SatCom For Net-Centric Warfare January 2012

MilsatMagazine

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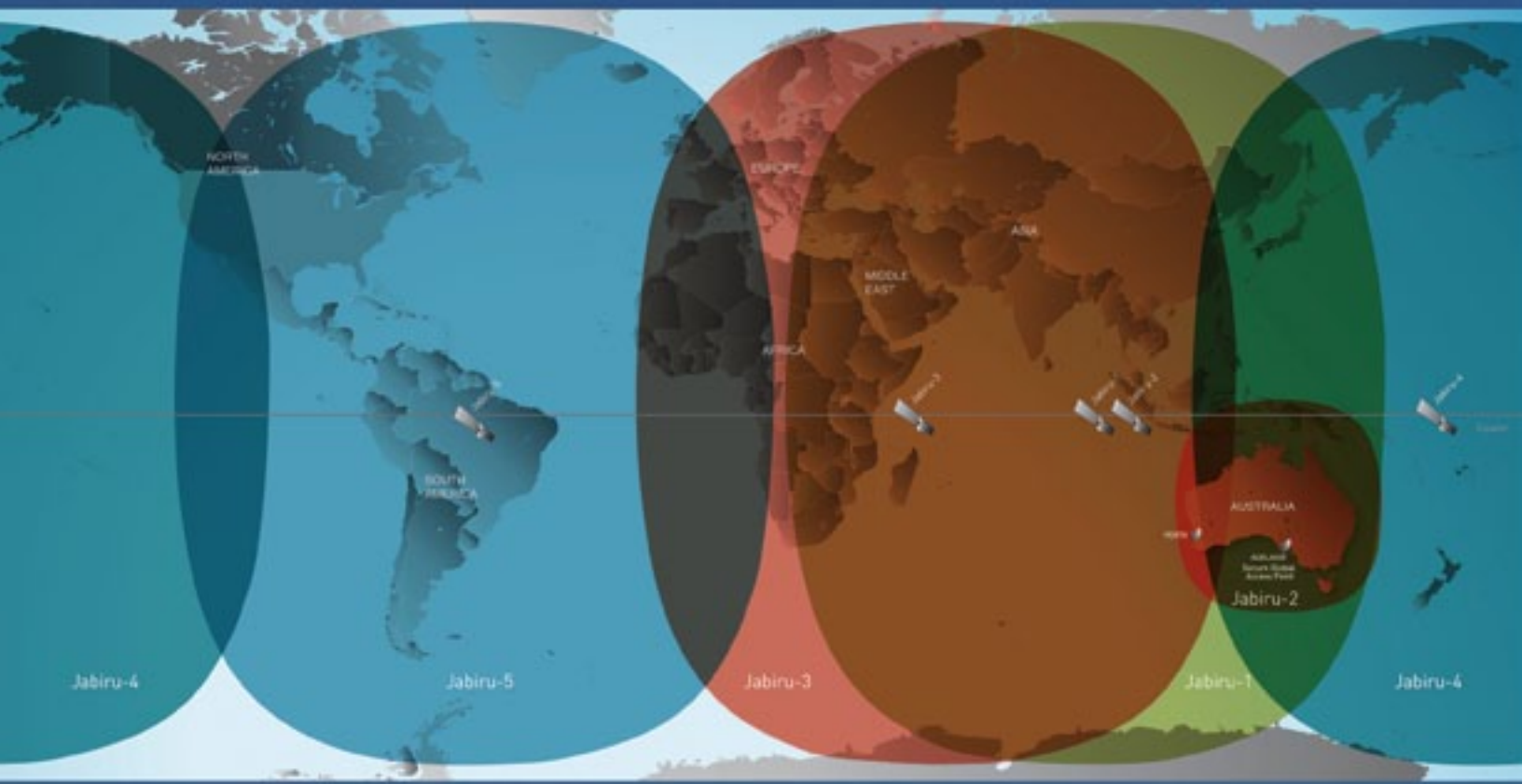

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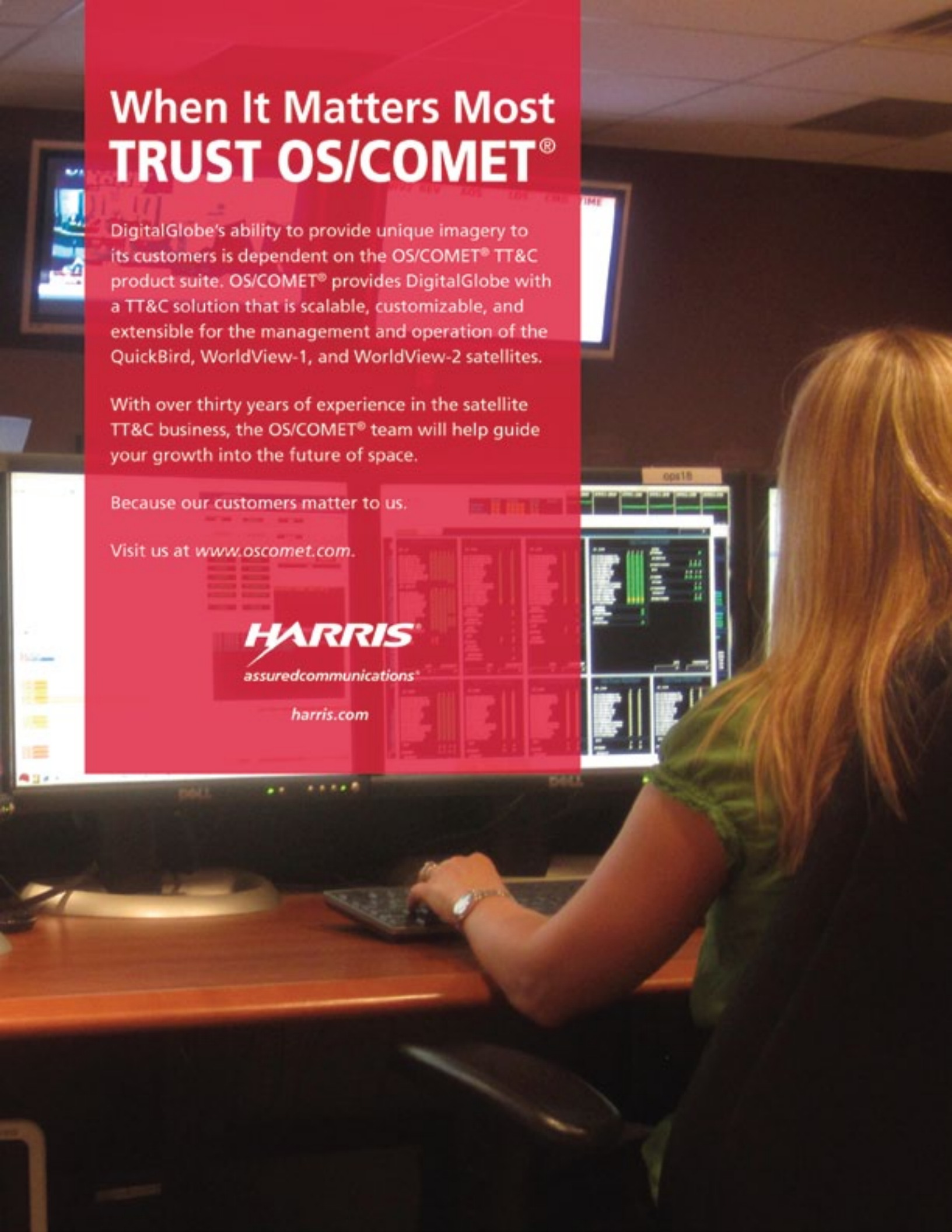

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A Commanding Move

The Air Force announced on December 16th that the Air Force Technical Applications Center will bid farewell to its current commander and welcome a new one in summer 2012.

Col. Aaron M. Prupas, AFTAC's present leader, joined AFTAC in June 2010. He has been selected as the commander of the National Air and Space Intelligence Center at Wright-Patterson Air Force Base, Ohio. Prior to his assignment at Patrick AFB, he served as the deputy director for the Commander's Initiatives Group at U.S. Central Command at MacDill AFB in Tampa, Florida.

In the same announcement, the Air Force selected Lt. Col. Christopher A. Worley to be Prupas' replacement. Worley, who has been selected for promotion to colonel, is currently serving as the chief of requirements and assessments for the Undersecretary of Defense's Intelligence, Surveillance and Reconnaissance Task Force at the Pentagon.

Air Force ISR Agency

Impatience With Interference

Glowlink has been awarded a competitive contract by the U.S. Air Force for satellite carrier monitoring and interference geolocation capabilities.

The Air Force will deploy a worldwide network of systems under the contract, all based on the Company's Model 8000 geo-location and Model 1010 wideband carrier monitoring systems.

The Model 8000 is a compact, commercial off-the-shelf (COTS) geolocation system that aims to swiftly detect, identify and geo-locate satellite interferences. The Model 1010 is an ultra-wide bandwidth spectrum monitoring and analysis system designed to provide enhanced carrier-monitoring capabilities.

Jeffrey Chu, Glowlink's CEO and a co-founder, said, "The U.S. Air Force did extensive market surveys, and decided on a product with unmatched price and performance ratio. We are exceedingly pleased to be selected based on merit, and look forward to working closely with our Air Force customer to deploy this capability expeditiously and responsibly."

Comms Exercises

Marines with the 7th Communication Battalion dispatched an array of communication equipment and established a secure working environment during their communications field exercise at Camp Hansen in Japan last month

The battalion, part of III Marine Expeditionary Force Headquarters Group, III MEF, conducted the exercise to maintain operational readiness, ensure efficiency within the Marines' military occupational specialties, and to allow the battalion to stay poised for future exercises and operations.

Lance Cpl. Kevin A. Wildman, a technical controller with 7th Communications Battalion monitors his equipment and conducts operations checks during the battalion's communication field exercise on Camp Hansen Dec. 1. The battalion, part of III Marine Expeditionary Force Headquarters Group, III MEF, conducted the field exercise to prepare for upcoming exercises or possible real-world operations.

"Each Marine is testing their individual equipment," said Master Sgt. Thaddeus S. Starkey, the communications chief of Satellite Platoon, 7th Comm. Bn. "We have to validate our systems to make sure everything is working properly.

"Communications [technology] is always progressing," he added. "We always have to train in communications, because you will never know everything."

Within 24 hours, the Marines were expected to set up tents, secure the working area, generate power for the tents and establish communications. It is imperative that the radios are set up first, said Pfc. Isael J. Rodriguez, a radio operator with 7th Comm. Bn.

"In any case of an emergency, we may have to call in a medevac," said Rodriguez. "Before we set up anything else, we have to ensure that we've set up initial communications."

Throughout the training, the Marines conducted operations checks on all of the equipment, ensuring the items on the equipment density list were operational and able to be used in any situation, said Starkey.

The equipment density list is a list of equipment the unit must bring when deployed to exercises or operations, said Starkey.

Most importantly, the unit establishes entry control points and gear watches, ensuring that the equipment is secure and only those authorized have access to the operating area. This simulates how they will operate in deployed environments.

"It's critical that nothing happens to any of the equipment," said Pfc. Ryan E. Hodge, security at the ECP during the exercise. "Anyone without

a specific clearance won't have access. The fact is, we have to keep all equipment up and working, so that makes the security mission critical."

The Marines know the importance of operational readiness, said Rodriguez.

"Anytime a disaster happens, we have to be ready to give aid," said Rodriguez. "We always have to make sure our gear is ready, so that when we get into the field, it can be used."

Overall, Starkey is pleased with the efforts of his Marines.

"They are doing an awesome job!" said Starkey. "It usually takes a day to set up, but the Marines got it done in an hour — while in the rain!"

Story by
Lance Cpl. Jacob Lagoze

Critical Support Continues

ITT Exelis (NYSE: XLS) has been awarded a $121 million U.S. Army contract to provide mission support to wideband satellite operations centers and management sites around the world.

The Wideband Satellite Communications (SATCOM) Operations and Technical Support (WSOTS) contract, awarded by the U.S. Army Space and Missile Defense Command and the Army Forces Strategic Command, Peterson Air Force Base, Colorado, includes the base year and six, one-year option periods. As a key provider of C4ISR (command, control, communications, computers, intelligence, surveillance and reconnaissance) and technical services for defense and government agencies, Exelis will continue to support global network and computer systems for critical military satellite communications.

The cost-plus-fixed-fee contract also calls for operations and maintenance, life-cycle engineering, on-site technical assistance, equipment installation, depot-level repair, logistics, cybersecurity, and training and sustainment.

Testing Expeditionary Readiness

Marines from Communications Company, Combat Logistics Regiment 17, 1st Marine Logistics Group, deployed a Jump Command Post during a training exercise, December 8. A Jump CP establishes a forward point for a command to communicate with its troops.

A CH-53 Sea Stallion helicopter flew into the simulated forward operating base. As it landed, Marines covered their faces as sand and debris was kicked up from the helicopter's propeller. The troops walked in a column forma-

A Marine from Communications Company, Combat Logistics Regiment 17, 1st Marine Logistics Group, boots a computer to establish a Support Wide Area Network at a Jump Command Post, during a training exercise aboard Camp Pendleton, California, December 8. A Jump CP establishes a forward point for a command to communicate with its troops.

tion into the rear of the helicopter, carrying radio equipment they would use to establish communications when they landed.

Marines from Landing Support Company, CLR-17, 1st MLG, rigged a Humvee to the bottom of a CH-53, making three trips in under half an hour. The helicopters transported one Humvee and more than 10 Marines during each of the three flights. Once all the Marines touched down, they transited via Humvee to a location where they would establish a Jump CP.

"Marines [from Communications Company] rarely get to conduct helicopter insertions," said Gunnery Sgt. Erich J. Wolfinger, operations chief, Communications Company, CLR-17, 1st MLG. "This exercise breaks the monotony and will give the Marines a good idea of their abilities and effectiveness."

After driving off-road to the jump location, the Marines dismounted their Humvees and began to construct the Jump CP. The setup included deployment of a Support Wide Area Network. A satellite dish is used in the network to increase the capabilities of long-range communications. It allows the unit to carry a smaller network package. A generator that was towed behind a Humvee powered the Jump CP's electronics through extensive wiring that also connected the system together.

Once power was established, Marines adjusted the dish to connect to a satellite with the aid of a computer program. The dish sent radio signals to the satellite which relayed them to another dish in the simulated FOB, allowing a clear connection. The mission was accomplished.

CLR-17 is transitioning back to its expeditionary roots, under the command of Col. James W. Clark, commanding officer, CLR-17, 1st MLG. The regiment is now conducting exercises that focus on the expeditionary nature of the Marine Corps.

"The future of the Marine Corps is likely smaller exercises," said 1st Lt. Samuel R. Howe, executive officer, Communications Company, CLR-17, 1st MLG. "The regiment plans to get back to its expeditionary roots. Colonel Clark's vision is to be able to get close to the front lines with dependable communications. This training exercise is a great example of operations with expeditionary nature."

Communication Company has conducted many training exercises. The repetition has allowed them to become more efficient and skillful at their work.

"It's good to get challenging and realistic training similar to real scenarios," said Howe. "I've been with the regiment for two years and every exercise I have seen improvement from the last. This is the best part of the job."

Story + photos by Pfc. Timothy Childers

A Marine from Communications Company, Combat Logistics Regiment 17, 1st Marine Logistics Group, braces a radio antenna during a training exercise aboard Camp Pendleton, California, December 8. The Marines established a Jump Command Post to increase the command's communication abilities.

Increased Capacity For UAVs

A communications conundrum has been solved that enables UAVs' capacity to greatly increase.

NovelSat has launched its groundbreaking third generation satellite modulation technology, NS3™ to the military market place. NS3™ technology addresses the chronic shortage of satellite bandwidth that is restricting the deployment of Unmanned Aerial Vehicles (UAVs) around the globe today. Time and again, NS3™ technology has been shown to boost satellite capacity by 28-70 percent over the previous highest performance alternatives offered by the second generation Digital Video Broadcasting Standard (DVB-S2).

UAVs such as Predators, Global Hawks, Reapers and the French Harfang generate huge amounts of data, including full motion video and complex sensors such as high definition video, laser designators, imaging radar, ground moving target indicators and multispectral imagers, demanding high bandwidth for transmission. One Global Hawk (UAV) requires around 500 Megabits/second of bandwidth, which is five times the entire bandwidth required by all of the US military during Desert Storm.

Furthermore, the Pentagon has recently announced its intentions of buying at least 50 more

UAVs of the extended range category, signaling to the satellite industry of its focus shift towards more Communications-On-The-Move (COTM) for UAVs in the coming years. The inevitable outcome of this focus shift is that the numbers of concurrent UAV flights will more than double itself in the future.

The NS3™ technology from NovelSat uses existing spectral bandwidth more efficiently to reduce satellite leasing costs by 20-37 percent over DVB-S2 (on 36MHz and smaller transponder segments), reduce antenna size by 33 percent, increase geographical coverage and/or increase capacity by up to 70 percent on wide transponders such as the 72 MHz transponders and offer unparalleled data speeds of up to 358Mbps today — growing to 1Gbps on a 250MHz transponder by Q4/ 2012.

For UAVs, NS3™ can contribute to a 33 percent reduction in the onboard pedestal and antenna's size giving an identical throughput. Such a reduction may contribute to improved UAV's aerodynamics, fuel consumption, and flight range as well as reducing its Radar Cross Section (RCS). Similarly, for Special Forces as well as Ground Forces, Communications on the Move (COTM) the reduction in weight and size of the antenna carried on the back of a fighting soldier and the improved signal quality can prove to be a critical advantage in a military theatre.

NovelSat's modulators, demodulators and modems are designed with increased resiliency. Therefore, in addition to the improved capacity and the highest data rate, they also provide a much more robust signal that will better sustain and be resilient to unfriendly, challenging conditions by 0.4dB to 3dB.

Info On Exports

An upcoming seminar will offer intriguing info to avoid some rather costly penalties...

On February 23 -24, an ITAR Basics Seminar will take place in Orlando, Florida that assists one in understanding U.S. export controls basics of the ITAR

compliance with the international traffic in arms regulations. ITAR is the key to successful business.

Entitled "Avoid Costly Fines & Penalties Through Your Compliance with and Understanding of the ITAR", the topics Include:

- *Getting to Know State/ DDTC & the ITAR*
- *Recent ITAR Violators — Charging Letters and Case Examples*
- *Registration and How to Classify a Product*
- *Step-by-Step Process — How to Apply for a License*
- *Agreements Workshop — Utilizing the Electronic Guidelines for Drafting Technical Assistance Agreements*
- *Defining Technical Data & Public Domain*
- *National Disclosure Policy and DOD*
- *ITAR Exemptions You Should Use Now*
- *Foreign National Employees and Visitors-Licensing and Badging*
- *Record keeping and the 10 Elements of Compliance*

More information is available at **this direct link**.

Inmarsat's New Branding

Inmarsat has begun the process of including its subsidiary companies within a new organizational structure that will align the Inmarsat business more closely to core vertical market segments and continue to support both direct and indirect distribution of its services.

As of January 1, 2012, Inmarsat Solutions, led by Jim Parm, is responsible for Inmarsat's global direct and indirect sales and marketing delivery. Inmarsat Solutions now operates through four new market-facing business units:

- *Inmarsat Maritime, led by Frank Coles, focusing on worldwide commercial maritime opportunities*
- *Inmarsat Government US, led by Mike Wheeler, focusing on US government opportunities, both military and civil*
- *Inmarsat Government Global, led on an interim basis by Ronald Spithout, focusing on worldwide (i.e. non-US) civil and military government opportunities*
- *Inmarsat Enterprise, led by Ronald Spithout, focusing on worldwide enterprise, energy, media, carriers, commercial aviation as well as M2M opportunities.*

These new global business units will be supported by a new group, Commercial Services & Support, which will provide cross-business unit services such as customer support, product and service management, channel development, commercial management and marketing communications.

The Stratos, Segovia, and Ship Equip operations are now providing their services within the relevant business units, and will use the 'Inmarsat' brand name.

Stratos, a global provider of mobile and fixed satellite communications solutions and one of Inmarsat's two largest distributors, was acquired by Inmarsat in April 2009; Segovia, acquired by Inmarsat in January 2010, provides secure end-to-end communication solutions in support of the US government strategic and tactical initiatives worldwide; Ship Equip, which provides VSAT maritime communications services to the shipping, offshore oil & gas and fishing markets, was acquired by Inmarsat in April 2011.

Despite the alignment of the Inmarsat group's direct and indirect sales activities into business units, Inmarsat does not intend to change its policy of distributing its services primarily through independent channel partners, comprised of its network of distribution partners and service providers with whom Inmarsat has worked successfully over many years. The Inmarsat restructure is expected to provide further support to independent channel partners through greater coordination between Inmarsat and its channel partners.

