SATCOM For Net-Centric Warfare December 2014

MilsatMagazine

YEAR IN REVIEW 2014

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INITIATIVE FOR INNOVATIVE U.S.A.F. ACQUISITION PROCESSES

With new technologies rapidly coming to the forefront of the global stage, remaining the world's greatest air force comes at an escalating cost, making responsible spending and cost-cutting initiatives high priorities for Air Force leadership.

The Air Force Office of Acquisitions is partnering with industry to realize some of these initiatives and help propel the Air Force into the future by "Bending the Cost Curve" with leaner, more innovative spending practices.

"Bending the Cost Curve is a broad initiative that consists of a lot of individual projects that are designed toward containing cost growth and escalation within the Air Force over time," said Dr. Camron Gorguinpour, Air Force Office of Acquisitions, director of the Air Force Transformational Innovation Office. "Over time, the value we get back for the amount of money we spend diminishes, so we're trying to bend that back to the point where we're actually getting more value for every dollar spent."

There are 11 projects and initiatives launching this year and they all center on finding more efficient ways of spending money, and harnessing the best capabilities for the lowest costs.

Some of the programs include conducting experiments to evaluate time and price outcomes of variations in the Truth in Negotiations Act requirements; identifying and capitalizing on acquisition successes with the Matchmaker project; cost-capabilities analysis and launching small business engagements.

"This (BTCC) is an open forum for good ideas," Gorguinpour said. "Any good idea that we can really get our teeth into, we will go out and do."

Working with industry, as well as ideas from Airmen, the Air Force hopes to find some best practice models that incorporate data analysis with basic common sense. One of the programs to implement these discussions is the cost-capability analysis.

"In a large organization sometimes you miss the obvious," he said. "Without having the discussion, you don't know. If you get your acquisition process functioning correctly, you can start acquiring products at the pace of innovation. You can actually see the point at which an incremental improvement in capability has a dramatic increase in cost, and the idea is that you set your requirement just short of that—you find the sweet spots where you get the most value for what you're doing."

Gorguinpour said learning from past successes is key to innovative spending.

"With the Matchmaker program, we look at huge successes we've already had," he said. "When we see a success, let's acknowledge that it happened, and think through the elements that allowed that success to occur—not just on our own but working with the company that helped us achieve those savings. By conveying what went well, you're able to transfer some of those successes. You create an enterprise-wide awareness you otherwise wouldn't achieve."

Bending the Cost Curve is about figuring out the right way to get Airmen what they need, when they need it, Gorguinpour said. The bottom line is improving wherever possible.

With the implementation of the new programs, and the nature of BTCC, the processes will continue to adapt and grow as new challenges emerge.

"Things are inherently going to change," Gorguinpour said. "It's a work in progress. We'll tweak some of these processes when we see the need for it. We're not afraid to change course if someone has better ways of doing something."

The U.S.A.F. Acquisition infosite:
http://ww3.safaq.hq.af.mil/

DISPATCHES

BRINGING INERTIAL REF SYSTEM TO SBIRS #5

Northrop Grumman Corporation has been selected by prime contractor Lockheed Martin to provide its space inertial reference system for the U.S. Air Force Space-Based Infrared System's (SBIRS) fifth Geosynchronous Earth Orbit (GEO) satellite.

Northrop Grumman was awarded a contract from Lockheed Martin to supply its Scalable Space Inertial Reference Unit for the Space-Based Infrared System's fifth Geosynchronous Earth Orbit satellite.

Northrop Grumman will provide its Scalable Space Inertial Reference Unit (Scalable SIRU™) for sensor pointing/stabilization and attitude control on the SBIRS GEO-5 mission.

Northrop Grumman has also provided its Scalable SIRU™ for previous SBIRS GEO satellites. Northrop Grumman's Scalable SIRU™ is the industry standard for high-precision, long-life attitude control solutions supporting commercial, government and civil space missions

Artistic rendition of the SBIRS GEO-1 satellite. Image courtesy of Lockheed Martin.

The Scalable SIRU™ has proven its performance during numerous space missions, including NASA's MESSENGER mission to orbit Mercury and the Global Precipitation Measurement mission.

At the heart of the Scalable SIRU™ is Northrop Grumman's patented hemispherical resonator gyro, which has been used in space without a mission failure for more than 28 million operating hours.

"This award extends our support of the SBIRS program and reaffirms our status as the provider of choice for complex technical missions," said Bob Mehltretter, vice president, Navigation and Positioning Systems, Northrop Grumman Electronic Systems. "We are committed to providing products that meet the highest performance and reliability standards for current and next-generation SBIRS satellites."

