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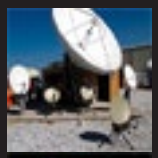
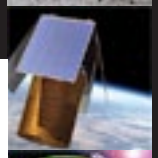
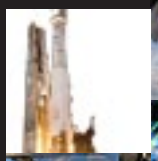
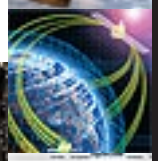
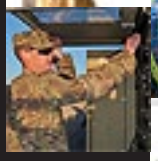

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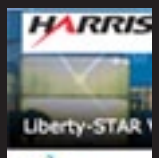

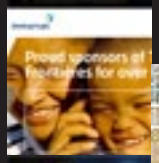

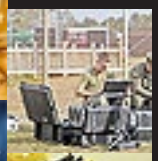
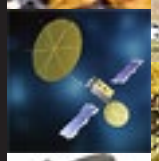
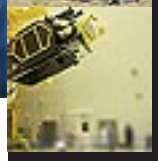
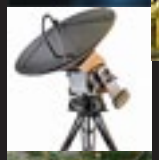
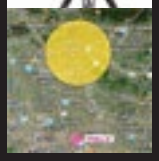

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THE SPECIAL "K" MAKES ITS MOVE

A United Launch Alliance (ULA) Atlas V rocket successfully launched NASA's Tracking and Data Relay Satellite (TDRS-K) payload at 8:48 p.m. EST on January 30th from Space Launch Complex-41. This was the first of 13 ULA launches scheduled for 2013, the 35th Atlas V mission, and the 67th ULA launch.

"ULA and our mission partners are honored to work with the outstanding NASA team and we are proud of the vitally important data relay capabilities that were safely delivered today," said Jim Sponnick, ULA vice president, Mission Operations.

This mission was launched aboard an Atlas V 401 configuration vehicle, which includes a 4-meter diameter payload fairing. The Atlas booster for this mission was powered by the RD AMROSS RD-180 engine and the Centaur upper stage was powered by a single Pratt & Whitney Rocketdyne (PWR) RL10A-4 engine.

NASA established the TDRS project in 1973 to provide around-the-clock and around-the-Earth communications for the network that routes voice calls, telemetry streams and television signals from the International Space Station, as well as science information from the Hubble Space Telescope and other orbiting spacecraft.

"With this team's innovative and ever-present focus on delivering mission success and best value through Perfect Product Delivery, final work at the Cape to prepare the Atlas V rocket that launched today was completed in record time—27 days from when the vehicle was first erected to launch," said Sponnick. "The ability for ULA to reduce its processing time both during manufacturing and at the launch sites, offers our customers added manifest flexibility as well as additional launch opportunities to ensure their payloads are delivered reliably and on-time."

ULA's next launch is the Atlas V LDCM mission for NASA scheduled for February 11, 2013 from Space Launch Complex-3 at Vandenberg Air Force Base, California.

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

"TDRS-K bolsters our network of satellites that provides essential communications to support space exploration," said Badri Younes, deputy associate administrator for Space Communications and Navigation at NASA Headquarters in Washington. "It will improve the overall health and longevity of our system."

"With this launch, NASA has begun the replenishment of our aging space network," said Jeffrey Gramling, TDRS project manager. "This addition to our current fleet of seven will provide even greater capabilities to a network that has become key to enabling many of NASA's scientific discoveries."

After a three-month test phase, NASA will accept the spacecraft for additional evaluation before putting the satellite into service.

The TDRS-K spacecraft includes several modifications from older satellites in the TDRS system, including redesigned telecommunications payload electronics and a high-performance solar panel designed for more spacecraft power to meet growing S-band requirements. Another significant design change, the return to ground-based processing of data, will allow the system to service more customers with evolving communication requirements.

The next TDRS spacecraft, TDRS-L, is scheduled for launch in 2014. TDRS-M's manufacturing process will be completed in 2015.

NASA's Space Communications and Navigation Program, part of the Human Exploration and Operations Mission Directorate at the agency's Headquarters in Washington, is responsible for the space network. The TDRS Project Office at NASA's Goddard Space Flight Center in Greenbelt, Maryland, manages the TDRS development program. Launch services were provided by United Launch Alliance. NASA's Launch Services Program at the Kennedy Space Center was responsible for acquisition of launch services.

#

PULLING TOGETHER

Inmarsat showcased an extensive portfolio of voice and data solutions at the inaugural Asia Pacific Aid and International Development Forum (AIDF) 2013, together with Inmarsat partner Singapore Telecommunications (SingTel) and applications development partner AnsuR Technologies (AnsuR).

The world leading forum for the humanitarian aid, relief and development sector, AIDF was held for the first time in the Asia-Pacific region from January 30th to 31st, at the IMPACT Convention Centre in Bangkok, Thailand.

At AIDF, Inmarsat is unveiling a new humanitarian aid package for the IsatPhone Link—Inmarsat's fixed satellite phone service.

Focusing on NGOs operating in a fixed location for an extended period of time, the IsatPhone Link package is a highly cost effective option. It includes a total of 3,000 minutes per month, shared between three terminals, to deliver one predictable, low monthly charge.

This new offer from Inmarsat builds upon the package announced in 2012 for the IsatPhone Pro. Meanwhile, the BGAN Link broadband service offers NGOs working on longer-term field projects options of high-volume data packages for a fixed monthly fee.

IsatPhone Pro, IsatPhone Link and BGAN Link operate over Inmarsat's I-4 network, offering around 99.9 percent satellite and ground network availability, giving assurance for voice and data connectivity anywhere in the world.

#

GOING ABOARD THE NEWEST YAMAL

Newtec has been selected by Gazprom Space Systems (GSS), in a competitive tendering process, to provide the equipment for a new VSAT Platform to be run via the launched Yamal-402 satellite.

Contracts have been signed, making Newtec the preferred partner of choice to provide the complete VSAT system including hub, modems and antennas for the project.

Ensuring Internet access in the remote areas of Russia at an affordable price is essential. Until this year, only expensive, professional, VSAT installations in limited hot spots in the Moscow and Saint Petersburg regions were available.

GSS plans to offer satellite broadband access services to local ISPs that will, in turn, supply services to consumers and enterprise customers within the Yamal-402 footprint, which covers the whole of Russian territory.

In 2012, Newtec started shipping its new high-speed Ka-band VSAT broadband technology. This new technology has already been selected by several customers, including Europe's most successful satellite broadband service.

While the GSS network will use Ku-band (via the Yamal-402), the terminals can be easily adapted to function with higher throughput Ka-band frequencies by a simple change of the interactive LNB and with no hardware adaptation to the modem and the antenna.

The Yamal-402 satellite, located at 55 degrees East, was launched by GSS in December 2012 and is equipped with 46 Ku-band transponders, with four fixed and one steerable beam.

#

The Yamal 402 satellite sits atop the Breeze M upper stage in pre-launch preparations. Photo credit Roscosmos.

MUOS MOVES

The U.S. Army ordered kits from General Dyanmics last December to upgrade 100 Handheld, Manpack, Small Form Fit (HMS) AN/PRC-155 two-channel Manpack radios to enable them to communicate with the military's Mobile User Objective System (MUOS) satellite communications system.

This MUOS channel upgrade, comprising a field-replaceable power amplifier and supporting software, will allow secure voice and data communication with the MUOS system. The order is valued at $5 million; the kits will be delivered in the fall of 2013.

"By upgrading fielded PRC-155 radios, the Army will greatly enhance soldier effectiveness by providing a tenfold increase in SATCOM capacity for secure, over-the-horizon military communications," said Chris Marzilli, president of General Dynamics C4 Systems. "MUOS access on the two-channel PRC-155 will also allow current Army networks to be bridged and extended far beyond their current reach."

The two-channel PRC-155 Manpack radio also runs the essential waveforms from the defense department library. They include the Soldier Radio Waveform (SRW) that connects dismounted soldiers to the network, the Wideband Networking Waveform (WNW) that seamlessly transports

Artistic rendition of MUOS

large amounts of data and the legacy SINCGARS waveform for communication with existing radios.

Using the PRC-155's two-channel capability, soldiers operating on any one of these waveforms on one channel, can interconnect with soldiers using another waveform on the second channel. With the MUOS capability in the PRC-155, a network of soldiers can be interconnected with others in a far distant location.

The MUOS waveform, based on the communications interface found in commercial cellular networks, will deliver high-speed voice and data communications and 10-times greater capacity than the military's current Ultra High Frequency (UHF) satellite communications system.

With a smartphone-like flow of information, the upgraded PRC-155 radios will allow soldiers to access the MUOS communications system wherever they are deployed, on foot or from land vehicles, ships, submarines and aircraft.More information: *www.gdradios.com/ANPRC-155.cfm*.

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HOME + HAPPINESS IN AFGHANISTAN

Forward Operating Base Mescal in Afghanistan has no Morale, Welfare and Recreation facility. It has no Post Exchange, no laundry drop off and no post office.

Soldiers stationed here receive mail about once a month and the chow hall offers two choices at every meal: Take it or leave it.

Despite the spartan accommodations however, six National Guard soldiers with the 101st Expeditionary Signal Battalion from Yonkers, New York, call FOB Mescal home and they are perfectly happy to do so.

"I looked FOB Mescal up before we got here and it didn't look very pleasant. There was a lot of talk about the food and the bad winters, but it's not that bad," said Sgt. Sergio A. Rodriguez, a light wheel mechanic from the Bronx, New York. "I guess you could say it's become home."

All of the soldiers from the unit come from densely populated urban areas in New York: Mount Vernon, the Bronx, Brooklyn, Staten Island—places where crowds are the norm and convenience is often taken for granted. Now they live on a FOB that has fewer inhabitants than an average New York City elementary school, and on which money is essentially useless because there's no place to spend it.

"As far as my team is concerned, I feel like being away from the comforts of Kandahar Airfield has been beneficial to them," said Staff Sgt. Marcus A. Jones, a non-commissioned officer in charge of the signal team.

The Yonkers' team was definitely not impressed when they arrived and surveyed the facilities they inherited from the outgoing signal unit.

"This place was really bad when we got here, especially the living conditions," said Sgt. Rodriguez. "The tent was just a big hollow shell. It was very messy with clumps of stuff here and there—very, very disorganized."

But when the outgoing unit showed the New York team around, they offhandedly mentioned a pile of wood they hadn't used and were leaving behind.

"We saw the wood as gold," said Rodriguez. "Our eyes lit up and instantly there were a million ideas of what to build. Now everybody claims we have the best living conditions in the southern region because of the way that our tent is set up."

Sgt. James P. O'Connell, 31, from Bronx, New York, checks that the satellite transmission system is working properly on Forward Operating Base Mescal, Afghanistan, December 25, 2012. O'Connell, a multichannel transmission systems operator with the 101st Expeditionary Signal Battalion, a National Guard unit from Yonkers, New York, is deployed to FOB Mescal, a small FOB in southern Afghanistan where he is part of a team responsible for providing secure and unsecured radio and satellite capabilities for the FOB. (U.S. Army Photo by Sgt. Lori Bilyou)

Inside the tent, the team built individual rooms for each soldier. They separated the living area from the work area and created a common room where they can gather for meals or a movie. They built shelves to store and organize supplies and a workstation to set up their computers and signal equipment.

"I think in the short time that we've been here we've accomplished great things with what we had." said Rodriguez. "And that has made everything much easier."

In addition to learning construction skills, the signal team is of course, doing their job by providing both secure and unsecured radio and satellite capabilities for the entire FOB as well as boosting the networks of other nearby FOBs.

Their small number has also enabled each soldier to cross train, which in turn ensures that things run smoothly. The network specialists have learned some transmission skills and the transmission specialists have learned some networking. They've all learned to lay cable.

"Even Rodriguez, who's a mechanic, comes in and tries to trouble shoot some issues or helps out with installing printers or Google Earth or whatever the request is," Jones said.

Without the distractions that larger bases have, Jones insisted that he and the other members of his team have been able to utilize their time better than others who might

waste it on video gaming or hanging out on the boardwalk like some do on KAF.

"People on larger bases could do more constructive things, self development things like looking into schools, applying for jobs or researching what they'd like to do when they get home," Jones said. "I think everyone on our team has found their own way or what direction they'd like to travel since they've been out here."

"This is probably the most peaceful state of mind I've been in, in a very long time," said Spc. John Martin, an information and technology specialist with the team.

Members of the 101st Expeditionary Signal Battalion, a National Guard unit from Yonkers, New York, deployed to Forward Operating Base Mescal, Afghanistan, December 25, 2012. The six-man team is responsible for providing both secure and unsecured radio and satellite capabilities for the entire FOB as well as boosting the networks of other nearby FOBs. From left to right: Pfc. Curtis L. Brewington, Sgt. Sergio A. Rodriguez, Spc. John Martin, Sgt. James P. O'Connell, Staff Sgt. Marcus A. Jones and Spc. Jonathan Pereira. (U.S. Army Photo by Sgt. Lori Bilyou)

"Being here has made me realize all the stuff I used to take for granted back home. Whether it's something as simple as hot water or vegetables, being here has made me grateful for all the stuff I have back home and conscious of the fact that people in this country are not as fortunate as we are." This might explain why this six-man team, despite their separation from all things urban, is quite content to remain on FOB Mescal for the duration of their deployment.

As Rodriguez explains it, "It's complicated, but to me I feel like I can learn more out here than I can at KAF. I'm actually hoping that they'll fly us home from Mescal. "I don't even want to go back to KAF, not even for transition. If it was my option, that's how it would be. I really like it out here."

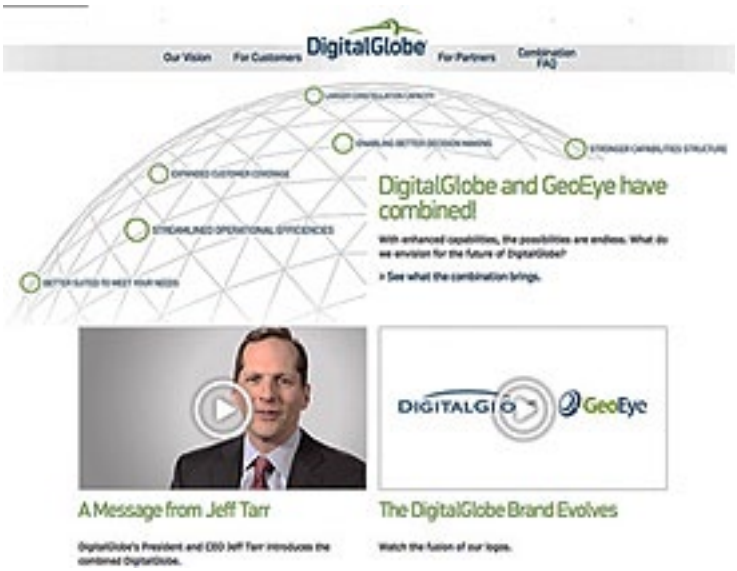
Story by Sgt. Lori Bilyou, 117th Mobile Public Affairs Detachment, U.S. Army

COMBO CONGRATZ + FINANCIALLY SPEAKING

DigitalGlobe, Inc. and GeoEye, Inc. have announced the completion of their company combination, creating a global leader in Earth imagery and geospatial analysis. The combined company will trade on the NYSE stock exchange as DigitalGlobe under the symbol DGI. Based on the closing price of DigitalGlobe stock on January 30, 2013, the combined company has a market capitalization of $2.1 billion.