"Inmarsat has been delivering mission-critical satellite communications services for customers who operate beyond the reach of terrestrial networks for

more than three decades," said Rupert Pearce, CEO, Inmarsat. "We have led the mobile satellite services market as a wholesale organisation. This restructure will build on that by bringing us closer to our partners and customers, making us more responsive to their needs and more efficient in the delivery of our services.

"It streamlines our decision-making process and focuses our activities on the primary markets we serve. It enables us to fully leverage our end-to-end capability — from managing the satellite network, to delivering solutions to end users through our highly-motivated channel partners who add global reach and value-added services to our core service proposition.

"Our goal is to grow Inmarsat's overall business through both direct and indirect channels. We are committed to continue working with our high-performing independent channel partners who can differentiate themselves with sector knowledge and experience. By minimizing the overlap between the Inmarsat businesses, we can better target our investment into market development activities that benefit our entire distribution channel."

Getting More Than A Worm

Saving a significant amount of money is always appealing, especially when it is for a much anticipated event.

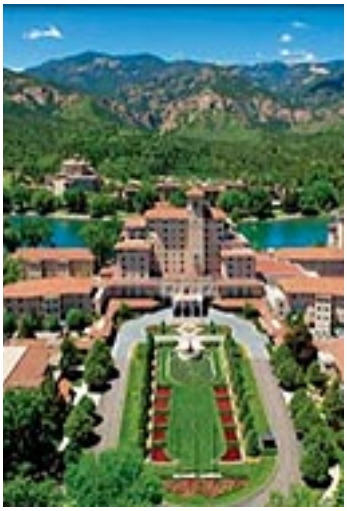
The 28th National Space Symposium will be held April 16-19 at The Broadmoor Hotel in Colorado Springs, Colorado. The Space Foundation is offering a Super Early Bird rate with up to $500 in savings for industry attendees who register before January 13. Plus, attendees can order the Space Foundation publication The Space Report 2012: The Authoritative Guide to Global Space Activity at the same time for an exclusive low rate of $69.50 — a 50 percent savings.

The Symposium is offered in conjunction with a separate Space Foundation event, Cyber 1.2, which will be held during the day on April 16 at The Broadmoor Hotel, immediately preceding the Symposium's opening ceremony. Register for both events to receive a substantial discount at www.NationalSpaceSymposium.org/register. The secure online registration page includes a live chat tab for customer service questions.

Recognized as the premier gathering of the global space community, the 28th National Space Symposium will feature forums, panels, presentations, speeches, special events and ample opportunity to hear from and network with the space community's most influential leaders. Among speakers confirmed for the 28th National Space Symposium are:

- *Maj. Gen. Charles Bolden, Jr., USMC, Ret., NASA administrator*
- *Bruce Carlson, director, National Reconnaissance Office*
- *Gen. C. Robert Kehler, USAF, commander, United States Strategic Command*
- *Letitia A. Long, director, National Geospatial-Intelligence Agency*
- *Gen. William L. Shelton, USAF, commander, Air Force Space Command*
- *William H. Swanson, Chairman and CEO, Raytheon*

Full details and speaker biographies are available regarding the 28th National Space Symposium website — select the graphic on the previous page to travel to that site. Information will be constantly updated as additional speakers confirm their participation. SatNews Publishers is an official sponsor of NSS.



NSS is located at the magnificent Broadmoor Hotel in Colorado Springs, Colorado.

Slicing + Dicing

Given the recent announcements regarding Obama's orders on cuts to the Defense Department, this is the official statement from the Chairman of the Joint Chiefs of Staff, General Martin E. Dempsey... (this will happen, so take a deep breath)...

"As Chairman, it is my responsibility to work with the Joint Chiefs to ensure that the armed forces of the United States keep America immune from coercion. The Strategy just described by the President and the Secretary of Defense enables us to fulfill that responsibility. It sustains the sacred trust put in us by the American people — to defend them and our country.

"This strategy stems from a deeply collaborative process. We sought out and took on insights both within and beyond the Department of Defense to include the intelligence community and other government departments. We weighed facts and assessments. We challenged every assumption. We considered a wide range of recommendations and counter-arguments. I can assure you that the steps we have taken to arrive at this Strategy involved all this and more.

"This strategy has also benefitted from an exceptional amount of attention by our senior uniformed and civilian leadership. On multiple occasions, we held all-day and multi-day discussions with the Service Chiefs and every Combatant Commander. The Service Chiefs — charged with developing the force for the strategy — were heard early and often. The Combatant Commanders — charged with executing the strategy — all weighed in time and time again. And, we were all afforded extraordinary access to both the President and the Secretary of Defense. Frankly, the breadth and depth of dialogue to arrive at today's strategic choices was both necessary and noteworthy.

"Today, we are here to discuss the broad contours and central choices of this strategy. But, this is not the end. Rather, it is a waypoint in a continuous and deliberate process to develop the Joint Force we will need in 2020. There are four budget cycles between now and then. Each of these cycles presents an opportunity to adjust how and what we do to achieve this strategy in the face of new threats...and in the context of a changing security environment.

"It is a sound strategy. It ensures we remain the preeminent military in the world. It preserves the talent of the All-Volunteer Force. It takes into account the lessons of the last ten years of war. It acknowledges the imperative of a global, networked, and full-spectrum Joint Force.

"And, it responds to the new fiscal environment — though as a learning organization, it is important to note that even if we didn't have fewer resources, we would expect to change. As a consequence, it calls for innovation — new ways of operating and partnering. It rebalances our focus by region and mission. It makes important investments in emerging and proven capabilities like cyber and special operations.

"There has been much made about whether this strategy moves away from

a force structure explicitly designed to fight and win two wars simultaneously. Fundamentally, our strategy has always been about our ability to respond to global contingencies wherever and whenever they happen. This does not change. We will always provide a range of options for our nation. We can and will always be able to do more than one thing at a time. More importantly, wherever we are confronted and in whatever sequence, we will win.

"We do accept some risk, as all strategies must. Because we will be somewhat smaller, these risks will be measured in time and capacity. However, we have to be honest — we could face even greater risks if we did not change from our current approach.

"I'm pleased with the outcome. It's not perfect. There will be people who will think it goes too far. Others will say it doesn't go far enough. That probably makes it about right. It gives us what we need — in this world and within this budget — to provide the best possible defense for our nation at a time of great transitions. It prepares us for what we anticipate needing in 2020.

"This is a real strategy. It represents real choices. And, I am here today to assure you it has real buy-in among our senior military and civilian leadership. This is not the strategy of a military in decline. This is a Strategy — and a Joint Force — on which the nation can depend.

"I want to wrap up by saying just a couple of words about leadership. It is always important, but absolutely essential during tough times. Make no mistake — these are tough economic times, and this strategy required some tough decisions. I want to thank President Obama and Secretary Panetta for their leadership throughout this process.

"The real test, though, is in execution. Fortunately, the young men and women who will be charged to carry out the lion's share of this strategy know something about leadership too. It is the very cornerstone of our profession — the profession of arms. And for the past ten years, they have done nothing but lead in some of the most difficult circumstances imaginable. For that reason, above all others, I am absolutely convinced and fully satisfied that this strategy will meet our Nation's needs for the future.

"Thank you."

Key Operational Test Completed

An advanced lightweight radio that will connect troops on the front lines to the Army's tactical communications network has completed its operational test.

The Joint Tactical Radio System, or JTRS, Rifleman Radio and its Soldier Radio Waveform, known as SRW, Network Manager component were the only systems under a formal program of record test at the recently concluded Network Integration Evaluation 12.1 at the White Sands Missile Range in New Mexico and at Fort Bliss in Texas.

While Soldiers from the 2nd Brigade, 1st Armored Division, also informally evaluated more than 45 other tactical communications systems, the Rifleman Radio test represents a key step toward fielding the Army's future network. The two-pound radio, which is carried by platoon, squad and team-level Soldiers for voice communications, can connect with handheld devices to transmit text messages, GPS locations and other data. Through SRW, it connects lower echelon Soldiers to one another and back to their leaders at the company level so they can rapidly exchange information.

A soldier with a Harris Falcon III® AN/PRC-152 handheld radio for JTRS communication. Photo courtesy of Harris.

"I use it for overall command and control because it builds a network that allows me to talk to my subordinate elements," said Capt. Ryan McNally, a company commander within 2/1 AD who evaluated the Rifleman Radio at Network Integration Evaluation, or NIE, 12.1. "It's the first time I've actually had radios down at the squad level. So my dismounted riflemen, they all have the radio as well. It allows them to talk to their team leaders when they're spread out, and also allows them to talk to the squad leader."

McNally said the ability to communicate with the radios instead of shouting or using hand-and-arm signals had altered his Soldiers' tactical approach to their missions.

"We have to factor in being able to talk to each other over a distance, rather than everybody being essentially co-located with a limited amount of space and distance between them," McNally said. "Now we can expand that space and distance. We can cover a larger area."

McNally's company used the radios in conjunction with handheld devices running Joint Battle Command-Platform software. JBC-P is the future version of the Army's friendly force tracking and messaging system, known as Force XXI Battle Command Brigade and Below/Blue Force Tracking, known as FBCB2/BFT, which also allows users to plot hazards and enemy locations on a digital map. Plugged into the Rifleman Radio, these devices provided mission command and situational awareness information down to Soldiers at the tactical edge.

"They can get their grid (position) off of it, and they can see anybody else who has a Rifleman Radio," McNally said. "You can send messages, create routes, drop a chem light (to show a building has been cleared), and send reports."

During the test, the Army captured data on the radio's performance in two ways: Through instrumentation on the systems themselves, and through human data collectors who accompanied Soldiers throughout their missions.

"When they have a radio and they're talking on it, I have a guy there that's writing down information and talking to them, with specific questions that we've given them," said test director Mike Nott.

He said the company formally testing the Rifleman Radio was physically isolated from the rest of 2/1 AD to ensure the integrity of the test, despite the complex NIE environment.

"Although they're still part of the overall exercise and still in the scheme of maneuver, we physically separated them on the ground, and we did that on purpose," Nott said. "We wanted to be able to control that battle space."

The Army will evaluate those test results during the coming months, as it finalizes the makeup of its network Capability Set 13, which will begin fielding to up to eight brigade combat teams in fiscal year 2013.

The Rifleman Radio is part of the JTRS Handheld, Manpack, Small Form Fit, or HMS, family of radios. In June the HMS program achieved Milestone C, authorizing the Army to procure a low-rate initial production lot of up to 6,250 Rifleman Radios and up to 100 Manpack Radios. NIE results will help inform further purchasing decisions for the equipment.

The software-programmable JTRS radios, which can use encryption to safeguard information, are built to send Internet Protocol packets of data, voice, video and images via multiple waveforms between static command centers, vehicles on the move, and dismounted individual Soldiers on patrol. The JTRS waveforms, SRW and the Wideband Networking Waveform, known as WNW, are integrated with the satellite communications backbone of the Army network, Warfighter Information Network-Tactical, or WIN-T, to transmit that information on the upper tactical Internet.

The Rifleman Radio is a key component to building the ground-level lower tactical network, bringing the most communication disadvantaged

A 2nd Brigade, 1st Armored Division Soldier demonstrates a Joint Battle Command-Platform Handheld and a Joint Tactical Radio System Rifleman Radio. The radios and handhelds enable lower-echelon Soldiers to better communicate with oneanother and higher headquarters.

SATCOM Equipment/TWTAs

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users — the small unit down to the individual user — into the network.

During NIE 12.1, Soldiers used the radios and handheld devices in a variety of realistic scenarios, including convoy operations, medical evacuation, reconnaissance and counterinsurgency. One 2/1 AD platoon leader, 2nd Lt. Travis V. Mount, said the technology showing the positions of his troops allowed him to save time by immediately adapting and executing his plans rather than tracking down personnel first.

"No matter what kind of organization you're running, if you have dismounts who are going to be on the ground you like to be able to see where your personnel are," Mount said. "If all I need is information on their position, I don't have to go through an intermediary. I can on the spot adapt my plan."

He said the Tactical Ground Reporting, known as TIGR, software application running on the handhelds was also valuable for sharing patrol information such as routes, places and people of interest.

"Instead of having to go to the Tactical Operations Center at the end of the day to download the information on the events and observations, I can either (do it in) real time or when I have a lull in the mission," Mount said. "I can just plug it in right there."

Story by Claire Schwerin, PEO C3T. Ashley Blumenfeld, JPEO JTRS, contributed to this report.

China's Increased Activity

China will launch the Shenzhou-9 and Shenzhou-10 spacecraft and achieve space rendezvous and docking missions with the orbiting Tiangong-1 vehicle in 2012, a spokesman for the China National Space Administration has revealed.

Spokesman Zhang Wei made the announcement at a press conference held in Beijing for the release of a white paper titled "China's Space Activities in 2011." However, the spokesman did not unveil a detailed timetable for the launches.

China issued the white paper on the development of the space industry since 2006 and the major tasks for the next five years. The white paper was the third white paper on the country's space activities issued by the State Council Information Office, following one in 2000 and another in 2006. The Chinese government has made the space industry an important part of the nation's overall development strategy and adhered to the exploration and utilization of outer space for peaceful purposes, the white paper said.

Over the past few years, China has ranked among the world's leading countries in certain major areas of space technology, it said, adding that in the next five years, there will be new opportunities for the country's space industry. At the same time, China will work together with the international community to maintain a peaceful and clean outer space environment and endeavor to promote world peace and development, the document said.

China's Tiangong-1 launch vehicle.

Major tasks listed in the white paper for the next five years include a space transportation system, Earth satellites, human spaceflights and deep-space exploration. China also plans to launch space laboratories, a manned spaceship and space freighters, and will start research on the preliminary plan for a human landing on the moon, the document said. As an important part of deep-space exploration, the country's lunar probe projects follow the idea of "three steps" — orbiting, landing and returning.

In next five years, the country plans to launch orbiters for lunar soft landing, roving and surveying to implement the second stage of lunar exploration, then it will start the third-stage project of gathering samples of the moon's surface matter and getting those samples back to Earth, the white paper said. China will also build a space infrastructure frame composed of Earth observation satellites, communications and broadcasting satellites, as well as navigation and positioning satellites. According to Wei, China will also conduct special project demonstrations in other deep-space projects, including an exploration of Mars.

China has signed 66 international space cooperation agreements with 22 states and regions, and 44 of them currently remain in effect, Zhang said at the press conference

The country has engaged in 12 bilateral cooperation mechanisms within intergovernmental frameworks, Zhang said, adding that China has exported communications satellites to Nigeria, Venezuela and Pakistan, and has also contracted with countries, including Bolivia, Belarus, Indonesia and Laos, to export satellites. (Source: *Xinhua*)

Mounting More MTS

Comtech Mobile Datacom Corporation, a subsidiary of Comtech Telecommunications Corp. (Nasdaq:CMTL), has received multiple orders totaling $16.6 million to support the U.S. Army's Movement Tracking System ("MTS") and Blue-Force Tracking-1 ("BFT-1") programs. These orders were placed under the auspices of the BFT program office and brought the total orders received-to-date under Comtech's $384.0 million BFT-1 contract to $378.2 million.

The first order for $12.0 million included the supply of MT-2012 mobile satellite transceivers to support the MTS program and MT-2011 mobile satellite transceivers to support the BFT-1 program.

The second order was for the continued supply of satellite bandwidth, satellite network operations, engineering services and program management to support the MTS program for the period January 1, 2012, through March 31, 2012. Pricing for the second order has not yet been finalized with the U.S. Army and related funding cannot exceed $4.0 million. Additional orders aggregating approximately $0.6 million primarily related to engineering services to develop an operational interface between the MTS network and a standard FBCB2 protocol currently being used by the BFT-1 system.

None of the above orders included a separate fee for the use of Comtech's intellectual property. Comtech continues to have ongoing discussions with the U.S. Army related to a potential multi-year sustainment contract including the licensing of its intellectual property to support the BFT-1 and MTS programs. Fred Kornberg, President and Chief Executive Officer of Comtech Telecommunications Corp., said, "We are pleased to receive these orders which provide for

the uninterrupted delivery of MTS services to the U.S. Army and which continues our long standing support of the MTS and BFT-1 programs. We also believe the receipt of additional hardware orders demonstrates the ongoing importance of the U.S. Army's BFT-1 and MTS satellite tracking communication systems which currently support deployed U.S. forces worldwide."

Wheeling + Tracking

Antenna Technology Communications Inc. has been selected by the U.S. Defense Department to supply the their Ka-band networks designed for high throughput Ka-band satellite communication systems worldwide.

In accordance with ACORDE, headquartered in Santander Spain, ATCi offers turnkey solutions for broadband wireless communications, engineering projects for video, voice, data solutions and advanced IP security solutions. The core partnership offering includes ACTX Ka-band series (5, 10, 20, and 40W) block up converters, which have demonstrated superior reliability and performance in severe operational conditions.

The compact units are designed for demanding shock and vibration environments of wheeled and tracked vehicles, and are specifically engineered to support Department of Defense (DOD) agencies worldwide. Additionally, ATCi adds network operations and dynamic remote access equipment to its SkyWay Fiber Connect network providing anywhere to anywhere broadband access.

Agency Access

Skycasters has been awarded a GSA Federal contract to provide affordable satellite Internet service to GSA Government agencies.

Through the GSA contract SIN# 132-55, Skycasters will deliver commercial-grade SATCOM services to U.S. military and government agencies. The GSA contract allows Skycasters to provide primary broadband satellite Internet service for GSA federal government buyers under the Cooperative Purchase Program, ARRA Program, Disaster Recovery Purchase Program, and other qualifying programs. Their primary service plans are so dependable, that it doesn't matter how remote the government location is, Skycasters goes there.

When natural disasters strike, an unexpected interruption in service occurs and communications are shut down. GSA federal government buyers can't afford to incur outages like these. Skycasters' business continuity satellite Internet service is independent of all local landline infrastructure. Meaning they aren't exposed to the same threats that could disrupt primary connectivity, which makes Skycasters broadband international satellite Internet service the perfect Continuity of Operations (COOP) solution for any GSA Government customer.

Skycasters rapid deployment systems are business-grade products that are intricately designed and equipped with an auto-pointing satellite dish which delivers an Internet connection within 10 minutes of deployment. These products are ideal for first response situations because they are easy to maintain, transport, and simple enough to use that even untrained personnel can operate them.

Seizing SBIRS Support

Kratos Defense & Security Solutions, Inc. (Nasdaq:KTOS) has announced that its RT Logic subsidiary has been awarded an initial contract valued at approximately $5 million by Lockheed Martin Information Systems & Global Solutions.

The Company will supply the U.S. Air Force (USAF) with the Space-based Infrared System (SBIRS) Enhanced Multi-Band Modem (SEMM). SEMM is based on RT Logic's industry-leading Telemetrix® 400XR (T400XR) software-defined receiver and digital processing unit.

The USAF's SBIRS satellites provide the nation with significantly improved missile warning capabilities and simultaneously support other critical missions including missile defense, technical intelligence and battlespace awareness.

RT Logic's solution simultaneously transmits and receives data from the SBIRS satellite on multiple radio links. In addition, the SEMM provides protection against jamming through an integrated frequency hopped subsystem provided by the Secure Satcom Systems division of Astrium Limited.

RT Logic's Telemetrix 400 Modulator/Receiver

RT Logic's rugged CompactPCI® (cPCI) hardware and flexible Telemetrix software-defined architecture ensures the modem will support not only current requirements but also future upgrades and enhancements.

John Monahan, President of RT Logic, said, "The SEMM leverages RT Logic's decade-long support of the SBIRS ground system combined with advances in our T400XR product line and our partnership with Astrium to provide an unmatched modem solution. We are proud to be working closely with the USAF and Lockheed Martin to supply these advanced modems for a program of such national importance."

Taking A Higher Step

When a company announces a new subsidiary it's usually followed by healthy growth...such can be anticipated here.

ARINC Incorporated has announced it has formed a new subsidiary, ASES LLC, doing business as ARINC Aerospace. The new

SatFinder

Satellite Database & Calculation Software

DATABASE

Information on over 500 satellites (orbital location, frequencies, EIRP, G/T, SFD, bandwidth, programming etc.)

Information on 9,000 companies (address, tel, fax, web, products, services and contact names etc.)

Information on 19,000 executives in the commercial satellite industry.

800 hundred EIRP, G/T & SFD maps in color not published anywhere else.

CALCULATION

Has full up-down digital link budget calculators with input provision for uplink power control (UPC), ALC, various interferences and multiple carriers.