The SBIRS program delivers early warning of ballistic missile launches, missile defense, technical intelligence and battlespace awareness.

The SBIRS architecture features a mix of satellites in GEO, hosted payloads in highly elliptical orbit, and ground hardware and software.

Please visit
http://www.northropgrumman.com/
for additional information.

DISPATCHES

BOEING'S CDR + BASELINE DESIGN DONE

Boeing and NASA recently completed the Ground Segment Critical Design Review and set the baseline design for the company's Commercial Crew Transportation System, moving a step closer to the planned early 2017 voyage to the International Space Station.

Completion of the Certification Baseline Review allows construction on system hardware, spacecraft and United Launch Alliance (ULA) launch vehicle adapter, to begin and also keeps the effort on track for achieving human-rated certification of the vehicle and ULA Atlas V rocket.

"This is an important step towards achieving human-rated certification," said Boeing Commercial Crew Program Manager John Mulholland. "This review provided an in-depth assessment of our training, facilities, operations and our flight processes."

Setting the design was the first milestone under the $4.2 billion contract NASA awarded to Boeing in September.

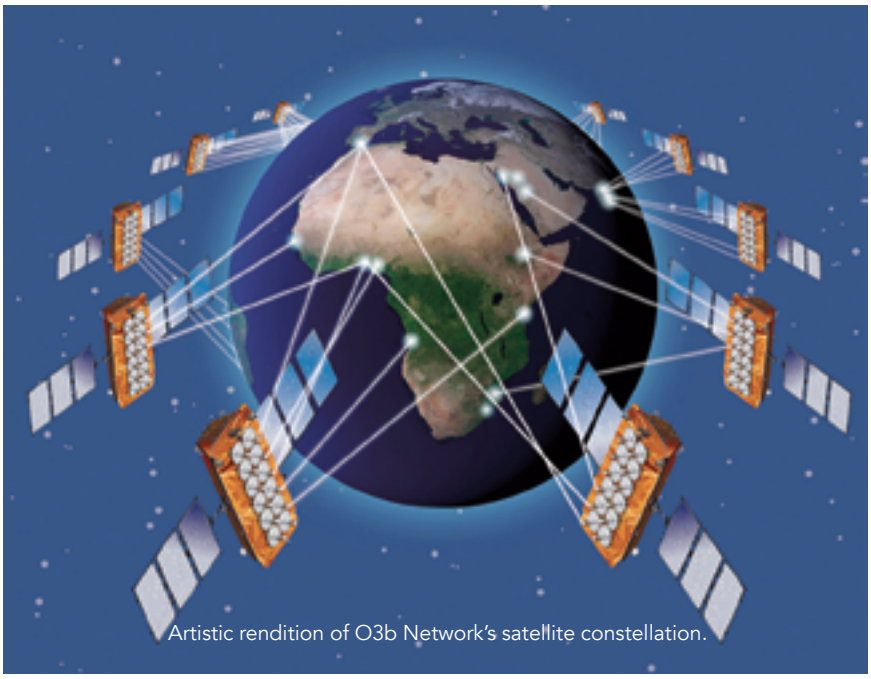
The second milestone in the Commercial Crew Transportation Capability (CCtCap) phase of the Commercial Crew Program, the Ground System Critical Design Review, evaluates all the ground operations and systems, mission operation systems, facilities, training systems, including mock-ups and trainers, and the control center.

The Crew Space Transportation (CST)-100 spacecraft, being developed in partnership with NASA's Commercial Crew Program, will provide a U.S. system for taking astronauts and cargo to low-Earth orbit destinations, such as the space station.

The spacecraft will accommodate up to seven people, or a mix of crew and cargo, and features a weldless structure, wireless Internet, and Boeing LED "Sky Lighting" technology.

More information about the CST-100 can be found at ***http://Boeing.com/CST100*** and at ***http://www.beyondearth.com/space-systems/commercial-crew-transportation-system***

SES GS DEMOS O3B TECHNOLOGY FOR MAG PERSONNEL



Artistic rendition of O3b Network's satellite constellation.

Global satellite solutions provider SES Government Solutions (SES GS) hosted a capabilities demonstration of the O3b satellite constellation for U.S. Government customers at MacDill Air Force Base in Tampa, Florida.

Members of the armed forces witnessed the enhanced communications capabilities available to them through the new O3b satellite fleet, including increased information throughput and significantly reduced latency.