As a result of the combination, DigitalGlobe is now uniquely positioned to provide a wider array of Earth imagery and geospatial analysis to help customers solve their most complex problems and compete in a high-growth and dynamic global market. Together, the combined company will have:

- *An expanded global presence with a larger and more diverse revenue base*
- *A larger constellation with optimized orbits, coordinated scheduling and improved revisit rates*



"With a stronger financial profile, more robust suite of services, and among the world's most advanced geospatial production and analysis capabilities, we will be even better positioned to meet customers' needs and create value for shareowners," said Jeffrey R. Tarr, President and Chief Executive Officer of DigitalGlobe. "Together, we are poised to achieve our vision of being the leading source of information about our changing planet."

- *Better integrated imagery collection, processing and analytics capabilities*
- *A strengthened balance sheet and financial profile with more than an expected $1.5 billion in net present value of operating expense and capital synergies, with approximately one-third of those synergy savings related to operating expense and the balance from capital savings*

Mr. Tarr continued, "We have a deep bench of talented and experienced team members from both GeoEye and DigitalGlobe, and I am confident that, together, we will continue to raise the bar for innovation and service in our industry. I look forward to working closely with our Board of Directors, our leadership and all of our team members to ensure a seamless transition for our customers worldwide."

In connection with the combination with GeoEye, DigitalGlobe has entered into new senior secured credit facilities in the aggregate amount of $700 million.

The facilities consist of a term loan facility of $550 million and a revolving credit facility of $150 million.

The Company has borrowed the full amount of the term loan facility to fund the combination with GeoEye and to refinance certain existing indebtedness of GeoEye and DigitalGlobe.

The revolving credit facility remains undrawn at closing. Borrowings under the term loan facility will bear interest at an amount equal to the adjusted LIBOR rate plus 2.75 percent, with a step-down to the adjusted LIBOR rate plus 2.50 percent if the Company's leverage ratio is equal to or less than 2.50:1.00.

The credit agreement contains affirmative and negative covenants that the Company believes are usual and customary for a senior secured credit agreement.

The credit agreement also requires the Company to maintain a maximum leverage ratio and a minimum interest coverage ratio.

Also in connection with the combination, GeoEye discharged and called for redemption all of GeoEye's 75 outstanding 9.625 percent Senior Secured Notes due 2015 and 8.625 percent Senior Secured Notes due 2016. DigitalGlobe expects to announce fourth quarter 2012 and full year 2012 earnings on February 26, 2013, and intends to provide full-year 2013 financial guidance at that time.

#

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TRAINING IS THE KEY TO SUCCESS

Communication is key in every workplace, but even more so for the military. Keeping up-to-date equipment is the first line of defense.

For 2nd Radio Battalion, Marine Headquarters Group, II Marine Expeditionary Force, recent equipment acquisition included new, lightweight satellites for field training.

The newest arrival—the High Bandwidth Special Intelligence Team Terminal—meets the Marine Corps' urgent request for new satellites to be employed.

The new dish provides the battalion the capability to pass collected data to intelligence analysis centers in near real time, resulting in timely and actionable intelligence product. It also provides an ability for the battalion to access national and theater-level intelligence networks.

HBSI-TT consists of two main subsystems. The radio frequency subsystem provides voice connectivity, while the network subsystem provides for Internet requirements. This lightweight solution can be deployed in a matter of minutes.

Twelve Marines took part in the training and fielding of the new systems and were instructed on how to bring the new system online and conduct function checks.

On the final day of training technical inspections were conducted on the equipment and the HBSI-TT's were added to the battalion's capability set for current and future operations.

"All the testing has already been completed, the gear passed its validation," said Maj. David Arjona, project officer at Networking and Satellite Communications, Satellite Communications Systems, Marine Corps Systems Command. "This fielding is for the Marines to train on the gear before it's turned over to them."

MCSC will continue new equipment training and fielding to other units across the Marine Corps receiving the HBSI-TT.

Story by Lance Cpl. Joshua Grant, Marine Corps Base Camp Lejeune

#

Marines from 2nd Radio Battalion, Marine Headquarters Group, II Marine Expeditionary Force, set up new equipment as part of a field training exercise aboard Marine Corps Base Camp Lejeune recently. 2nd Radio Bn. received new High Bandwidth Special Intelligence Team Terminal's in order to fill a Marine Corps request for new equipment. Photo by Lance Cpl. Joshua W. Grant.

INSIGHTS FROM SIA'S DOD WORKSHOP

Last December, the Satellite Industry Association (SIA) held its 2012 DoD Commercial SATCOM Users' Workshop, which brought together government leaders from the Department of Defense along with commercial satellite operators and manufacturers.

The event covered a wide range of issues and challenges that confront the state of SATCOM and defense today.

For U.S. Africa Command (AFRICOM), commercial SATCOM is critical as existing systems in this region are not sufficient for manned or unmanned ISR, reinforcing the need for Ku- solutions.

In addition, U.S. Pacific Command (PACOM), now requires commercial SATCOM resources that are portable to any part of the region and support UAV and comms-on-the-move efforts.

During the Mission Assurance Panel, which was moderated by Dr. John F. Plumb, Acting Deputy Assistant Secretary of Defense for Space Policy, the key topic was the vulnerability of U.S. communications capabilities to attack, reinforcing the need for prevention and retaliation strategies.

Another theme was the growing need of the DoD for viable SATCOM solutions. The U.S. Air Force is increasing the use of SATCOM to meet ISR needs, with assured access in all environmental conditions. The U.S. Marine Corps is moving towards the use of tri-band terminals to access MILSATCOM and commercial SATCOM. The U.S. Army needs more satellite power delivered to smaller terminals to meet the needs of its fragmented user base, while the U.S. Coast Guard needs streamlined solutions for supporting its aging fleet.

Kay Sears, President of Intelsat General, participated on a panel where she discussed the best ways for meeting the DoD's SATCOM needs. In particular, she highlighted how satellite operators must continue to invest in ground and space infrastructure, as the DoD cannot "do it all." In addition, she discussed how the commercial sector must always play a critical part in military communications, yet one that does not duplicate what the DoD is doing.

In terms of Intelsat General's support for the DoD, the company, and its team of partners, delivers worldwide commercial telecommunications services to the U.S. Navy's fleet of ships under the Commercial Broadband Satellite Program (CBSP). It is also a leading supplier of global satellite services in support of UAVs in the ISR arena.

The annual DoD Commercial SATCOM Users' Workshop is always the ideal forum for government and industry to gather to discuss the biggest issues and trends that face our sector. This year's event proved that commercial SATCOM solutions will continue being viable as new opportunities and challenges lie ahead.

Story courtesy of Intelsat General's Satcom Frontier blog

#

SPECIAL OPS CONTINUE COLLABORATION WITH AVIATION AS ARMY DOWNSIZES

Army aviation special operations forces and conventional aviation forces will continue to collaborate and forge bonds that will become tighter as the Army downsizes special operations forces and others, commanders have said.

Col. John R. Evans, commander of the 160th Special Operations Aviation Regiment (Airborne), said as demands for his unit's services have increased, conventional aviation has stepped up in every regard and supported operations across a broad spectrum.

Evans spoke as part of a four-member panel made up of conventional and special operations commanders at the Association of the U.S. Army's annual Aviation Symposium and Exhibit. They discussed the present and future roles of conventional and unconventional aviation units.

"I can tell you right now, we have as good a relationship as we've ever had with conventional aviation. It's been a very collaborative and collegiate one," he said. "We've got units within the conventional Army that are doing missions that are very similar to what we're doing with regard to assault, precision fires and then all the critical medevac, logistics and supply functions as well."

Evans noted that special operations forces, or SOF, rely heavily on the Army aviation enterprise for virtually everything it does—from manning, to training and resourcing—and will continue to tighten its bonds with its conventional brothers to make the overall aviation enterprise even more successful.

"As we take a look at not just the current battlefield and what our emerging battlefields are going to be and see our forces become more regionally aligned, we're also looking at things like our emerging global force requirements," he said.

Addressing emerging global force requirements and the shift from Afghanistan to the Pacific-Asia area of responsibility, Col. Daniel E. Williams, director of aviation for U.S. Army Forces Command, said maritime over-water competency was already in place, the book written by Army aviation SOF.

"We've taken that book and made it match to Apaches, so as recently as four weeks ago, we had conventional 160th Apache aviation 75 miles off-shore in the Atlantic Ocean on Navy ships," he said. "That's happening today in limited operations."

Williams said Army conventional and SOF had been working with each other for the last decade and as a result long-term friendships have been made between the groups and their commanders. He also said FORSCOM's headquarters move to Fort Bragg, North Carolina, was "huge" because it cemented conventional with SOF aviation.

Today, Joint Special Operations Command, U.S. Army Special Operations Command, known as USASOC, the Joint Special Warfare Center, XVIII Airborne Corps and the 82nd Airborne Division are all at Fort Bragg, and the geographical location has made all the difference.

"Synergy probably didn't happen as easily as before when we were down in Atlanta and other places," Williams said. "It's now happening—it's too easy to get out of your office to go talk with your brothers, and that's air and ground."

Williams said that with rapidly dwindling resources and the drawdown of Operation Enduring Freedom, conventional and SOF aviation would find themselves in contact in the same battlespace with little notice or planning, so it was

A four-member panel made up of conventional and special operations commanders discuss the present and future roles of conventional and unconventional aviation units, during the Association of the U.S. Army's annual Aviation Symposium and Exhibit at National Harbor, Maryland.

imperative they stay in synch and interoperable at all levels.

Former commander of the 82nd Combat Aviation Brigade, or CAB, Col. Terry "TJ" Jamison addressed the challenges he and his Soldiers had as a conventional CAB commander in working with SOFs. He said that in Afghanistan he had 196 rotary-wing aircraft—made up of utility helicopter, cargo helicopter, and medevac helicopters out of the Army Reserve and National Guard communities. On any given night 15 to 20 percent of those aircraft were in a direct support role to SOF mission sets.

"As you look at SOF mission sets that we did, we had what was a 20 percent utilization rate," Jamison said. "What I mean by that is you would commit aircraft and crews to an SOF mission set as they waited for target fidelity and the ability to execute that target opportunity sometimes that took time, but you still had to have those aircraft and crews dedicated to that mission set."

Jamison said "counter-intuitive" to what most people would think, his conventional force usually had the riskier missions and often pulled five and sometimes six air assaults a night if the "hunting was good during the fighting season." His crews also had the autonomy to engage the enemy when positively identified, whereas an SOF mission was more specific to the target and rarely performed an air assault more than once per night.

"The biggest challenge we had was the terminology and the verbiage that the aircrews use in talking to the SOF elements on the ground," he said, adding that since the SOF community is "joint" across the board, they all use joint terminology.

"We are not there in most of the conventional CABs," he said. "The ground force customer is working off standard operating procedures; we're working off SOPs for terminology. Just in my own brigade we had four different words for 'in-flight, link-up'. There's an effort to fix that and that should continue."

Rounding out the panel, Brig. Gen. Clayton Hutmacher, commander, Army Special Operations Aviation Command (Airborne), said that on the materiel side, the interaction with conventional aviation has been going on for quite a while, noting that "Army influence and participation in programs such as Future Vertical Lift and Armed Aerial Scout is not only desirable, but critical because we're likely going to see ourselves in a COIN (counter-insurgency) fight for the future, which will require an SOF-like approach to a lot of these problem sets."

"We're moving into the UAS (Unmanned Aerial Systems) world now with Gray Eagles, Ravens, and Shadows, and I think you will see in the future our influence over those programs within the Army as we try to break new ground and incorporate new technologies into those platforms which I see will proliferate down," he said.

Story by J.D. Leipold

#

ALGERIAN AVIATION CONTROL

Harris Corporation has been awarded a contract to provide a voice communications system for military air traffic control in Algeria.

This will be the seventh Harris Voice Communication and Control System (VCCS) deployed in Algeria, with an option for four additional systems to be deployed over the next two years.

Harris will supply the Liberty-STAR™ VCCS to a partner that will integrate the system into a mobile military shelter for monitoring aviation activity in remote locations.

The mobile shelter system will be equipped with touch-screen operator positions, radio and telephone interfaces, and a System Maintenance, Administration and Reconfiguration Terminal (SMART) POSITION™.

Liberty-STAR features a modular architecture, open-platform software and commercial-off-the-shelf hardware that delivers a reliable, scalable communications solution for air traffic control (ATC) towers, airline and area control dispatch, flight service stations, and mobile shelters.

Harris has extensive experience developing mission-critical solutions that support civil and military air traffic control operations worldwide, including more than 200 customers in 50 countries.

The company has installed more than 60 mobile military ATC systems, including six in Algeria. Harris also has installed one civil ATC system in Algeria.

As part of its initiative to further expand internationally and introduce new products to market, the company launched a new IP-based, ATC voice communications system during ATM World Congress that was held February 12-14, 2013, in Madrid.

#

Liberty-STAR Voice Communication System (VCS)

TWO ARE LOFTED

Japan launched two new satellites on January 23rd, one of which was designed to strengthen its monitoring capabilities amid concerns that North Korea may carry out more missile and nuclear tests.

A rocket carrying a radar-equipped satellite blasted off from a space centre at Tanegashima in the southwest, the Japan Aerospace Exploration Agency (JAXA) announced. The space agency said the satellite would be used for information-gathering, including data following Japan's 2011 quake and tsunami, but did not mention North Korea by name.

The launch was carried out by a H-IIA rocket and the satellite should give Tokyo the ability to detect areas as small as one square meter at night or through cloud cover.

The second satellite was designed to test new optical technologies.

#

A FAB TIME

Boeing recently achieved two important milestones on the U.S. Air Force Family of Advanced Beyond Line-of-Sight Terminal (FAB-T) program, which will provide protected wideband satellite communications among ground and airborne terminals for the command and control of U.S. nuclear forces.

The Boeing FAB-T team has completed software qualification testing and systems integration testing on the FAB-T development program. The team demo'd FAB-T's integration with the Advanced Extremely High Frequency (AEHF) and Milstar mission control subsystem, which commands both satellite constellations. Conducted in Boeing's factory, this test validated FAB-T's ability to control strategic satellite communications payloads on orbit. The AEHF and Milstar satellite constellations will relay FAB-T communications once FAB-T is operational.

During testing, FAB-T also transmitted data using both low-data-rate and extended-data-rate (XDR) communications protocols.

The system's advanced XDR capability offers Internet-like functionality and improved speed compared with earlier systems and software.

In April 2012, Boeing and the Air Force agreed on a set of additional FAB-T capabilities, including Presidential and National Voice Conferencing, to be developed under Boeing's firm fixed-price contract.

The Boeing team has implemented those capabilities and expects to enter functional qualification testing early this year.

#

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ADDRESSING AERONAUTICAL NEEDS

ORBIT Communication Systems Ltd., a subsidiary of ORBIT Technologies Ltd., has won a major contract for a large Asian's country defense organization to supply an end-to-end aeronautical test telemetry solution.

The telemetry project, comprising ORBIT's off-the-shelf tracking systems, third-party equipment, software and services is estimated at more than US$ 3 million.

A follow-up order for a similar project is expected in the near future. To service its growing base of customers in this strategic market, ORBIT has established a local customer support center in one of the evolving markets of Asia.

Using these resources, ORBIT will provide the defense organization with local training and support to solve problems in the field with minimum downtime.