Finds HPA size, uplink power requirements, bandwidth and power usage per carrier.

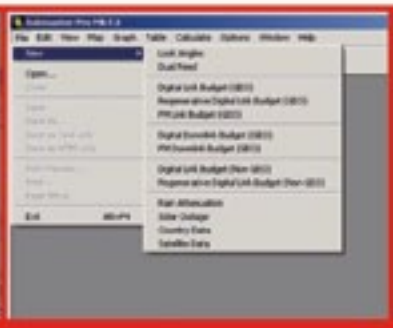
Calculates atmospheric losses and rain fade margins for any desired availability on uplink and downlink.

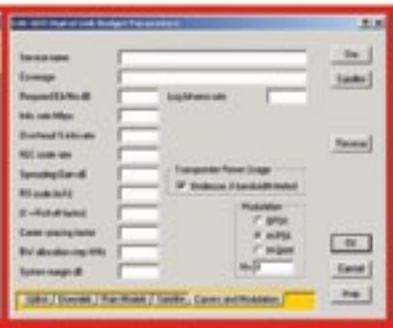
Handles BPSK, QPSK, M-PSK or M-QAM with any FEC code rate.

Determines power or bandwidth limited modes and calculates the power equivalent bandwidth, if appropriate.

Provision for RS codes or 'Turbo' modems. Option for rain up AND rain down scenarios where uplink and downlink are from/to the same city.

UPDATED QUARTERLY!





http://www.satnews.com/satfinder

company will specialize in the modification, modernization, upgrade and maintenance of aircraft for the military, government, and commercial marketplaces.

ARINC Aerospace assumes most of the operations of ARINC's former Aerospace Systems Engineering & Support (ASES) business unit.

Michael A. Young, who led the ASES division as Vice President for the past eight years, has been named Vice President of the new company, ARINC Aerospace. Approximately 500 ASES employees will also be transferred. ARINC Aerospace will have two divisions: Aircraft Integration, Modification, & Maintenance, and Aircraft Logistics & Sustainment.

"We have re-aligned our divisions to focus on our core capabilities within the marketplace, with the major focus on aircraft," Young stated. "Our mission is to provide high quality, independent, and cost-effective aircraft modification and sustainment solutions to the aerospace industry."

In the transition, ARINC's other major defense division, Defense Systems Engineering & Support (DSES), will assume some engineering and support requirements of ARINC Aerospace, including SETA (Systems Engineering & Technical Assistance) engineering and A&AS (Advisory & Assistance Services) support. This will enable ARINC Aerospace to pursue installation contracts with large defense engineering firms without engineering conflict.

ARINC has recently experienced exceptional success as a subcontractor to large primes, servicing U.S. Air Force, Navy, and State Department aircraft. It is currently upgrading large C-130 transports for the Indonesian Air Force fleet.

"ARINC has consistently offered high value and fast turnaround times at our AS9100 Certified aviation facilities, making us very competitive," added Young. "As an independent corporation, ARINC Aerospace will be able to target modification and maintenance contracts more closely, and deliver more value to our customers."

Among the ARINC facilities being transferred to ARINC Aerospace are the company's large Aircraft Modification and Operations Center near Tinker Air Force Base in Oklahoma City, Oklahoma, which includes the area's two largest commercial aircraft hangars, and ARINC operations near Warner Robins AFB in Warner Robins, Georgia.

"By realigning ARINC's defense contracting capabilities, we have developed a more customer-focused, responsive, and efficient organization," Young concluded.

ARINC Incorporated, a portfolio company of The Carlyle Group, provides communications, engineering and integration solutions for commercial, defense and government customers worldwide. Headquartered in Annapolis, Maryland with regional headquarters in London and Singapore, ARINC is ISO 9001:2008 certified.

Ensuring Chopper Safety And Efficiency

Communications from anywhere 'twixt Sikorsky S-92 choppers and crews is a done deal...now.

Blue Sky Network's ACH1000

Satellite tracking, fleet management, and automated flight following solutions leader, Blue Sky Network announced that its two dominant aviation products, the D1000 and ACH1000, have been certified for use on Sikorsky S-92® helicopters.

The newly type-certified equipment provides S-92 helicopter operators with enhanced communication between managers and crew from anywhere in the world, adding safety and tracking capabilities to increase security and efficiency.

Blue Sky Network's D1000A offers near real-time tracking of aircraft through built-in GPS position reporting combined with an Iridium satellite transceiver and telemetry data link. The ACH1000 communications control head adds voice communication and two-way messaging connectivity between operators and the control center.

Managers are also able to visually track aircraft and view take-off, landing and other flight updates using SkyRouter, Blue Sky Network's secure online web portal.

"This certification is proof of the high quality of our asset management equipment," said Jon

Gilbert, President and CEO of Blue Sky Network. "We are very proud to provide our customers the added value and assurance of another STC. Blue Sky Network will continue to add product certification where needed in order to bring secure tracking and communications to more aircraft worldwide."

The S-92 helicopter is the most advanced aircraft in Sikorsky's civil product line, certified to the most stringent safety requirements of the Federal Aviation Administration (FAA) and the European Aviation Safety Agency (EASA). The helicopter's advanced health and usage monitoring system sets a new level of reliability and enables cutting-edge fleet management services, making it an ideal fit with Blue Sky Network's tracking and communication solutions.

Foundational Space Capabilities

Space efficiencies and effectiveness, the importance of STEM education and foundational levels of space capabilities were highlighted by the Air Force Space Command commander during a speech this month in Nashville, Tennessee.

General William Shelton kicked off the 50th American Institute of Aeronautics and Astronautics Aerospace Sciences Meeting as the keynote speaker. The general said the future of space transportation in the U.S. is completely dependent on more efficient and much less expensive space launch and that launch underpins much of the command's business. The AFSPC commander highlighted that many of the engine designs currently in use are decades old and that newer, more efficient designs are needed.

"I've said for years that the person or the company who finds a breakthrough in space propulsion would become very wealthy," the general added.

General Shelton also discussed cost-savings initiatives like the command's block buy strategy for Evolved Expendable Launch Vehicles and multiple launch capabilities.

"I can see multiple launch concepts becoming much more prevalent in these times of decreasing budgets, proving once again that necessity is truly the mother of invention," the general said.

Aging infrastructure was also on the general's mind and he noted the facilities at Cape Canaveral Air Force Base, Florida, and Vandenberg Air Force Base, California, are 50 to 60 years old. Additionally, the two launch locations aren't standardized.

"It's a problem akin to the late 19th century when every railroad had their proprietary rail sizes and rail spacings," General Shelton noted. "Once they standardized the gauges, all of them realized more efficient operations, lower costs and greater profits."

The general acknowledged current budget decreases as a silver lining that will force the many agencies that use the various launch facilities to work together.

"My vision for the future of space launch as it relates to our ranges is that they become planned communities instead of the hodgepodge of one-off capabilities and specialty facilities they are now," General Shelton said. "We are working toward an intra-range standardization solution to combine operations, maintenance and sustainment into a single contract known as the Launch and Test Range System Integrated Support Contract, or LISC.

"Technical education is often referred to as STEM--science, technology, engineering and mathematics," General Shelton said, "and the lack of these graduates in America could constitute a national security issue in the broadest sense." The general, who is also an astronautical engineer, explained the current STEM-educated workforce is aging.

"Over 30 percent of the people in the aerospace industry nationwide will be eligible to retire next year, and that number grows to 40 percent by 2014," he explained. "We need an exciting STEM curriculum to keep students interested in these subjects through high school so they'll have the choice and the chance of majoring in them in college," the general said.

General Shelton called for partnership between industry, non-profit educational institutions, educators in school districts, colleges and universities to encourage STEM education and careers and shared some examples.

"Just think how many kids we could get off the fence and down the path of a STEM career once they got to participate in some real-world science and engineering," the general said, "encouraging high school summer internships with industry."

General Shelton wrapped up his speech by emphasizing the foundational level of space capabilities required to keep national defense strong during challenging fiscal times.

He said, "There's a foundational level of space that enables many taken-for-granted aspects of Americans' way of life and enables the way the nation's military has learned to fight.

"From highly secure, worldwide communications to navigation and timing; from combat weather observations to the missile warning capabilities critical to defending our homeland, it's tough to imagine a military without these critical capabilities," the general said.

General Shelton also emphasized space assets supporting civilian endeavors, like pay-at-the-pump fueling, in-car navigation systems, hurricane tracking prediction, and national infrastructures like banking and emergency response. "I believe there's a foundational level of space support that we must sustain to continue to enable America's military operations across that spectrum of conflict," the general cautioned. "Cutting below this foundational level, the level I believe we're already very close to, would likely have cascading effects across the entire Department of Defense."

Satellite Rebirth = Phoenix Recycling Program

by David Barnhart, Phoenix ProgramManager, DARPA

Communication satellites in geosynchronous orbit (GEO), approximately 22,000 miles above the Earth, provide vital communication capabilities to warfighters, providing everyting from Intelligence, Surveillance and Reconnaissance (ISR) to mapping to weather reports to command communications and battlefield analysis/tracking. Today, when a communication satellite fails it usually means the expensive prospect of having to launch a brand new replacement communication satellite is the answer. Many of the satellites, which are obsolete or have failed still have usable antennas, solar arrays and other components that are expected to last much longer than the life of the satellite — currently have no way to re-use them.

The goal of the Phoenix program is to develop and demonstrate technologies to cooperatively harvest and re-use valuable components from retired, nonworking satellites in GEO and to demonstrate the ability to create new space systems at greatly reduced cost. Phoenix seeks to demonstrate around-the-clock, globally persistent communication capability for warfighters more economically by robotically removing and re-using GEO-based space apertures and antennas from de-commissioned satellites in the graveyard or disposal orbit.

The Phoenix program envisions developing a new class of small 'satlets', or nano satellites, which could be sent to the GEO region more economically as a "ride along" on a commercial satellite launch. They would then attach to the antenna of a non-functional cooperating satellite robotically, essentially creating a new space system, leveraging the System F6 architecture. A payload orbital delivery system, or PODS, will also be designed to safely house the satlets for transport aboard a commercial satellite launch.

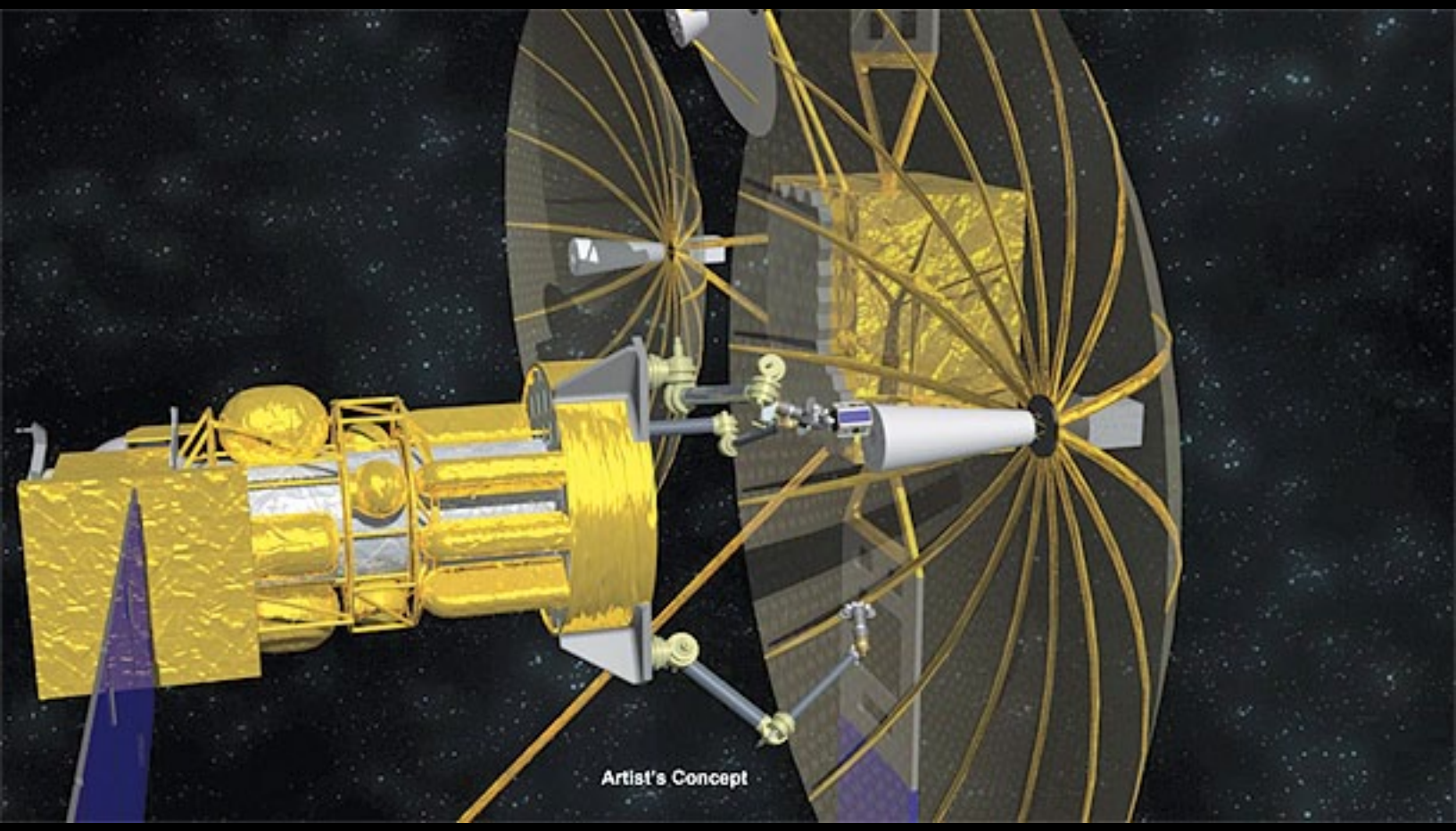
A separate on-orbit 'tender,' or satellite servicing satellite, is also expected to be built and launched into GEO. Once the tender arrives on orbit, the PODS would then be released from their ride-along host and link with the tender to become part of the satellite servicing station's 'tool belt.'

The tender plans call for it to be equipped with grasping mechanical arms for removing the satlets and components from the PODS using unique space tools that will also be developed in the program.

The traditional process of designing, developing, building, and deploying space technologies is long and expensive. Through Phoenix, DARPA seeks to hasten the insertion of emerging technologies into space system development at a much lower cost.

Critical to the success of the Phoenix program is active participation from the international and non-traditional space communities involved in vital technical areas such as:

- Radiation tolerant micro-electronics and memory storage
- Distributed "wireless" mobile platform solutions for ad-hoc connectivity and control industrial electronic control systems
- Terrestrial micro-miniature guidance and control measurement units
- Industrial robotics end effectors and tool changeout mechanisms and techniques



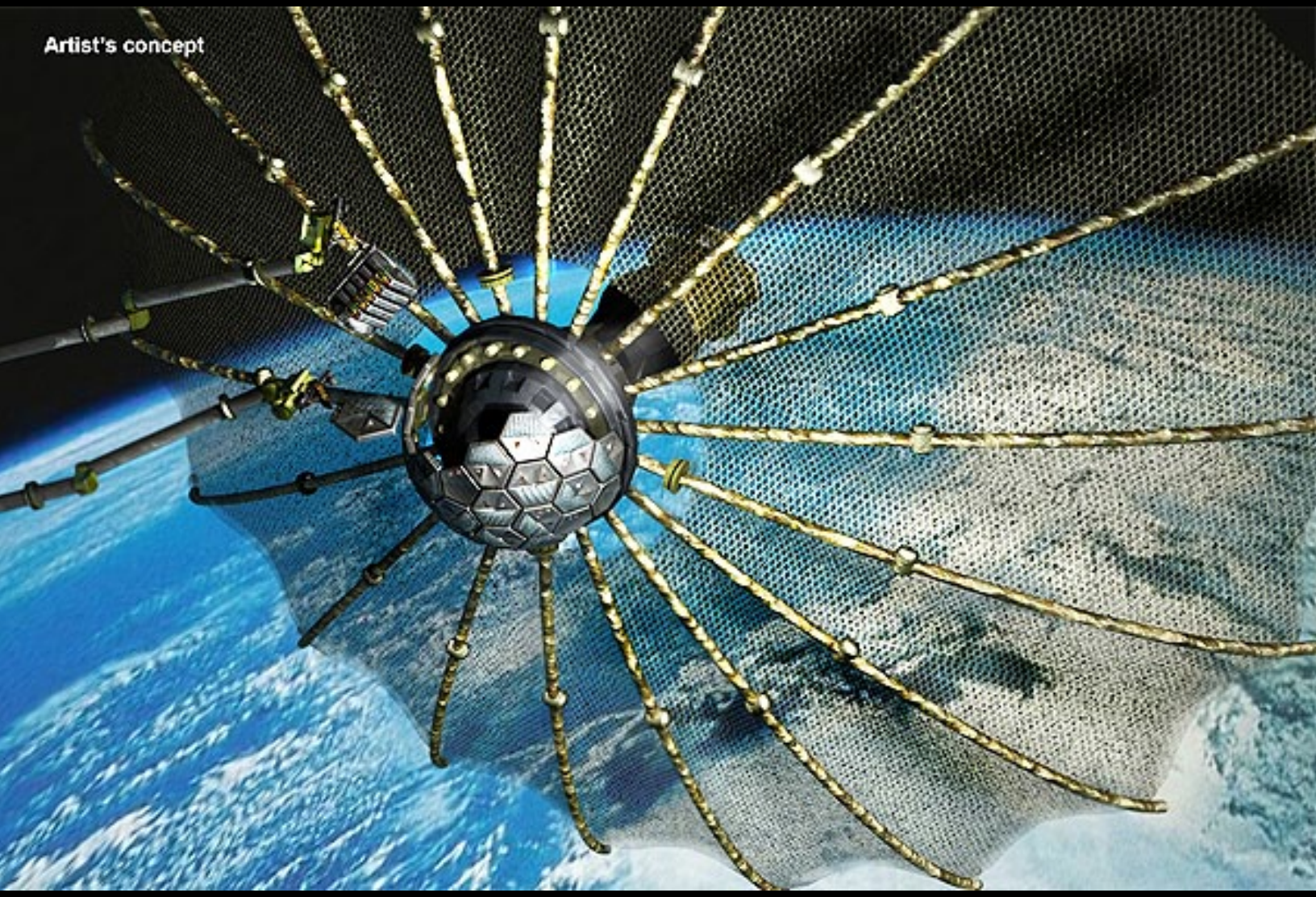
INTEL

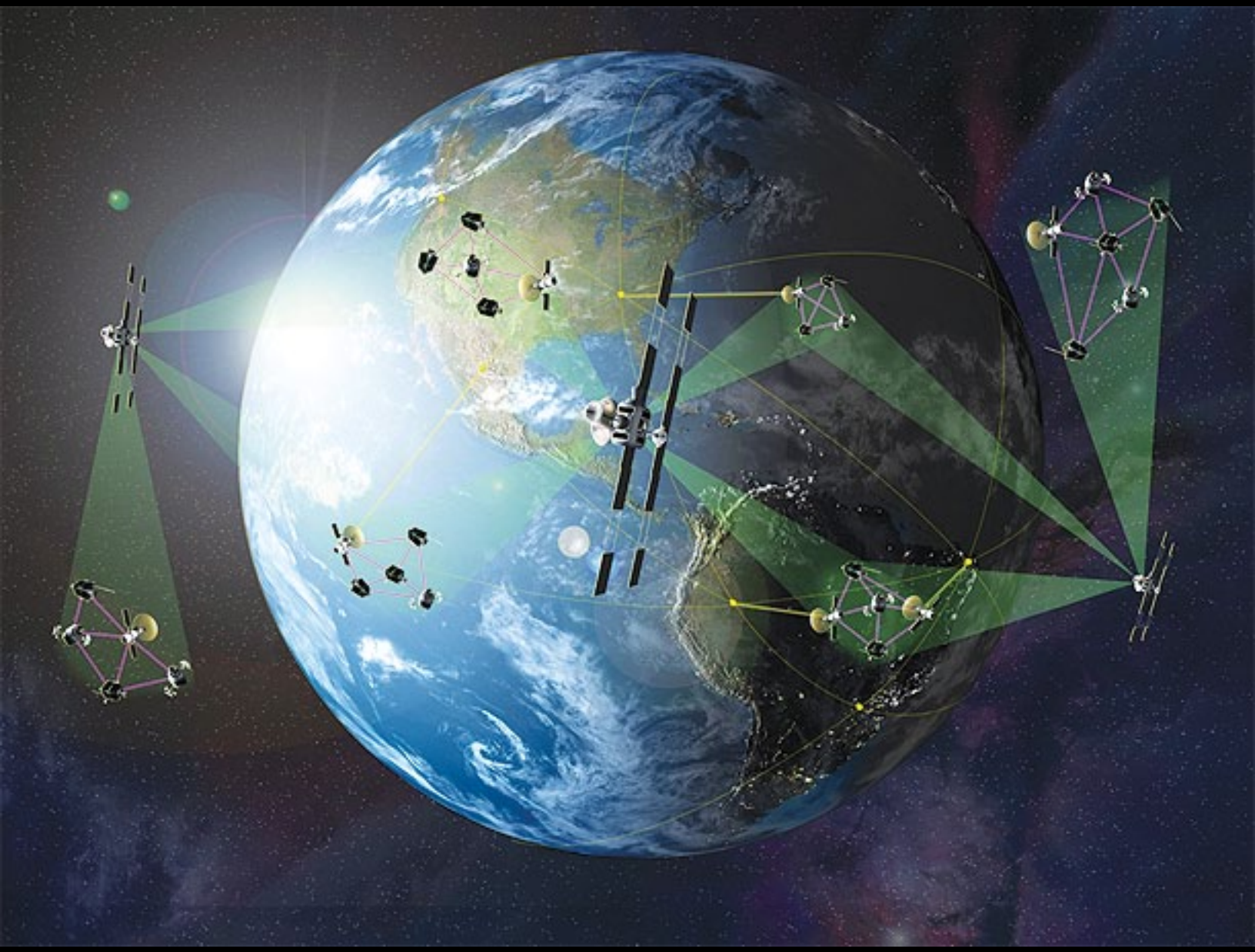
- Computer-assisted medical robotics micro-surgical tele-presence, tools and imaging
- Remote underwater imaging/vision technologies used in the offshore oil and gas drilling industry
- Terrestrial manufacturing of high volume micro-electronics and computer data storage
- Terrestrial thermal management design technology of electronic devices and systems
- Low-cost industrial manufacturing of high volume sheet metal and other structural materials
- Additive manufacturing on various structural materials

The first keystone mission of the Phoenix program in 2015 plans to demonstrate harvesting an existing, cooperative, retired satellite aperture by physically separating it from the host non-working satellite using on-orbit grappling tools controlled remotely from Earth. The aperture will then be reconfigured into a 'new' free-flying space system and operated independently to demonstrate the concept of space "re-use."

