less.

The ***Delta II*** expendable launch vehicle is currently used to launch GPS satellites from **Cape Canaveral Air Force Station**, Florida. In the future, ***Block IIF/III*** spacecraft will use the Air Force's ***Evolved Expendable Launch Vehicle*** (**EELV**).

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Force Base, California, ***Boeing Reusable Space Systems***, Seal Beach, California, designed, built, and tested 11 developmental Navstar GPS satellites; developed and qualified a second-generation production prototype; and built 28 production Navstar GPS satellites under a $1.35 billion contract awarded in 1983. The original Air Force contract for GPS was awarded in 1974, resulting in the first Block I ***Navigational Development Satellite*** (**NDS**) satellite being launched in 1978 by an Atlas F rocket.

Today, the majority of the constellation consists of Boeing Block IIA satellites. The GPS Block IIR satellites, built by **Lockheed Martin**, are currently being launched on Boeing Delta II rockets.

Boeing is currently under Air Force contract to build 12 GPS IIF satellites. The GPS IIF satellites, with a design life of 12.7 years, will have improved anti-jam capability and substantially increased accuracy from earlier satellite versions. The first GPS IIF launch launched on May 27, 2010, from Cape Canaveral Air Force Station.

Guarding South Africa's Shipping Lanes

From a building high on the slopes of the Tygerberg, north-east of Cape Town, South Africa's *Centre for Sea Watch and Response* (CSWR) keeps an eye on the hundreds of ships that pass around the Cape each day.

"When busy, the center might be using its sophisticated satellite technology to track as many as a thousand vessels," CSWR executive head *Karl Otto* said. The CSWR is a division of the ***SA Maritime Safety Authority*** (**Samsa**).

With its *Long-Range Identification and Tracking system* (**LRIT**), launched 18 months ago, at the time the CSWR was established, his staff could "see" ships up to 1,850km off the South African coast.

Otto said another satellite-based system, **AIS** (***Automatic Identification System***), allowed his staff — who man the center around the clock, seven days a week — to access information relating to each vessel. This includes the size and type of vessel, the ship's origin and destination, and what cargo was being carried.

"Over 90 percent of South Africa's trade is carried to and from the country by sea; it is important we know what is going on," *Otto* said.

Both systems rely on transponders, fitted to ships, which transmit information to orbiting satellites. This data is then transmitted to ground stations and fed through to the CSWR.

Once there, the information is displayed, via computer, on large screens. Software allows operators to forecast from the data, factoring

South African Navy Frigate SAS AMATOLA

in information such as weather, winds and currents. This is useful in the event of the center having to respond to an emergency, such as a sinking ship or an oil spill. The system can then be used to predict the likely drift of survivors, or slicks, allowing rescue or clean-up efforts to be focused on a particular area.

The maritime region South Africa monitors, in terms of its international obligations, is vast: 27.7-million square kilometers. It stretches from Antarctica in the south to the Kunene River in the north; and from 10 degrees west in the mid-Atlantic to a point well past Madagascar in the Indian Ocean.

Among the CSWR's functions is watching for ships that pollute. "Ships, at night, pump out dirty oil into the water. But by the time we see the slick, we don't see the ship," *Otto* said.

The center was hoping to acquire more high-tech equipment, in the form of a synthetic aperture radar system, to catch the culprits. This would allow his center's operators to view, from satellite, the stretch of sea the ship was passing through and provide direct evidence of the offence. *Otto* said a lack of long-range maritime aircraft restricted South Africa's ability to directly monitor shipping. "It's a concern, yes, definitely," he said.

It is understood that the only official aircraft available for long-range marine surveillance off the Cape coast are two ageing C130s.

On illegal fishing within South Africa's economic exclusion zone, which stretches to 200 nautical miles offshore, *Otto* said this was certainly happening, but was unable to say to what extent. Many foreign fishing vessels were not fitted with transponders. He said coastal radar had a range of about 50 nautical miles; beyond that, it was not possible to know what was happening if the area was not patrolled by ships or planes.

Samsa CEO *Tsietsi Mokhele* said South Africa was the only country on the continent with the capacity to monitor shipping off its coast.

The center's focus was on maritime traffic management, accidents and incidents at sea, pollution and security.

"The CSWR represents a high concentration of maritime experience that can serve the nation," he said.

Article is courtesy of SouthAfrica.info, available at...
http://www.southafrica.info/

Kodiak Communications

Communicating from land to sea and air plays a vital role during joint operations in the U.S. military. Soldiers and Marines have made this communication possible in Kodiak, Alaska, for *Exercise Northern Edge 11*.

Signaliers attached to **Charlie Company**, ***307th Expeditionary Signal Battalion***, joined with Marines of ***Marine Air Control Squadron One*** to ensure communication needs are met during the joint training. **MACS-1**, from Marine Corps Air Station Yuma, Arizona, is typically an autonomous unit.

However, with their communications detachment currently deployed overseas, they looked to the **59th Signal Battalion** at **Joint Base Elmendorf-Richardson**, Alaska, for the connection they needed.

"We normally work with our own assets; it is a new and rewarding experience working with the Army 'com' guys," said Marine Master Sgt. *Brad Barber*, MACS-1 senior air director, from Atlanta. "At home, we don't get the opportunity to work with joint contingencies."

The Marines and soldiers are working in the same capacity here as they do during combat deployments.

"We're learning how they work; they're learning how we work," said Army Spc. *James Havens*, a native of Gulfport, Mississippi. "We all have one main goal, to accomplish the mission."

Their mission for ***Northern Edge*** is to ensure land, air and sea units are able to communicate effectively to accomplish their respective missions. The Army signaliers install, operate, maintain and protect communication systems, to enable MACS-1 to receive information instantaneously via secured and unsecured communications and relay messages between military services.

Army Spc. Harrison Black, a satellite specialist, briefs his platoon commander, 2nd Lt. Rose Munroe, on a satellite the soldiers provided for Marines from Marine Air Control Squadron-1 to communicate with Air Force aggressor pilots during Exercise Northern Edge 11, June 14. The Soldiers are from Company C 307, 59th Signal Battalion at Joint Base Elmendorf-Richardson, Alaska. (Photo by Cpl. Marionne T. Mangrum)

"It's a good experience for [the soldiers] to work with the Marines before they deploy overseas," said Army 2nd Lt. *Rose Munroe*, the 307th ESB Heavy Signal Platoon leader.

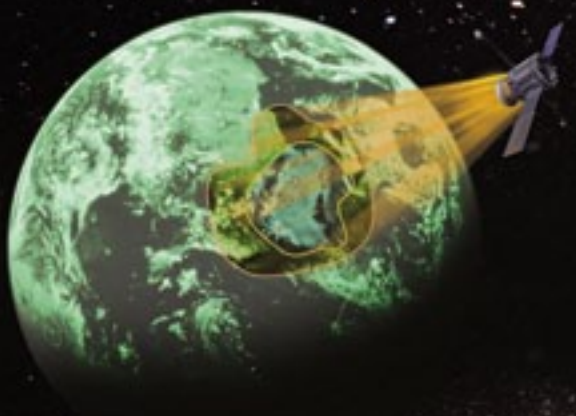
NE11 was Alaska's largest joint military training exercise and ran through June 24th in various locations throughout the state and the Gulf of Alaska. It prepares U.S. forces to respond to crises throughout the Asian-Pacific region. The exercise affords Army, Navy, Marine, Air Force and National Guard members — active duty and reserve — highly flexible, tactical real life experiences.

(article is courtesy of Alaskan Command Public Affairs via DVIDS)

Smart Phones Have U.S. Army's Attention

The Army is finding the use of smart-phone devices such as an Android or iPhone leads to an increase in "SPOT" reports, wherein Soldiers share tactically relevant information across the force in real-time.