ORBIT will supply the defense organization with a turnkey end-to-end aeronautical telemetry solution. Additionally they will assume full project ownership from installation to operation with ORBIT's highly accurate, off-the-shelf tracking systems for L- and S-bands for antennas ranging from 1.2 to 3 meters in diameter.

By offering a combined L- and S-band feed with auto-tracking capabilities, ORBIT's solution eliminates the need for dual antennas, reducing customer's cost by almost half.

In addition, the use of off-the-shelf products enabled ORBIT to realistically commit to very fast delivery times. Consistent with customer's functional requirements,

ORBIT's products are proven to operate in high temperatures and humidity, and their portability facilitates use in different applications. ORBIT's tracking antenna systems are part of ORBIT's field-proven suite of Tracking & Telemetry systems, which enable continuous communication with aircraft, missiles and UAVs. ORBIT's flight telemetry systems can be operated from fixed positions as well as mobile platforms such as vessels. #

MILSATCOM OPS STRENGTHENED

Infrastructure for the 3rd and 4th Space Operations Squadrons' integrated operations environment at Schriever Air Force Base is complete, and combined operation began on January 15th.

"The start of satellite command and control operations in the integrated ops environment this week is the culmination of countless hours of work by hundreds of government and industry people," said Col. James Ross, 50th Space Wing commander. "This new facility will allow 3 SOPS and 4 SOPS professionals to more effectively and efficiently deliver decisive communication effects on a global scale."

The IOE is a 50th Space Wing initiative to integrate the operations of Department of Defense military satellite communications systems and architectures into a single operations floor.

"This is designed to strengthen the effectiveness of military satellite communication operations and enhance operational efficiencies and situational awareness while creating a truly integrated MILSATCOM operations center," said Capt. Gail Smicklas, 3 SOPS IOE project officer.

"Without question, the geosynchronous space environment has become increasingly congested," said Lt. Col. Chadwick Igl, 3 SOPS commander. "The warfighters demand for reliable, space borne communications becomes even more critical as the nation prepares for a potentially contested environment. IOE realizes this vision of a combined MILSATCOM operations center where the two premier SATCOM squadrons at the 50th Space Wing will have unprecedented situational awareness to recognize, react and respond to potential hostile actions and satellite anomalies. We hope to expand the synergies realized to our mission partners when they join us in the IOE and provide an even greater opportunity to enhance the combat effects provided by the 50th Space Wing to our U.S. and allied partners."

The IOE concept has been in development for a decade, but the current configuration was solidified in 2005.

"During 2012, 3 and 4 SOPS tested the IOE concept by performing co-located operations," said Capt. Micah Dodds, 4 SOPS operations flight commander. The IOE aims at preparing the U.S. to successfully operate far into the future, in a spectrum of environments.

The layout of the ops floor is designed to encourage inter-squadron communication and situational awareness to respond to satellite anomalies, potential attacks or interference.

"What started with a vision many years ago by my forward thinking predecessors Lt. Gen. John Hyten, Brig. Gen. Teresa Djuric, Brig. Gen. Cary Chun and Col. Wayne Monteith is now becoming a reality. We should be proud to continue the 50 SW tradition of innovation and operations excellence," said Ross.

Story by Staff Sgt. Robert Cloys. 50th Space Wing, U.S.A.F.

#

REMOTE SENSING AUGMENTATION

Andrews Space (Andrews) has been funded by the U.S. Army Space and Missile Defense Command to design and deliver a Kestrel Eye Block 2 Earth imaging spacecraft as part of the Army's Kestrel Eye program.

Under the current effort, known as Kestrel Eye Block 2, Andrews will develop, build and deliver an Earth imaging nanosatellite.

The spacecraft embodies a paradigm shift to lower-cost, higher persistence overhead reconnaissance capabilities.

While not meant to replace traditional imaging assets, Kestrel Eye Block 2 seeks to augment the current approach to remote sensing by demonstrating the application of low-cost, commercial technologies to enable a new tier of reconnaissance capability.

The overall Army effort is a Joint Capability Technology Demonstration (JCTD) that requires the demonstration program be completed in 24 months, or 2014.

Incremental subsystem hardware demonstrations will occur regularly during development to build confidence in the system and assess subsystem performance against threshold objectives and goals.

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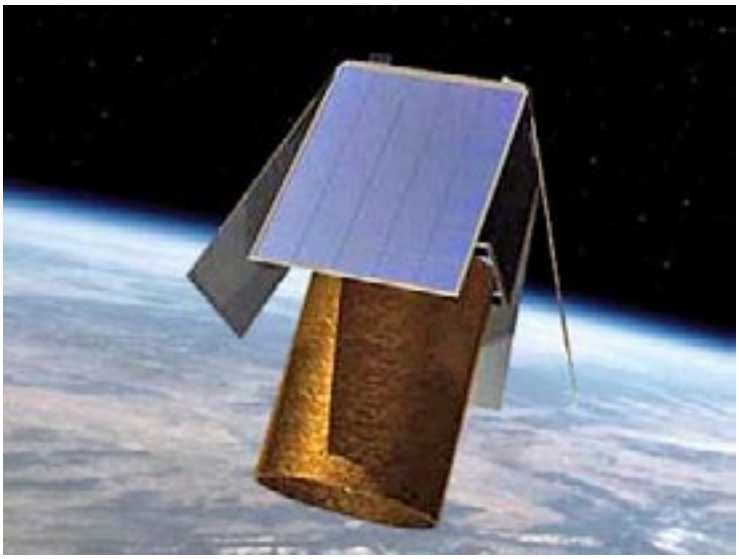

Artistic Rendition of Kestral Spacecraft. Courtesy of SMDC.

AGILE, LIGHT + COMPACT W/LARGE RESULTS

More mobile, Manpack Antenna options for warfighters in theater, on-the-move small form factors, high data rate, rugged systems with lower cost broadband connectivity.

Agile Milcoms revealed their newest MST-series manpack antenna, the MST Ultra-light flat panel Ku-band antenna, and two of their most popular antenna systems, at the AFCEA/USNI West 2013 event.

The new MST Ultra-light Antenna includes either an X-, Ku- or Ka-Band flat panel ultra-light Flyaway Manpack antenna with a CAP (Computer Assisted Pointing device) controller—this enables a warfighter to locate the desired spacecraft in a matter of minutes.

The MST-100M-HD features a fully motorized, Tri-Band platform with auto-acquisition that locates and peaks on the desired satellite. This allows a warfighter to focus on other tasks while the system locates the network that typically takes between two to five minutes. The antenna supports X-, Ku- and Ka-bands.

ACS is expanding its line of MST ultra-light man-packable terminals with an ultra-small (10" x 32") X-or Ku-band CTS technology, (Continuous Transverse Stub), Flat Panel Antenna which reduces adjacent satellite interference.

The Ka-band version measures only 10" x 15" in size and is one of the smallest manpack terminals available. This Planar Array antenna Technology provides "large dish performance" and is optimized for maximum efficiency of Eb/No Performance which requires no spreading, unlike other larger antennas.

The narrow aperture beamwidth is equivalent to a 1m 1M dish, without the bulk of a larger antenna. It features:

- *70 percent+ efficiency versus 50-60 percent of 1M dish*
- *No spillover or tapering required*
- *Discreet sidelobes axes that can be slightly rotated off-axis to further reduce any ASI*
- *Requires no reflector panels, simplifying installation and improving performance*

MST-100 Terminals with iDirect or Similar Hub

The ACS-COTM-300 satellite system is an affordable, low-profile (11cm / 4"), high data rate (up to 10 Mbps 2- way) highly efficient and rugged Ku-Band Satellite Comm's-On-The-Move system which provides continuous broadband connectivity. The System is based on Variable Inclination Continuous Transverse Stub (VICTS) array technology developed by ThinKom Solutions.

VICTS provides superior side lobe performance opposed to other on-the-move-array technology which typically requires signal spreading to meet Adjacent Satellite Interference (ASI) requirements. Elimination of the necessity of spreading allows the ACS-COTM-300 to be more easily adapted to a broader range of satellites on a global basis.

The unit tracks at speeds up to 300°/second that enable the system to perform continuous "on-the-move" tracking of satellite signals with minimal interruptions.

Also provided is 3x to 10x higher spectral (MB/$) efficiency than competing OTM products resulting in a huge reduction in bandwidth costs over other systems requiring Spread Spectrum bandwidth and higher G/T transponders

This unit is configurable with any satellite modem, including the rugged ACS-e850MPR (powered by iDirect) with full TRANSEC FIPS 140-2 security, which is optimized to achieve high-performance and quick response time for professional, enterprise and government applications for voice, video, and data in iDirect Star or Mesh topology configurations and ISCPC networks) or the rugged ACS-DVB-RCS modem which are intended for outdoor applications in the most demanding of environments.

Both modems have been designed to interface directly with the ACS-COTM-300 or the SQD (Super Quick Deploy) antenna systems or the CAP controllers for all the non- motorized ACS-MST-series antennas.

The MST-100M Man-Pack Satellite Tri-Band Terminal is a portable X-, Ku-, or Ka- communications system consisting of a .75m satellite dish, tripod, and modem which are conveniently carried in a rugged case (measuring 21" x 35") for easy, remote use. The system can be configured to accommodate various up and down bandwidths. With Advanced DVB- RCS/S2 the system is capable of uplinking up to 6MB of usable bandwidth.

The MST-100 is available in two models: MST-100-HD (non-motorized for less weight, with CAP (Computer Assisted Pointing), and MST-100M-HD (motorized, fully auto- acquiring).

Both models feature:

- *Optional Advanced DVB-RCS/S2, TDMA, FTDMA, DAMA or SCPC Topology*
- *Dual Frequency DVB-RCS remote terminals*
- *Manual point with CAP or Auto-Acquire/deployed systems*

#

PRESIDENTIAL CAMPAIGNING REQUIRED GEOFENCES

During the recent presidential campaign, local law enforcement agencies and other departments needed to be aware of the temporary flight restrictions (TFRs) in place to accommodate the presidential candidates' movements across the country.

LA County Sheriff's Department (LASD) made extensive use of SkyWeb, SkyTrac's asset management program to ensure aircraft avoided TFRs, and to identify and respond to questions about aircraft flying during the restrictions.

When new TFRs were announced, LASD were able to set up geofences so they could be notified if any of their aircraft flew into or near a restricted area.

LASD was also easily able to identify if an aircraft belonged to them when questioned by other groups monitoring the TFRs.

"Having an ISAT installed on our aircraft made navigating the TFRs a much simpler process. At a glance we were able to redirect our aircraft if needed," stated a sergeant at LASD.

LASD has also found the service valuable for when their aircraft are operating out of state, and have no radio communications with the base.

The system provides an extra layer of safety for the unique flying environment found in California, which includes deserts, mountains, oceans and other bodies of water.

"LASD has employed many advanced features in SkyWeb, and the efficiency and effectiveness of their operation is obvious," commented SkyTrac President and CEO Malachi Nordine. "It is amazing to be able to watch how differently each client uses our system, and how we can help tailor a solution to fit each individual's needs."

#

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COMTECH EF DATA

MARCH OF THE COTS: THE TIME FOR TABLETS?

By Giles Peeters, Senior Contributing Editor and Defence Sector Director at Track24 Defence. In this latest column, Mr. Peeters considers the latest developments in commercial technology that impact MISLATCOM.

Technology evolves quickly. Take *Moore's Law*, which suggests computer processing power doubles approximately every two years. Western militaries have struggled to get to grips with this concept as they continue to labor themselves with deals that can stretch for decades (take the U.K.'s *BOWMAN* project for example). These types of arrangements are not always a bad thing, especially when the concept of operation is complex. However, they are indicative of an ingrained way of thinking that is not flexible enough to cope with today's warfighters' needs.

Warfare has evolved and the equipment required to fight in today's conflicts has changed. Yet an evolution in military procurement is still required for many of the world's major powers. This has already occurred in some parts of the world. Militaries in South America and Africa, for example, are happy to turn to the commercial sector for the latest "fit for purpose" technologies and to obtain the most cost effective solutions.

Commercial solutions providers are flexible and can quickly adapt their offerings to respond to urgent operational requirements. They are also more likely to offer better value, as procurement is subject to stronger competition in the commercial sector. This is an issue that's worth taking a closer look at, as recent commercial developments do impact heavily on the MILSATCOM community.

EIGHT WINDOWS

The first of these technologies to consider is the recent launch of **Microsoft**'s latest operating system, ***Windows 8***. Up until this point in time, tablet computers used for blue force tracking and other satellite communication exercises were specialized kit pieces that cost thousands of dollars per device—their prohibitive price tag made them a rare commodity.

However, as stated, warfare has evolved, and battlefield intelligence transmitted via *beyond-line-of-sight* (**BLOS**) satellite technology is an essential component of successful intra community warfare. Forces deployed hundreds of miles from forward operating bases need to be able to communicate quickly and easily with their HQs.

Military applications have traditionally been designed for Windows operating systems—the previous Microsoft OS, *Windows 7*, was retrofitted to operate on touch screen devices. The user interface was clunky and slow as the OS had been designed for a desktop computer—this meant that any tablet Windows 7 was installed on needed to be state-of-the-art as well as processor heavy in order to adequately support the OS.

Unfortunately, high specification equates to high cost, which is why tablets were a rare commodity within the military environs. Windows 8 changes the game. This OS is designed for touch control and can be deployed on a range of tablets made by different manufacturers. Windows 8 is user friendly and perfect for exercises, such as *blue force tracking*.

Take a mapping application like ***FalconView***, for example. On Windows 7, it's extremely hard to navigate. On Windows 8, it is expected to work quite smoothly. As the OS has been designed for a touch screen, the technology required to run it is not as expensive as what was required for Windows 7.

Android tablets are a great example of how this market is evolving. The challenge for military organizations will be how quickly they can adapt to high quality commercial products and services.

As a result, military commanders could procure six tablets for the same price they would have previously paid for one military spec device. In addition, commanders don't have to place the order six months in advance, as COTS solutions are easy to procure and adapt to need.

Smaller militaries are getting ahead of the game and are faster to adapt as they don't have the traditional relationships with incumbent suppliers to navigate through, which explains the heightened demand from South America and Africa, for example, for this type of technology.

SIMULTANEOUS BROADCASTING

Any tablet device designed to receive battlefield intelligence via satellite needs a communications bearer. Another commercial technology that's predicted to impact heavily on the MILSATCOM community is ***IsatData Pro*** from **Inmarsat**. It uses a variety of satellite cellular terminals (each designed for different uses, fixed asset, troop on the move, etc.) to send and receive small packets of data (no larger than 10,000kb per message) to multiple assets, wherever they are in the world. It's a cost effective low-data alternative to traditional MILSATCOM as it's designed to send the same message simultaneously to multiple units, rather than a single message repeated. This creates airtime savings and ensures all assets are receiving identical data simultaneously.

The Raytheon "RATS" system

Photo of soldiers with Apple® iPads®. Courtesy of the website iPads for Soldiers.

Seeing what a UAV observes with the ability to control the airborne craft using a tablet.
Photo courtesy of Harris Corporation.

IsatData Pro is used in commercial sectors, as well, such as transportation and fleet management and oil and gas—it is now being considered by forces looking for a cost effective, scalable, command and control SATCOM bearer. BLOS satellite communications are essential for first responders and forces operating in austere conditions which don't lend themselves to radio communications. By using one of the IsatData Pro devices in conjunction with a new tablet, and the appropriate situational command and control software, troops can be cost effectively equipped with situational command and control blue force tracking capability.