The satellite network, consisting of Medium Earth Orbit (MEO) satellites flying 5,009 miles above the Earth's surface, was able to backhaul and disseminate multiple channels of HD full motion video and simultaneously stream 4K real-time video at fiber-like speeds in a remote field of operations with no fiber infrastructure.

"O3b is a ground-breaking technology that will greatly enhance government capabilities. This is not just an incremental boost in network performance, but offers the potential to change the way users operate, providing communication capabilities not previously available," said President and CEO of SES Government Solutions, Tip Osterthaler. "It gives the warfighter fiber-like connectivity on day one of operations."

The applications for this technology include backhaul and forward distribution of Intelligence, Surveillance and Reconnaissance (ISR) data, as well as enhanced, real-time command and control. O3b satellites can facilitate the immediate distribution of high resolution maps, weather data and other processed information for use by deployed forces.

Since O3b has fiber-like performance, it will allow deployed commands to optimize the current architecture of deployed communications networks, enabling them to leave latency-sensitive applications in the rear and lighten their IT infrastructure footprint with no loss of capability.

O3b also offers steerable spot beams which can be repointed on short notice or follow a moving asset. O3b system operations and narrow spot beams can make communications difficult to intercept and jam, enhancing security for the government user.

By steering an O3b satellite beam to remote locations, customers can also acquire the superior performance, including lower cost per bit for higher throughputs, at locations specified by customers.

O3b's satellites include Ka-band coverage of +/-45 degrees over major world conflict hotspots, Latin America, Africa, Middle East, South and East Asia and the Pacific Ocean. SES GS was the first government distribution partner to include O3b on their General Services Administration (GSA) Schedule (as of June 30, 2014), making them the first distribution partner to offer O3b capability directly to the U.S. Government.

The equipment used at the demonstration is currently available on their GSA Schedule. Additionally, O3b products and capacity are available for purchase through the Future COMSATCOM Services Acquisition (FCSA) contract jointly administered by the U.S. General Services Administration (GSA) and the Defense Information Systems Agency (DISA).

The first four O3b satellites were launched in June 2013. The second four were launched in July 2014. With eight satellites on orbit, O3b declared it was ready for service on September 1, 2014.

On December 18, 2014, an additional four satellites are expected to launch and join the constellation, adding additional capacity and the ability to serve many more users.

The SES GS infosite may be accessed at ***http://www.ses-gs.com/***

The O3b Networks infosite is available at ***http://www.o3bnetworks.com/government***

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DISPATCHES

GPS ANALYSTS BRIDGE GAP BETWEEN LAUNCH, ORBIT

The Air Force launched four GPS satellites into orbit this year, the highest number of GPS launches since 1993.

As the Air Force continues to upgrade its most recognizable space constellation, a small team is busy testing and evaluating, and ensuring that each spacecraft is ready to begin its job of providing position, navigation, and timing to more than three billion worldwide users.

Between the time of a satellite launch and before the 50th Space Wing receives satellite control authority the 2nd Space Operations Squadron mission analysis flight works through a complex launch and early-orbit process, all while maintaining each of the other 38 satellites in the GPS constellation.

"It can be a stressful time," said 1st Lt. Robert Heffner, the 2nd SOPS chief of GPS subsystems analysis shop. "If there is a lag on anyone's part, it can set the whole launch timeline off, which means more work for everyone."

Their work often begins more than 60 days out from launch.

Heffner, who concentrates on the GPS vehicle or "bus," first sets up links with the satellite as it sits on the ground at Cape Canaveral, Florida. "We start with compatibility tests," he said. "Our teammates at the Cape plug it into our monitor-station network. We put the vehicle in a known configuration, upload software and then ensure its components are functioning properly. This is our last chance to test before launch. We don't want any surprises when it's actually on orbit."

As Heffner evaluates the vehicle, Capt. Aaron Blain, the 2nd SOPS chief of GPS navigation payload analysis shop, focuses on the spacecraft's payload—its position, navigation, and timing components. Like Heffner, he's testing and ensuring functionality.

Much of the action occurs while the satellite is still waiting to be lifted on to a launch platform at Cape Canaveral Following the launch, their work kicks into an even higher gear.

Once the vehicle reaches its proper orbit, 2nd Lt. Christopher Phillips, the 2nd SOPS chief of Nuclear Detonation Detection Subsystem (NDS) analysis and tactics shop, begins testing and evaluating the secondary payload that resides on every GPS vehicle: the Nuclear Detonation Detection System.