Through a series of ongoing evaluations called *Connecting Soldiers to Digital Apps* — an initiative which places smart phones and PDA-like devices in the hands of Soldiers in mock combat operational



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- **Brigadier General Ian Fordred,** Director, Information Communication Technology (DICT) in the Command and Management Information Systems Division (CMIS), **South African National Defence Force (SANDF)**
- **Malcolm Green,** Chief CAT 9 NII Communication Infrastructure Services, **NATO C3 Agency**
- **Colonel Michael Lakos,** Chief MILSATCOM Division, **US Air Force**
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- **Rusty Collins,** ASSIST Project Manager, **Department Information Systems Agency (DISA)**
- **Colonel Edwin Pinheiro,** Chief of Telematics, **Ministry of Defence, Brazil**
- **Colonel Christophe Debaert,** Syracuse III Team Leader, **Ministry of Defence, France**
- **Lieutenant Colonel Michael Delorey,** C4ISTAR Branch (Deployable CIS), **NATO Joint Airpower Competence Centre**
- **Lieutenant Colonel Abde Bellahnid,** Space Development Department, **Canadian Department of Defense**
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- **Commander Andy Rayner,** Royal Navy, SO1 Core Networks, Cap CC&II, **Ministry of Defence, UK**
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- **Commander Christophe Le Garff,** Syracuse III Syestems Architect,DGA, **Ministry of Defence, France**
- **Major John Genouw,** Operational CIS Equipment Pool Manager, COMOPSLAND/G6, **Ministry of Defence, Belgium**
- **David Lascelles,** ISS Defence Core Network Services BLOS Deputy Head, **Ministry of Defence, UK**
- **Dr. Mohammed N Mubarek Alahbabi,** Information Communication Technology (ICT) Advisor, **United Arab Emirates Armed Forces**
- **Captain Thomas Lockhart,** Leader, C4ISTAR, General Staff, **French Navy**
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scenarios — Army officials are learning that sharing data, images and even video instantaneously can potentially provide a tactical advantage on the battlefield.

"Think of mission command," said *Rickey Smith*, director of the **Army Capabilities Integration Center - Forward**. "Part of what we have to have shared is understanding. This is another way for the individual Soldier to send something back to his squad leader or fellow squad members."

Soldiers that went through mock-combat exercises with mobile smart devices achieved as much as a 40-percent increase in "SPOT" reporting, which included taking photographs and sharing data within their formation.

"As much as possible, this ability to get information in real-time horizontally and vertically is important," Smith said. "A smart phone is a camera. It is a voice communication device, and it provides chat text. You can send or receive photos, graphics and videos."

During evaluations, Soldiers have been able to take pictures and send them back to headquarters, or speed up the pace of a MEDEVAC by providing location information quickly, he added.

In addition, the Army has had success running situational awareness Battle Command applications on smart phones such as ***Joint Battle Command - Platform***, a next-generation force-tracking program able to show locations of friendly forces.

"The Army is now conducting cost-benefit analysis of the use of various smart phones and applications. Some of the applications involve the use of icons and maps with key location-related information," *Smith* said. At the same time, there are information assurance challenges with the use of smart phones, *Smith* explained. "You don't want to use a device that might give away your locations to a potential enemy."

The Army's ***Connecting Soldiers to Digital Apps***, or **CSDA**, initiative is considering various types of encryption-and other methods, designed to mitigate these concerns, *Smith* said.

With this in mind, the **Defense Advanced Research Projects Agency** has Soldiers in Afghanistan using a smart phone/PDA-type device which translates Pashtu into English and vice versa. However, the "phone" function on this device is turned off, for now, so as to mitigate security risks, *Smith* explained. Another option being explored is the use of portable cell-towers able to establish a mobile, ad-hoc cell network for deployed forces. This technique creates a mobile "hot spot" which can be extended by adding nodes to the network.

As part of these evaluations, the Army is assessing whether ad-hoc mobile cell networks can successfully integrate with an existing tactical network, which includes satellites, software-programmable radios, and other communications technology. The CSDA initiative is also having success in using smart devices for training materials, which can be pulled down and used by students at the place and time of the student's choice, *Smith* said.

Documents such as the *Army Blue Book* instruction manual for new Soldiers, military police basic officer courses, and Patriot missile launcher crewmen courses, are using smart phone applications.

"We can postulate a future where smart devices are with every Soldier," *Smith* said. "We are thinking in terms of capability. The real key is whether the benefit outweighs the cost."

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COMMAND CENTER

Dr. James A. DeBardelaben, Founder, CEO, IvySys Technologies

Dr. James A. DeBardelaben founded IvySys Technologies, LLC in 2005 with the vision of creating an innovative technology solutions and services firm exclusively dedicated to solving the critical situational awareness problems of the defense, intelligence, and homeland security communities. Under his leadership as president, IvySys has become a lead technical consultant to the DARPA Strategic Technology Office and the Office of the Secretary of Defense for Intelligence, Surveillance, and Reconnaissance (ISR) sensor networking, robust wireless communications, and tagging, tracking, and locating (TTL) programs.

Before founding IvySys, he was the program manager for Special Operations ISR programs at the Johns Hopkins University Applied Physics Laboratory (APL). While at APL, Dr. DeBardelaben served as an expert consultant to the DARPA Advanced Technology Office and Naval Special Warfare Sea Eagle program. He also served as supervisor for Real-time Embedded Software and Tactical Distributed Systems and Networking in the APL National Security Technology Department. As the APL project manager for the NAVSEA Silent Hammer Limited Objective Experiment (LOE), Dr. DeBardelaben led the Special Operations Land Products Team that developed unattended ground sensor; an unattended land mesh network for high data rate, long-range persistent communications; and custom software applications to enhance SOF situational awareness. In addition, Dr. DeBardelaben was the lead software engineer for the Special Operations unattended ground sensors and wireless network implemented in the NAVSEA Giant Shadow LOE. Prior to his tenure at APL, Dr. DeBardelaben developed global sales and trading systems as an information technologist in the Distributed Systems Group at Morgan Stanley in New York City.

Dr. DeBardelaben received a Ph.D. in electrical and computer engineering from the Georgia Institute of Technology, an M.S.E in computer engineering from Princeton University, and a B.S. in electrical engineering with honors from Brown University. He has authored more than 20 technical journal and conference papers in wireless networking, embedded system design, and rapid system prototyping.

MilsatMagazine (MSM)

Good day, Dr. DeBardelaben. Your career spans a number of disciplines, from embedded system design to rapid system prototyping to wireless networking. How did you move from developing global sales and trading systems at Morgan Stanley to becoming ensconced in the government/military market segment?

Dr. DeBardelaben

Before the 9/11 attacks, I was working on Wall Street developing global sales and trading systems. After the 9/11 attacks, I was overcome by a strong sense of duty and developed a desire to work in a field that would allow me to make a greater impact protecting national security.

As a result, I joined the technical staff at the Johns Hopkins University Applied Physics Laboratory (APL), where I got my start developing unattended ground sensors in support of special operations forces (SOF) missions. My work at APL as a program manager for special operations intelligence, surveillance, and reconnaissance (ISR) sparked my vision for creating IvySys, an innovative ISR technology solutions and services company. We exclusively focus on solving the situational awareness problems of the defense, intelligence and homeland security community.

MSM

Was it while you were with APL that you developed an affinity for, and ability to work with, DARPA? Could you tell our readers what projects you worked on while at DARPA and why they were important to what you accomplish now?

Dr. DeBardelaben

Yes. During my time at APL, I had the privilege to serve as an expert consultant to the DARPA Advanced Technology Office, which later became the Strategic Technology Office. I also served as supervisor for Real-time Embedded Software and Tactical Distributed Systems and Networking in the APL National Security Technology Department.

It was my work providing subject matter expertise to DARPA programs that ignited my passion for developing mission-oriented ISR technologies for the tactical war fighter. At DARPA, I provided expertise to programs focusing on advanced low-cost, high-data rate SATCOM, robust wireless communications and networking in extreme environments, tactical SIGINT, navigation in GPS-denied environments, and "see-through-fog" image enhancement capabilities.

My experience working with DARPA highlighted the importance of cultivating close relationships with the military user communities. At IvySys, our objective is to tightly align our ISR technology development efforts with the current and future needs of the war fighter. We do this by leveraging our relationships with tactical operators from the special operations, intelligence, and maritime user communities to elicit feedback throughout the development process.

MSM

What are some of your guidelines for a commercial firm to be successful in working with a government procurement entity? Is the transition from a purely commercial environment into the government/military complex one fraught with challenges? How are they overcome?

Dr. DeBardelaben

The key challenges facing commercial firms entering the defense contracting environment are developing relationships with defense program managers, obtaining necessary clearances, and complying with government accounting standards.

The first obstacle is overcome by attending networking events with government program managers and building collaborative relationships with traditional defense prime contractors. Commercial firms must first look for unclassified subcontracting opportunities with prime contractors to develop a trusted partnership. After developing a strong collaborative relationship, commercial firms can then work with prime contractors to sponsor their facility clearance for new opportunities on classified programs.

Commercial firms should consult with accounting firms experienced in government contract accounting to help them develop accounting policies and procedures that are DCAA compliant.

MSM

While at APL, you led a Special Operations Land Product Team — what did you accomplish with this team? Please describe the workings, and benefits of, unattended land mesh network and long-range persistent communications.