The Pentagon has signed a three year agreement with Microsoft for Windows 8 licensing to use in mobile devices.

WHAT'S NEXT?

There is increasing commercial crossover in the military world as procurement teams look for cost effective, flexible solutions. Taking a commercial satellite solution such as the IsatData Pro and combining it with a commercial tablet computer running a commercial OS is a highly effective way of increasing capability quickly and easily. The solutions are interoperable, and there is no excessive lead time or long term procurement buy-in.

Carriers such as Inmarsat and Iridium provide the satellite backbone for COTS solutions that range from blue force tracking applications to electronic counter measure signal jamming solutions. Certainly such technology implementations for forces need to be regulated and properly managed. However, by using combined commercial technologies, it is now possible to quickly build military capability that would otherwise have taken years to procure.

About the author

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

Information regarding Track24 is available at their website:

http://www.track24defence.com/

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- **Mohamed Ibrahim**, Director of Satellite Systems Development & Test Laboratory, **National Authority for Remote Sensing and Space Sciences (NARSS) Egypt**
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ANTENNA INTEGRATION: THE OPEN-AMIP STANDARD FOR SATCOM

By Karl Fuchs, Senior Contributing Editor

Satellite *Communications-On-The-Move* (COTM), or, sometimes referred to as *Satellite-On-The-Move* (SOTM), has come a long way in the past few years. The satellite industry has taken many technological leaps forward in order to provide high bandwidth, global satellite coverage on a moving platform.

Spread spectrum waveforms allowed the use of even smaller aperture antennas without violating adjacent satellite interference regulations. Global, distributed *Network Management Systems* (NMS) allow *Internet Protocol* (IP) satellite routers to maintain a consistent set of IP subnets despite roaming. However, no technology has been more instrumental in enabling COTM than modem-to-antenna integration. With fixed very small aperture terminal (VSAT) installations, antenna integration is simple. An installer points the antenna, adjusts polarity, runs a 1dB compression test, and locks the entire system down with just a wrench as the required tool.

General Atomics' Sea Avenger UAV

This is *not* the case on a COTM platform. In a COTM system, the modem and antenna must work closely together. This is especially true for long duration vehicles, such as ships and aircraft, which are likely to traverse satellite coverage areas. In a COTM system, the antenna and satellite router must communicate current geographic location, satellite handoff, beam quality values and other information if a beam switch is to be successful.

The first challenge encountered in trying to integrate COTM antennas and satellite routers is agreeing on a communication language. At the dawn of the COTM age, antenna manufacturers and satellite router vendors each had their own proprietary protocols. These protocols were never designed to work together.

Some vendors offered a bundled solution. A bundled solution did allow for more convenient integration but severely limited end-user choice as to the best available technology and mission flexibility by locking the user into a proprietary solution.

To help enable the market and to achieve best-in-class airborne solutions, an open protocol was required. This market need drove the development of the ***Open Antenna to Modem Interface Protocol*** (**Open-AMIP**). Open-AMIP has now been widely adopted by a number of maritime and airborne antenna manufacturers as the protocol of choice for their ***antenna control units*** (**ACUs**).

In some cases, however, vehicle or mission requirements may dictate the use of an antenna which has not yet adopted the Open-AMIP standard. In this case, a protocol translation between the satellite router and antenna will have to be performed. This protocol translation can be accomplished through specialized software running on a PC platform. In order to facilitate this protocol translation, some satellite routers built for COTM applications have a **PC104 CPU** built-in so the translation software can be run locally to the router. (*PC104 Single Board Computer formats are for specialized computing environs, most often within an extreme environment. This form factor enables the use of a rugged system that's customized without having to wait for months of design work.)*

True system level antenna integration is much more than just a communications protocol, of course. System level integration requires the satellite router and the antenna make intelligent decisions regarding when to change beams, and in the case of overlapping beams, making the correct choice of beams.

Knowing when to switch beams and selecting the correct beam cannot be done by simply monitoring out-route signal quality, as signal quality can degrade for reasons other than reaching the edge of the beam. To make an intelligent decision on beam selection, the system must be aware of the relative signal strengths and the EIRP contours of all the beams from which a vehicle could possibly derive service. This data must then be cross-referenced with vehicle path and speed in order to initiate a beam switch.

Once a system has been completely designed with global, beam signal quality maps, the other vexing problems of satellite COTM solution can be tackled. One such issue is known as the *skew angle* problem. Skew angle refers to off axis radiation from an oblong or rectangular, flat panel antenna.

The transmission pattern of a rectangular, flat panel antenna is itself non-symmetrical. When properly oriented with the satellite orbital arc, there is minimal *adjacent satellite interference* (**ASI**). However, when an aircraft banks or changes direction, the orientation of the radiation pattern changes—such can cause an unacceptably high degree of ASI.

This skew angle problem is most apparent when an aircraft or ship is close to the equator. By leveraging a map server with the relative strengths of the beams with an overlay of the skew angle of an antenna as a function of latitude and coupling a robust adaptive in-bound channel mechanism, skew angle ASI can be effectively mitigated

The final element of modem to antenna integration is the human element. Satellite routers and antenna control units are each, in their own right, complex equipment. Once integrated, troubleshooting can become an exercise in finger pointing at different vendors. In addition, an operator in an aircraft or maritime vessel must have situational awareness of the communications links. Information such as time to beam switch becomes critical to providing a satisfactory experience for the end-users. Fortunately, graphical displays have been developed which can provide not only a moving map with EIRP contours overlaid but a health status of the satellite router and antenna control unit.

Future developments for satellite router and antenna integration are focusing on the seamless hand-over needed for the spot beam architecture of the new *High Throughput Satellites* (**HTS**). Much of the development done previously can be leveraged onto HTS platforms—however, the overlapping nature of the spot beams allows for the flexibility of make before break.

About the author

Karl Fuchs is vice president of technology for iDirect Government Technologies (iGT). He joined iGT in 2004 as the director of sales engineering, just as the satellite-based IP communications company was expanding its very small aperture satellite (VSAT) market presence into the federal government and international Internet Protocol (IP) networking world. He now works as the vice president of technology. With more than 20 years of experience in technology and with the federal government, Fuchs leads iGT's team of federal systems engineers and serves as chief architect for new product integration. Prior to joining iGT, Fuchs was director of systems engineering at Nortel Networks, where he oversaw the Verizon account team of systems engineers, leading the design of IP, frame relay, asynchronous transfer mode (ATM) and dense wavelength division multiplexing (DWDM) networks. Before joining Nortel, he designed IP and ATM networks for Sprint and the federal government. Active in the satellite industry for more than 10 years, Fuchs has contributed editorially to numerous publications and has been a featured speaker at leading industry events.

WGS + Ka-band impact on high power amplifiers

The introduction of Ka-band satellite communications (SATCOM) has changed MILSATCOM forever—and influenced commercial SATCOM as well! A major ground system component that has been dramatically affected by the advent of Ka-band is the *high power amplifier* (HPA).

Photo of SATCOM-On-The-Move (SOTM) product. Courtesy of Boeing Defence Australia.

Some of the key changes in HPA requirements due to the introduction of Ka-band include: the necessity of locating the transmit amplifier even closer to the feed; transitioning from multi-band capability in a single amplifier to use of separate, interchangeable amplifiers for each band; and the move to making linear output power the key amplifier requirement.

With MILSATCOM frequencies in X-band, the loss encountered in the waveguide runs from a transmit amplifier located a few feet from the feed, or even farther, could be accommodated in typical link budgets without too much difficulty. The commercial C-band SATCOM band has similar low waveguide loss. *Figure 1* shows the loss in dB/meter of straight waveguide at each transmit band frequency for X-, Ku- and Ka-bands.

As the military transitions to using large amounts of commercial Ku-band SATCOM capacity, a drive was initiated to place the transmit amplifier closer to the antenna feed, as the Ku-band waveguide loss is 1.7x the loss at X-band. Moving to Ka-band increases the waveguide loss of any runs to the feed by a factor of 6, and the cost/watt of Ka-band RF power is also higher. This has meant that system integrators have been under great pressure to put the Ka-band HPAs as close to the feed as possible, often complicating other system aspects to make such happen.

In order to move the Ka-band HPAs close to the feed, amplifier size, weight, and power consumption have all had to be dramatically reduced. The HPA weight can be critical in allowing the antenna to meet tighter pointing requirements at Ka-band, and many mounting configurations demand small HPA size to reduce or eliminate blockage.

This has been accomplished with a range of technology and design adjustments, resulting in higher power available from smaller units in the band than ever before possible. An example of this is the reduction in SWP made when transitioning from a standard size 250W rated Ka-band HPA, which provided about 100W of linear power for fixed Earth station applications, to a compact, ruggedized, HPA that is suitable for transportable *on-the-halt* (**OTH**) terminals while providing 110W of linear power at Ka-band over the challenging environment seen by these terminals.

Figure 2 shows that similar linear power provided by the 48lb. fixed Earth station unit can now be provided by the much smaller 30lb. transportable unit without surrendering any capability. An additional factor at Ka-band is that, due to the higher waveguide losses, the upconverter can no longer be located remotely from the amplifier, even for larger systems. This means that all Ka-band HPAs come with the option of including the upconverter inside the unit—almost all military applications do so.

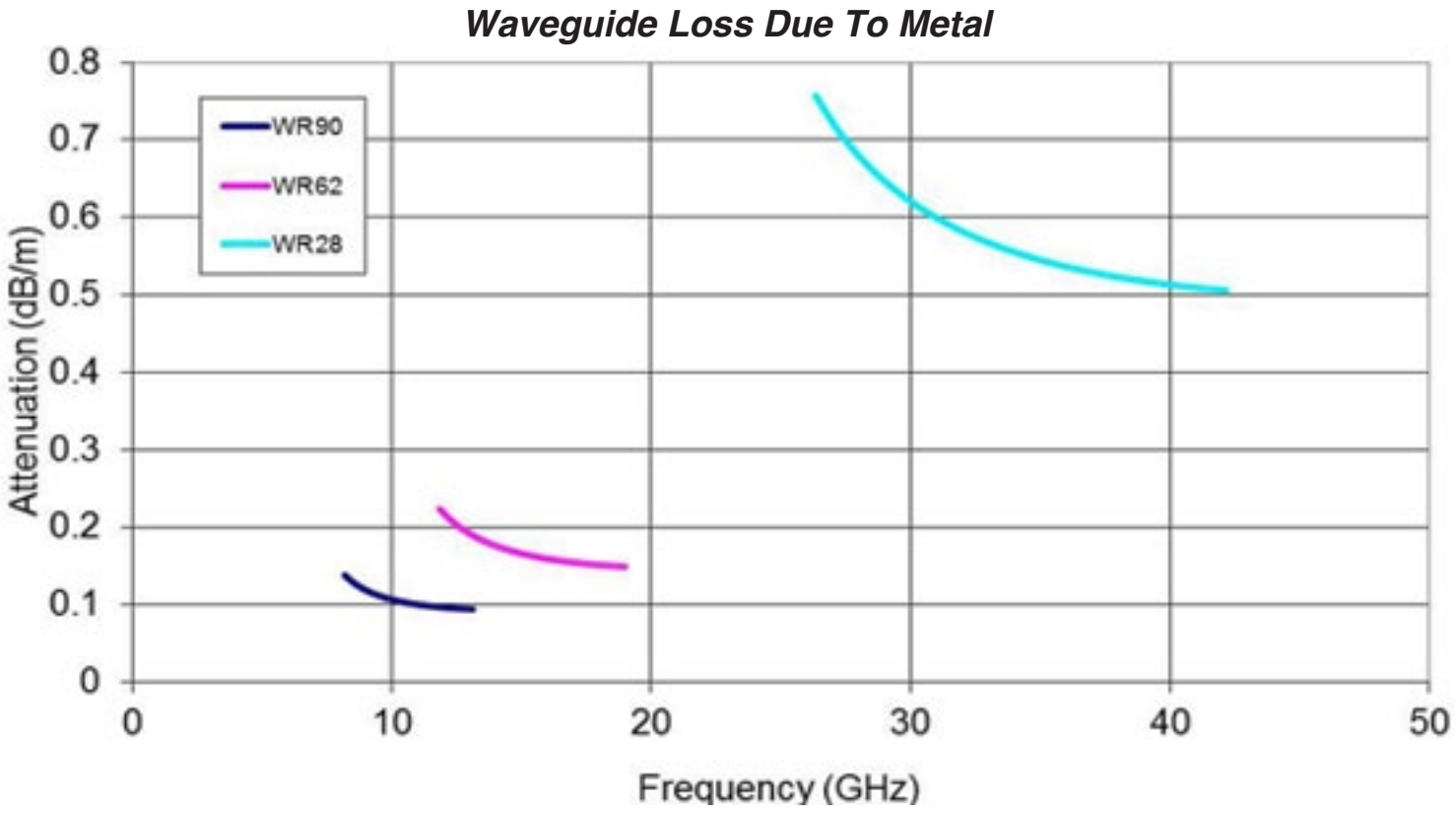


Figure 1. Waveguide Loss at Standard SATCOM Frequency Bands — Source: Microwaves101.com

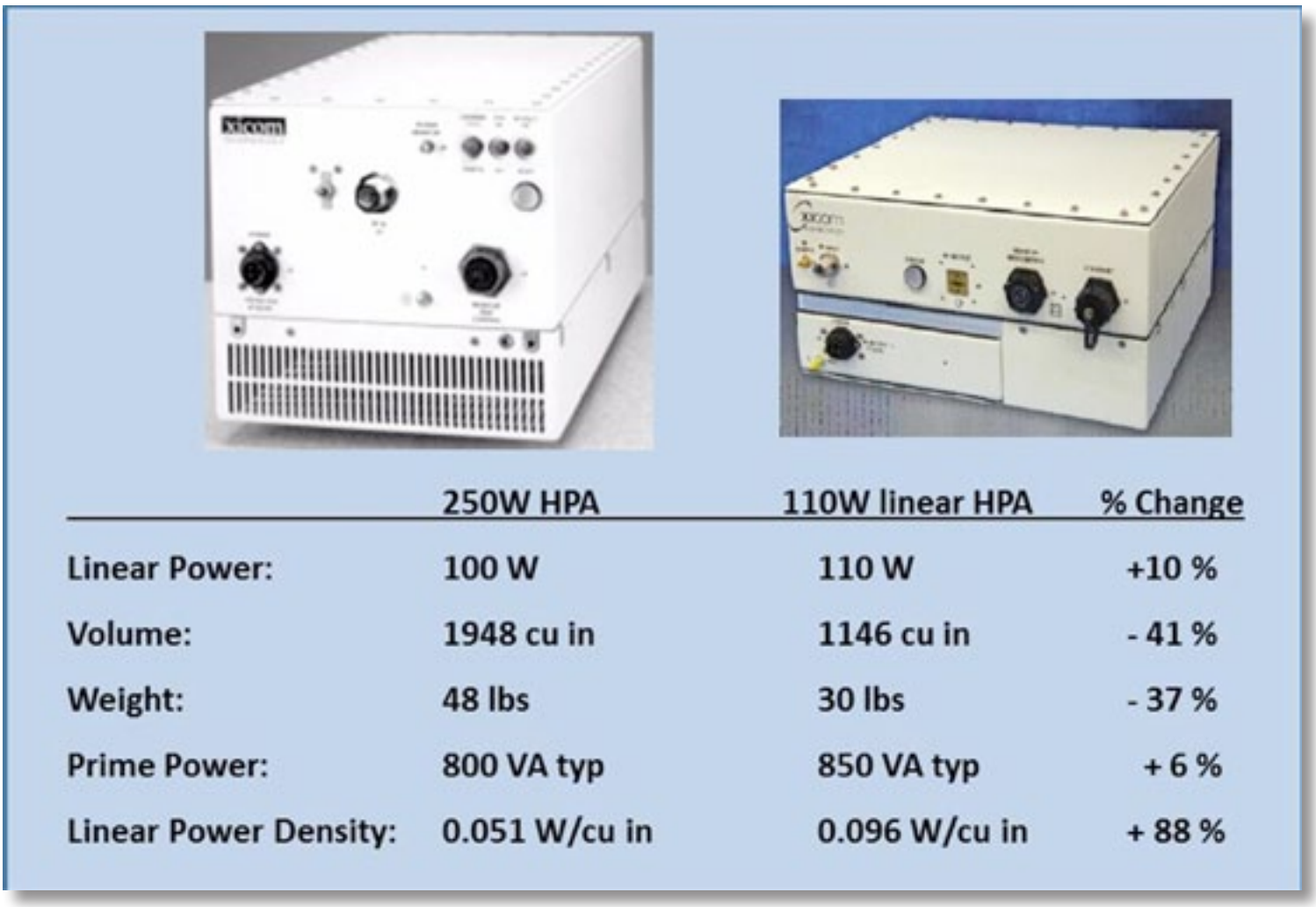


Figure 2. Smaller, Rugged Ka-Band HPAs Enable Mounting at the Feed

The wide frequency gap between Ku- and Ka-band makes it prohibitive to build an amplifier that can cover both bands, much less one that includes X-band. The result is that multi-band terminals that used to include a tri-band C-, X- and Ku-band transmit amplifier must now take another approach.