Editor's Note:
Thanks to DARPA's Tactical Technology Office for this article.

Website: **www.darpa.mil/**





Another project, developed under the National Cyber Range (NCR) program, finds DARPA developing the architecture and software tools for a secure, self-contained testing capability to rapidly emulate large-scale complex networks that match the depth and diversity of real-world networks. The capability, demonstrated at scale with an operational prototype, will enable realistic testing and evaluation of new cyberspace concepts, policies and technologies by the Department of Defense (DoD) and other federal entities. DoD's Strategy for Operating in Cyberspace, released in July 2011, highlights the NCR's role in DoD's pursuit of revolutionary cyberspace technologies. The NCR complements federal cyber testing capabilities by providing rapid and automated configurability and scalability for users across the government. It should provide a 5-10x reduction in the time and cost to test and evaluate new cyber tools while improving confidence in the real-world performance of these tools, a vital feature considering the extremely dynamic and evolving real-world cyber threat. The NCR is designed to allow potentially virulent code to be introduced and tested on the range without compromising the range itself. Additionally, multiple experiments will be able to run on the range simultaneously at different security levels, maximizing the range's use across government agencies.

Three's A Charm... When It Comes To Mission-Critical Communications

by Steven Horr, Chief Architect & Engineer for AGN + Ronald Watt, Senior Director, ARINC

Now, more than ever, our military personnel need secure, flexible and affordable voice, video, and data communications solutions that they can count on anytime and anywhere. From command centers around the globe to remote operations in the field; in the wake of a disaster or as part of daily operations; whether sending complex mission plans or critical logistics information — reliable military communications networks are essential to our national security and the safety of the warfighter.

With RapydConnex, ARINC extends connectivity and Open Systems Interconnection (OSI) Layer 3 Enterprise Network Management from fixed terrestrial connections to Beyond-Line-Of-Sight (BLOS) IP broadband secure and non-secure connections for fixed and mobile applications. The ability to proactively manage mission-critical communications is now possible anytime, anywhere military operations demand.

Moving Beyond Connectivity

In order for communication systems to be reliable, the ability to proactively monitor, control and manage the flow of traffic through the network is essential. Yet, traditionally, satellite communications has been offered by providers as an OSI Layer 2 connectivity path, making reliable communications difficult to ensure.

Layer 2 is one of seven layers defined by the OSI model to characterize and standardize the functions of communications systems. In general, the first two layers are focused on physical connectivity, Layers 3 and 4 focus on management and operations, and the top layers focus on usage and applications. By using Layer 2, satellite communications providers deliver the physical connection but can't support overall monitoring or management of end-to-end system performance. If the network fails, takes hours to connect to, doesn't perform at necessary speeds, or can't handle bandwidth requirements, the user is left in the dark while hardware vendors, software vendors, and service providers try to identify and resolve the issue. The more remote the user, the more difficult and time-consuming the process becomes.

When mission success requires reliable communications systems performance, this model simply doesn't work.

The Benefits Of Layer 3 Enterprise Network Management

Satellite communications networks with end-to-end Layer 3 Enterprise Network Management that is built-in ensure communications systems performance and free the user from management headaches. The benefits of Layer 3 enterprise network management are many, including:

- Enterprise-wide performance monitoring — with Layer 3 support across the entire enterprise service, coupled with a design that supports multiple communication paths, the service provider has end-to-end visibility across every aspect of the network to quickly identify or anticipate potential performance issues

- Fault monitoring and proactive management — ubiquitous Layer 3 support at the transport layer means that the service provider has the tools to proactively monitor all devices across the network to the endpoints and automatically switch over to redundant, or alternative, systems in the case of failure. For example, typically a service provider doesn't have the visibility to see that a landline has been cut. However, with a managed network device (router) at the endpoint of the data flow supporting Layer 3 visibility, the service provider can quickly identify the issue and seamlessly switch to a redundant or alternative connection path.

- Dynamic switching between different networks — with intelligence built-in IP mobile devices, when users move from one coverage region to another, or for best performance, the device can automatically switch from one type of network to another — terrestrial, satellite or even wifi — immediately and seamlessly reconnecting with no loss of IP sessions or phone connections. IT administrators don't need to be involved, even in the event of a network failure.

- Effective application of policies — network policies, such as those related to security, load balancing, quality of service (QoS) management and performance management can be set to automatically enforce compliance with internal and external regulations across the enterprise.

- Improved help desk visibility and responsiveness — a U.S.-based Network Operations Center staffed by U.S. citizens around the clock shifts management responsibilities to the service provider and frees up agency resources for other mission-critical initiatives.

- Establish server clouds without any performance penalties — leveraging in-network virtual servers, agencies can transition applications, such as inventory management, to the cloud with minimal risk. Using this approach, the end-user devices can use a web interface to operate without storing sensitive or classified information. Hence, if the device is lost or seized then the data isn't compromised

- Lower overall operational costs — shifting the management burden to the service provider reduces IT staff costs, enforces network performance with service level agreements (SLAs), minimizes downtime thus increasing user productivity and advances support for mission-critical operations in the field by leveraging pre-built infrastructure.

These benefits are only possible with true Layer 3 Enterprise Network Management — a comprehensive approach to proactive performance monitoring and control. Offering Layer 3 controls only on particular devices or architecture segments fails to deliver the end-to-end visibility, access and management mission-critical operations require. With government personnel increasingly on the move, Layer 3 support needs to be woven into the very fabric of communications architecture design and services.

Layer 3 In A Mobile World

Today's military and government operations require mobility and the power of Layer 3 is quickly being applied to this arena. Layer 3 is an ideal enabling technology for IP mobility, opening up a world of sophisticated applications to support mission-critical activities reliably and securely wherever resources are needed, including the following examples.

- Remote Operations: When operating in remote areas, military forces and other government agency personnel must be able to relay critical voice, video and data transmissions — simultaneously and at broadband speeds — regardless of the platform (land, air, or sea).

- Disaster Communications: In the wake of any disaster, emergency responders immediately mobilize to begin rescue and recovery efforts and need the most effective, interoperable and coordinated communications capabilities possible.

- Cyber Operations Support: With threats coming from every direction — terrorist organizations, nation-state actors, and individual hackers — government needs a common operating picture. Situational awareness and analysis across physical, virtual and cloud-based network operations is needed to stay ahead of cyber threats and mitigate costly downtime and breaches.

- Inventory Management: In a world of ongoing military conflict and regularly-occurring global disasters, responding forces require an immense amount of logistical support. This includes total asset visibility of critical supplies and weapons in storage, in transit and in-theater, as well as reliable and secure transmission of massive amounts of data.

Connecting personnel and systems deployed across the U.S. and around the globe is a cornerstone of mission success. In every one of these scenarios, when infrastructure is lacking or compromised, the combination of full IP mobility, alternate communications paths, and Layer 3 Enterprise Network Management delivers fast and reliable communication.

Government and military organizations need assurance that their communications systems are performing at the highest levels. The service providers that support them must be able to demonstrate a Layer 3 mindset — this includes technology, service and a vision for the future of communications.

About the authors

Mr. Steven Horr is the Chief Architect and Engineer for the ARINC Global Network (AGN) and for RapydConnex solutions. Mr. Horr has over 25 years of technical and managerial experience in the design, development, implementation, application, integration, and production of communications, signal processing, and information management systems for military and commercial applications. He architected, designed and led the implementation of the AGN which combined six legacy network systems into a secure, homogenous communication network that supports the needs of all ARINC services and customers.

Mr. Ronald Watt is the Senior Director for ARINC's new RapydConnexSM product line. He has over 30 years of DoD and commercial experience in space systems. Mr. Watt provides expertise in systems engineering and integration, communications systems, and enterprise management systems.

A Vision for Layer 3 Enterprise Network Management

ARINC is a world-class provider of secure, mission-critical network and messaging services to the air-transport industry, government and military organizations, rail transport providers and other customers. With a nearly 30+ year history in cockpit communications, the ARINC Global Network (AGN) was created from the ground-up as a worldwide Layer 3 managed transport service. Designed, built, owned and operated by ARINC, AGN is proactively managed 24 x 7 by ARINC employees at the company's U.S.-based Network Operations Centers. The AGN spans 160 countries and delivers more than 25 million messages per day with reliable, secure and flexible communications services to more than 10,000 commercial aircraft and many US government agencies. Designed to provide an availability of 99.999 percent, the company's worldwide IP backbone has never lost a single packet of data since 2001.

With RapydConnex, ARINC extends connectivity and Layer 3 Enterprise Network Management from the AGN fixed terrestrial connections to Beyond-Line-Of-Sight (BLOS) IP broadband connections. With secure and non-secure connections for fixed and mobile applications, military users can, in effect, move their desktop to the battlefield. The ability to proactively manage mission-critical communications is now possible anytime, anywhere military operations demand. RapydConnex offers land mobile, aircraft, or marine terminals for user applications.

Interest In Spot Beam Capabilities Of Ka-Band Systems

by David Alexander, Business Development Manager, Space Communications Systems, Harris

The demand for bandwidth continues at exponential rates, driving operators to search for new solutions. Recently, attention has turned to the emerging Ka-band, high-throughput satellite (HTS) market and solutions that utilize multiple spot beams to serve a region or regions of interest. The key advantage of the spot beam approach is increased frequency reuse, enabling a significant increase in the capacity of a given satellite. This, in turn, allows operators to more efficiently use their frequency spectrum allocations.

Key Technologies Maximize Benefits of Spot Beam Systems

GEO satellite operators are investing in and deploying ever-increasing numbers of ***High-Throughput Satellites*** (**HTS**) into the GEO-arc, resulting in an increased capacity and reduced cost-per-bit for enterprise customers and individual consumers, and providing new competition to some established terrestrial operators.

While the future is difficult to predict — and the success of these HTS systems is not fully demonstrated — bandwidth demands continue to rise at ever increasing rates and both direct-to-home, enterprise and mobility users will continue to be key drivers of that increase.

The success of HTS satellites hinges on three enabling technologies to fully exploit the inherent benefits of spot beam systems: larger apertures, multi-beam feed developments, and enhanced satellite bus capabilities. This article will focus on the need for larger apertures to support HTS systems.

Larger apertures are a key enabler for future HTS systems to provide smaller spot beams and increased gain performance over smaller solid reflectors. The smaller spot beams are needed for high capacity frequency re-use strategies, as well as to increase gain to minimize the required user ground terminal aperture. The primary technology challenges for larger reflector apertures are surface performance and pointing stability at Ka-band frequencies. Two reflector technologies have recently been adapted to support operations at Ka-band and address these challenges. The first is an extension of existing, flight-proven Radial Rib unfurlable mesh reflector technology and the second is a non-unfurlable, Fixed-Mesh Reflector. Both types of reflectors can provide for smaller spot beams and increased gain to support advanced frequency re-use strategies.

Unfurlable, Radial-Rib Design

Unfurlable mesh reflector technologies are well understood, have extensive flight heritage, and recently have been adapted for Ka-Band multi-beam applications. A five-meter, unfurlable mesh reflector projects a spot beam size of approximately 0.2 degrees from GEO, allowing multiple spots to cover the same area that a typical smaller solid reflector spot beam would normally cover. Multiple spots covering the same geographic area increases the potential number of users for a given coverage area. A typical 5-meter unfurlable reflector is shown in *Figure 1.0.*

Ka-band operations using a 5-meter aperture require a surface accuracy of 0.3 mm, or 0.010 inches on-orbit or better. Building on the existing Radial Rib reflector technology, higher accuracy is achieved through the use of additional surface shape control points and by careful selection of material combinations to achieve the best possible thermal stability. This approach does not require any new or unproven materials or changes to existing thermal controls. Surface accuracies that support Ka-band operations have been successfully demonstrated and RF analysis of resulting beam patterns have shown acceptable performance can be achieved with large unfurlable reflectors.

A typical Radial Rib mesh reflector with flight heritage is shown in *Figure 2*. The system shown is operating today as part of the Tracking and Data Relay Satellite (TDRS) at Ku-band, with 12 flight units delivered and more than 28 years of operational experience on the oldest TDRS reflectors.

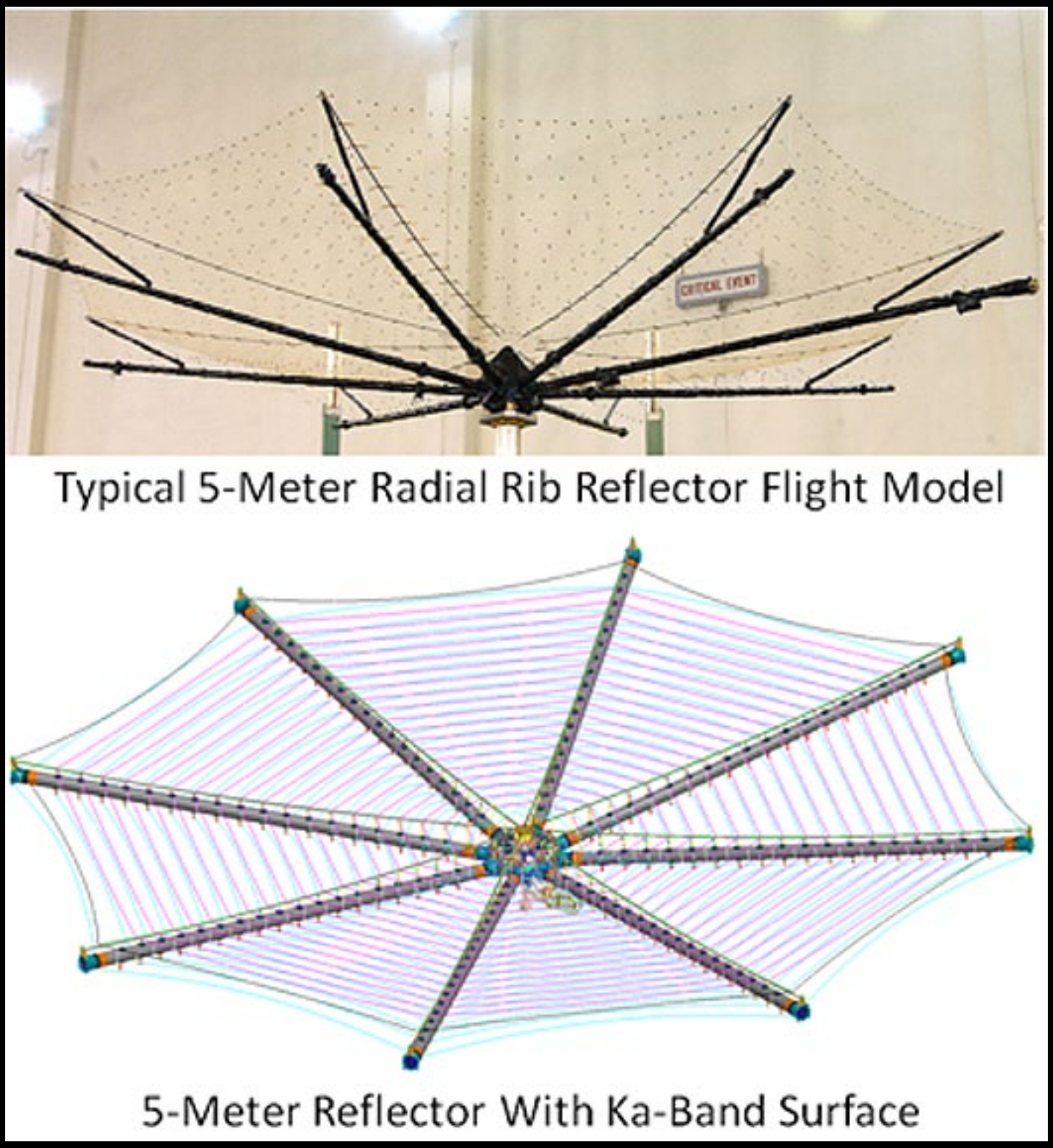


Figure 1: 5.0m Ka-band Reflector

The Radial Rib reflector design is ideally suited to address the pointing concerns of small spot beam systems, with the addition of an antenna pointing mechanism (APM) located behind the deployment mechanism in the center of the unfurlable reflector structure, directly along the focal axis. The APM, when coupled with a tracking feed in the feed network, assures accurate pointing of beams. This mitigates the need for more demanding satellite pointing required by smaller spot beams at Ka-band. The simple deployment and unique mounting scheme of the radial rib reflector design, with the positioning of the APM directly in line along the focal axis, greatly simplifies the required translation and tracking adjustments needed.

The radial rib design provides the simplest and most reliable solution available in the industry. More than 15 radial rib reflectors have been successfully deployed operationally dating back over 30 years and most recently in the successful deployment of two 9m reflectors in 2009 on the **Sirius-XM *FM5*** satellite.

Fixed-Mesh Reflector Design

Leveraging patented mesh technology and high-accuracy, unfurlable reflector knowledge, the Fixed Mesh Reflector (FMR) replaces the solid or tri-axial weave surface of a traditional, non-unfurlable reflector system with a highly reflective surface of mesh supported by a low-distortion graphite support structure, as shown in *Figure 3.0*.

The mesh surface has better RF performance at Ka-band than comparable tri-axial graphite surfaces and approaches that of a solid graphite surface with exotic surface treatments. In addition, the development of mesh materials that operate with minimal losses up to 50GHz and beyond has been accomplished and can be readily applied today.

Use of high reflectivity mesh technology can enable inter-satellite links via V- and Q-bands, and has potential usage for gateways, freeing additional spectrum in Ka-band for potential users (if issues such as atmospheric losses can be accommodated).

A mesh surface results in significant savings in the mass of the reflector – as much as 50%. In addition, a mesh surface significantly lowers the acoustic response, and loads into the spacecraft. Lower loads result in less interface structure required to support large reflectors for launch, and thus results in additional mass savings on the spacecraft.

Once deployed, solar torque loads from the FMR are much less than a solid or tri-ax weave reflector, increasing potential satellite life and reducing the amount of fuel needed for station keeping. The high mesh transparency (~90%) also reduces the thermal interactions with the spacecraft.