Dr. DeBardelaben

As part of the NAVSEA Silent Hammer Limited Objective Experiment, I led the Special Operations Land Products Team. The exercise showed how a submarine could covertly launch networked ground forces supported by unmanned systems to fill ISR gaps. The team that I led designed and fielded clusters of unattended ground sensors (UGS) to give embarked ground forces and commanders eyes and ears on targets from multiple, hidden locations. The UGS autonomously captured digital images and seismic/acoustic events and communicated the data over a persistent wireless land mesh network that linked sensors and ground forces to the submarine.

MSM

What were the main driving forces that led you to found IvySys Technologies? Please describe what your Company develops and accomplishes.

Dr. DeBardelaben

It started as a direct result of my work on the DARPA programs while at the Johns Hopkins APL. I became deeply rooted in trying to solve some of the many challenges that war fighters face day in and day out. One overarching problem that I witnessed was the deluge of data overwhelming the war fighter. Over the past few years, the increased demand for ISR capabilities has led to an exponential increase in data collection capacity that shows no signs of slowing in the foreseeable future. However, ISR data processing, exploitation and dissemination (PED) capabilities have only improved linearly over the same period, leaving a critical gap between collection and analysis capabilities.

I founded IvySys to address this collection-analysis gap — also known today as the "Intelligence Gap" — by developing solutions that automate intelligence processing, exploitation and dissemination to provide actionable intelligence for neutralizing threats in combat. IvySys' flagship product, Next-Generation Exploitation Optimization System (NEOS), sifts through vast amounts of data to determine the good intelligence from electronic chaff, or "noise," using complex algorithms. The system then draws correlations from a number of sensors and presents the intelligence

to the soldier in the field in an easy-to-read graphical interface that displays a real-time geospatial view of the battlefield in question, giving the war fighter complete situational awareness.

MSM

With your Company as a lead technical consultant to DARPA's Strategic Technology Office, what does such encompass?

Dr. DeBardelaben

We provide DARPA program managers with new program development, program management, technology assessment, test and evaluation, and systems engineering support, specifically focused on special operations, maritime, and responsive space domains. We apply subject matter expertise in these domains to determine military utility of new ISR program concepts. We also help identify technology transfer opportunities for new DARPA STO programs by cultivating relationships with the SOF, maritime, and responsive space user communities.

MSM

How involved is IvySys Technologies in the UAS/UAV market segment? What programs are you involved with in this arena?

Dr. DeBardelaben

Existing UAS/UAV assets have the capacity to collect large amounts of ISR data. They are, however, limited in their ability to disseminate perishable intelligence to tactical operators in near real time over bandwidth-constrained communication pipes. Data is typically collected for post-processing and exploitation at a remote tactical operations center after fleeting targets have vanished.

IvySys focuses on developing advanced signal processing algorithms that enable real-time, automated onboard processing and exploitation of ISR data to quickly deliver actionable intelligence to the war fighter. Our algorithms sift through large amounts of data collected onboard the UAS/UAV and automatically filter out noise and interference. We then detect, classify, geo-locate, and track signals of interest. The resulting intelligence products are then disseminated either directly to the tactical war fighter or to remote, centralized processing stations to

automatically correlate and fuse the data. Processing data onboard the UAS/UAV significantly reduces the amount of information that is sent over wireless communication links, allowing for improved speed of command and increased situational awareness.

MSM

When discussing military communications (satellite, ISR, BLOS, COTM and so on), where do you see this technology leading over the next few months?

Dr. DeBardelaben

With shrinking budgets and increasingly volatile asymmetric threats facing the military, I see the DoD pushing towards the establishment of open communication architectures with well defined interfaces to maximize interoperability and reduce costs. Commercial industry has extensively leveraged open architectures to increase competition, increase innovation, and drastically reduce costs. With standards committees defining communication protocol stack interfaces, DoD vendors are encouraged to specialize in developing specific communication components to foster increased innovation, while lower costs by exploiting economies of scale.

As more ISR assets enter the battlespace, bandwidth-constrained satellite and BLOS reach-back communication links quickly become single points of failure. Peer-to-peer (P2P) tactical communication approaches have emerged as a viable means to maintain situational awareness in an unreliable communication environment. Applications such as Blue Force Tracking, inter-squad communications, sensor network data fusion, and unmanned vehicle control are well suited for future P2P communications architectures.

Rapidly changing mission scenarios and conditions on the battlefield will require cognitive functions across the communication protocol stack. Future cognitive radio capabilities will better utilize scarce spectrum and dynamically adapt network functions and configurations based on the needs of the warfighter mission.

MSM

Due to drawdown for our military overseas, do you sense a lessening of government commitment in funding/acquiring even more advanced technologies for our service members?

Dr. DeBardelaben

While we are scaling back our presence overseas, the Department of Defense (DoD) will still need to heavily invest in innovative new technologies to maintain national security. Continuous investment in new ISR technologies is critical to protecting the nation from the next major attack both at home and abroad (in the physical world and in cyberspace).

The growth in the national deficit will almost certainly lead to stagnant growth or a reduction in the overall DoD budget in the coming years. This will lead to shift from acquiring new ISR platforms to modernizing existing platforms. As a result, there will be significant funding opportunities for advanced ISR payload modules that can be used to upgrade existing platforms with new capabilities.

IvySys is positioning itself to take advantage of these opportunities by mapping its innovative, high performance signal processing algorithms on to pre-integrated, multi-core COTS subsystems. This approach allows for cost-effective, rapid insertion of new processing and exploitation capabilities onboard existing ISR platforms.

MSM

Lastly, Dr. DeBardelaben, what do you enjoy most about your work?

Dr. DeBardelaben

Hands down the best part of our work is knowing that our solutions are helping war fighters in the field get vital information in time to neutralize threats, ensuring their own safety. I'm really pleased that I was able to take that desire that ignited after 9/11 and turn it into a company that enables war fighter safety, mission success and the apprehension of our nation's enemies.

Mobile Routers For MILSATCOM Ops: What To Look For...

author: Roly Rigual, Director of Systems Engineering, iDirect Government Technologies (iGT).

Communications On The Move (COTM) has gained a great deal of attention recently as the need for broadband connectivity on a mobile platform has increased dramatically in the past few years for both commercial and military applications. When assessing routers for COTM MILSATCOM operations, there are several physical layer, security and operational considerations that must be taken into account. This article will look at physical, security and operational characteristics of routers that are best suited to COTM MILSATCOM operations.

Physical Layer Considerations

Ideally, a mobile MILSATCOM router should be available in multiple form factors to accommodate the varying physical constraints of different mobile platforms. For example, a terrestrial vehicle will have different size, weight, power and regulatory constraints than an airborne system. The ability to have the same router — running the same software — in different form factors allows for platform flexibility while maintaining the same hardware (of varying form factors) and software throughout the network.

In addition, due to the more stringent link budget requirements for small aperture antennas used for on-the-move applications, routers should provide support of the latest and most efficient *forward error correction coding* (**FEC**). In MILSATCOM applications where there is greater demand for higher and higher inbound rates, having the option of highly efficient FEC codes like ***2D 16-State Forward Error Correction*** (FEC) brings a new level of IP payload and link budget efficiency. Codes such as 2D 16-State can operate at a lower threshold and utilizes a superior algorithm to older Turbo Product Codes.

Also, in OTM MILSATCOM networks which access methodology to use in conjunction with spread spectrum is a major consideration when deploying larger mobile networks.

A major consideration when deploying larger **OTM** (*On-The-Move*) MILSATCOM networks, consideration must be given to the methodology that is used in conjunction with the speed spectrum.

The most efficient approach to spread spectrum for a **COTM** (*Communications-On-The-Move*) network is to apply *Direct Sequence Spread Spectrum* (**DSSS**) in a **TDMA** architecture. In DSSS, a pseudo noise code is applied prior to data entering a carrier modulator. The modulator, therefore, sees a much larger bit rate, which corresponds to the chip rate of the pseudo noise code number sequence. The spectrum is spread by the chip factor, resulting in lower transmitted power spectral density. By using DSSS in a TDMA architecture, only one remote terminal will be

transmitting at a time. This lowers the required spread factor and yields a much more resource efficient system as compared to other access methods such as *Code Division Multiple Access* (**CDMA**).

While DSSS in a TDMA architecture provides more resource efficiency and network scalability, the very nature of TDMA creates security challenges that must also be addressed for OTM routers.

Security Considerations

The mobile and itinerant nature of COTM MILSATCOM exacerbates already existing security requirements for SATCOM routers. In the world of satellite communications, the definitions of **COMSEC** (*Communications Security*) and **TRANSEC** (*Transmission Security*) are often confused. For clarity in this article, COMSEC refers to the methods used to ensure confidentiality, authenticity, and integrity of the user data (type 1 encryption, digital signatures, and so on). TRANSEC refers to the measures used to secure channel activity (e.g., traffic flow analysis), control channel information (e.g., acquisition activity), unit validation (e.g., X.509 certificates, crypto module validation), and physical security.