Some existing terminals have opted to retain the older tri-band HPA and add a Ka-band one to be switched in as needed for Ka- operation. However, many newer terminals, especially smaller, tactical terminals, have incorporated a modular band switching capability that allows the user to reconfigure for a different band in the field.

Examples of this type of terminal are shown in *Figure 3*; the terminal can be configured for X-, Ku- or Ka-band by simply removing the feed, BUC and HPA (a single feed-boom assembly) and installing one of a different band. This approach is, again, made possible by smaller and lighter transmit amplifiers that mount on the feed boom.

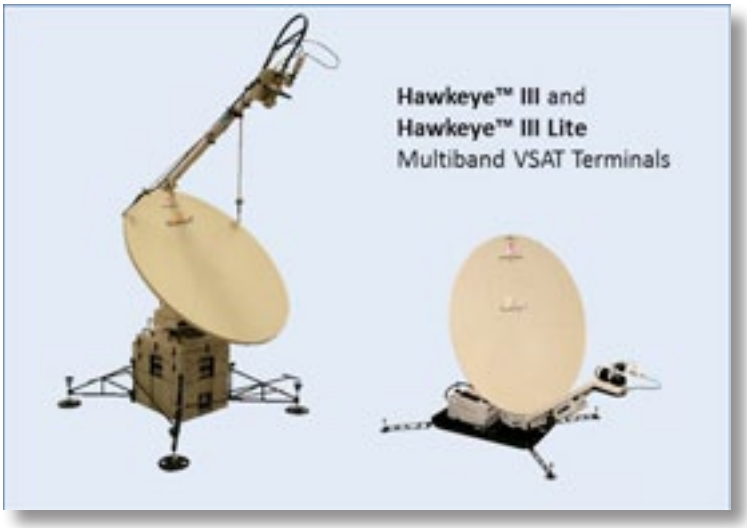


Figure 3. Modular Frequency Band Switchable Terminals. Source: http://www.globalcoms.com/Hawkeye_III.asp

Traditionally, transmit amplifiers have been specified by their highest guaranteed output RF power, either as a saturated power or a 1dB compressed power (see *Figure 4*). Communication systems don't generally operate the HPAs at these power levels, as the distortion caused by the non-linearities of the amplifier at those levels would create too much interference, either in-band or out-of-band for low error rate performance.

Most amplifier specifications also included one or more linearity requirements. These could be specified in varying ways and applied at a reduced or "*backed-off*" power level relative to the rated power. The *backed-off-from-rated power level* necessary to meet the linearity or distortion requirements and ensure that it is not interfering with transmission of in-band or out-of-band signals over the satellite is called the linear output power (again, *Figure 4*).

In the past, most HPAs were specified and procured according to the "rated" or highest guaranteed output power. With the ***WGS*** (**Wideband Global SATCOM**) emphasis on specifying linear power, the "rated" power (either saturated or P1dB) is not specified at all as it is irrelevant. Only the linear power at which the amplifier will actually operate is of interest.

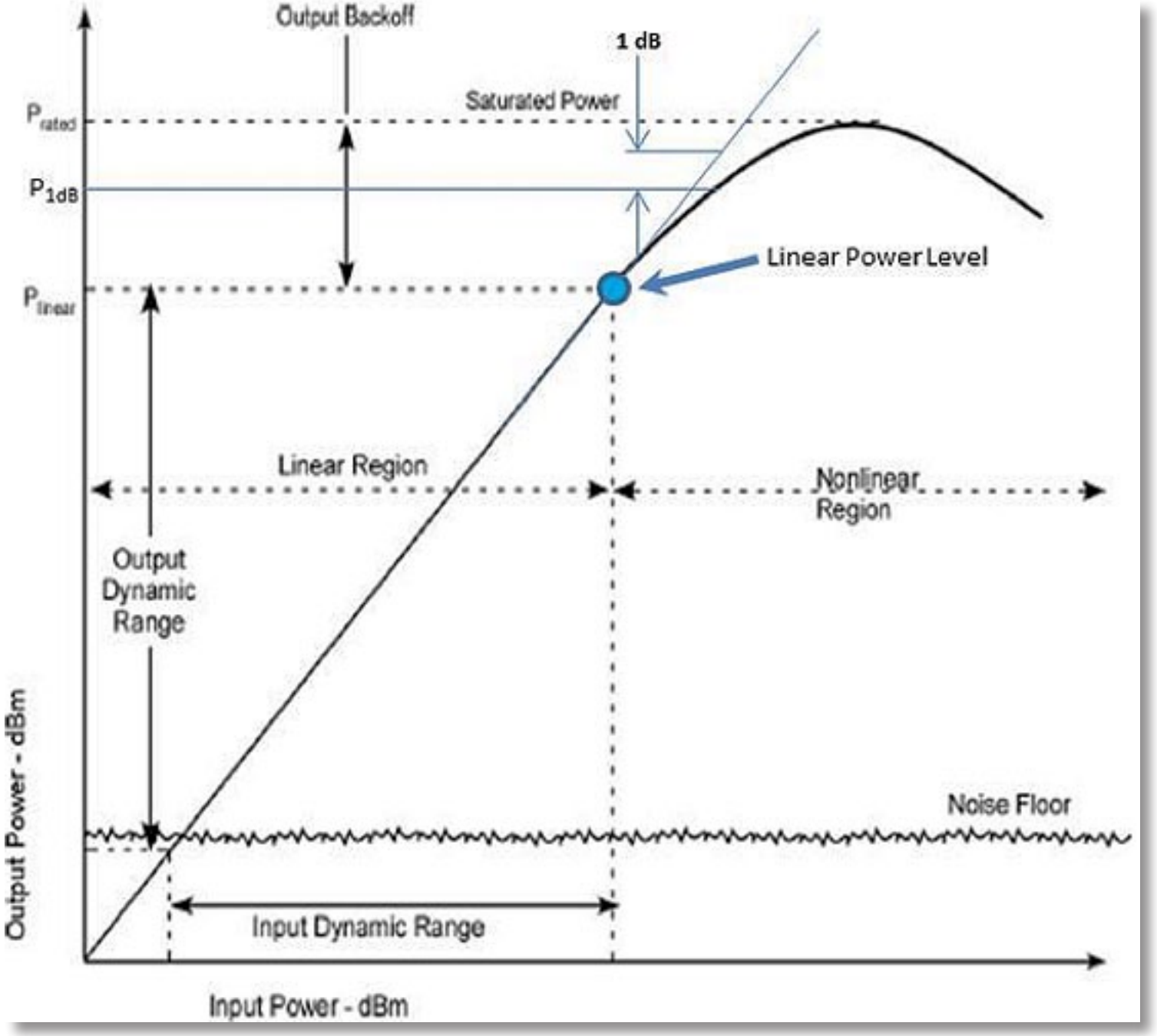


Figure 4. Rated and Linear Power Definitions Shown on Power Saturation Curve

Linear power can be different for the same amplifier if the linearity requirements are different, so it becomes critical to define linearity appropriately for the terminal and its application. Traditional amplifier linearity requirements have generally focused on *third order intermodulation* (**IM3**) products, however, for single-carrier terminals, the user does not create any intermodulation products. For single-carrier terminals, *spectral regrowth* is a better indicator of the operational linear power available.

Spectral regrowth (see *Figure 5a*) is an indicator of how much of a modulated signal's power will fall out of band and interfere in the adjacent band due to the HPA's nonlinearities. Power is typically measured relative to the in-band modulated carrier power at one symbol rate from the carrier frequency using the system's planned modulation format (*i.e.*, **QPSK**, **OQPSK**, and so on).

For systems with two or more carriers, intermodulation products—or IMs (see *Figure 5b*)—provide a good indication of the level of interference with other links using nearby frequency channels due to the interaction of the multiple carriers through the amplifier. The IMs are measured by passing two equal-powered unmodulated carriers through the HPA and measuring their output along with the levels of the mixing products created by the non-linearities in the amplifier.

In industry, these have been traditionally measured relative to the power level of a single carrier, but with ***WGS***, they are measured relative to the sum of the power of the two carriers.

A third approach to determining linear output power applies if there are many carriers, such as is often the case with hubs or teleports. In these cases, the *noise power ratio* (or **NPR**) can be used to indicate the level of distortion introduced in the channels transmitting the other carriers (see *Figure 5c*).

For this test, white noise with a large notch (typically 40dB deep) cut out of the white noise spectrum is injected into the amplifier and the output measurement shows how much distortion falls back in the notch due to the non-linearities of the HPA. *Figure 5* shows typical specification values for each of these parameters.

As transmit amplifiers cannot perform with excellent linearity all the way up to the maximum output power, communications engineers came up with the idea of accomplishing the opposite in gain and phase of what the amplifier does to the signal, so that at the output of the HPA it is much flatter in both gain and phase response. This is called a *pre-distortion linearizer*; *Figure 6a* shows an idealized gain and phase response of a TWTA and an SSPA without and with pre-distortion.

Figure 6b shows the improved power saturation curve of a linearized TWTA; the predistortion actually shifts the curve as well as the maximum location on the curve at which linear operation is achieved. SSPAs at lower frequencies typically do not require linearization as they can operate fairly close to saturation (within 3dB) while meeting key linearity specifications.

However, at Ka-band most of the high power chips available for use in power combined HPAs do not have as good of linearity as those at Ku-band and below, making linearization of SSPAs a real option. Linearizers have played a key role in achieving the power levels needed for military

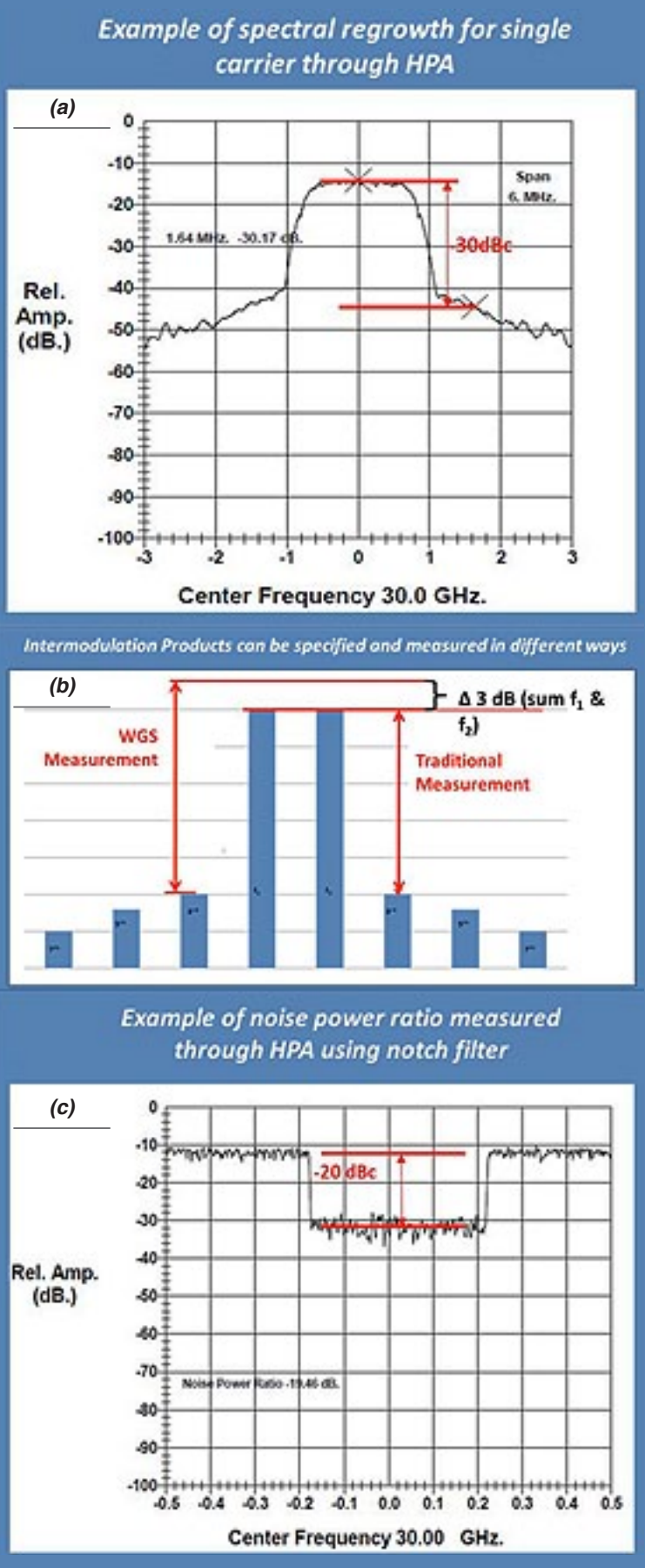
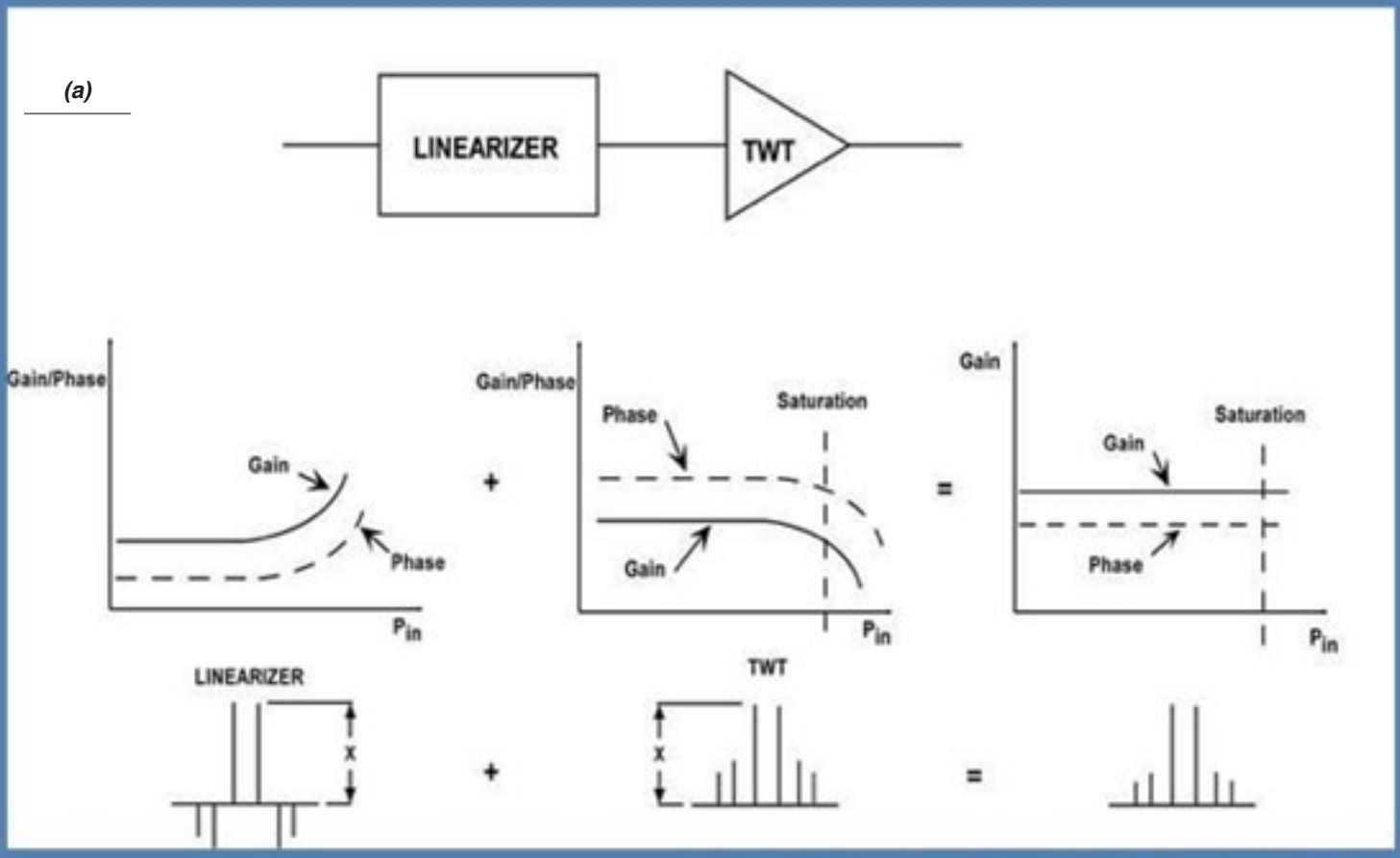