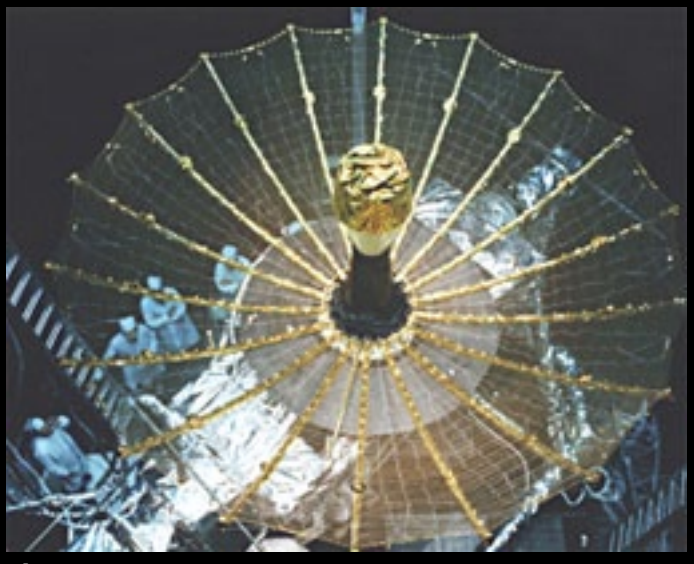


Figure 2
4.8m TDRS S-/Ku-band Antenna
12 Units - Operating since 1983

Figure 3: Fixed Mesh Reflector

The FMR is best suited for larger reflector systems, from 2.5 meters to 3.5 meters, where substantial mass savings can result. The 3.5-meter aperture FMR allows for smaller spot beam coverage of a given geographic region over existing 2.6- to 2.7-meter standard systems, and supports the increased capacity goals of operators.

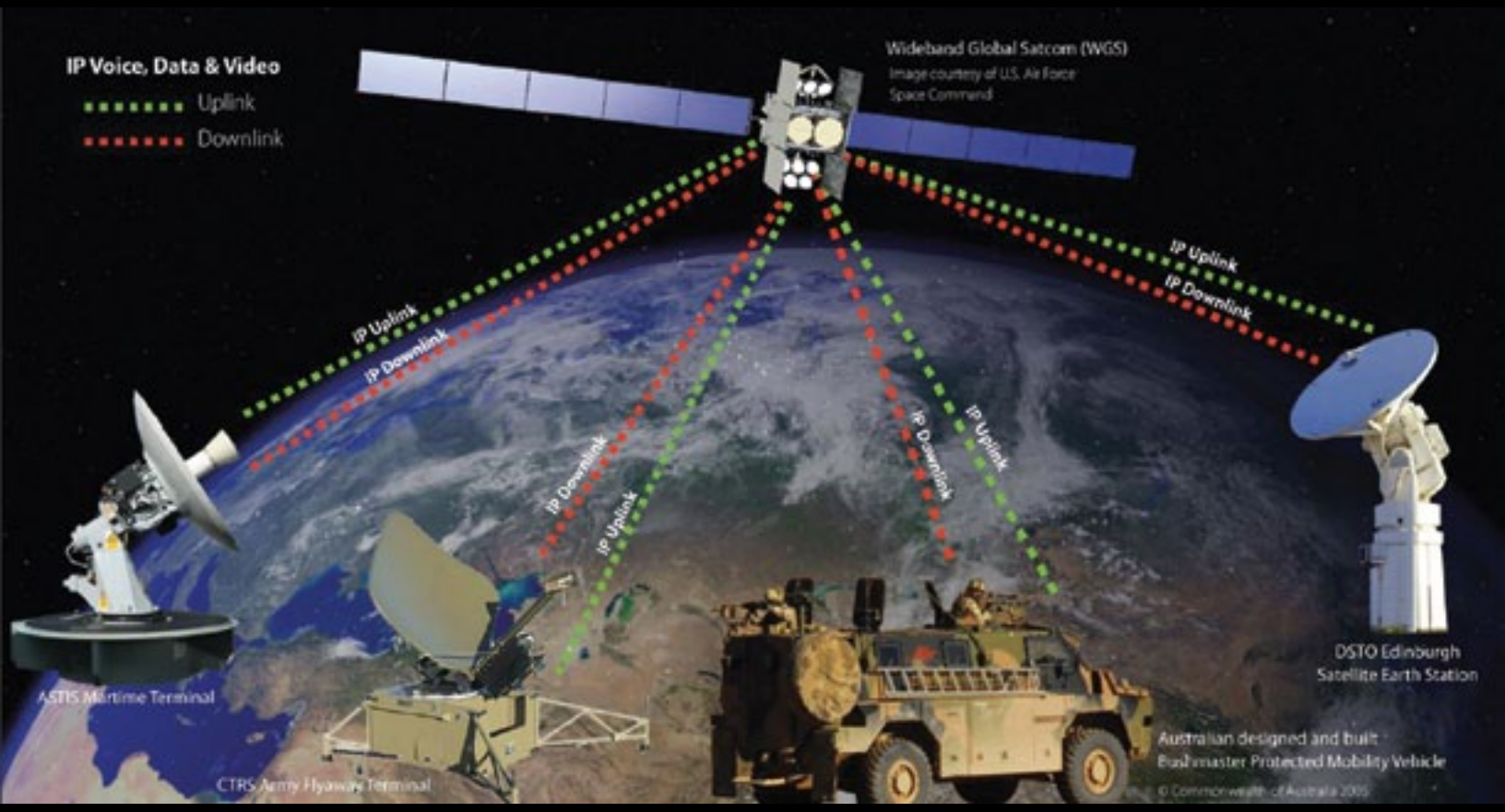
The Ka-Band Unfurlable Mesh Reflector and the Fixed Mesh Reflector both are viable technologies needed to fully capitalize on the move to Ka-band spot beam, high-capacity systems. Though these technologies were directed at implementation on Ka-band systems, they can easily be implemented at any frequency range including C-, X- and Ku-bands to provide small spot beams, allowing for frequency re-use and resulting increased system capacity. As future satellite systems continue to demand increased gain, smaller spots, and higher accuracies, the current state-of-the-art reflector technologies are prepared to support the emerging HTS market.

About the Author

David Alexander has more than 25 years of experience in the area of precision unfurlable reflectors and antennas for space applications. Since 1983, he has had various roles within the Space Communications Systems (SCS) business of Harris Corporation – an international communications and information technology company, and a leader in the development of unfurlable reflectors and steerable, solid Ka-band antennas. He is currently a Business Development Manager for the commercial product business area within the SCS business. Prior to this assignment, he was an Advanced Programs Engineer responsible for the development of engineering solutions and program identification with the business unit. He is a member of SSPI and AIAA.

Staying On Track — Satellite Communications On The Move

Mobile communications are continuing to surge in growth, driven by two key factors — the need for greater throughput to support ever more demanding multimedia user expectations, and the need to communicate anywhere, anytime. Fiber, for all its benefits, can satisfy only the first requirement. Meeting the second requirement calls for a wireless solution, and satellites, long denigrated by the fiber community, are the only realistic choice for untethered, long-haul, high-capacity communications from anywhere in the world. In particular, Ka-band satellites, operating at frequencies around 30 GHz, offer much greater channel bandwidths and data throughput than existing satellite solutions at lower frequencies, such as X- and Ku-band.



However, true mobility demands that communications can continue even while users are themselves travelling, for instance in a plane or on a four-wheel drive vehicle. This presents a major problem for satellite communications, because at the microwave frequencies typically used, the signal is directional and the terminal antenna must be oriented directly towards the satellite, for optimal signal transmission and reception. Systems capable of finding the satellite and maintaining the terminal oriented towards it, even from a moving vehicle, are known as On-The-Move (OTM) systems.

Although there are many X-band and Ku-band satellite tracking antennas for OTM applications, only a few have been developed for Ka-band. Most of these are adaptations of lower-frequency systems, rather than designs specifically for Ka-band operation.

The Differences At Ka-Band

What are the differences with OTM systems operating at Ka-band?

First, the Ka-band signal has higher path loss and is more susceptible to atmospheric effects than lower frequency signals. Increased free space loss must be compensated for by higher antenna gain — either a larger antenna, or an antenna that is more accurately "focused" on the satellite.

Second, the wavelength at Ka-band is a mere 10mm in air, and even shorter in typical radome materials such as plastic or fiber. This means the signal can be severely refracted as it passes through the radome, and traditional methods of correctly pointing the antenna must account for the change in angle the signal will suffer as it passes through the radome.

This can be particularly important for OTM applications, as the moving platform will cause the signal to pass through different apertures on the radome as the platform moves. The change in angle of incidence as the signal passes through different sections of the radome can cause refraction in the same way as occurs with an object immersed underwater, shifting the apparent position of the satellite. This is not only a function of motion of the platform, but also of the frequency of the signal, requiring that the tracking signal and communications signal are at the same frequency and derived from the same apparent source.

This effect becomes worse in the high Ka-band frequency band, and is exacerbated by the use of circular polarization in the signal since the effect is also polarization dependent.

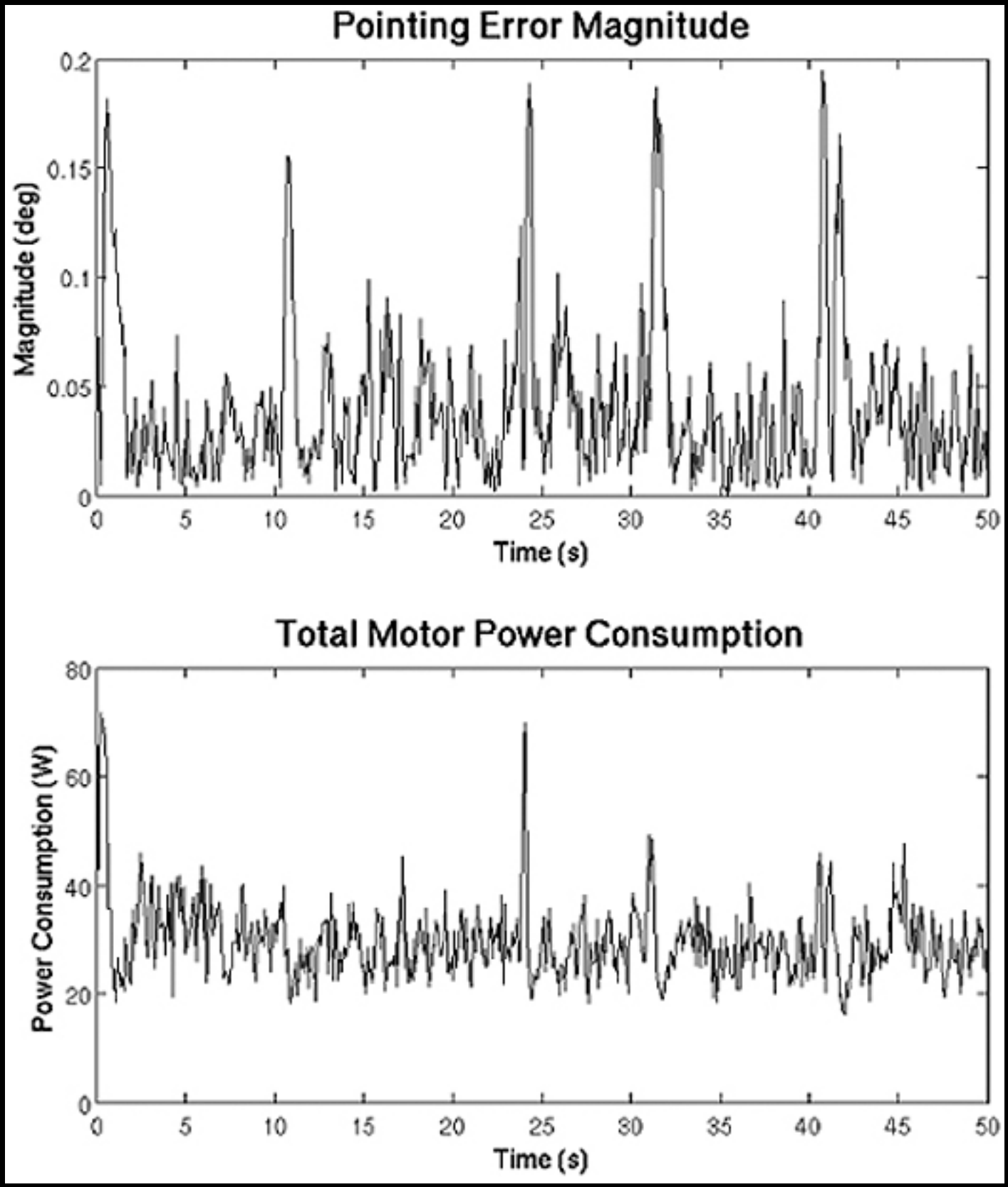
With the deployment of the Wideband Global SATCOM (WGS) system by the U.S. military among other Ka-Band satellite deployments, coupled with the demand for continuous Command and Control (C2) on the Battlefield, the demand for OTM terminals operating at Ka-band is expected to increase. With the increase in the number of small terminals deployed, it becomes imperative that these systems use the channel bandwidth available to them efficiently.

EM Solutions, a Brisbane-based advanced manufacturer of innovative microwave communication systems, has developed a dedicated Ka-band On-The-Move Satellite Communications System under Australia's Defence Capability & Technology Demonstrator (CTD) Program. The CTD program is designed to investigate and demonstrate technology, and EM Solutions has used the opportunity to implement a number of innovations to improve the performance thresholds for a Ka-band OTM antenna system.

The purpose of this article is to describe some of the challenges in working at Ka-band frequencies.

Mechanical Design To Physical Control System Modelling

At Ka-band, with millimeter wavelengths, mechanical and electromagnetic considerations are even more closely coupled than at X- or Ku-bands. Modelling these effects is critical in the design of the RF system. Achieving high output power levels with solid state components requires careful combining of active power devices — no mean feat at such high frequencies! EM Solutions solid state power amplifiers use a novel three-dimensional serial power combining technique that achieves


Pointing Error Magnitude
Magnitude (deg)
0.2
0.15
0.1
0.05
0
0
5
10
15
20
25
30
35
40
45
50
Time (s)
Total Motor Power Consumption
Power Consumption (W)
80
60
40
20
0
0
5
10
15
20
25
30
35
40
45
50
Time (s)

the highest power density (in the smallest volume) in the industry.

However, mechanical design of the stabilization platform is itself a critical task. Design simulation tools will import mechanical designs, created using a 3-D CAD package, into a physical model of the control-system. This modelling extracts mass and inertia properties, joint locations and the physical appearance of the system. EM Solutions used SolidWorks and CosmosWorks for mechanical design, and Simulink and Matlab (MathWorks products) to create mechanical and system control models. This then provided a design platform to optimise and update the tracking system.

The entire antenna control system was incorporated into the model, including non-linear effects such as noise and bearing friction, to yield an accurate physical model. The design process was iterative, with the model being updated to match measurements made on constructed jigs.

Recorded motion data (real or simulated) can be used as an input to the system model in order to simulate the expected tracking performance. EM Solutions used recorded vehicle motion data from a test vehicle (Bushmaster) in the system simulation model. Typical simulation inputs included limits up to 65 degrees per sec for rotational velocity; 300 degree per sec2 for acceleration; and up to 10Hz frequency vibrations. Simulations then allowed the tracking control loop design to be optimised. The following image shows plots of the pointing error magnitude, and motor power consumption of a Ka-band tracking antenna simulation model. The power consumption of the tracking platform can be a critical design constraint in moving vehicles, since their power budget is often limited by other

operational systems. In our case, the total power budget of the entire satellite terminal system was limited to 500W. The power consumption of the system was minimized by "balancing" the RF components at the base of the antenna, to keep its center of gravity balanced in a neutral position, avoiding the need for constant use of the tracking motors to simply maintain the static balance of the system.

Antenna Tracking Mount

Motors and their associated tracking amplifiers need to be optimised as part of the control loop design. This process involves sending test waveforms through each motor in order to characterise the motor response to various inputs. Modifications to the amplifier circuit may be required to meet design control loop parameters of the tracking mount.

Encoders are also required as part of the motor drive circuit and to determine axis position. There are two options for rotary encoders — absolute and incremental. Absolute encoders have the advantage that they provide axis position at any instant without needing to move the axis. The drawback is that absolute encoders are more complicated and they are mostly optical, which may not be robust enough for certain applications. Incremental encoders need to have some sort of homing (e.g. a limit switch or another encoder head) in order to determine the absolute axis position. Furthermore, because the control system will generally integrate the pulses coming from the encoder to determine the absolute axis position, any noise that causes pulses to be missed or added will gradually deteriorate the measured position and cause inaccuracies. There are also more options available for incremental encoders compared to absolute encoders, including both magnetic and inductive forms.

Physical Effects — Friction and Balance

Friction causes the tracking mount to lose its pointing angle during vehicle motion, so the motors must apply torque to overcome the friction. High friction within the motor and bearings result in the motors having to use more power to overcome the friction. Having some friction in the bearings/motors, however, does alleviate power consumption as the motors will otherwise need to compensate for any out of balance effects. Friction will automatically tend to hold the mount in its present position.

Balance is a critical factor in tracking mount design, as having a balanced system (i.e. one where the axes pass through the centers of mass) can aid in reducing power consumption and increase system performance. In an unbalanced mount, linear acceleration of the vehicle will translate into rotational motion about the axes, forcing the motors to consume power just to maintain the original pointing angle. A more balanced design can avoid this effect.

Keyhole Effect

A further challenge with satellite tracking mounts is the "keyhole" effect, which occurs when the mount is required to track a satellite at elevation angles approaching 90 degrees from its base (i.e. looking straight up). In some systems, to reduce the overall vertical height, the drive does not permit the antenna to point directly overhead. In this region, such a tracking system would need to rely on its gyros and an external navigation system (referred to as non-closed-loop tracking) to achieve a position as close to vertical as possible, until the antenna is once again able to track the satellite. This blind region may also result in a large movement around the azimuth axis during the reacquisition process.

A system with a two-axis tracking mount, known as an Azimuth and Elevation (Az-El) mount, will experience the worst keyhole effect. When such a mount is facing straight up i.e. at high elevation angles, the azimuth may need to track to a direction which could require a rotation of up to 180 degrees.

The simplest way to prevent the keyhole effect in such a two-axis system is to increase the vertical profile of the antenna mount to allow it to face straight up, in spite of the issue of massive rotation. However in some applications this extra vertical height may be unacceptable, since it increases the height of the total system. To avoid this, more complicated approaches will need to be considered, such as using an additional cross-elevation axis, or using an offset feed. An offset feed, though, simply shifts the pointing problem to lower angles of elevation.

The best solution then is to add a third axis to the system oriented at 90 degrees to the primary elevation axis. This cross-elevation axis may only need limited angular movement to reduce the load on the azimuth axis when the mount is pointing at high elevation angles. The additional degree of freedom in elevation will allow direct overhead pointing with the base able to rotate to an optimal position. Tracking control loops will need sufficient bandwidth on the azimuth axis so it is able to move to a new optimal position before the angle limit on the elevation axes are reached. Adding the second elevation axis will increase the cost and height of the terminal as more mechanical and control system design is required, however it will ultimately result in power savings and less wear on the azimuth axis.

The Value Of Closed-LoopTracking At Ka-Band

Ka-band SOTM operation on the WGS satellite constellation imposes quite stringent constraints on pointing-error control. These constraints are due to a combination of regulatory and link-budget considerations required to efficiently use the available bandwidth on these satellites. For example, during transmission, it is important the beam is pointed directly at the desired satellite, rather than off-centre, where it may leak to another satellite or reduce the desired signal level below its detectable threshold. While the actual pointing-error requirement for a SOTM terminal will depend on a number of parameters, it is likely to be of the order of a few tenths of a degree.

This degree of pointing accuracy is very difficult to achieve with an open-loop tracking system that relies solely on inertial measurement systems to steer the antenna. Furthermore, inertial measurement systems rely on GPS measurements made at a frequency that cannot account for beam refraction through the radome, and are therefore susceptible to radome variations and large offset errors that depend on the angle of incidence and the RF frequency of the measurement signal. Therefore, EM Solutions has adopted a closed-loop tracking system that directly measures the pointing-error using the satellite signal itself.