Transmission security prevents an adversary from exploiting information available in a communications channel without necessarily having defeated the encryption inherent in the channel. For example, even if an adversary can't defeat the encryption placed on individual packets, by analyzing transmission patterns, cloning inactive terminals, and traffic flow analysis, etc. an adversary may be able to gather operational intelligence including location of a terminal.

A mobile router should present to an adversary that is eavesdropping on the RF link a constant wall of fixed-size, strongly encrypted (AES, 256 bit key, CBC Mode) traffic segments, the frequency of which do not vary in response to network utilization. All network messages, including those that control the admission of a remote terminal into the network, should be encrypted and their original size hidden. The content and size of all user (Layer 3 and above), as well as network link layer (Layer 2) traffic, should be completely indeterminate from an adversary's perspective. Also, no higher layer information should be revealed by monitoring the physical layer (Layer 1) signal.

Finally, remote unit validation should be a part of a mobile routers security protocol. Mobile routers are often dropping in and out of networks and there must be a methodology to provide a high level of confidence that an adversary is not trying to assume the identity of a trusted entity. This can be accomplished by ensuring that mobile routers are required to have valid X.509 certificates before being allowed to come into a network.

In regard to cryptographic module validation and physical security of COTM MILSATCOM, mobile units may require additional levels of security due to the increased risk that an adversary may acquire physical access to the router. The *Federal Information Processing Standard* (**FIPS**) **Publication 140-2** is a U.S. government security standard used to accredit cryptographic modules. Four levels of security are defined by the *National Institute of Standards and Technology* (**NIST**). **FIPS 140-2 Level 1** validates the cryptographic module of the router. The required security level of a mobile router should be determined and the existence of tamper-evident coatings and the reduction of physical access to the cryptographic keys should also be considered (**FIPS 140-2 Level 2**).

Operational Considerations

- Efficient MILSATCOM mobile networks require the ability to rapidly acquire into global networks, be flexible enough to operate on different commercial and military satellites and to support different bands (Ku-, Ka-, X-, C-bands, etc.).

- As many mobile MILSATCOM routers need to be able to roam over larger geographic areas, mobile router systems should have the built in intelligence to communicate with

antenna control units and on-board navigation systems to switch between beams based on geographic location, visibility of beam, and usability of beam. The remote must be able to communicate with the antenna controller to control and point the antenna while maintaining its IP addressing, routing, and connectivity.

- To further ensure proper operation of a network in which routers are in constant motion and in varying states of operation, powerful network management tools should be a part of any mobile router solution. Maintaining real-time situational awareness, centralized control of global networks, and visual correlation of large numbers of mobile router's statistics is necessary to maintaining high reliability and rapid deployment of mobile MILSATCOM networks.

- Communications On The Move (COTM) satellite routers have matured to the point where simple 'one-off' terminals that lack efficiency, high level security, and comprehensive network management tools are a thing of the past. When considering today's COTM routers, there is no reason to compromise performance for operational and security requirement.

For additional details, please visit...
http://www.idirectgt.com/

About the author

Roly Rigual is Director of Systems Engineering for iDirect Government Technologies (iGT).

An Emergency Calling For C-COM

author: Drew Klein, Director, International Business Development, C-COM Satellite Systems Inc.

On March 11th, 2011, a massive earthquake shook the Northern coast of Japan, sending a 10 meter high tsunami crashing into the island nation. Up to 10 km inland, and across 140 km of coastline, the tsunami devastated the lives of millions of people, destroying homes, businesses and cutting critical communication lines. Almost three months later, the country continues to mourn, as residents and rescue workers comb through the immense debris field.

What many of us take for granted is that we are almost always able to connect with our loved ones via our handheld communication devices. In emergency scenarios such as the 3-11 Tsunami, the vulnerabilities of the cellular networks connecting massively wired countries, like Japan, become quite evident. Nearly 100% of the communication connections were disabled through the affected areas of Sendai and surrounding regions following the disaster.

How can a country overcome such a problem, and how can it be prepared for similar adversity in the future? Enter **Telemann Communications Co. Ltd.**, located in Tokyo, a Factory Authorized Reseller for **C-COM Satellite Systems Inc**. C-COM is the Canadian manufacturer of the ***iNetVu***® mobile antenna, which provides broadband internet access via satellite to remote locations around the world. Telemann began working closely with a major cellular provider in Japan, **Softbank Mobile**, for the restoration of inoperable cell towers in the affected region. The Japanese companies would work together, marrying their technologies and expertise with the iNetVu® mobile antenna, to employ a temporary structure that would provide communications coverage for the survivors of this monumental catastrophe.

Within three days, and on extremely short notice, C-COM was able to ship more than 100 iNetVu® mobile antennas to Telemann, who then worked to integrate the units into Softbank Mobile's vehicles. Once installed and integrated with Softbank's Femto-cell technology, the iNetVu® antenna was able to restore cellular communication within a specific geographic region shortly after arriving on the scene. The iNetVu® antenna and attached satellite modem provided the necessary link to backhaul the calls to a wired network located elsewhere. The satellite antenna was able to replace the downed cell tower within 8 minutes, restore cell service in the area, and deliver immediate relief to survivors who have been unable to communicate for days. Cell calls and internet access were restored, and most importantly, the solution was mobile, so the integrated vehicles were able to move from place to place and make it possible to deliver instant cell communication upon arrival.

C-COM's iNetVu mobile communication in operation in Japan

iNetVu emergency communication after the Japanese earthquake and tsunami

As fixed satellite based replacement systems were susceptible to aftershocks, and would require time-consuming and costly manual re-pointing of antennas, a mobile solution was deemed to be most cost-effective and efficient. Hundreds of aftershocks in the days and weeks after the main quake created a need for a specific answer: an antenna that could automatically re-peak and re-acquire the satellite without the need for human intervention.

The Company was able to assist Telemann in the integration and installation of over 300 iNetVu® mobile antennas over the weeks following the disaster and even sent its own engineers and application specialists to the Sendai region to assist Telemann and its customer with the timely deployment of the iNetVu® antennas. Software engineers in Canada developed a quick solution that dealt with the effects of the aftershocks, which were numerous and frequent, and disabled the satellite antennas pointed to the satellite. Within hours of the first aftershocks, new software was developed and uploaded to the iNetVu® controllers that made it possible for unattended automatic re-pointing of the antennas. Other issues that were solved during the installation stage were related to implementation of a strategy for automatic satellite re-pointing in case of power failure in the satellite backhaul vehicle.

Telemann and Softbank were able to outfit and deploy many vehicles with the C-COM 98cm and 120cm iNetVu® mobile antenna systems, which performed flawlessly during the disaster recovery. They continue to work towards a model of preparedness should another calamity come their way by positioning these cellular backhaul antenna systems across Japan.

In a testament to the immediate assistance with the tsunami relief effort and their gratitude for the help that was extended to the Japanese people in their time of need, Softbank Mobile, sent C-COM a beautiful plaque to commemorate this shared effort.

About the author

As Director of International Business Development, Drew is responsible for the day to day management of the sales and marketing team. Drew assists C-COM's global reseller network in the development of new vertical markets for the iNetVu Mobile products, and he assists in the supervision of the technology team as the company continues to branch out into new and exciting projects.

HERE'S LOOKING @ EARTH

On The Hunt For The Birth Of A Hurricane

author: Rosemary Sullivant
This article is courtesy of NASA/Jet Propulsion Laboratory, California Institute of Technology
AIRS portal, site manager Sharon Ray

NASA researchers went on a very special hurricane hunt this past year. The six-week field campaign, called GRIP, for *Genesis and Rapid Intensification Processes* experiment, was one of the agency's largest hurricane research efforts. The goal was to gather new information on how hurricanes form and intensify. To do that, scientists needed to catch tropical depressions in the act of turning from loose collections of winds into full-blown hurricanes. Once they had a storm in their sights, the plan was to collect as much information as possible about its development using the latest remote-sensing technology.

Global Hawk on the tarmac at NASA Dryden Flight Research Facility. Photo is courtesy of DFRC

HERE'S LOOKING @ EARTH

Hurricane Earl gave NASA scientists a perfect target for study. It rapidly grew to a category 4 hurricane and then fell to a category 1 in just one day.This GOES image shows the weakened storm on September 3, 2010, heading toward New England.