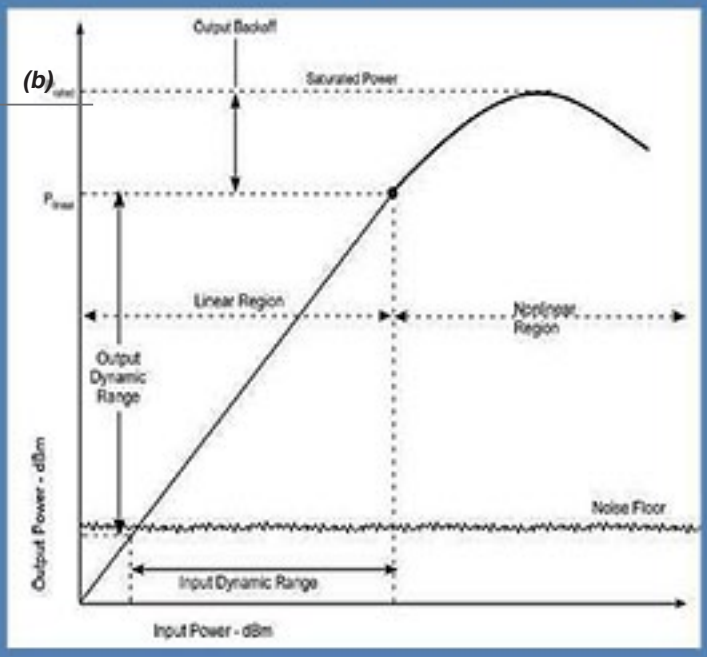
Figure 5. Linearity Can Be Specified, Based On Spectral Regrowth, Intermodulcation Products, Or Noise Ratio

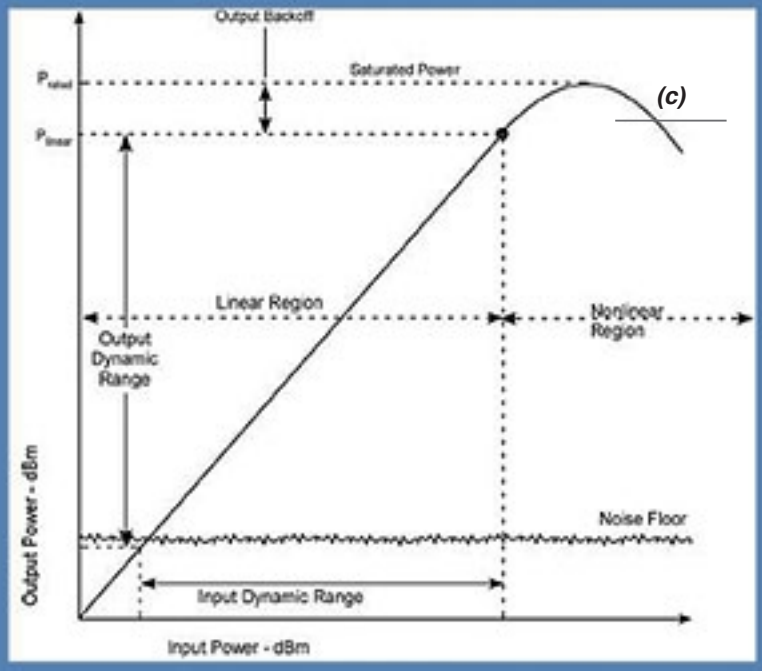
Pre-distortion of Gain and Phase for a TWTA



Power saturation curve for linearized TWTA

Power saturation curve for unlinearized TWTA





Improvement of ~3dB in Linear Power is Typical for TWTAs with Predistortion

Figure 6. Pre-distortion Linearization Flattens Gain and Responses and Shifts the Gain Cuirve to Provide Higher Linear Power

Ka-band systems; while there is a cost for linearizers, it is almost always worth it at Ka-band.

With linear power as the key specification, being able to operate up to saturation becomes unnecessary for many communication systems, and not even allowed over ***WGS***. The output power can be limited in the amplifier design to just above the linear power, typically around 3dB below the rated power of the equivalent full power or "*CW*" tube.

In TWTAs this is called a *peak TWTA* and it allows the collector depression ratios of the traveling wave tube itself to be optimized for better efficiency over the lower total operational power range. The resulting higher efficiency and reduced power dissipation, along with the smaller power supply that only has to power the tube up to the linear power level, allow for safely reducing the heat sink size and mass.

The result is a smaller, lighter, more efficient and, yes, less expensive, TWTA. The resulting amplifier has the same RF performance characteristics as the CW TWTA, up to the point at which the power limits. *Figure 7a* shows the power saturation curves for a 400W Ku-band CW TWTA and a corresponding 400W Ku-band Peak TWTA. The plots are nearly identical, but a comparison of the two units (see *Figure 7b*) illustrates the dramatic reductions possible in size, weight and power draw.

With the continued announcement of additional ***WGS*** satellites, it is clear that Ka-band MILSATCOM will be a requirement for a long period of time and will continue to drive development of new and innovative ground system solutions. The changes already occurring to the HPAs have made a significant and lasting impact on how transmit amplifiers are specified, integrated, and used for Ka-band MILSATCOM as well as in the commercial SATCOM industry.

Where they are located, what size and weight they must be, and how their linearity and linear power are specified and measured have been affected … this leave us to wonder what may be next? Commercial Ka-band has many variations, and military terminals may need to have dual-band (commercial and WGS) capability in a single package.

Incorporating more functionality into the transmit amplifier package, similar to transceivers in the past could buy some additional size and weight savings to further improve pointing. We do know that ***WGS*** Ka-band and MILSATCOM will be leading the way.

About the company

Comtech Xicom Technology, founded as Xicom Technology in 1991, has grown to be a world leading satellite communications (SATCOM) amplifier supplier, offering the broadest product line in the industry. Their focus on customers, innovation, and quality has driven growth and created a company with a reputation for excellence. Regarded as an industry leader across the board, Xicom provides rugged, highly efficient and reliable Traveling Wave Tube Amplifiers (TWTAs), Klystron Power Amplifiers (KPAs), Solid State Power Amplifiers (SSPAs), and Block Upconverters (BUCs) for commercial and military broadcast and broadband applications around the world. These Xicom High Power Amplifiers (HPAs) are in use in critical communications links on the ground, in the air and on the sea; they support fixed traditional and direct-to-home broadcast, mobile news gathering, transportable and flyaway systems, secure high data rate communications, and broadband access over SATCOM.

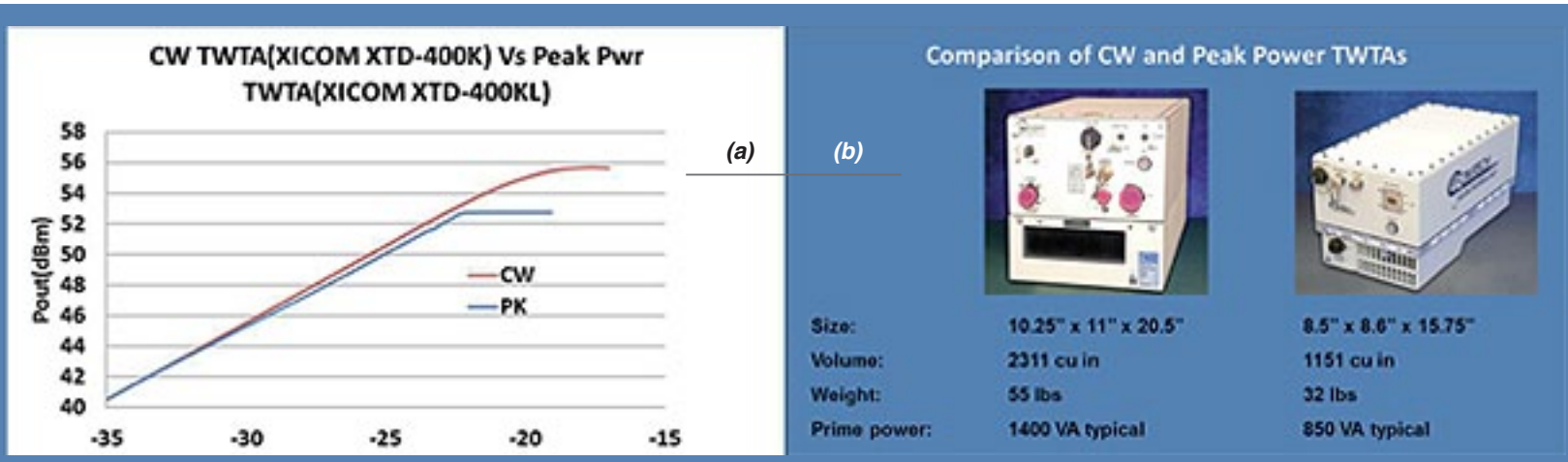
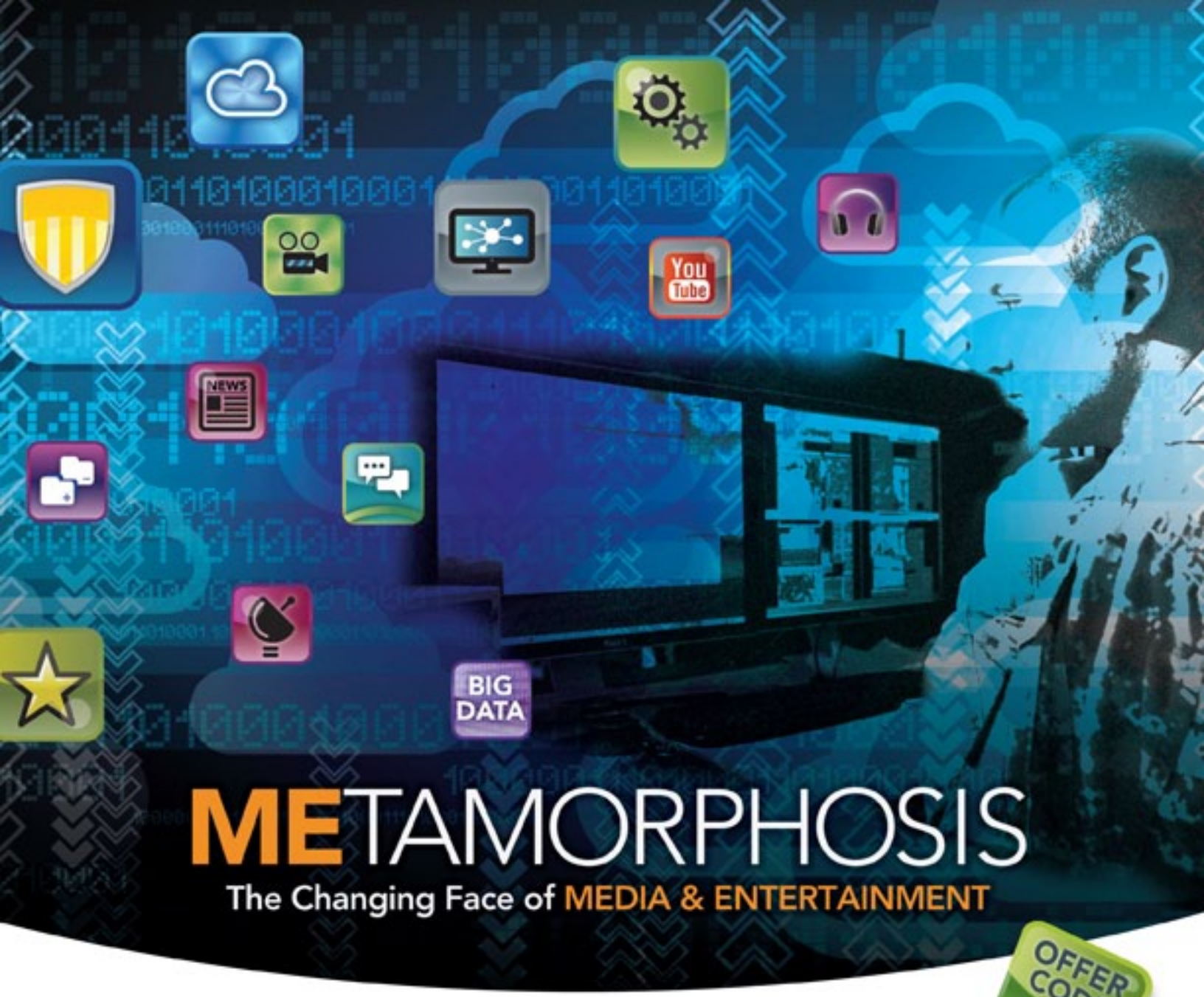


Figure 7. Peak and CW TWTAs Have Nearly Identical RF Performance—and Peak TWTAs Can Be Far Smaller and Lighter