The pointing-error is the deviation between the desired antenna orientation and its current actual position. It is the control signal that drives the tracking system. A closed-loop control system will attempt to reduce the pointing error to zero. There are many well-known methods for estimating pointing-error. These include:

- Mechanical scanning
- Monopulse
- Phased array (scanning and multi-beam)

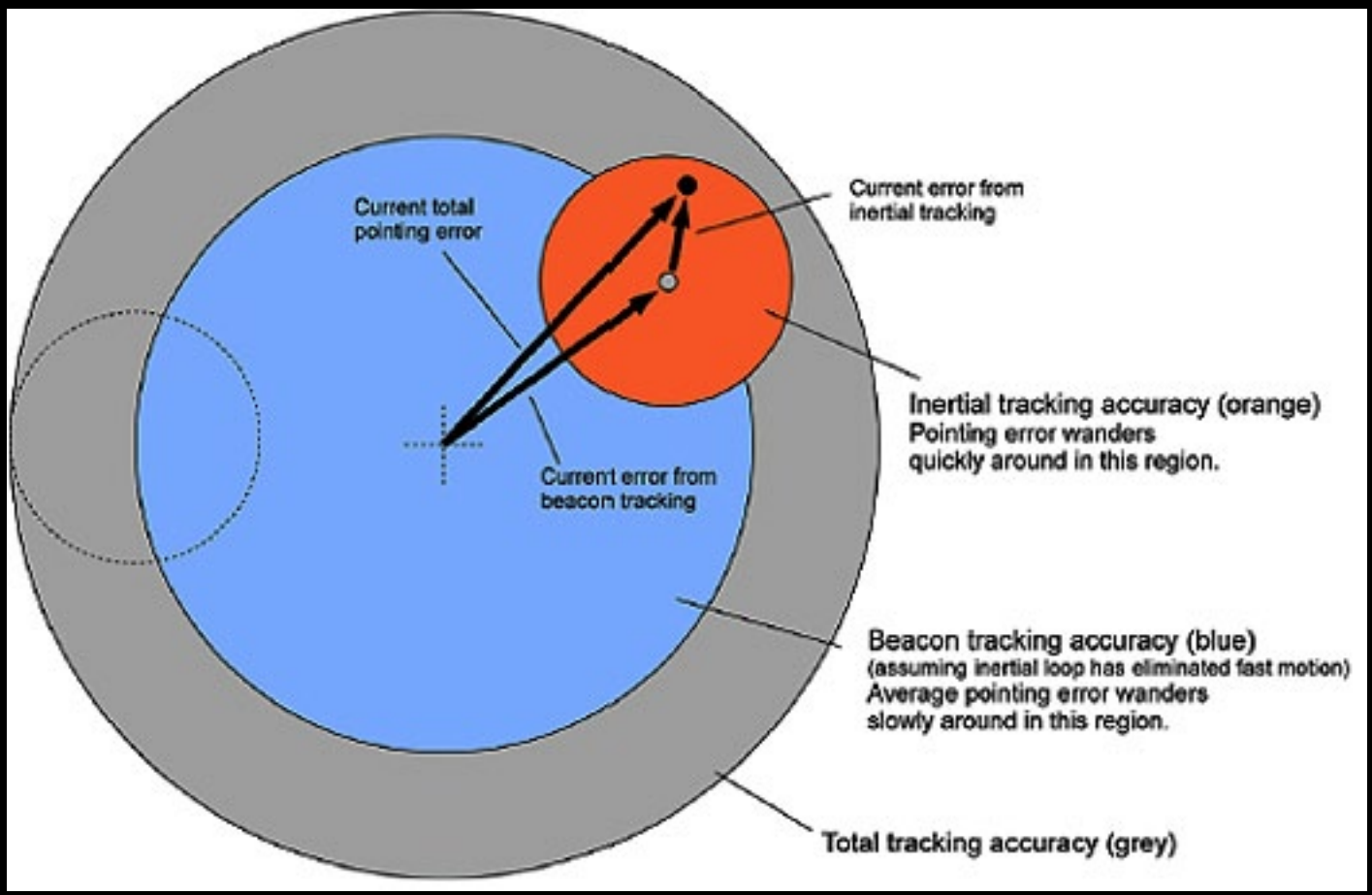
All of these approaches would normally rely on the use of a beacon on the satellite.

A. Mechanical Scan

A conventional reflector antenna can be mechanically scanned to estimate the pointing-error. Examples of this approach are conical scan and step-track. Mechanical scanning has two main disadvantages: It requires introducing a deliberate pointing-error, which can reduce the link budget; and it requires rapid mechanical motion so that pointing-error can be tracked during motion of the vehicle.

B. Monopulse

Monopulse systems are able to estimate the pointing-error without any mechanical scanning and without needing to deliberately mis-point. Monopulse antennas generally have two feeds: One feed has a normal antenna pattern, while the other has a pattern with a sharp notch along the bore-sight. By comparing the signals from the two feeds, the magnitude and direction of the pointing-error can be determined.



While the monopulse is an attractive solution to the problem of determining the pointing-error, it still has a number of disadvantages. Monopulse feeds are generally mechanically complex and so tend to be physically large, making it difficult to integrate into a SOTM terminal. They also require at least two phase matched down-conversion chains.

C. Phased Arrays

Phased array antennas have many features that would be beneficial for SOTM. For example, the beam could be steered rapidly, by electronically phase shifting the input signals (the so called "inertia-less beam"), enabling the use of a high-speed scan without mechanical motion to estimate the pointing-error. Alternatively, a multi-beam phased array could also be configured to operate in a monopulse mode.

Unfortunately, phased array operation at Ka-band presents many technical difficulties. In particular, it is very difficult to share the physical aperture between transmit and receive signals because of the frequency separation between the uplink and downlink bands. This means the phased array antenna must be nearly twice the size of a conventional reflector, if it is to achieve the same system gain. Other challenges are also introduced by use of a phased array, for example ensuring that transmit and receive beams point in the same direction, and proving that regulatory requirements, such as antenna sidelobes, are satisfied for all possible pointing angles. The technical challenges of phased array operation at K-band make the conventional reflector antenna a more attractive solution.

Estimating Noise + Pointing-Error

The pointing-error signal, no matter how derived, is required to steer the beam into the correct orientation from its current position. Thermal noise from the antenna and LNA will cause noise on the estimated pointing-error, no matter which of the pointing-error estimations techniques are adopted.

Noise on the pointing-error estimate will induce errors in the control signal. The antenna control loops treats the noise as a "real" pointing-error and will try to track it out, thus inducing a "real" pointing-error. The antenna control loops can only track the noise at frequencies up to their loop bandwidths. Therefore, the antenna control loop acts effectively as a low-pass-filter on the noise.

Narrow-band filtering of the beacon signal is normally required to increase the carrier-noise ratio well above the threshold required for estimation of the pointing-error. Choosing the filter's bandwidth is a compromise. It must be narrow enough to reduce noise to a tolerable level, yet it must not be so narrow that it upsets the stability of the antenna control loop and excessively slows down the tracking response. The actual bandwidth required is a function of many system parameters, but values are likely to range from hundreds of Hertz to a few kilo-Hertz.

Actual pointing error induced by noise on the output of the beacon signal processing is only one part of the total pointing error budget. Control systems generally will also still use gyroscopes to correct for higher frequency motion that cannot be corrected quickly enough by the control loop. The following diagram illustrates how beacon noise and gyro inaccuracies combine to result in a total pointing error.

Doppler Shift + Frequency Offsets

The challenges do not end there. Because the platform can be travelling, the satellite beacon, used to generate the pointing error, suffers Doppler shift. Uncertainty in the beacon frequency is consequently quite large. This is due to drift in the satellite's own local oscillator as well as the Doppler shifts caused by vehicle motion. The frequency offset can be several hundred kilo-Hertz, and the Doppler shift can change at a few kiloHertz per second as the vehicle maneuvers. These frequency offsets normally exceed the filter bandwidth typically required in pointing-error estimation. This means that some form of tracking filter is required.

A conventional Phase-Lock-Loop (PLL) tracking filter could be used to follow the wandering beacon signal. However, a Fast Fourier Transform (FFT) based approach is a possible alternative if the pointing-error calculation algorithm is relatively tolerant to small frequency offsets. With either approach, a balance must be reached between the speed, and the accuracy of the filter's frequency tracking.

Summary

The information above describes some of the options that were considered during the design phase of EM Solutions Ka-band Satcom OTM system. After taking into consideration the performance requirements for operation on the WGS constellation, together with the design options outlined above, it was evident to the engineering team that the most cost-effective and technically low risk option would be to design a tracking system based on a parabolic antenna utilizing closed-loop beacon signal tracking specifically for Ka-Band.

The program has culminated in the production and successful demonstration of a prototype Ka-Band SATCOM On-the-move terminal which provides synchronous satellite link data rates

Ka-band On-The-Move Satellite Communications Antenna Terminal, developed for the ADF by EM Solutions.

of 2Mbps up and 8Mbps down. EM Solutions has since conducted further development of the terminal to improve the systems RF performance and evolve the terminal from a prototype to a production Satcom On-the-move system. The system will be commercially available in 2012.

About EM Solutions
EM Solutions is a technology provider to commercial and military customers in the telecommunications sector. EM Solutions is a market leader in the supply of Ka-band products to defence and enterprise customers. Their products include LNBs, BUCs and SSPAs, and Fixed Point-to-Multipoint radios based on the WiMAX IEEE 802.16d standard.

Acknowledgement
The support and cooperation of the Australian Department of Defence through its Capability Technology Development program, which made this work possible, is gratefully acknowledged.

Wrap Up — SMi's MilSatCom 2011, London

The decision as to which MILSATCOM trade shows, exhibitions, conferences and events to attend each year becomes more and more difficult, given budget and travel restrictions, press of business, and locations. For those who have come to lean upon SMi's conferences as their source for such events, the 13th annual Global MilSatCom 2011 event, held late last year, was a definite success.

There was a fantastic array of International speakers from the SATCOM arena. Global MilSatCom leads the way in offering attendees a wide range of international military speakers and the capability to network with key European and NATO players. This event presented speakers from South Africa, USA, UAE, Canada and the South American region to cover all the key international countries that lead the way in Military Satellite Communications.

New topics presented at this conference included coverage of UAV/UAS and Cyber Security, helping attendees remain updated on all of the latest developments within these market segments. Senior professionals presented included...

- Brigadier General *Gregory Brundidge*, Director, Command, Control, Communications and Warfighting Integration, U.S. European Command
- *Malcolm Green*, Chief CAT 9 NII Communication Infrastructure Services, NATO C3 AgencyColonel Patrick Rayermann (Ret'd), DOD Executive Agent for Space (EA4S) Staff, U.S. Army
- Colonel *Edwin Pinheiro*, Chief of Telematics, Ministry of Defence, Brazil
- *Rusty Collins*, ASSIST Project Manager, Defense Information Systems Agency (DISA)
- Brigadier General *Ian Fordred*, Director, Information Communication Technology (DICT) in the Command and Management Information Systems Division (CMIS), South African National Defence Force (SANDF)
- Colonel *Michael Lakos*, Chief MilSatCom Division, U.S. Air Force
- Colonel *Neil Fraser*, Department Head of Service Assurance, Ministry of Defence, U.K.
- Colonel *Christophe Debaert*, Syracuse III Team Leader, Ministry of Defence, France
- Lieutenant Colonel *Michael Delorey*, C4ISTAR Branch (Deployable CIS), NATO Joint Airpower Competence Centre (JAPCC)
- Lieutenant Colonel *Abde Bellahnid*, Space Development Department, Department of Defence, Canada
- Commander *Kevin Fincher,* Royal Navy, CBM J6 Operations 1 Head, Ministry of Defence, U.K.
- Commander *Andy Rayner*, Royal Navy, SO1 Core Networks, Cap CC&II, Ministry of Defence, U.K.
- Commander *Trond Hermansen*, Director SATCOM Advisory Board, CHOD Norway, Norwegian Armed Forces Commander
- Christophe *Le Garff*, Syracuse III, Systems Architect, DGA, Ministry of Defence, France
- *David Lascelles*, Deputy Head DCNS, Information Systems & Services (ISS) Programmes, Ministry of Defence, U.K.
- Dr. *Mohammed N Mubarek Alahbabi*, Information Communication Technology (ICT) Advisor, United Arab Emirates Armed Forces
- Major *John Genouw*, COMOPSLAND G6, Ministry of Defence, Belgium
- Captain *Thomas Lockhart*, Leader, C4ISTAR, General Staff, French Navy
- *Rodolophe Paris*, PT SatCom Chairman, Space & Radio Spectrum Project Officer, Capabilities Directorate, European Defence Agency
- *Kjetil Bilic Michaelsen*, Senior Engineer, Norwegian Armed Forces

Plus, there was also a half day pre-conference workshop whose topic was *Why Ka? Understanding the benefits and shortcomings of Ka-Band Mobile Satellite Systems*. The special workshop was presented in association with Cobham. For more information on the SMi Group's conference schedule:

http://www.smi-online.co.uk/default.asp

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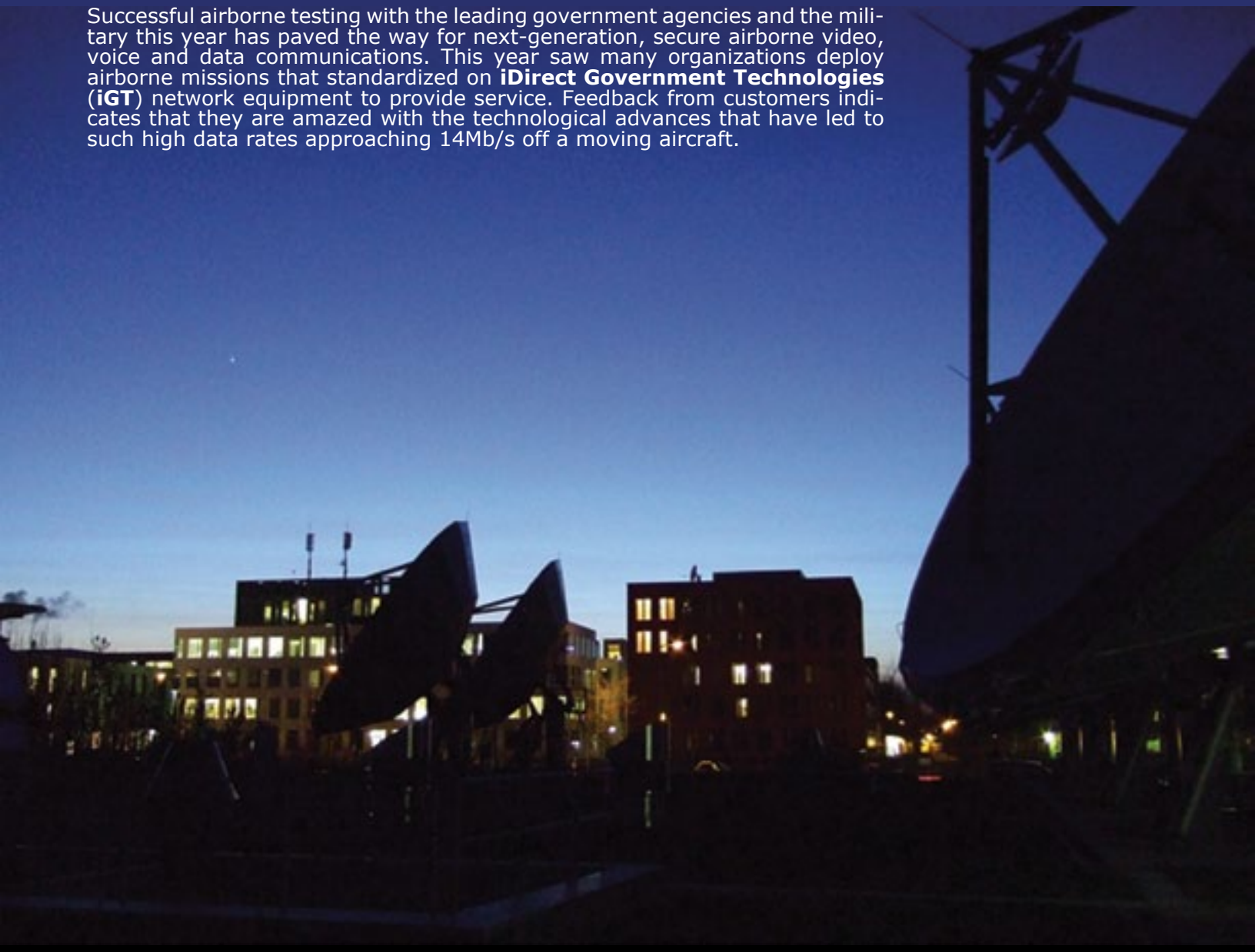
- Providers of Satellite Services
- General Services
- Satellite Operators
- Geosynchronous Satellites
- EIRP Maps
- Uplink Facilities
- Buyer's Guide and Index

The Impact Of Airborne Technology

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

Looking back on 2011, the advances in speed and throughput of SATCOM signals have resulted in significant breakthroughs for airborne satellite communications. Similar to when battery technology enabled smaller military communications packs in support of the warfighter, technological airborne innovations are adding value to help the military meet its missions for both homeland security and disaster support. Airborne's achievements include the ability to upload full-motion video while in flight, giving the military a bird's eye view for intelligence, surveillance and recognizance. Airborne communications can be used for command assignments, target information imagery, and imagery of natural and man-made disasters.

Successful airborne testing with the leading government agencies and the military this year has paved the way for next-generation, secure airborne video, voice and data communications. This year saw many organizations deploy airborne missions that standardized on **iDirect Government Technologies** (**iGT**) network equipment to provide service. Feedback from customers indicates that they are amazed with the technological advances that have led to such high data rates approaching 14Mb/s off a moving aircraft.



Since airborne SATCOM was used in 2010 to send video images of the extent of the *Deepwater Horizon* oil spill and to track where the oil was spreading in the Gulf of Mexico, made possible by an iGT secure satellite communications backbone, more improvements have been made. These include the release of ***version 3.0*** of iDirect software that encompasses a sophisticated *Communications on the Move* (**COTM**)/airborne set to support full-motion video, increased data transmission speeds, and antenna control for automatic beam switching and the building of an iGT airborne platform.

Along these lines, iGT will deliver two ***e850mp*** series satellite router airborne enclosures — a standard 19-inch rack-mount unit and an ***ARINC 600*** enclosure — that will enable the e850mp Series Satellite Router Board to integrate with satellite data from various Ku-, Ka- and X-band airborne antennas. The e850mp router will provide a much-needed performance increase across all band communications throughout the military aircraft fleet to meet the growing demand for airborne communications.

In addition to airborne, the massive *Joint User Interoperability Communications Exercise* (**JUICE**), an annual worldwide exercise sponsored by the *Executive Agent Theater Joint Tactical Networks* and hosted by the *U.S. Army CECOM Life Cycle Management Command Software Engineering Center* at Fort Monmouth, New Jersey, and the *Coalition Warrior Interoperability Demonstration* (**CWID**), a *Joint Chiefs of Staff*-directed event that evaluates cutting-edge technologies and capabilities for information sharing, highlighted many MILSAT technologies in a joint task force environment. COTM demonstrations showed how military vehicles can be transformed into high-speed broadband-enabled networks, capable of supporting Internet, voice, data and video services, and bringing that same functionality to troop ruggedized laptops and IP phones.

At JUICE, iGT focused on the four tiers of the tactical edge of the joint information environment: Fixed centers, mobile centers, mobile platforms and dismounted users. Testing in which iGT participated included:

U.S. Soldiers with 2nd Platoon, Attack Company, 1st Regiment, 503rd Infantry Battalion, 173rd Airborne Brigade Combat Team set up a tactical satellite communication system in Shekhabad Valley, Wardak province, Afghanistan. Photo by Sgt. Russell Gilchrest

- United States Army Pacific Command (USARPAC) validation of network operation and communications interoperability while on the move
- Air Force, Air Force Reserve and Air National Guard operation of Theater Deployable Communications (TDC) Initial Communications Element (ICE) v3.0 Hub/ Spoke Satellite Architecture
- National Guard Joint Incident Site Communications Capability (JISCC) system participation
- Riverbed and LifeSize third-party product interoperability and performance testing

This year saw iGT debuting new *transmission security* (**TRANSEC**) *version 2.3* software, which is architected with guidance from **National Security Agency** requirements and includes over the air re-keying.

This latest edition provides the highest level of security available in modems. Additionally, iGT released a **FIPS 140-2 Level 2** hardware platform. These routers meet government and **Department of Defense** (**DoD**) requirements for security, providing fast, reliable, quality of service-enabled connections for COTM.

The iGT router "single box" solution includes a satellite modem, Internet Protocol (IP) router, optional encryption, transmission control protocol optimization over satellite and quality of service/ prioritization. The e850mp easily integrates into a portable, very small aperture terminal solution, delivering always-on broadband capabilities into smaller form factors that support data, voice and video connectivity in highly mobile military and government applications.

Managing Today's Networks

An inroad in 2011 was the introduction of ***SatManage*** web-based software tools that integrate, monitor and automate hybrid networks and *Network Operations Center* (**NOC**)-based applications. For integrated, satellite-based military and emergency response networks, such tools enable agencies to transform how they manage complex deployments, resulting in stronger network performance, faster response times and more secure communications.