For their task, researchers enlisted NASA's high-flying unmanned *Global Hawk* aircraft, *DC-8* aircraft and the *WB-57* aircraft equipped with a special array of instruments. They marshaled ground resources and coordinated their efforts with NASA's fleet of Earth-observing satellites. By the time the experiment had concluded in September, it had documented the birth and progress of two major hurricanes, *Karl* and *Earl*; observed several smaller storms; and collected an enormous amount of new data on the life cycle of tropical cyclones that researchers will be studying for years.

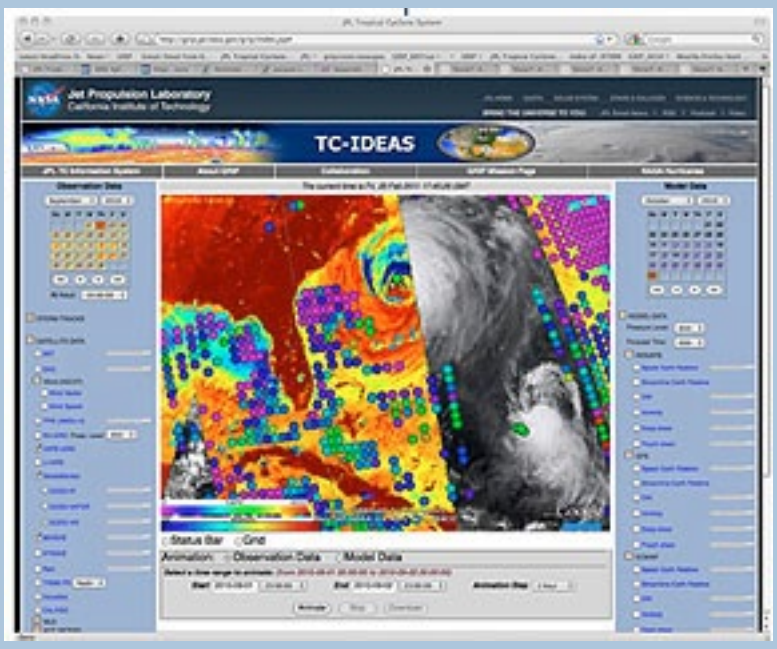
GRIP mission scientist *Scott Braun* during the campaign.

The ***Atmospheric Infrared Sounder*** (**AIRS**) instrument flying on NASA's ***Aqua*** satellite was one of the many tools the researchers used to find what they were looking for. With its ability to create three-dimensional maps of the atmosphere showing temperature, water vapor, and cloud properties, AIRS provides a unique view of the environment in which storms come to life. It served two roles in the GRIP experiment. The first was to help scientists decide when the aircraft would have the best chance of observing changes in a storm. The second, still on-going, is to help them as they interpret the results.

"We used AIRS data to help our understanding of the potential for storm development, which was a factor in our decisions on when to fly,' said GRIP mission scientist *Scott Braun* of NASA's **Goddard Space Flight Center**. Each day, a forecast team evaluated ocean and atmospheric conditions to decide where best to look for a developing storm, and, when they did have a storm in view, anticipate where it might be headed or how its intensity might change. Advance planning was critical, since it could take several days to get aircraft and other resources in place.

"Timing is everything when it comes to trying to observe storm formation or rapid intensification. Getting this timing right includes fully understanding what is going on in the storm environment, and AIRS was useful for that purpose," *Braun* said.

HERE'S LOOKING @ EARTH



During the GRIP campaign, scientists used the JPL Tropical Cyclone-IDEAS website to see all the data being collected by airborne and satellite instruments and combine it indifferent ways. The window above shows the path of AIRS superimposed on a GOES satellite image hurricane Earl and Fiona on September 2, 2010. The colored dots link to AIRS measurements. The website, http://grip.jpl.nasa.gov/grip/index.jsp,continues to be an important tool for researchers and is also available to the public.

As it circles the globe, AIRS's surveys the atmosphere and surface below with more than 2,000 infrared detectors. Each senses a different wavelength, which is sensitive to temperature and water vapor at a particular height. By combining all these measurements, AIRS creates vertical temperature and moisture profiles of the atmosphere. While its infrared sensors cannot penetrate thick clouds, AIRS's microwave sensors can and provide information about the storm structure.

"With a tropical depression or hurricane, it is important to understand its environment,"says JPL scientist *Bjorn Lambrigtsen*, a GRIP participant and the AIRS microwave instrument scientist.

In the Atlantic, cyclones often begin with a loose collection of thunderstorms moving east from the coast of Africa. "To try to figure out if one of these weather disturbances will turn into a cyclone, forecasters look to see if the minimum requirements are there for this to happen," said *Lambrigtsen*. "Two requirements are high sea surface temperature and high vorticity that's when the clouds have already started to spin. Another is low wind shear when the wind has little variation with altitude. All of those things are good for hurricanes."

Hurricanes also need a lot of moisture to grow. "Convection typically starts bubbling along at about 90 percent humidity," *Lambrigsten* said. "If dry air gets into the system, it can snuff it out. AIRS tells us how much moisture is in the air and how it is distributed vertically in the atmosphere. Other sensors show only the total amount of water vapor in a column of air." During the GRIP campaign, forecasters looked specifically at AIRS data to see if there were layers of dry air around a storm and how they might impact a storm, he said.

Los Angeles PBS station KCET featured the Global Hawk and GRIP campaign on the program SoCal Connected. Microwave instrument scientist Bjorn Lambrigtsen (left) in the control room at NASA's Dryden Flight Research Center.

Weather agencies around the world routinely use AIRS' data in their forecast models to improve their predictions. For hurricane researchers, AIRS is more than a forecasting tool. It is helping answer fundamental questions about which conditions contribute to hurricane development and which do not. One of these, for

example, is the role that dry air plays in hurricane development — a mystery that AIRS may help solve as researchers begin analyzing GRIP results.

NASA's Aqua Spacecraft on which AIRS flies aboard

Winds frequently blow westward from the Sahara over the tropical Atlantic, forming a layer of hot, dry and dusty air low in the atmosphere called the *Saharan air layer*. This air layer travels westward in the middle troposphere with an air current known as the African easterly jet. The jet is associated with waves of thunderstorms that sometimes result in tropical depressions and eventually hurricanes.

"Some people argue that the Saharan air layer has a negative effect on hurricane development, while others argue that it could amplify it," said *Braun*. On the negative side, the westward stream of hot dry air could help create wind shear'mowing off the tops of gathering storm clouds. The temperature difference between the hot Saharan air and the cooler, moist atmosphere below could shut down convection, the engine that drives hurricanes. On the other hand, Braun said, "It is possible that this jet is a source of energy and could increase a storm's activity."

With the success of GRIP, researchers are planning for the next major hurricane field effort scheduled to begin in 2012. "While there has been progress in hurricane prediction,' said *Braun*, "we still do not fully understand what makes a storm get rapidly stronger or weaker." The Hurricane and Severe Storm Sentinel will be a five-year experiment to learn more about what causes a storm's intensity to change — whether it is something in the storm's environment or within the storm itself.

Further information is available at...

NASA's GRIP Mission website

GRIP Mission on NASA Portal

GRIP on YouTube

About the author

Rosemary Sullivant is a science writer and editor living in Los Angeles. She recently retired as a science writer for NASA's Jet Propulsion Laboratory but continues to write for the laboratory on occasion. Before moving to California, she was the managing editor of Sea Frontiers, a national science magazine focused on the oceans. She has written and edited stories for scientific, medical, and consumer publications including Astronomy, Earth, Healthy Living, and One Source.

INTEL

Satellite Based Real-Time Tracking + Data Monitoring

Helicopter operators providing emergency medical services (EMS) are currently fighting a safety battle. More so than any other aviation services provider, the pressure to fly when the conditions are less than ideal is extreme as lives are usually hanging in the balance. Unfortunately, the accident rate for these operations is significantly higher than others and the industry, encouraged by governments and industry associations, is working feverishly on many fronts to improve their record.

Aerial fire fighting has a similar challenge. While the pressures to fly might not be as extreme as EMS, they are still relatively high as are the risks associated with flying in confined areas, close to major fires with their resulting contrary winds and reduced visibilities.

From an administrative point of view, both EMS and aerial fire fighting operations are flown for public clients. These clients need to be able to audit operations and to know where their aircraft are at any given time. In many situations, the clients are insisting on ***automatic flight following*** (**AFF**) to provide real-time tracking and data monitoring as the bulk of the operations take place outside of normal ***air traffic control*** (**ATC**) radar coverage. The most common requirement is for a position report every few minutes including latitude, longitude, altitude, speed and direction along with ***Out of the gate***, ***Off the ground***, ***On the ground*** and ***In the gate*** (**OOOI**) times for the flight. More elaborate requirements can include the real-time reporting of exceedences (such as airspeed, bank angles, engine over speed, engine over temp, etc.), two-way text messaging and even voice and video.