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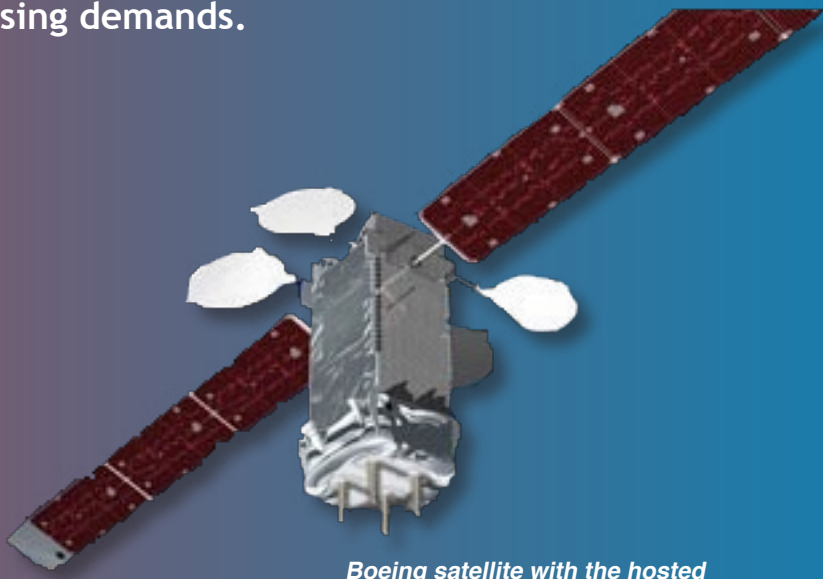
HOSTED PAYLOADS: ON THE LEADING EDGE

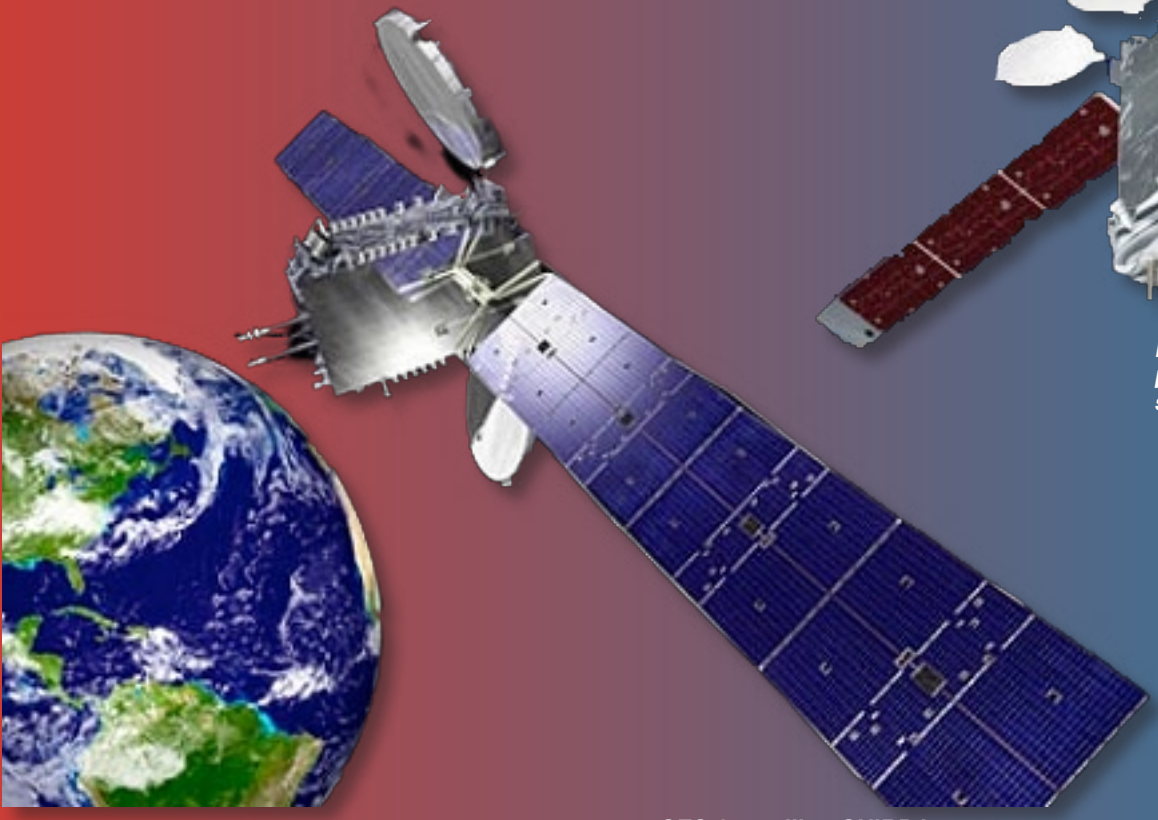
Abstract by Rich Pang, Senior Director For Hosted Payloads, SES Government Solutions

At the leading edge for driving Hosted Payloads is the United States Air Force' Space & Missile Systems Center (SMC), located at Los Angeles Air Force Base in Southern California. At the forefront of innovative ideas to help overcome the many challenges that face our nation and its national security programs today, and well into the future, is *Lieutenant General Ellen Pawlikowski*.

She is breaking paradigms, spearheading new thinking, and creating new options for delivering capability to warfighters in support of national defense. The U.S. Air Force (U.S.A.F.) is to be applauded for their forward-leading creation of a *Hosted Payload Office* (HPO), under her command. The soon-to-be-released *Hosted Payload Solutions*, indefinite delivery/ indefinite quantity (ID/IQ) contract is a clear sign that hosting government payloads on commercial satellites is a viable option when designing and delivering the future architectures that will be needed to meet tomorrow's ever-increasing demands.



Boeing satellite with the hosted payload being the four-pronged square at the "base" of the spacecraft



SES-2 satellite, CHIRP host

CHIRP hosted payload before it was placed on SES-2. Photo courtesy of SES.

Hosted payloads will complement and supplement dedicated platforms while providing significant cost savings and improved resilience across most mission architectures. With the recent success of the ***Commercially Hosted InfraRed Payload*** (**CHIRP**) program, the hosted payload concept has also proven its ability to help mature and space-qualify new and innovative technologies.

Although the funding is fairly modest at this time, the U.S.A.F.'s *Space Modernization Initiative* will not only allow existing systems to be modernized and upgraded, but enable the use of hosted payloads to deliver these state-of-the-art capabilities in a more timely and cost effective manner.

The **Space and Missile Systems Center** is forging the path to ensure the nation has as many options available as possible as we enter a new austere budgetary environment. Requirements and demand for capability will continue to increase with shrinking budgets, so they must use technology and innovation to drive down cost while sustaining and improving capability.

Question:

What can we, as an industry, do to help the Space and Missile Systems Center advance the use of commercially hosted government payloads?

Don Thoma, President and CEO, Aireon:

"The SMC has taken the initiative to become a leader in driving the U.S. Government to recognize commercially hosted payloads as a viable alternative for space missions. To support this advancement, industry can help SMC in several key ways. First, we can provide SMC with subject matter expertise on commercial space practices. Commercial space programs are executed with processes that create substantial efficiencies and are proven to be successful. Industry leaders can help SMC better understand these practices and identify how the government can collaborate with commercial satellite operators to benefit from these efficiencies. Second, we can work with SMC to identify flexible options for executing hosted payloads during all stages of a hosted payload program. Finally, we need to help SMC maintain the momentum they have built by working with SMC to keep an ongoing dialog with leading organizations, like the HPA, ensuring that hosted payloads become an on-going part of SMC's procurement strategy.

Jim Mitchell, Vice President, Boeing Commercial Satellite Services:

"Partner with Space and Missile Systems to create a joint database that tracks the pipeline of satellite projects and the size, weight and power margin available to accommodate hosted payloads. This would serve as a single database that all government customers could access in determining potential candidates to host government payloads."

Bill Gattle, Vice President, Aerospace Systems, Government Communications Systems, Harris Corporation

"Hosted payloads provide an extraordinary opportunity to both government and industry to improve access to space. SMC has recognized the value and taken aggressive steps to capitalize on this approach. We congratulate them on their success to date and applaud their continued efforts to realize further benefits. Along with the economic benefits, hosted payloads introduce a unique set of technical, contractual and operational challenges. Our experience indicates technical challenges are typically addressable through proven engineering practices, whereas contractual and operational challenges require creativity and a revisit of industry paradigms. The key to success is open collaboration between all parties. Recognizing the time pressure of commercial launch schedules, both parties must be forthright in disclosing areas of flexibility and areas critical to mission success, such as integration schedules, information

assurance, satellite resources, funding, etc. Business models can be shaped collaboratively by government and industry to balance economic benefit with mission utility."

Robert Burke, Vice President, Strategy and Business Development, Northrop Grumman Aerospace Systems

"At Northrop Grumman, we are strong supporters of SMC's hosted payload initiatives. As a payload supplier to SMC programs, it is incumbent on us to provide payloads that can be adapted to a variety of platforms, including both free-flyer, dedicated satellites and multi-mission commercial and government hosted arrangements. Among the capabilities we bring to the table are scalable payloads that can be sized to meet different user needs and to fit within the host satellite weight, power, thermal and size demands. We build payloads that are largely platform agnostic and can be integrated with a variety of satellite prime power, thermal and data interface criteria. This flexibility allows us to adapt our payloads to a variety of potential platforms, not only for space but high-altitude, long-endurance air platforms as well. A good example of our capabilities is the scaling of components from Advanced EHF payloads to meet the needs of users requiring protected EHF connectivity in the high Northern latitudes where geostationary satellites do not have line of site with users. This is a hosted payload, and by all measures a success. In addition to our satellite payloads, we are now developing a control and mission planning capability that will monitor, manage and plan polar EHF communications missions. Like our satellite payloads, this control and planning capability is scalable and adaptable to user needs. We stand ready to meet DoD needs for hosted payloads with existing, proven and in-production systems that the government already trusts and deeply understands."

David Anhalt, Secretary of the Hosted Payload Alliance and Vice President, U.S. Government Solutions, Space Systems/Loral

"As pointed out in the article, CHIRP has shown the way to mature and space-qualify new technologies as well as pioneer the use of inventive, nontraditional arrangements for acquiring commercial space goods and services to enhance U.S. military capabilities. What remains is to legitimize these commercially leveraged approaches as valid alternatives during the Air Force's early acquisition planning processes. Here is where industry can help SMC to gain access to new skill sets, data bases, and streamlined commercial business acquisition tradecraft, so these approaches can be deliberately considered during pre-Milestone A Analyses of Alternatives. I believe that robust interaction between commercial industry and SMC can overcome the remaining challenges for assessing the potential of commercially hosted payload concepts during the trade space characterization, architecture consideration, and concept characterization reviews leading up to major milestone acquisition decisions for the next generation of military space systems."

James Jordan, Treasurer of the Hosted Payload Alliance and Senior Manager, Raytheon, SAS

"Industry should push for a more robust dialog with SMC's mission directorates to secure an understanding of the complete value proposition that hosted payloads could provide. The discussion must move away from the qualitative positions that hosted payloads could be a possible mission solution; and move in the direction of driving definitive quantitative analyses to support a specific mission capability within a broad mission context."

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DEBRIS DETECTION DEVELOPMENTS—THE SPACE FENCE

Debris fills the spatial environs that surround our Earth. Once a satellite is decommissioned, or otherwise incapacitated via intentional or accidental intrusions, remnants drift dangerously within orbital slots, as well as above and below such designated orbits. Such has been going on since Earth's first artificial satellite launch in 1957.

Two companies who have been engaged in the creation of a debris identification solutions are Lockheed Martin and Raytheon. Their cause is more than just these issues, for more than Global Positioning System viability is at stake—debris has the potential to be downright lethal to multi-million dollar communication and intelligence satellites, national security, astronauts and, yes, even the citizenry of Earth. These two companies have produced exceedingly important information regarding Space Fence and an examination of this technology is in order for MilsatMagazine readers. We thank both firms for their illustrative and insightful websites that assisted in the preparation of this article.

The "*tipping point*" has been reached as far as space debris is concerned, according to the **National Research Council**. Havoc could easily result if a section of debris crosses paths with a satellite—the damage incurred could last from days to months and the fact is that at some point the debris fields will be filled with so much space debris, and the slots with so many satellites, there may be no method whereby new objects could be launched into orbit.

The **Space Fence** program will bring to the **U.S. Air Force** the capability to detect and track space objects. The estimate is that there are more than a half a million pieces of debris in existence, with more than 20,000 objects identified. According to the U.S.A.F., about 95 percent of all space objects are debris.

Debris sizes as small as 1 centimeter cruising at almost 17,000 miles per hour can actually destroy a satellite, or at the minimum, damage its operational capabilities. Debris that has already been documented as part of the plethora of debris includes rocket parts that have been abandoned, a space glove from the Gemini 4 flight in 1965, disabled satellites and debris resultant of an already occurred collision.

An example of the latter is the 2007 intentional satellite destruction by China which resulted in 900+ pieces of debris littering *Low-Earth-Orbit* (**LEO**) as well as the massive debris field that resulted from the 2009 collision between the ***Iridium 33*** satellite and the Russian ***Kosmos-2251*** satellite.

Far more recently, debris threatened the **International Space Station** in 2011 and 2012. The near miss in 2011 had the ISS crew move into the ISS' escape capsules for emergency evacuation to Earth, and the latter evacuation procedure was necessary when a parts of a discarded Russian satellite threatened the space station.

Imagine, if you can, a world where accurate weather forecasting can no longer depend upon satellites, or where a consumer's satellite TV is devoid of downlinked content. Without GPS satellites, banks would find their global operations at a complete standstill, transportation would come to a grinding halt, warfighters would have to operate without ISR leading to more loss of life and fewer successful missions, and power grids would fail. As you can easily determine, this is no "shrug of the shoulders" situation. Much is at stake with the continued health of satellites.

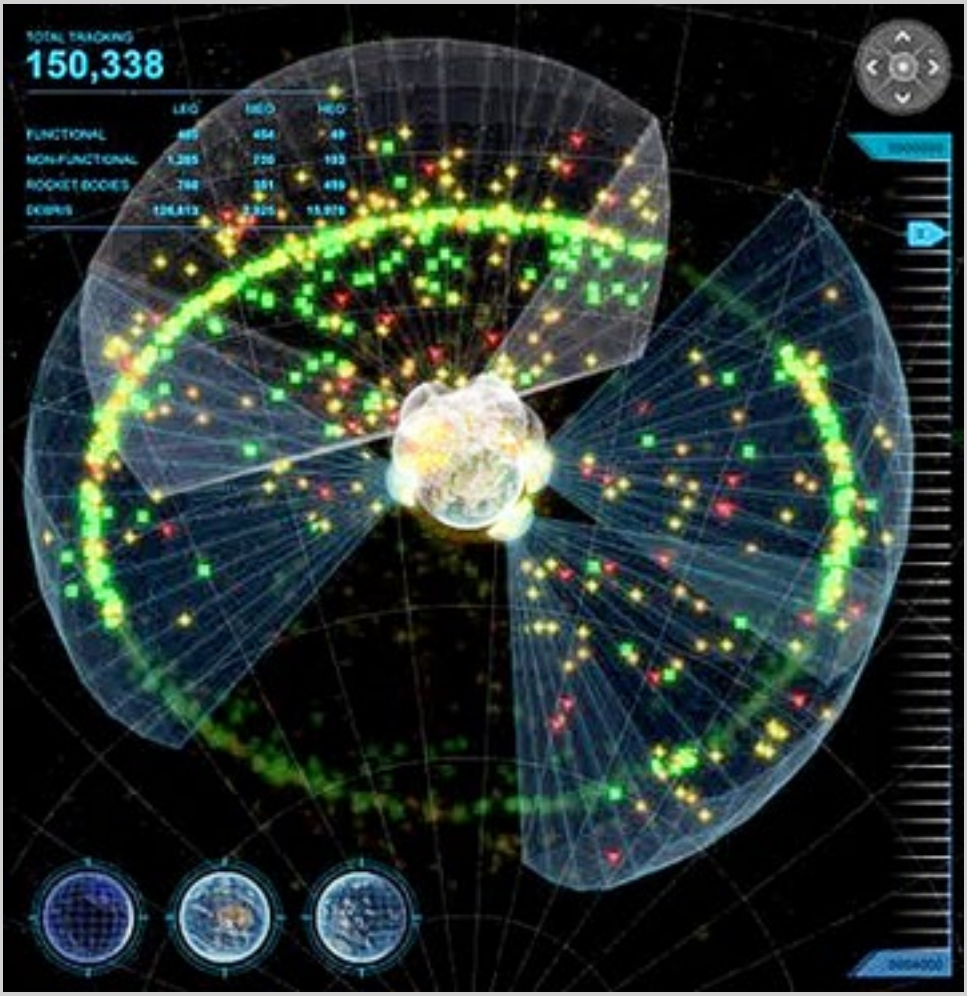
THE SPACE FENCE—WHAT IT IS...