SatManage Standard and ***SatManage Enterprise*** editions enable any network operator to streamline NOC operations, enhance customer visibility and provide a higher level of service and responsiveness, improving the overall efficiency of their network operations. NOC technicians can easily and proactively identify problem areas and initiate automated trouble-shooting and fault-management activities to solve network performance issues in real time. A comprehensive range of visual correlation tracking and reporting tools, and a centralized monitoring dashboard, provide immediate visibility into network performance so operators can rapidly identify, respond to and prevent service degradation. SatManage offers intuitive customer management tools and portal interfaces that provide enhanced communication, reporting and network visibility to customers to improve satisfaction.

Across the MILSAT industry, new hardware is making a difference in security as well as TRANSEC and FIPS being incorporated into offerings. Also evident is the increase in bandwidth and higher data capabilities. These improvements industry-wide will help the military in the battlefield and when responding to disasters such as hurricanes, flooding and other events.

On The Horizon

Within the next year, iGT will be positioned to better serve MILSATCOM customers with the development of smartphone applications for the commissioning of remotes in the field. What this means is that the workload of soldiers in the field will decrease as they will be able to bring remotes into a network without a full options file.

This mobile application for remote configuration and management speeds the deployment of remotes and simplifies the commission of them as well as the monitoring of them. Called ***iCommand***, this new app will be used to manage iDirect satellite routers and provide remote operators with the capability to monitor statistics and perform various remote functions from a smart phone. iCommand functions include:

- ◇ *Downloading/uploading options files*
- ◇ *Creating basic options files*
- ◇ *Upgrading/downgrading software*
- ◇ *Remote commissioning*
- ◇ *TRANSEC key configuration*
- ◇ *Manual beam selection capabilities*

iCommand allows a remote operator to commission an iDirect satellite router without the use of a PC. The remote commissioning function allows the remote operator to put up a continuous wave carrier or a pseudo noise carrier at a designated frequency and power. The remote commissioning function also includes a signal meter and a look-angle calculator. The operator can upgrade or downgrade the software on the remote modem, as well.

As can be seen by the MILSAT accomplishments achieved this year, and as the solutions gained through iGT technology progress, advances are helping warfighters to improve their tactical and communications skills in the battlefield environment.

Author's Bio

Karl Fuchs is Vice President of Technology for iDirect Government Technologies (iGT), a wholly owned subsidiary of VT iDirect, Inc., that delivers secure satellite-based voice, video and data applications with anytime and anywhere connectivity in the air, at sea and on land. iGT's satellite IP solutions are used for critical communications ranging from force protection, logistics, situational awareness, disaster recovery and emergency response; www.idirectgt.com. Fuchs can be reached at kfuchs@idirectgt.com.

Middle East Ops Have Australian SATCOM Support

NewSat's *Satellite Seminar* was held at NewSat's ***South Australian Teleport*** — the event, which was supported by **Defence SA**, the Australian government's leading defence agency, attracted more than 50 defence, government, resources and satellite industry heavyweights, and provided guests with insights and forecasts into the future demand for satellite capacity.

Satellite communications is a growing global market with many opportunities and the event reinforced Australia as a global player through its attractive, secure and unique space infrastructure.

Adding a global touch to the event, NewSat invited one of the world's leading satellite communications experts, *Marc LeGare*, Chief Executive Officer of Texas-based **Proactive Communications**, to discuss the global satellite industry and the military's growing demand for secure, mission critical satellite communications.

As 75 to 80 percent of the U.S. **Department of Defence** satellite consumption is supported by the commercial satellite communications arena, Proactive Communications' mission is to provide reliable and secure enterprise-class communication capabilities to government agencies, military, and corporate entities around the world through a partnership with **NewSat**. Since 2004, Proactive Communications has supported U.S. Army operations in the Middle East.

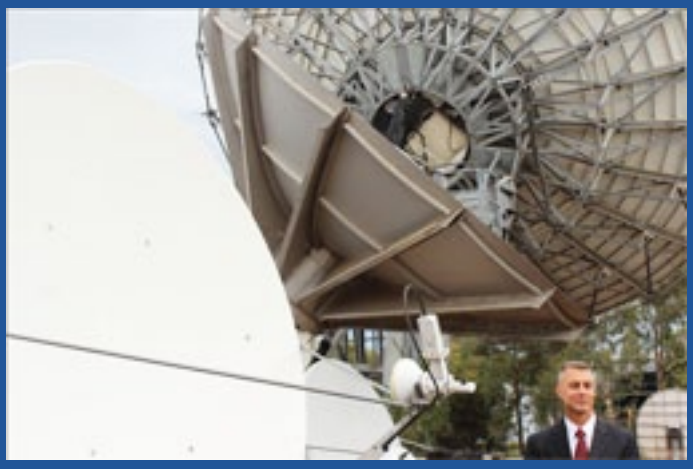
"Proactive's operations in the Middle East rely heavily on satellite communications. Almost everyone on the U.S. side, and from my experience in the Middle East, even the coalition forces have access to the open Internet for various purposes, whether it's for moral welfare and recreation, telephone, or for unclassified research, and it is all provided by satellite communications. Another great thing about satellite telecommunications is that in some cases the visible signs of the antenna system cannot be differentiated from other commercial customers." said Mr. LeGare.

At U.S. *Foreign Operating Base* (**FOB**) locations, reliance on communication technologies is crucial, as soldiers, emergency staff, medical technicians, firemen, electricians, construction builders and other various resource providers need to communicate to the camp commander and beyond. As they all use a variety of communications systems, Proactive Communications works towards providing a system to seamlessly tie together all communications services so that communications run smoothly between camps and the support headquarters.

While discussing this process, Mr. LeGare stressed the importance of satellites for the integration of camp communications. The process involves turning data, usually in the form of radio signals, into IP data streams via Internet Protocol addresses, which are then backhauled over the satellite to a Teleport, such as NewSat's in Adelaide, and then back to another base, or to the home country. "Where there are soldiers, there will be a need for satellite communications," Mr. LeGare said.

Moreover, in his business, there are many advantages of using Australian Teleports. According to Mr. LeGare, Australia is politically stable, geographically viable, and economically competitive.

"The element of national power that Australia has is the geopolitical position relative to a very complex, chaotic region of the world. Australia is safe, reliable and trusted and we share a common legacy. Australia also has the correct space infrastructure, with a range of satellites that can be seen from South Australia. I think these are some of the main things that Proactive Communications has discovered here, through our partnership with NewSat in Adelaide." he said.



Marc LeGarre + NewSat Teleport Antenna

Proactive Communications had to weigh its options when selecting a Teleport that would meet its customers' growing requirements. From America, they could go to the East, to Europe, and be one of many and be almost undifferentiated from their competition, or they could go to the West.

"What we did is we went to the West and what we found was a politically stable ally. We found a geographically optimal location here in South Australia where we were able to see from the Pacific rim of the United States all the way to Africa and Eastern Europe. Also, what we found out over time with NewSat is that it has the best radio frequency and sales and engineering team that we have ever worked with. It has a technically responsive, very flexible management team which accounts to PCI growth," Mr. LeGare said.

There is an ever increasing demand for high quality bandwidth via satellite in the military. In the future, Mr. LeGare predicts that every soldier will be linked into a communication network of fellow soldiers and political allies, which will enable overseas missions to run smoothly and efficiently.

"The U.S. soldier of 2016 is going to have to rely on data fusion, knowledge management, dynamic targeting and persistent Intelligence, Surveillance and Reconnaissance (ISR). All this data gets communicated via satellite. This makes for a growing, competitive market. For a team such as NewSat's, they can put together an entire delivery chain, from the Teleport to the satellite, to taking care of the customer out in the field — this is an exciting time," concluded Mr. LeGare.

According to Mr. LeGare, NewSat's Satellite Seminar marked an important milestone for the Australian satellite communications industry, which is distinguishing itself on the global stage.

Building End-To-End Networks For BLOS Airborne ISR Missions

In April 2008, the U.S. Department of Defense (DoD) empowered a new task force called **Task Force Odin** (**TFO**) to significantly improve *Intelligence, Surveillance and Reconnaissance* (**ISR**) capabilities in Iraq and Afghanistan. The DoD needed its airborne platforms to have a persistent and pervasive ISR capability with sensors and communication systems capable of simultaneously delivering real-time *full-motion video* (**FMV**) and 3D images, *Signal Intelligence* (**SIGINT**) and *Communications Intelligence* (**COMINT**) to both field and command personnel.

A critical requirement was for high bandwidth communication links from ISR aircraft to *Beyond-Line-of-Sight* (**BLOS**) locations. To achieve this, a global commercial satellite footprint was necessary to ensure worldwide coverage as required, especially in active hotspots. Other critical requirements included the airborne *Comms-on-the-Move* (**COTM**) equipment *size, weight and power* (**SWAP**), integration with existing aircraft power and navigation systems, performance and remote manageability. Airborne COTM solutions were expected to achieve commonality across multiple manned and unmanned platforms, wherever possible. Airborne systems integrity, accuracy, resiliency and availability were absolutely critical and of paramount importance for the forward deployed warfighter and command centers alike.

Tachyon's 18-inch Ku-band antenna, used for the MARSS program.

Tachyon was awarded the MARSS contract for airborne COTM systems supporting TFO. In fulfilling this contract, Tachyon identified and acquired the exclusive rights to satellites ideally suited for BLOS airborne communications, and even relocated one to cover both Afghanistan and Pakistan.

Tachyon designed and built the onboard system, integrating Tachyon's ***aXiom 9300*** Terminal with third party equipment, including an 18-inch satellite parabolic antenna, *Antenna Control Unit* (**ACU**) and satellite modem, aboard C-12 aircraft. Tachyon also designed, built and installed a completely redundant Earth station in Bagram, Afghanistan, which linked with its San Diego Network Operations Center (NOC) and the corresponding satellite equipment for the aircraft, enabling full remote monitoring, reporting and control. Tachyon's solution almost doubled the original speed of the SATCOM link, which allowed for both SIGINT and live video to be transmitted simultaneously between aircraft and satellite and delivered in real time to monitoring stations around the world.

Tachyon's turnkey *End-to-End* (**E2E**) solution met all of the U.S. Army's critical requirements, including a proven solution with a classical SWAP terminal, increased bandwidth throughput to support real-time video feeds, and the ability to support required commercial space segment capacity in-theater. Multiple ***aXiom*** systems are flying missions in Afghanistan today, delivering ISR data and video in real-time to command centers on the ground with worldwide reachback.

The deployment of a successful Airborne COTM Network relies on unwavering focus and dedication in executing each and every step of the total E2E solution:

- **Remote Customer Premises Equipment**: Integrate field-swappable custom terminal equipment on various aircraft platforms, using multiple antennas, ACUs, IRUs, routers and modems
- **Teleport**: Design, build, install and test completely redundant satellite gateways
- **Network Operations Center**: Perform seamless 24x7 monitoring of all aircraft and teleports from US-based NOC by developing customized NMS tools to increase operational efficiency and customer visibility while providing the industry's only financially-backed Service Level Agreement (SLA)
- **Tech Support**: 24x7x365 customer support helpdesk with professional support personnel
- **Space Segment**: Acquisition and deployment of extremely scarce satellite capacity for Airborne Networking
- **Training**: Educate field personnel in the operation of airborne satellite systems

Tachyon's aXiom 7000 Series of E2E solutions include hardware, software, engineering services, network services and space segment – integrated, tested, certified and managed for specific mobile platforms – all enabled by Tachyon's aXiom Services Platform (ASP).

About Tachyon

Tachyon was founded in 1997 and is headquartered in San Diego, California, from where the Company operates its world class Network Operations Center. Tachyon was the first 100 percent TCP/IP standards-compliant, carrier-grade, true satellite broadband network for the enterprise and government markets. With more than our 13 years of business, the Company has amassed a significant amount of engineering and operational expertise in delivering end-to-end satellite broadband communications solutions. We hold dozens of patents and maintain an important ongoing commitment to research and development.

For more information, access the Tachyon website:

http://www.tachyon.com/

Rescue In Space

by Robert S. Dudney, former editor in chief of Air Force Magazine

The first AEHF satellite looked like a goner, but the Air Force's unusual recovery effort pulled it back from the dead. The U.S. soon will begin heavy usage of a first-of-its-kind Air Force spacecraft stationed 22,300 miles above Earth. The Advanced Extremely High Frequency satellite will link the President, commanders, and U.S. forces the world over. It's built to work even in a nuclear war.

This step forward almost did not happen.

Space Vehicle 1, launched August 14, 2010, suffered many serious setbacks. The $2 billion spacecraft's main propulsion subsystem failed—it could have exploded — and it faced lethal space debris and radiation. The giant communications satellite could have died a quick death, but it didn't.

Instead, SV-1 was the beneficiary of a remarkable 14-month rescue effort. Last October 24, against very long odds, SV-1 finally eased safely into its assigned orbit. The Air Force expects it to enter full operational service in March.

With the satellite safely in its proper orbit, Air Force Space Command officers have begun talking fairly openly about the rescue mission. It is an unusual tale.

The AEHF program, one of the largest space programs of the decade, is designed to augment and eventually replace the legacy Milstar satellite communications network. Lockheed Martin is the prime contractor, Northrop Grumman built the payload, and everything is run by Space and Missile Systems Center at Los Angeles AFB, California. The constellation of four cross-linked AEHF satellites is expected to provide a communications capacity exceeding that of Milstar by a factor of 10.

However, the AEHF program fell behind schedule. A planned 2008 first launch was delayed by two years. For that reason, more than the usual anxiety attended its August 14, 2010, blastoff.

A giant Atlas V rocket flawlessly lifted SV-1 from Cape Canaveral's Complex 41. Once in space, the booster and spacecraft separated exactly as planned. The 13,420-pound SV-1 went into a highly elliptical orbit, meaning its altitude varied greatly from apogee (the point farthest from Earth) to perigee (the one closest to Earth). In fact, the satellite swung from 31,000 miles above Earth at apogee to 143 miles above Earth at perigee.

No one intended SV-1 to stay on that unstable path. USAF planned to use three AEHF satellite propulsion systems to drive the perigee up and apogee down, in time creating a circular geosynchronous Earth orbit. SV-1 was to wind up 22,300 miles above the equator, hovering almost directly over the Galapagos Islands.

It was at this stage — the start of the satellite "transfer" from HEO to GEO — that things went haywire.

The 45th Space Wing successfully launched the first Advanced Extremely High Frequency (AEHF) satellite onboard an Atlas V launch vehicle.

Fig. 1: Phases of the AEHF's Recovery

Phase	Operation	Perigee	Apogee	Completed
0	Space injection	140 mi	31,000 mi	Aug. 14, 2010
1 & 2	REA burns	3,000 mi	31,000 mi	Sept. 22, 2010
3	HCT burns 1	17,000 mi	32,000 mi	June 2, 2011
4	HCT burns 2	22,300 mi	22,300 mi	Oct. 24, 2011

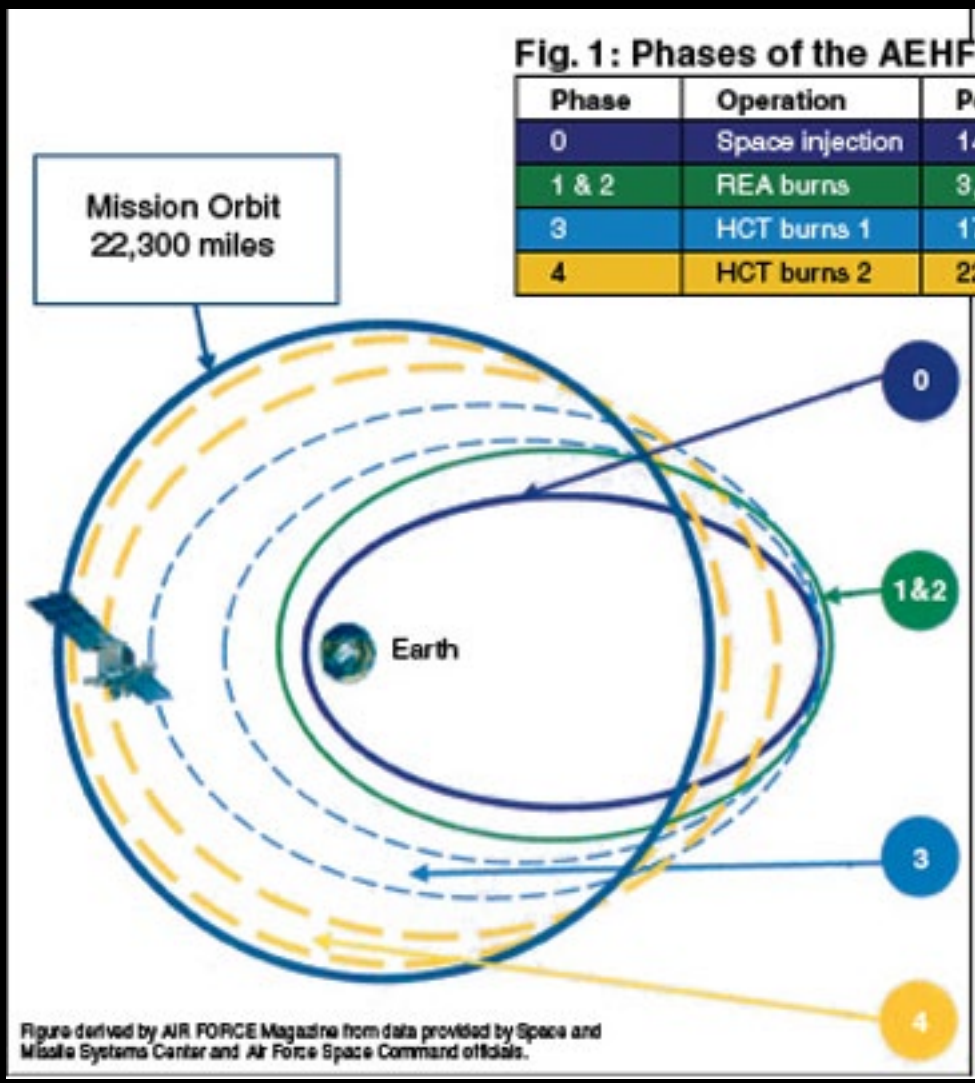


Figure derived by AIR FORCE Magazine from data provided by Space and Missile Systems Center and Air Force Space Command officials.

The mission profile called for operators to fire the AEHF satellite's hydrazine-fueled liquid apogee engine (LAE) several times. The thrust was supposed to raise SV-1's perigee to 11,800 miles in a short period. Smaller engines would then take over and continue the orbit circularization.

Alarm Bells

However, disaster loomed on August 15. USAF controllers and their contractor partners ignited the LAE and, after several seconds, the hydrazine engine failed. The AEHF satellite had detected a problem and shut the LAE down.

Operators were puzzled but not yet alarmed. Two days later, on August 17, they gave it another go. In a few seconds, the LAE shut down again, this time with ominous signs of overheating.

Col. Michael L. Lakos, the MILSATCOM command lead at AFSPC, recalled thinking that it was "an Apollo 13 moment." The words that came to mind were, "Los Angeles, we have a problem." The space vehicle had no readily apparent way to reach its orbit.

Alarm bells went off all over Space Command. The burden of responsibility fell on David W. Madden, the chief of SMC's MILSATCOM Systems Directorate and a recently retired Air Force colonel. His initial reaction was "that we'd lost the mission." At the time, he added, "there was huge uncertainty."

On August 17, Madden moved to assemble four teams of handpicked experts. The first question to answer: What had happened to the LAE? Madden's engineers rapidly worked through the telemetry and modelled the problem. They concluded — correctly — that the LAE had suffered a propellant-line blockage. Worse, they said, another firing could cause an explosion.