Offshore oil and gas exploration is another demanding application. Additionally, a number of North American-based helicopter fleets operate globally in areas well beyond ATC radar and terrestrial communications network coverage.

Guardian Mobility Corporation wanted to respond to this requirement by developing a real-time tracking, data capture, communication and data management system. The goal was to provide a valuable service to support increased safety and efficiency for these (and other) operators. The high-level system design process is described in the following sections.

Communication Network Band Selection

Aircraft trditionally use VHF-FM radio (118-136 MHz) for communications and L-Band RADAR for tracking, both of which are limited to line of sight. As EMS and fire fighting operations take place at lower altitudes, range is severely limited. Similarly, the terrestrial wireless networks don't have coverage in the operational areas leaving satellite as the only viable method to provide the reliable communications in the remote valleys.

The data rate required for this sort of task is fairly low (a few dozen bytes every few minutes) which is an advantage because helicopter mounting considerations favor small antennas. Also, as weight is always a factor, low system weight is of prime importance. A system resistant to weather effects is also highly desirable. This all leads to an L-band system as they are resistant to rain fade. Furthermore, combo antennas are available that include the required GPS and the comms antenna in the same package. In fact, there are triple antennas available that include a second comms antenna should a voice channel be required as well as the one for data. This greatly simplifies the installation and further reduces weight.

Guardian Mobility's GUARDIAN 7 system. Select this graphic to download the Spec Sheet or http://www.guardianmobility.com/downloads/product/Guardian7SpecSheet.pdf.

Antenna location on the aircraft is another constraint. Typically, the only available real-estate that has a clear view of the sky is the engine cowling (known as the "dog house"). Unfortunately, this location is subject to high vibration, temperature extremes and electromagnetic interference

Extensive field experience has shown that this harsh environment does not affect L-Band systems at all. Even though the width of most helicopter rotor blades is similar to the L-Band wavelength (19 cm), there is no discernible impact on system performance due to blockage.

Network Provider Selection

There are a number of L-band service providers in the marketplace, including both GEOs and LEOs. The drawback for all GEO systems is that coverage degrades towards the Poles. While all LEOs can, in theory, cover the entire globe, other network issues (ground station locations, licensing, and so on) can conspire to reduce the effective coverage below 100 percent. **Iridium**, with their inter-satellite links, can provide truly global coverage without needing ground stations around the globe. This simplifies licensing as well. The network also supports data and voice. Small radio modules are available so that value-added manufacturers can easily integrate this communications capability into almost any application.

Overall Application Design

Back-hauling the data to a management center is not the end of the task. The aircraft position data, both current and historical, must be presented on a map in clear and concise manner. The status information must be both displayed in an interactive tabular form and made available to other, existing applications such as aircraft logs, maintenance tracking systems and billing packages.

Guardian Mobility has developed a system using the Iridium network, a series of on-board sensors and communicator packages and a suite of "back-office" applications that can efficiently display and archive this data. The simplest on-board system, while still being compliant with government AFF requirements, consists of a GPS and the Iridium communications subsystem. The back office system can still infer take off and landing times for rudimentary log-keeping. The most capable system adds a number of sensors and an on-board processor to detect critical parameters. Exceedences are communicated in real-time to alert maintenance and operations staff to issues that may need correction when the aircraft lands. The back-office applications also provide an open platform to allow the exchange of data with other applications such as maintenance tracking, billing and flight time and technical logs.

Using these flexible and expandable ***Flight Data Monitoring*** (**FDM**) and ***Engine Trend Monitoring*** (**ETM**) tools, operators can build a system to support their ***Safety Management System***, a government-mandated initiative to make operators responsible for the safety of their operations. Guardian Mobility is providing a flexible open platform that can be adapted to any size operation using almost any kind of aircraft so that they can be pro-active in improving safety.

FOCUS

Staying Connected

author: Tony Bardo, Assistant Vice President, Government Solutions, Hughes

There's no telling when an emergency situation might occur—or how severely mission-critical applications may be affected. As recent natural and man-made disasters have demonstrated, enterprises, government agencies, relief organizations, and small businesses must sustain vital communications, even in the event of a large-scale disaster.

Government agencies and businesses, large and small, are in a unique position to lead the recovery following a disaster. From first responders providing emergency relief, to local grocery stores operating on backup generators, to pharmacies using backup data networks to maintain operations, disaster ready organizations hold the key to enabling the communities in which they operate to withstand disaster and return to normalcy as soon as possible.

Small businesses and government agencies can learn from the example of larger enterprises. During the aftermath of Hurricane Katrina in 2005, for instance, Walmart used its satellite broadband network to enable local pharmacies to act as a community resource. As a result of its preparedness, **Walmart** was able to quickly offer access to life-saving medicines, food, and basic supplies.

According to a survey of small businesses located in the Gulf Coast region, in the aftermath of Katrina, 37 percent of those surveyed were without broadband service for more than five business days and 25 percent of those businesses reported losses of more than $25,000 due to their lack of Internet connectivity.[1] Businesses, government, and the communities they serve cannot afford this downtime.

A disaster-ready organization will be able to recover faster and suffer less financial loss. Even more importantly, a quickly recovered organization is good for the local economy as it enables employees to return to work more quickly.

In April 2011, **Weather Services International Corp**. (**WSI**) predicted another very active season for hurricanes in 2011, which may affect businesses and government entities in the Atlantic and Gulf Coast regions.[2] The 2011 forecast calls for:

- 15 named tropical storms compared to an average season of 12 in number
- QQ 8 hurricanes compared to an average of seven
- QQ 4 intense hurricanes of Category 3 or greater compared to an average of three

According to researchers from John Hopkins and Texas A&M University, during the last five major hurricanes, nearly 30,000 businesses and government entities were forced to cease operations

due to power outages and loss of Internet connectivity.[3] During such weather events, business and government offices can expect to experience network downtime, impairing emergency response and recovery efforts, disrupting business activities, and impacting the ability to keep mission-critical operations running smoothly.

Before Disaster Happens

The best time to respond to a disaster is before it happens. Every area in the country is subject to disaster — whether natural such as a flood, hurricane, earthquake, ice storm, or landslide — or man-made such as an oil spill, civil unrest, or a terrorist attack. Even areas that have never suffered from a disaster in the past have no sure protection from potential disaster and devastation in the future.

With a relatively small investment of time and money now, businesses may prevent disruptions in the future. Clearly, a disaster-ready organization will recover more quickly and suffer less financial loss than one that is unprepared. Taking proactive steps toward preparedness contributes to the health and well-being of the local population and to an expedited economic recovery that can re-energize the community. Equally important, organizations that recover quickly help pave the way for employees and the greater community to return to work as soon as possible.

Tips

As a result of the company's experience in assisting businesses and government agencies with disaster recovery operations, **Hughes** has compiled a list of simple steps that can help enterprises, government agencies, and small businesses stay connected—helping to minimize losses and eliminate Internet downtime in case of disaster.

— Maintain Remote Site Backup Generators

Maintaining electrical power is a top priority for business and government sites. Without electrical power, organizations cannot support an Internet connection for their emergency data and voice communications. Additionally, a backup generator is essential for supporting refrigeration, lighting, and security systems in the event of a power failure.

In hurricane-prone areas, many companies are making backup generators an essential component of their business operations. For example, **Publix**, a Florida-based grocery chain with about one-third of its stores located in hurricane-prone areas across the Gulf States, initiated a program to install generators in these stores. During previous hurricane seasons, power outages played a major role in the losses the stores experienced. Although each store was equipped with a backup generator, it did not provide enough power to keep the stores open for customers, and run coolers and freezers to prevent food spoilage. As a result, in 2006 the company announced an investment of $100 million to purchase higher power 500- watt generators to protect Publix stores in nearly 575 communities.

— Protect Critical Data

According to the *U.S. Department of Labor* statistics, more than

40 percent of all businesses that experience a disaster never reopen and more than 25 percent of the remaining companies close within two years. These failures are due in large part to a lack of planning, which results in the loss of critical business data. Developing a disaster recovery strategy is a critical undertaking for any organization. It is essential that businesses and government agencies evaluate which applications and data are vital to their operations, such as point-of-sale, accounting, logistics, inventory, and services to the public.

Back-up and storage of critical information should be performed routinely and in a timely manner, using a safe, secure, an dependable facility. Since data may be lost due to flooding or fire, consider storing data at an off-site location or centralizing data storage at a headquarters data center. Consider the amount of time, money, and effort it would take to recover a system whose files are destroyed by mechanical failure, a virus attack, or user error. In addition, consider the losses that would be sustained simply because of downtime.