Though GPS is perhaps the most recognizable satellite constellation in the world, it's safe to say most people don't know that each of its satellites carries an NDS payload.

"NDS performs an important mission," Phillips said. "It helps verify the Limited Test Ban Treaty of 1963. It makes sense. The whole reason the GPS constellation has these nuclear detonation sensors is because it provides global coverage. We can see every part of the planet."

While Phillips tests the satellite's NDS components, Heffner and Blain perform a second round of evaluations.

"We have to make sure the telemetry, tracking and control system works, so that we can command the vehicle. That's our first concern," Heffner said. "This occurs the same day as the launch, while the vehicle is in sun safe mode and still spinning."

Meanwhile, Heffner performs a ground-antenna evaluation, loads programs and commands, and evaluates the vehicle's computer processor and electrical power system. Then he switches individual components on.

"We evaluate everything just like we did on the ground," he said. "Because ... things behave differently in space."

Blain's first job once the vehicle reaches orbit is to determine its exact location. He uses a variety of ground antennas to narrow down and then determine the precise orbit trajectory of the satellite. Once complete, he begins turning on payload components as well.

"When we turn on the payload antennas, the vehicle heats up," he said. "We do that partly to cook off all the excess particulate matter, specifically air. The vacuum of space will pull air out of the vehicle. That step helps us avoid electrical shorts. It's one of our lessons learned throughout the years from previous launches."

From there, Blain switches the navigation payload on, then attempts to get all of the computers that generate the GPS signals to synchronize.

The process performed by each of the analysts is an important segment of what's known in the Air Force as the on-orbit check out. All of a satellite's systems must check out prior to the transfer of satellite control authority, which typically occurs within a few weeks of launch.

Recently, the 50th Space Wing received satellite control authority of the GPS Block IIF-8 satellite, also known as SVN-69, but it's not the final step for the vehicle. It must be approved for operational acceptance, which is on pace to occur later this month, in order to be an official active satellite in the GPS constellation.

The Air Force plans to continue upgrading the constellation in the next few years, replacing aging Block IIA vehicles with more robust, modern, and capable Block IIFs. Three Block IIF satellites are planned for launch in 2015, with the first tentatively scheduled for March.

Story by By Scott Prater, Schriever Sentinel

DISPATCHES

FRONTIER COMMUNICATIONS HONORED

Frontier Communications is the recipient of praise from Brewster-based client U.S. Electrodynamics Inc., for emergency response efforts during the series of wildfires that raged across Central Washington this past summer.

U.S. Electrodynamics (USEI) operates a 100-acre, 54-antennae satellite Ground Station in the town of Brewster, providing critical communications to U.S. Government agencies in the continental U.S., as well as in the Pacific and Atlantic regions. These services are supported by high-tech infrastructure, transmitting mission-critical U.S. Defense Department communications, which accounts for more than half the services at the USEI Brewster Ground Station.

According to USEI CEO Jim Veeder, the Ground Station faced one of its biggest challenges when the series of wildfires began to wreak havoc—on July 18, with the Carlton Complex fire still on the move, more than 20 miles of critical telecommunications fiber burned to the ground. USEI lost all terrestrial (land-based) communication. The Okanogan County Public Utility District (PUD) estimated it would take several weeks before they would be able to restore communications. Knowing this, Frontier responded immediately to assist USEI, restoring communications within approximately 46 hours.

As a service provider that promises "Brewster never goes down" as part of its work with mission-critical U.S. Government customers, USEI was very humbled by the Carlton Complex Wildfire. "We were in crisis recovery mode; we lost nearly all communications due to the raging 300,000-acre wildfire," Veeder said. "For our U.S. Government customers, the situation was precarious at best. Thanks to Frontier, the situation dramatically improved as Frontier fully restored their services to USEI in less than 48 hours. Frontier did not stop restoration efforts once their fiber infrastructure was operational. They continued to work hand in hand with USEI, Okanogan County PUD and Douglas County PUD to develop a restoration solution for the destroyed Okanogan County PUD fiber serving our facility and others."

USEI was not the only organization adversely affected by the wildfires. Frontier and CenturyLink also restored services quickly to the Okanogan County 911, Ephrata 911, and Ferry County 911 through mutual collaboration and support. In addition, Frontier provided emergency temporary services to the "hot shot" crews of firefighters battling the wildfires, including service to a temporary heliport at the Pangborn Airport in Wenatchee.