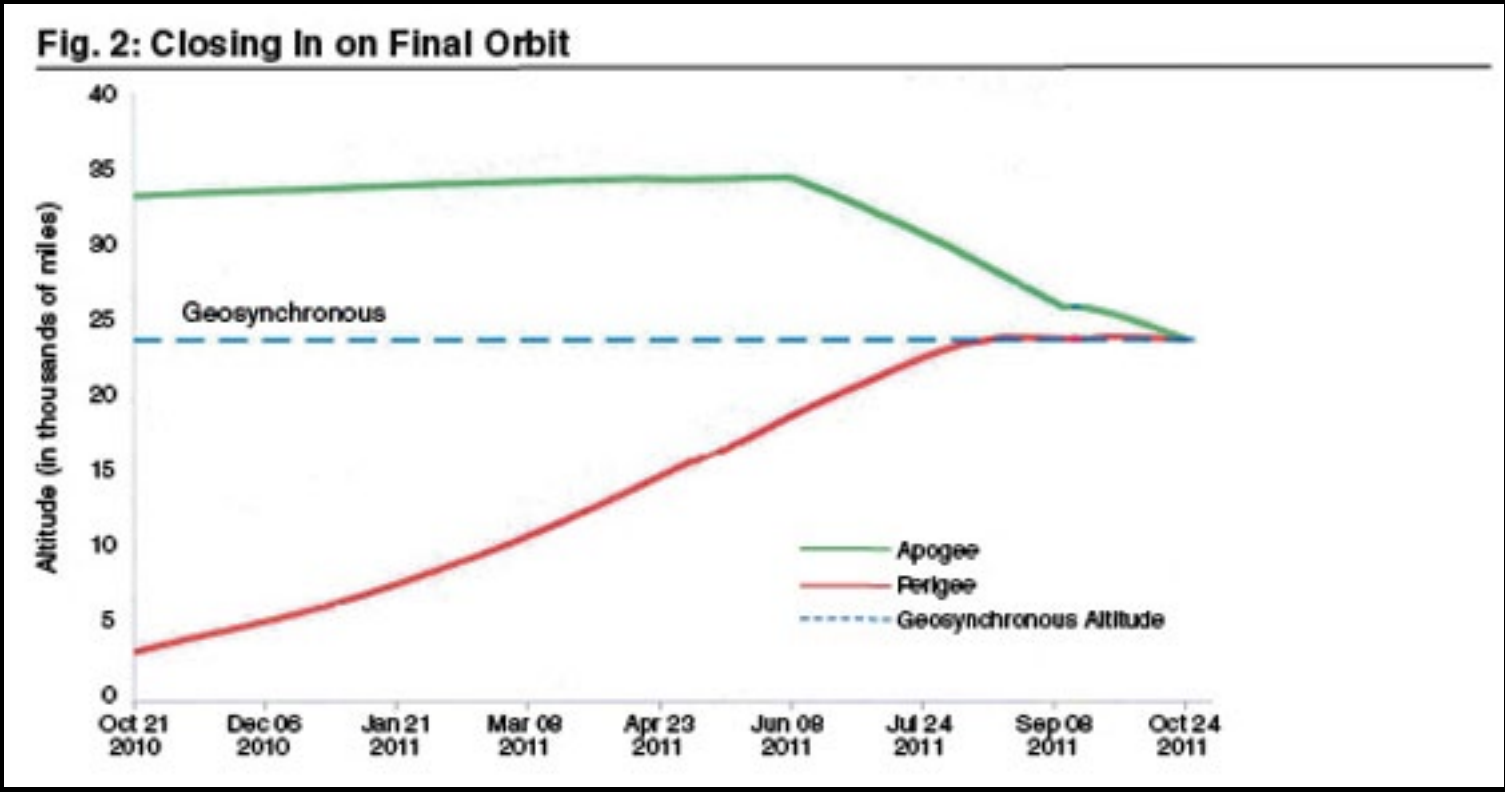
"They probably saved the satellite," said Madden of USAF's decision not to attempt a third firing. "We could have had combustion outside of the engine, which could have either totally damaged our payload or caused catastrophic damage to the vehicle."

"We're very, very fortunate that the satellite didn't blow up," said Gen. William L. Shelton, AFSPC commander.

Thus warned, USAF sealed off the AEHF satellite's oxidizer tanks, rendering the LAE safe but unusable. Madden's experts then set to work on a makeshift strategy to raise SV-1's orbit. They proposed to use the AEHF satellite's two remaining propulsion systems, though in ways no one ever had tried.

As the project got under way, team members were told — politely, but firmly — they were to stay put and continue the work until they sorted out the critical issues and developed a get-well plan. "We literally were shoving pizza under the door so that these guys could keep working," said Madden.

The pivotal show-and-tell moment came on Saturday, August 21 — a mere one week after launch and four days after the last LAE burn. Lt. Gen. John T. Sheridan, then SMC commander, held a meeting in Los Angeles, assembling senior experts from the contractors, program office, and AFSPC. Madden presented a notional plan, based on four distinct phases of action (*see Fig. 1, p. 54*).



The stars of the plan would be SV-1's two smaller engine types — hydrazine-fueled reaction engine assemblies (REAs) and tiny xenon-fueled Hall Current Thrusters (HCTs) of about 0.05 pounds of thrust.

In a vote of confidence, Sheridan gave a go-ahead, stepped back, and let his experts work the problem.

"The trust was significant," Madden said. "They gave us a lot of rope. Early on, that rope was critical...We were encountering problems [in] real time. We weren't having to report on the crisis of the hour."

"It was not a 'mother, may I?' thing," Lakos added. "It was basically an Air Force Space Command thing. It was, 'Let's go off and do this.' We didn't want to study something to death."

Phase 1 began right away and lasted only a few days. In it, Madden's team sought to quickly blunt the two most immediate dangers to the spacecraft. One was Earth's gravitational pull. The second was orbital debris.

"The way this thing was put into its initial orbit, it was very low — a roughly 140-mile entry point," said Madden. The drag exerted by gravity caused the satellite to lose more than three miles of altitude every day.

Equally worrisome was the prevalence of space debris at that orbital altitude. "That's a pretty nasty area," noted Madden. On several occasions, in fact, controllers had to maneuver SV-1 to avoid a collision with speeding space junk. This burned up valuable—and limited—fuel.

To get the satellite out of this danger zone, Air Force controllers on Aug. 29 began firing the spacecraft's REA thrusters. These motors had been designed to help stabilize the AEHF satellite, not propel it.

By early September, ground controllers had conducted four burns and the perigee had risen to some 600 miles above Earth. It was the end of Phase 1.

Phase 2 was essentially an extension of Phase 1, after a brief pause to assess results. USAF ground controllers continued to use the hydrazine-based REA thrusters to move the satellite. The goal was to raise the perigee from 600 miles to about 3,000 miles. That would prevent orbital decay, among other things.

Unusual Burns

New problems emerged. For one thing, the REA system was never expected to burn for time. During this time, SV-1 was held in fixed position, such that it was exposed to significant solar heating and potential damage.

In response, the team devised a technique that allowed ground controllers to occasionally flip over the spacecraft, thus giving exposed panels an opportunity to cool. Madden's experts had to

devise a whole strategy to carry out this maneuver while keeping the spacecraft on course.

The biggest problem of all: fuel usage. To minimize it, engineers had to write and upload new flight software to enable the plan to work and to save every ounce of fuel. This allowed the REA thrusters to be used in new, more efficient ways and allowed controllers to properly position the satellite using its onboard reaction wheels instead of fuel.

"We had to do the calculation to make sure that each time we burned, we knew exactly where we were going to end up," Madden said. "It's kind of like in 'Star Wars'—if you're going to jump to light speed, you had better know what's in your way."

During all of this, Air Force Space Command's 50th Space Wing worked the orbital aspects of these unusual burns. "It was almost like you're doing a launch," said Madden. "We had to do the orbital aspects every time we did a burn plan—every day, for a month. All of this was extra work, just absorbed by the 50th Space Wing guys," even as they handled regular Milstar operations. In addition, 14th Air Force personnel handled the mission's collision avoidance work, all of which was unplanned and taken up on an emergency basis.

In Phase 2, the daily burns of the thrusters tapped into the store of hydrazine once reserved for the LAE. The Madden team had calculated how much hydrazine could be used to try to get up to 3,000 miles at perigee, and still leave enough to do the mission once the satellite reached GEO—if it did.

On Sept. 22, 2010, the spacecraft reached a perigee of more than 2,900 miles. "That was

the optimum place to stop [the firing of the REA thrusters] and our use of that fuel," said Madden. The team had reached the end of Phase 2.

Phase 3 turned out to be by far the longest and perhaps most innovative part of the AEHF satellite rescue. It began in October 2010 and did not end until June 2, 2011. Those eight months saw the beleaguered satellite get far along in its trek to GEO.

Propulsion now was provided by the spacecraft's exotic Hall Current Thrusters, small motors that use electricity and xenon gas as propellant. The thrust of an HCT is far less than that of chemical-fueled power plants—it puts out small puffs of power—but a thruster can fire for thousands of hours.

The HCTs were designed mostly for station-keeping, so the Madden team would use them in an untested way. "The HCTs, at this power level, ... it's the first time that they have been flown in space," said Madden.

Moreover, the spacecraft was much heavier than it should have been at that point. Because the LAE had been shut down, most of the system's oxidizer—about 1,000 pounds' worth—remained in the sealed tanks.

A new danger arose. The AEHF satellite was now in the Van Allen Belts of radiation, a zone of energetic charged particles held in place by the Earth's magnetic field. These particles can damage a satellite, which must shield its sensitive components if it spends much time there.

The AEHF satellite needed to extend its solar-panel "wings," which until now had remained stowed against the side of the satellite. HCTs run on electricity produced from sunlight collected by the solar wings. However, they are sensitive to radiation.

The AEHF satellite's power-generating solar wings were unfurled and HCTs were deployed. "Every hour we were in that environment," recalled Madden, "we were beating up our solar panel, which would harm our ability to get power once we got to our final geosynchronous location. We did not want our solar panels to degrade."

After much deliberation, the team came up with a burn strategy that got the satellite rapidly out of the Van Allen zone so that it could operate for longer periods.

From late October 2010 to June 2011, the HCTs burned for 10 to 12 hours per day. The motors were optimized to fire at the apogee of the AEHF satellite's orbit, so as to drive up the perigee. By last summer, nearly continuous firings were taking place. The HCTs had never been used in such a fashion in zero gravity conditions. The team began to see some features they had never seen before. For instance, they needed a warm-up period to operate at maximum efficiency.

"It seemed like every month or two, we thought we had the equation down for how to do it, and all of a sudden we'd see another hiccup," said Madden. "We'd get a fluctuation." He continued, "They're like a finicky old car, one that you've got to constantly adjust to get it to optimize. There's no instruction manual for how to do that. It's basically an art."

That was a big challenge for the engineers. As the system got older, it exhibited unexpected variation. The team thus had no choice but to collect data, review operations on a regular basis, and make adjustments on the fly. Complicating the operation was another computational task. The HCTs had not only to drive the perigee up; by this time, they were also needed to make major changes in the inclination of the satellite's orbit. This was a complex task.

As Madden put it, "We had to get the inclination down, because that enables us to 'see' more of the Earth. The higher the inclination, the smaller the amount of the Earth that can talk to your spacecraft. That's really where most of the energy was used, trying to drive down that inclination."

In Phase 3, ground controllers conducted burns only at the apogee of the AEHF satellite's flight. The HCTs had been able to raise the low point of the orbit from 3,000 miles to more than 17,000 miles. The phase ended on June 2, 2011.

The Circle Was Formed

The last part of the rescue—Phase 4—saw USAF take steps to change not only the AEHF satellite's perigee but also its apogee. The latter was 32,145 miles above Earth, which was far too high. It had to be reduced by a whopping 10,000 miles.

At the same time, the perigee had to go up from 17,000 miles to about 22,000 miles. Finally, the satellite's inclination had to be driven down closer to alignment with the equator.

The HCTs again were firing for long periods every day. The forces they produced induced a convergence of the apogee and perigee altitudes (see Fig. 2). These maneuvers had many complex orbital aspects. Madden said the shifts were timed to optimize beneficial effects of Earth's gravitational pull, thereby conserving valuable fuel.

The AEHF satellite's perigee finally reached its required altitude of 22,300 miles in early August. The declining apogee reached proper altitude Oct. 24. The circle was formed.

The sophisticated recovery campaign, entailing about 500 propulsion burns, was over.

When the spacecraft reached its orbit slot, USAF deployed the payload. It had been stowed to allow it to fit within the nosecone of the Atlas rocket. A long checkout of the antennas and other mission-critical equipment then commenced. Plans call for this checkout to take about three and a half months, after which SMC will turn over control to 50th Space Wing.

Madden said, as a result of the careful efforts to husband SV-1's hydrazine and xenon fuel during the orbit-raising phases, there will be no reduction in its planned 14-year life.

Moreover, the Madden team learned quite a few tricks along the way. "When we hand it over to the operator, we will show him how to use the system efficiently to make sure he gets at least 14 years of life."

Early in the rescue drama, Air Force leaders decided to postpone the launch of follow-on AEHF satellites. They wanted to have a chance to check out SV-1 before proceeding. Barring the discovery of more problems, the Air Force will launch SV-2 in late April.

"I'm feeling very good with the fuel that we have on board the vehicle," said Madden.

"All of the telemetry we're getting on the vehicle says we didn't violate any parameters. Our solar panels are doing great. We didn't do any damage that would hurt us in full operation. We've got a full mission life planned for this vehicle."

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Vice President Of Defense & Homeland Security
Gilat Satellite Networks Ltd.

Moshe (Chico) Tamir serves as Vice President of Defense and Homeland Security for Gilat. Brigadier General (Res.) Tamir served for 28 years in the Israeli Defense Forces (IDF) and held senior command posts including Brigade and Division Commander. In his role at Gilat, Mr. Tamir is responsible for overseeing the strategic direction of the Company's international defense and homeland security offerings, delivering network and communication solutions for national security and emergency response organizations worldwide. Mr. Tamir is a graduate of IDF Command and U.S. Army war college, and holds a BA in Middle East Affairs from the University of Haifa, and an MBA from the Interdisciplinary Centre Hertzelia.

MilsatMagazine (MSM)
Mr. Tamir, given your exceptional and effective career with the Israeli Defense Forces, what do you see today as the most challenging environments to overcome for MILSATCOM? How do you see this changing over the next few years?

Moshe Tamir
Almost all military ground forces today still use World War II communications concepts based on voice-over-radio for command and control (C&C). Over the next decade, I estimate that all forces will move to network-based C&C. This will be a real revolution for operations in that it requires constant and reliable broadband communications for all echelons. The high maneuverability and dispersion of forces drives an essential need for on-the-move satellite backhaul for these nets. The real challenge for MilSatCom lies in large communications-on-the-move (COTM) nets based on a VSAT (Very Small Aperture Terminal).

MSM
With your career with the IDF, how did you manage to effectively transition from the military world to that of the commercial services supplier? What was the most difficult area for you to manage?

Moshe Tamir
While these are different worlds, it is people and leadership that drive them both. One's decision making capabilities do not change. In both elements, we make decisions often based on incomplete information and in the face of uncertainty. However, one major difference is the consequences and outcomes of our decisions in these disparate areas are very different.

Gilat equipped Hummer in China

MSM
Do you find that your military career has assisted you, in your discussions within the commercial and government agencies, to present your product case more effectively? If so, how?

Moshe Tamir
Certainly — my long experience as a user of this equipment, especially of net-based C&C systems, has helped me quite a bit in presenting Gilat's offerings more effectively. It is an advantage in having the practical experience as a user rather than just approaching a potential client as a systems' supplier. My experience in the field enables me to understand the user's challenges, and present Gilat's solutions, as those in the field, as well as those at the different echelons will use it.

MSM
How does Gilat, a company based in Israel, present its product lines to allied governments? What makes Gilat's case so effective?

Moshe Tamir
Gilat has two main advantages; cutting-edge technology and experience in large projects. Our leading MILSATCOM technologies, including BUCs, antennas and MODEMS, are all under one roof, and these mesh well with our system integration capabilities. Our deep connections to Israel's defense community enable us to enjoy the knowledge and experience of those who are constantly on the front lines using the systems. In addition, we have an advantage of vast experiences in large, complex, and turnkey government projects across the globe that enables our team to bring this expertise to our defense offerings.

Our existing strong 'Glocal' presence enables us to work closely with system integrators, service providers and end customers to develop satellite-based solutions that solve problems and enable the use of new applications that were not feasible before.

MSM
The bottom line for any satellite communications role is to save lives and mission success. How does Gilat's military and government product lines enable such to occur? Given your real-time experience in an extremely hostile region of the world, what is your personal commitment to "boots on the ground" when you advise others on product offerings and installation?

Moshe Tamir
Gilat's defense and homeland security systems are focused on supplying reliable, quality broadband communications to the front line and to first responders. Command and control requires reliable communication systems that are essential for saving lives and contribute to the success of

Gilat equipped Hummer in the United States

mission critical operations. In that sense, network based C&C enables us to make a major leap forward in meeting the requirements necessitated by on-the-move situations. We are fully committed to providing quality and reliable systems that enable those, whose 'boots are on the ground', to successfully complete their missions safely and effectively.

MSM
What differing scenarios could be enhanced by Gilat's product? How would an NGO agency, or a first responder, find Gilat's products in actual use, as opposed to those in a military environment? Or, are the objectives and use similar to these cases?

Moshe Tamir
Gilat provides solutions to fit our various clients. For instance, NGOs and first responders need different combinations of functions and technologies for their systems. Our proven turnkey solutions are tailor made to meet those requirements and are based on the user's experience so that we explicitly know what they require for success. For instance, in China, we provided SATCOM on-the-move for a cellular base-station in rescue vehicles that were able to bring cellular coverage to disaster-struck areas. Using this vehicle, the first responders were able to restore cellular coverage to an affected area to thereby locate trapped people in collapsed buildings and save them in the golden hours of opportunity where this hope still exists.

MSM
What can we expect to see from Gilat over the coming months that would further the effectiveness of ground, air, and sea forces?

Moshe Tamir
This past year, we introduced more powerful on-the-move antennas for vehicles that enable even higher throughput for on-the-move communications. Gilat's Wavestream recently introduced the AirstreamTM family of solid state transceivers for military and commercial airborne and unmanned satellite communication systems.

We are also developing a new compact airborne terminal that includes a small low-profile antenna, extremely efficient BUC (transmitter) and an embedded high performance modem. The very small terminal is based on a six-inch antenna that provides extremely high quality video. Because all the components are developed and manufactured by Gilat, we achieve a very high level of integration resulting in one product, simple interfaces, and one management system.

MSM
With your experience in the military and in the commercial sectors, where do you see MILSATCOM,

Hummer in the field with Gilat SATCOM equipment onboard

in general, heading over the next few years, given extreme budget cuts by most countries due to their fiscal difficulties? Will we see more combination of technologies to produce leaner battle force groups?

Moshe Tamir
In a period of global economic uncertainty in which countries are reducing their military expenditures, budget cutting is compelling forces as well as suppliers to re-engineer their processes. To reduce costs, militaries and defense organizations are moving towards using Commercial Off The Shelf (COTS) solutions customized to the military environment. At Gilat, we are doing this by adapting and modifying our commercial products for military applications and requirements. For example, U.S. forces in Iraq used our low-profile antennas for Satcom on the move. We believe that we are a leader in this area. Our long commercial experience puts us in a favorable position to be able to modify COTS and bring their advantages to the HLS/defense communications market.

MSM
Tell us something about Gilat's products and solutions offerings. What makes them unique?

Moshe Tamir
Gilat is focusing on tactical military Satcom solutions: Satcom-on-the-move, or on the pause. All components of the various solutions are designed accordingly. Compact, low profile on-the-move antennas, powerful BUCs and SSPAs with small SWAP (size, weight and power consumption) and highly sensitive modems supporting small antennas with new adaptive waveform to support changing link conditions. All products and solutions are ruggedized according to all MIL standards working in the harshest environment.

MSM
Tell us about the company's defense/HLS strategy that has developed into acquiring Raysat and Wavestream.

Moshe Tamir
Gilat strategy is to strongly enter the defense market. The acquisition of Raysat Antenna Systems and Wavestream increased the portfolio of our defense products and enabled us to develop better and more efficient high-end terminals for the defense market. Developing products for the defense sector is time and labor-intensive, and these two acquisitions enabled us to quickly get, out of the door, mature products and new customers in that target sector. We defined our objectives and the challenge of satcom-on-the-move and used our knowledge of net centric communications to answer the markets needs.

MSM
Which Gilat products seem to hold the most interest for allied countries? Why?

Moshe Tamir
Our solutions create interest because of their combination of high performance, small footprint and attractive pricing. However, the most important element of our solution is interoperability. Gilat's solutions work with all MIL specs products utilized by various defense forces that work together. As modern net-centric C&C is becoming more common, and cooperation between nations and groups in allied maneuvers and engagements increases, interoperability between forces is necessary. Only solutions that meet these needs will be accepted, and Gilat is, and will be, there.

MSM
In conclusion, how does Gilat defense/HLS operate around the world? What types of agencies, governments, and defense organizations does Gilat target?

Moshe Tamir
We target the satcom needs of HLS agencies around the world and our solutions serve a large and diverse audience. Gilat has numerous clients that cannot be identified due to the nature of their activities. We reach HLS agencies whose activities go from infrastructure to first responders to border patrol to law enforcement to disaster recovery and communications networks. For instance, we have recently contracted with Latin American internal security and law enforcement agencies in a large contract worth above $10 Million.

Gilat military modem

"Great discussion and exchange of information on deployable comms and CIS networks." US Army

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