— Subscribe To A Resilient, Alternate Path, High-Speed Broadband Service

When disaster strikes, terrestrial networks are most vulnerable to failure — dial-up, DSL, cellular, and cable can be down for hours, days or even weeks. A satellite broadband service, on the other hand, offers an alternate communications path enabling organizations to maintain critical applications when terrestrial networks fail.

Broadband satellite services provide network connectivity that continues to operate when terrestrial networks — including cell towers — are severely damaged. Incorporating satellite services into emergency planning and response activities enables businesses and government agencies to maintain uninterrupted Internet connections needed to facilitate disaster response and day-to-day

operations such as sending and receiving emails, processing orders, sharing information, and checking inventory.

Hurricane Katrina, for example, aptly displayed the need for organizations to protect their mission-critical information in the event of terrestrial network failure. Because it provides instant infrastructure wherever needed when terrestrial networks are severely damaged, satellite communications allows organizations to continue conducting day-to-day business.

— Have A Written Plan + Be Prepared To Act

When in jeopardy of losing service for an extended period of time, put remote site managers on alert to support the organization and its data during and after the disaster. With a solid disaster recovery plan in place for each location, organizations will be better able to successfully weather a disaster and avoid being out of reach when communications are needed the most.

Hughes Help

As the world's leading provider of broadband networks and services, Hughes can accommodate virtually any emergency communications need. Its extensive portfolio of offerings includes solutions for emergency preparedness and emergency response, ensuring rapid deployment after an emergency occurs. Hughes broadband satellite service is scalable and deployable from across the city to across the nation.

The Hughes suite of Emergency Solutions features an Internet service plan with download speeds of up to 5 Mbps and upload speeds of up to 1 Mbps, made possible by using Hughes' advanced ***SPACEWAY® 3*** Ka-band satellite system. The service plan includes comprehensive 24/7 technical support, next-business day field maintenance, and provides organizations with the flexibility they need in an emergency, requiring only a two-month service commitment that may be extended on a month-to-month basis, depending on need.

In addition, a range of options are available for fixed and mobile solutions, including ***Inmarsat Broadband Global Area Network*** (**BGAN**) mobile satellite solutions. Bandwidth requirements are sized as the job dictates for efficient management of resources and budget. Moreover, Hughes operates highly secure satellite network management centers across the nation—a true alternative infrastructure that stays up and running when terrestrial systems fail.

Emergency Preparedness

Path-diverse, highly available networking solutions serve as an insurance policy for continuity of business and government operations, especially in crisis situations. With Hughes Emergency Solutions, organizations can ensure 24/7 network reliability, even when terrestrial systems fail:

- Fully-managed, continuity service with cost-effective satellite broadband backup for true path diversity
- Satellite solutions to complement existing terrestrial networks, for up to 99.99 percent availability
- Emergency Internet access with nationwide reach, and vehicle-mount, on-the-move terminals and flyaway kits that setup quickly
- Mobile satellite BGAN terminals for on-the-move deployment when needed
- Policy-based routing with automatic failure detection and switchover between primary and backup links

Rapid Emergency Response

After an emergency occurs, Hughes Emergency Solutions provide a true alternative infrastructure that stays up and running when terrestrial systems fail.

- Communications restoral within 48 hours
- Ideal for providing temporary service while primary communications are being restored after an emergency
- Internet access nationwide with a variety of affordable service plans
- Vehicle-mount terminals and flyaway kits with a mobile, self-pointing antenna system
- Integrated turnkey solutions with high-performance, onsite routers for any emergency communications need

Getting The Word Out

Businesses and government agencies nationwide are employing Hughes Emergency Solutions to protect their organizations. For example, the *Florida Emergency Management Agency* (**FLEMA**) uses Hughes satellite technology to power an alert system to warn citizens when potential emergencies threaten. The solution covers more than 100 state and county fixed sites, as well as three mobile units.

An Insurance Policy Through Path Diversity

The *Pennsylvania Emergency Management Agency* (**PEMA**) employs an advanced Hughes broadband satellite solution to provide path-diverse backup communications when its terrestrial network fails. The statewide solution connects more than 100 sites, including police, health, and county emergency operations centers. Similarly, **Cabela**'s, the world's largest outdoor outfitter, employs a high-performance Hughes broadband satellite backup solution to ensure uninterrupted service at its stores. When a remote site detects a primary connection outage, the Hughes service automatically engages and switches all data traffic to the satellite network to keep the store up and running.

By being prepared for emergency situations, businesses and government agencies — large and small alike — can avoid costly downtime, help secure the long-term health of their organizations, and play a major role in assisting their communities to recover as quickly as possible if disaster should occur.

For further information, visit
http://www.hughesnet.com

About the author

Anthony "Tony" Bardo has 29 years of experience with strategic communication technologies that serve the complex needs of government. Since joining Hughes Network Systems in January 2006, Bardo has served as assistant vice president of Government Solutions, where he is focused on providing Hughes satellite broadband applications solutions to Federal, State, and Local governments. Bardo also recently served as Chair of the Networks and Telecommunications Shared Interest Group (SIG) for the Industry Advisory Council, an advisory body to the American Council for Technology (ACT). Before joining Hughes, Bardo was with Qwest Government Services for nearly five years where he served as senior director of civilian agencies sales and marketing, senior director of marketing, and senior director of business development. Prior to Qwest, Bardo spent 14 years with the government markets group at MCI where he held the position of executive director for civilian agencies. During his tenure, his teams managed programs with the Federal Aviation Administration's national air traffic control network, the Social Security Administration's toll-free network, the U.S. Postal Service Managed Service Network, and the U.S. General Services Administration's FTS2001.

Artistic rendition of Hughes' Spaceway 3 satellite, which offers high-capacity, onboard switching, and routing. Image courtesy of Hughes.

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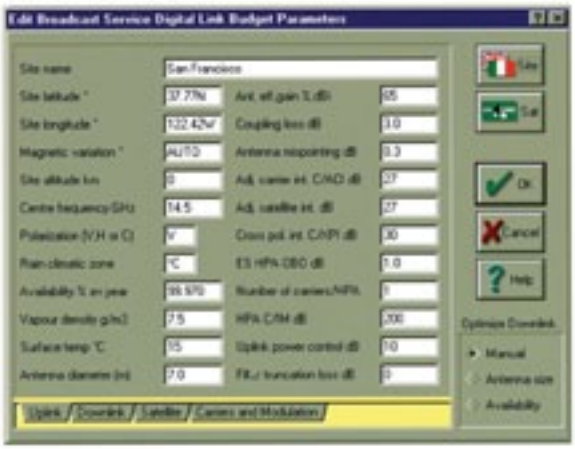

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Crucial Communications For Countering Piracy

Resolving global threats such as piracy and terrorism requires nations to work together to advance a coordinated strategy. These multinational operations present a unique set of challenges particularly in communication and coordination. A common view of shared information is essential for maritime domain awareness and paramount to mission success.

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While terrorism is usually driven by political activism, the havoc caused by modern-day piracy is mainly a matter of economics — the rewards vastly outweigh the risks. The frequency of piracy-related incidents has been rising at a steady rate since 2005. At the 2011 meeting of the *International Maritime Organization* (IMO), *Efthimios E. Mitropoulos*, Secretary-General of the IMO, stated that piracy is costing the world economy between $7 and $12 billion per year.

Successful Operations at Sea
Coalition operations such as the successful boarding and seizure operation that freed the M/V Magellan Star from pirates rely on clear and non-ambiguous communication. The U.S. and Turkish naval vessels participating in the operation were equipped with the TracPhone V7.

Still, ocean transport remains the primary, most cost effective, and fastest means of delivering goods and food around the globe. In response to the threats of piracy-related incidents, as well as global terrorism, 25 nations joined in the establishment of the ***Combined Maritime Forces*** (**CMF**) in 2009 to promote security and stability across the approximately 2.5 million square miles of international waters in the Middle East. The CMF naval coalition in turn established individual task forces to focus on preventing piracy, defeating terrorism, encouraging regional cooperation, and promoting a safe maritime environment.

KVH TracPhone V7 Maritime SATCOM System

A key to the success of the naval coalition efforts is the ability for all members of the multinational task force to communicate effectively and efficiently despite differences in data network specifications. To achieve the level of communication and cooperation necessary for the CMF to execute effective strategies against piracy, terrorism, and other criminal activities, coalition forces required a common satellite communications system that could deliver high-performance at low cost, handle heavy data flow, and was easy to deploy on multiple vessels. The CMF found a solution that meets all of these requirements — the ***TracPhone® V7*** with ***mini-VSAT Broadband***(sm) global service network from **KVH Industries, Inc**.