Since 1961, the U.S.A.F. has been operating the ***Space Surveillance System*** radar. Due to its age and other encumbrances, this system can no longer effectively provide the situational awareness for safe space operation. The US$3.5B (estimated cost) Space Fence will possess the capability of tracking approximately 200,000 space objects through the use of higher wave S-band radars. Such will enable greater accuracy and the identification of far smaller pieces than the existing system can identify and will operate 24/7, enabling unanticipated detection and debris tracking of objects in, primarily, low-Earth orbit (LEO).

In December of last year, the *Air Force Life Cycle Management Program* published a RFP to move the Space Fence program forward. This RFP is for the final development and construction of Site 1 and an option for Site 2 for Space Fence ops. The contract award is expected during the spring of 2013 and should result in the fielding and initial operation capability as well as the system's final development. Increment

Artistic rendition of Space Fence Monitoring control room. Courtesy of Lockheed Martin.

Space Fence command and control center simulation. Photo courtesy of Raytheon.



Simulation of the space fence radar in operation. Courtesy of Lockheed Martin.

1 of this award covers the aforementioned development and construction processes, and the Increment 2 option is for Site 2 completion and full system integration.

Lockheed Martin and **Raytheon** have received awards for an 18-month primary system and prototype development project, as well as to engage in the analysis of radar performance and other evaluations and technical activities. With four incremental reviews, there will then be a two day event for final demonstrations. The PDRs enable the government to conduct design review over time and enable the timely feedback of issues that require amelioration.

The importance of the Space Fence was underscored by General William Shelton, the commander of Air Force Space Command. He spoke at the recent Air Force Association's Air & Space conference and fully expects the contract award this quarter. He said operational capability is likely to occur by 2017 with the first site of the location for the big radar system, and a second site for a tracking radar. However, funding is not expected during Q1 2013 for the second site, as fiscal constraints are having their impact on a number of missions.

He added, "It will give us the ability to see a softball-sized object 1,200 miles from Earth. So, you can imagine what that will do for our [USAF] capability to catalog objects in LEO, or our ability to manage traffic. And understand the environment we are launching into for our launches. All that data is going to come from the Space Fence and the SBSS and other sensors around the world—perhaps missile defence radars—and allied capabilities, is going to provide a much better picture of what's going on in space. I can't sing enough praises on Space Fence and what it will represent."

LOCKHEED MARTIN

A prototype of a new radar system developed by a Lockheed Martin-led team is now tracking orbiting space objects, bringing the U.S. Air Force's Space Fence program one step closer to revolutionizing our nation's space situational awareness.

Using powerful, new ground-based radars, Space Fence will dramatically enhance the way the U.S. detects, tracks, measures and catalogs orbiting objects and space debris with improved accuracy, better timeliness and increased surveillance coverage. Lockheed Martin's prototype radar recently met a key contract requirement during a series of demonstration events by proving it could detect these resident space objects, as they are referred to by the Air Force.

On February 29th, the Air Force granted its final approval of Lockheed Martin's preliminary design for the system.

"The successful detection and tracking of resident space objects are important steps in demonstrating technology maturity, cost certainty and low program risk," said *Steve Bruce*, vice president of the Space Fence program at Lockheed Martin's *Mission Systems & Sensors* business. "Our final system design incorporates a scalable, solid-state S-band radar, with a higher wavelength frequency capable of detecting much smaller objects than the Air Force's current system."

Space Fence will enable the decommissioning of the aging U.S.-based Air Force Space Surveillance System (AFSSS), originally installed in 1961. With more than 60 nations operating in space today, the final frontier is much more complex than when the AFSSS first started tracking a few hundred orbiting objects. Today, with hundreds of thousands of objects orbiting the Earth, space debris and risk of potential collisions now threaten national space assets providing critical services, including the Global Positioning System, banking and telecommunications.

Bruce added, "Space Fence will detect, track and catalog over 200,000 orbiting objects and help transform space situational awareness from being reactive to predictive. The Air Force will have more time to anticipate events potentially impacting space assets and missions. Our net-centric design approach allows Space Fence to be easily integrated into the broader U.S. Space Surveillance Network of sensors already operated by the Air Force."

Lockheed Martin's Space Fence prototype was developed under an 18-month, $107 million contract awarded by the Air Force in January 2011. The Air Force has said it plans to award a Space Fence production contract later in 2012. The first of several Space Fence sites is expected to reach initial operational capability in 2017. The Company currently has 400 operational S-band arrays deployed worldwide. The Lockheed Martin-led team including **General Dynamics**, **AMEC** and **AT&T**—has decades of collective experience in space-related programs, including sensors, mission processing, cataloging, orbital mechanics, net-centric communications and facilities.

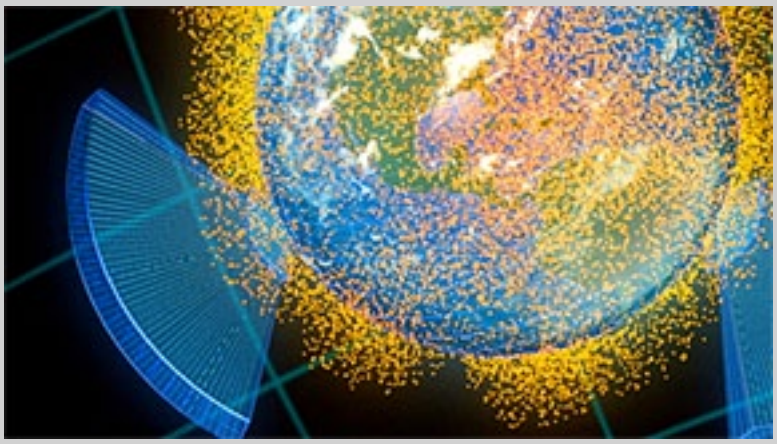
RAYTHEON

Raytheon Company has been awarded a $107 million U.S. Air Force contract to further the design of the Space Fence system. Under this contract, Raytheon will deliver a preliminary design and test a functional radar prototype to ensure cost and schedule certainty and technical maturity of the final design in support of Milestone B.

"As the amount of debris in space continues to rise, the ability to detect smaller and smaller objects with more affordable, ground-based sensors becomes increasingly urgent," said *Dave Gulla*, vice president, *National and Theater Security Programs* for **Raytheon Integrated Defense Systems**. "Leveraging our vast heritage in radar development, combined with our latest technological advancements, the Raytheon Space Fence solution provides the Air Force with an affordable and much-needed, increased space situational awareness capability for many years to come."

The work performed during this phase continues to reduce total program risk through the development of a preliminary design with mature technologies that meet or exceed Technology Readiness Level 6 and Manufacturing Readiness Level 6. In addition, a functional radar prototype, with hardware and software components representative of the technology in the final design, will demonstrate the maturity of these critical technologies.

In January, Raytheon's prototype detected and tracked Resident Space Objects. The Space Fence team also demonstrated the technical maturity of all program components as part of a comprehensive preliminary design review conducted by the Air Force. Later this year, Raytheon will compete for the final contract award to design and manufacture Space Fence.



Artistic rendition of the Space Fence in operation. Courtesy of Raytheon.

A SITE FOR RADAR EYES

The first Space Fence site will be constructed for the overall US$1.9B project on the Kwajalein Atoll in the Marshall Islands in the fall of 2013, with initial operations expected to start in 2017.

Located in the Republic of the Marshall Islands, the Space Fence radar will be capable of detecting, tracking, identifying and characterizing space objects in low and medium Earth orbits. Construction is expected to start in September 2013 and is planned to take 48 months to complete construction and testing.

Until the final design is determined, it is unknown exactly how many personnel will be required to construct the radar site. After construction is complete and the radar is operational, approximately 10 to 15 contractor personnel are projected for the long-term work force at Kwajalein to maintain the Space Fence radar.

A Support Agreement will be established between **Air Force Space Command** and the **U.S. Army Kwajalein Atoll/Reagan Test Site** for site support and facilities maintenance. Contractor operations and maintenance support for the radar site will fall under the responsibility of the USAF's **21st Space Wing**.

LOOKING FORWARD—SETTING THE TABLE FOR 2013

By Kay Sears, President, Intelsat General

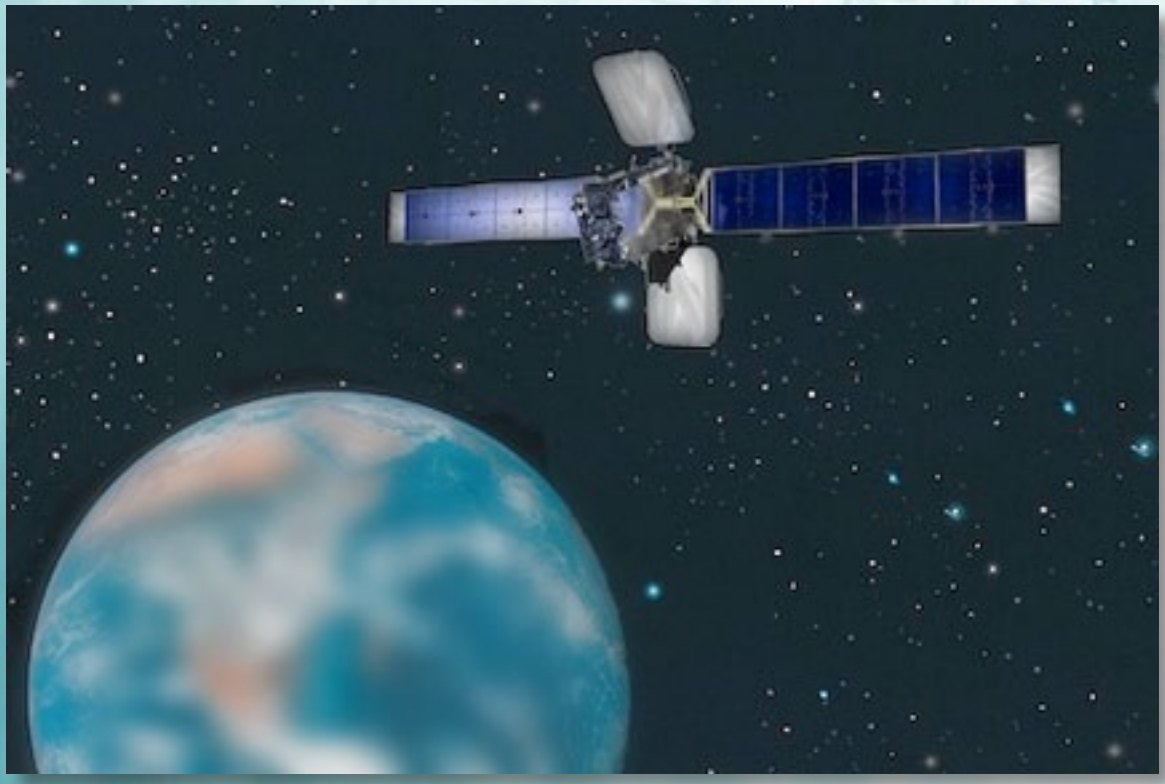
I hope all of you had an enjoyable holiday season. It's that time of year again to look back, and to look forward.

2012 was a successful year for Intelsat General Corporation (IGC). It was also a year in which the complex relationship between the government and the commercial satellite industry was extensively studied and re-evaluated in light of evolving national security needs. This re-evaluation has led to the beginnings of a culture change within DoD regarding the use of commercial satellite services. If sustained, this cultural change bodes very well for our industry.

In 2012, our partnership with the **Australian Defence Force** (**ADF**) via the hosted payload aboard the ***Intelsat-22*** satellite was a big success. Our client is extremely happy with the functionality that the hosted payload provides and the significant cost savings as well. I'm thrilled to have the hosted payload model definitively proven in the market.

The conclusion of **FCSA** (*Future COMSATCOM Services Acquisition*) was a great success for IGC, with our company securing spots on all three contracts. These contracts were for bandwidth capacity and end-to-end services. We also secured an important contract with the **Iraqi Ministry of Defense**, another example of IGC providing end-to-end services and a contract that demonstrated the often inverse relationship between boots on the ground and ISR demands.

This past year, Intelsat announced its next generation ***Intelsat EpicNG*** platform, which will provide government and commercial customers with a range of high-powered mobility solutions. These will include airborne service, manned and unmanned **ISR** (intelligence, surveillance and reconnaissance), and comms-on-the-move.



Artistic rendition of Intelsat Epic NG

2012 also provided clear guidance regarding some of the opportunities that 2013 will hold. The **U.S. Air Force**'s **Space and Missile Systems Center** (**SMC**) announced they would stand up a **Hosted Payload Office** and conducted multiple Broad Area Announcements to learn more about procurement options and architectures. In addition, the DoD announced the intention to perform a "pivot to Asia," signaling a profound change in SATCOM requirements.

Currently, there is about one fourth the satellite capacity in the Asia Pacific region compared to the Middle East—that's a challenge that cries out for true partnership and collaboration. Military visionaries such as *Charles Beames*, Lieutenant General *Ellen Pawlikowski* and General *William Shelto*n have demonstrated an open-minded flexibility regarding how best to work with the commercial sector to ensure our nation's supremacy in space.

It's my sincere hope that these signs of change translate to a year of execution and implementation in 2013.

Because our business demands it, the major commercial operators are constantly innovating and constantly replenishing their fleets. The regular augmentation of commercial fleets offers excellent opportunities for the DoD to procure hosted payloads and to engage in other creative partnerships. The concept of disaggregated architecture in space is a brilliant strategically, but requires challenging the status quo.

The attitude of "*if we don't own and operate it all, we don't trust it*" has to change. And not just on the part of the military. Appropriations committees need to stop hitting the "easy button" of familiar programs of record and be willing to consider alternative approaches that better serve today's needs in space.

Is all that asking too much? I don't think so, and I think 2013 will be a year of major progress. The commercial space operators are in this relationship with the U.S. government for the long haul, and we're ready to serve. We just need to know that we've got a reliable partner in space for the next decade.