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This end-to-end solution includes the 24-inch (60 cm) diameter TracPhone V7 maritime antenna, integrated below-decks equipment, and the global mini-VSAT Broadband service, built on a foundation of ViaSat's ***ArcLight***® spread spectrum technology.

Effective Communications For Effective Operations

The CMF consists of several ***Combined Task Forces*** (**CTFs**), including:

- **CTF-150** – focused on maritime security and counter-terrorism including the illegal transport of weapons, personnel and income-generating narcotics
- **CTF-151** – dedicated to counter-piracy operations in the Somali Basin, the Gulf of Aden, and the Indian Ocean
- **CTF-152** – in charge of Arabian Gulf security and cooperation.

The CMF is also tasked with guarding vital Iraqi oil and gas platforms, with the assistance of ***U.S. Coast Guard Port Security Units*** (**USCG PSU**s)

When assuming command of the CMF and its task forces, Navy commanders discovered that some coalition partners were deploying vessels into the region that did not have adequate datacom messaging capabilities, leaving them unable to communicate with other task force vessels. CMT operations require the use of the *Combined Enterprise Regional Information Exchange System* (**CENTRIXS**), encryption software that enables ship-to-ship operational dialogue between vessels of other nations in both text and web-based formats.

CENTRIXS, which consumes a high volume of data, is vital to the success of the operations. Since the task forces operate in a widely dispersed fashion, line-of-sight communications do not meet daily needs. Additionally, when multiple nations speak English with varying dialects, ensuring that all parties have the same level of understanding can be difficult. CENTRIXS enables the secure use of such widely used tools as chat/instant messaging and e-mail, as it is easier to reach understanding with written communications.

Battling The High Cost Of Multinational SATCOM

Initially CMF provided various coalition vessels with Inmarsat L-band systems, which were desirable based on their small antennas, straightforward configuration, and coverage throughout the operational region. Unfortunately, the high cost of Inmarsat data, combined with the high data volume required by CENTRIXS, resulted in prohibitively high SATCOM costs.

Further, the forces in the operations are constantly changing. Various countries assign vessels, aircraft and personnel to the task force operations. Therefore, the Navy felt there was a need to offer SATCOM systems that were simple to install and operate, as well as being able to deliver global coverage with reliable high-performance like Inmarsat, but at a low cost.

USCG Deploys TracPhone V7
The TracPhone V7 SATCOM system is installed on multiple USCG PSUs deployed in the Arabian Gulf to assist with guarding high-value oil and gas platforms.

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KVH Industries' TracPhone V7 with the mini-VSAT Broadband network presented the solution to these multiple challenges of performance, affordability and ease of installation and operation.

Rigorous USCG Testing

Coalition forces drew on the extensive testing, evaluations, and operational experience of the U.S. Coast Guard in selecting the TracPhone V7 and mini-VSAT Broadband solution.

The Coast Guard was faced with meeting the challenge of many new applications that required, or would be enhanced, by broadband connectivity, as well as the need to provide Internet and voice calling capabilities for their crew members while offshore. With that in mind, the USCG began testing KVH's integrated SATCOM system shortly after the service was launched in September 2007.

The system's flexibility and power ably met the USCG's rapidly expanding requirements, driven by the new biometric technology that is used in immigration and law enforcement activities, missions that sent USCG vessels to the Persian Gulf in support of the U.S. war on terrorism and anti-piracy efforts, and natural disasters that required the USCG to support humanitarian efforts. In addition, the 24/7 nature of USCG operations and the extreme sea and weather conditions in which these relatively small vessels operate are proof of the durability and reliability of the TracPhone V7 and mini-VSAT Broadband service.

The USCG began deploying KVH's TracPhone V7 systems on their 225-foot ***Seagoing Buoy Tenders*** and their 240-foot ***Seagoing Buoy Tender/Icebreakers***. Their primary interest was to provide broadband connections for non-classified operations and to improve crew morale.

During the Buoy Tender fleet rollout, the Coast Guard inquired about an urgent requirement to augment broadband communications aboard the Inmarsat-equipped, 110-foot ***Island Class Patrol Boats*** stationed in the Persian Gulf. The Coast Guard needed an alternative commercial satellite service to meet the communications needs of the Coast Guard vessels operating in the Middle East. KVH provided the TracPhone V7 units and helped the Coast Guard integrate the mini-VSAT Broadband network into its communications backbone.

Recognizing the significant benefits offered by the TracPhone V7 and the mini-VSAT Broadband service, the U.S. Coast Guard next looked to equip their *High Tempo/High Maintenance* (**HTHM**) 110-foot ***Island Class Patrol Boat*** fleet with mini-VSAT Broadband service. These vessels use new biometric instruments to positively identify every person the Coast Guard detains, requiring large amounts of data to be transmitted between the Patrol Boats and the central database in Virginia. The TracPhone V7 systems deployed on these vessels offered a dramatic improvement in performance, including tracking in very rough seas and maintaining communications in rain and other adverse weather conditions.

In late 2010, the Coast Guard awarded KVH a $42 million contract to replace the satellite communications equipment on more than 200 vessels with the TracPhone V7 and mini-VSAT Broadband service.

Coalition Forces Select mini-VSAT Broadband

Following its assignment to the Combined Maritime Forces, the **U.S. Navy** purchased six TracPhone V7 units with mini-VSAT Broadband global service based, in part, on the success of the USCG's mini-VSAT Broadband testing and deployment. The U.S. Navy also encourages allied forces working in the combined joint task force in the region to equip their vessels with the mini-VSAT Broadband service.

Today, TracPhone V7 systems are installed on high-value oil and gas terminals in the Arabian Gulf, and on U.S. Navy and coalition vessels participating in the Combined Maritime Forces. The units are available to be deployed as needed in the Gulf of Aden, the Gulf of Oman, and the Arabian Gulf. These systems have already been successfully deployed on vessels of the navies of Thailand, Pakistan and Bahrain, among others.

Based upon their experiences with the coalition, the **Republic of Korea Navy**, which recently took over command of **CTF-151**, purchased three of KVH's TracPhone V7 systems for installation in their vessels serving in the CMF task forces. Military forces using VSAT services travel all over the globe, switching from one regional network to another.

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Compact, Rugged, Easily Installed
The TracPhone V7 weighs only 60 lbs, allowing it to be installed easily and conveniently.

Bandwidth + Capacity

The mini-VSAT Broadband network is the first next-generation maritime SATCOM solution. The global spread spectrum satellite network, built with ViaSat's patented ArcLight® technology, offers more affordable airtime, voice service and Internet access as fast as 512 Kbps (ship to shore) and 2 Mbps (shore to ship).

The mini-VSAT Broadband network is based on ViaSat's *ArcLight Code Reuse Multiple Access* (**CRMA**) spread spectrum technology and is more than twice as efficient as older second generation *Time Division Multiple Access* (**TDMA**) technology used by all other maritime VSAT systems. Its spread spectrum signals can also be received by much smaller antennas while still ensuring high quality connections that withstand atmospheric interference, rain fade, and multipath errors.

In addition, mini-VSAT Broadband's transmission technology is highly efficient at managing network traffic and provides affordable, consistent data rates. This ensures that vessel commanders and crews get what they need with regard to service speeds, reliability, clear *Voice over Internet Protocol* (**VoIP**) phone connections, and performance.

The modern spread spectrum broadcast technology used by mini-VSAT Broadband permits the service to operate using smaller antennas like the TracPhone V7, which is 85 percent smaller by volume and 75 percent lighter than those employed in 1m VSAT equipment. By way of comparison, the TracPhone V7 is only 24-inches (60 cm) in diameter and weighs 60 lbs (27 kg), as compared to the 40-inches (1 m) or larger traditional VSAT antennas that weigh 250-400 lbs (115-180 kg).

With a wide range of affordable, flexible airtime plans, including always-on, fixed-price airtime plans and per-megabyte plans, TracPhone V7 customers can save as much as 85 percent or more per megabyte over existing maritime data services.

The Bottom Line

Reliable, high-quality SATCOM is crucial to successful multinational security operations, especially when coordinating multilateral military strategy. The effective deployment of coalition forces requires communications systems capable of supporting high-volume data use, such as Internet access and onboard video teleconferencing.

KVH's mini-VSAT Broadband network and TracPhone V7 system have proven themselves ideally suited for such operations thanks to compact antennas, affordable broadband service, and global coverage. More than 1,000 TracPhone V7 systems were shipped in the first three years after the product's introduction, making the mini-VSAT Broadband network the fastest growing maritime VSAT solution.

For additional information, please visit...
http://www.minivsat.com