More information is available at ***http://www.frontier.com/***

DISPATCHES

PATHFINDERS REMAIN VIGILANT AS FORCES DRAW DOWN IN AFGHANISTAN

Senior Airman Jesse Waldron, a Grand Rapids, Michigan, native who serves as a joint terminal attack controller with the Air Support Operations Squadron out of Fort Drum, New York, sets up his satellite communication system on the airfield of Camp Dahlke, Afghanistan. He, along with a pathfinder platoon with Fox Company, 2nd Attack Helicopter Battalion, 82nd Combat Aviation Brigade, 82nd Airborne Division, were staged there to be geographically closer to a coalition operation in case their recovery capabilities were needed.

Banter filled the corridors as the pathfinder platoon known as Red Team readied their rucksacks with recovery equipment such as ropes, glow sticks, extraction saws and weaponry to stage at Camp Dahlke, Afghanistan, November 8, 2014.

The Red Team pathfinders serving with Fox Company, 2nd Attack Helicopter Battalion, 82nd Combat Aviation Brigade, 82nd Airborne Division, are the primary rescue or extraction force for personnel in need, standing ready to stage themselves wherever operations within the Train Advise and Assist Command-East area of operations necessitate their recovery capabilities. Due to a reduction of U.S. and coalition forces across Afghanistan, such planned staging of rescue and recovery personnel is necessary to ensure a quick response should such life saving actions become necessary.

"We have mission-ready aircraft and personnel that can respond in 15 to 30 minutes to a downed helicopter, or to whatever is needed on the battlefield," said 1st Lt. Kevin Frey, a native of Fort Worth, Texas, who serves as a pathfinder platoon leader for Fox Company's Blue Team, 2nd Bn., 82nd CAB.

Frey explained there are two pathfinder platoons, the Red and Blue Teams, which make up the pathfinder (Fox) company. "We are a specialty subset of infantry, like a scout or mortar platoon are specialty groups, and as such have a very specific mission… There are only three pathfinder companies in the Army, one in the 82nd (Div.), and two in the 101st Airborne. Our mission is to stand ready for personnel recovery missions throughout eastern Afghanistan."

As coalition troops continue to become more and more scarce throughout Afghanistan, the pathfinders will preposition or forward stage themselves somewhere geographically closer to operations that are underway to reduce risk, said Capt. Matthew Hoffman, a native of Limestone, Maine, who serves as the pathfinder company commander.

"Our job is mainly for downed aircraft and we have a lot of specialty equipment for that mission. We have belaying capabilities if the landing zone isn't safe for the helicopter and we can rappel to where we need to be," Hoffman said. "We also have the K12 saw that cuts through armor, and a hand-held pneumatic Jaws of Life that really helps if you ever had to get someone out of an aircraft. We can also sanitize the aircraft if needed. Our goal essentially is to get in and get out quickly without leaving anybody or anything important behind."

The pathfinders have also taken part in the downsizing effort, doing another traditional pathfinder role of sling loading equipment from several forward operating bases throughout TAAC-East with Chinooks.

"We moved millions of dollars worth of equipment to different locations quicker and safer than it would have been if they would have moved it on the ground," said 1st Sgt. John Ferrante, a New York City native, who serves as the pathfinder company's first sergeant.

Frey explained that the rescue and extraction mission that is now inherent to pathfinders has evolved over the last few years in Afghanistan due to needs on the battlefield.

Pathfinders traditionally go forward into enemy territory ahead of the main body of airborne forces to find drop zones where aircraft can safely drop paratroopers, as well as designate helicopter landing zones. He said they are basically logistics liaisons between air and ground commanders getting Soldiers and equipment on and off the battlefield safely. The insignia that embodies the pathfinder mission is a flaming torch with wings. Frey explained that the torch represents leadership and lighting the way forward similar to Olympic tradition where an athlete would lead the way with a torch to an athletic event, and the wings represent airborne capabilities.

Hoffman said that the rescue and extraction teams work very closely with their Army aviation partners and naturally share a special bond with them.

"The aviation companies to our left and our right that we fly around with are not just any aviators, they're our aviators," Hoffman said. "So when something goes wrong, those guys are not just coworkers, they're our friends, and my guys know when we're dragging them out of bed at all hours it is because we're doing something really important for them (the aviators)."

As Operation Enduring Freedom comes to a close and troops continue to draw down to suit a Resolute Support framework, pathfinders maintain a vigilant watch to keep what troops are left on the battlefield safe.

Story by
U.S. Army Staff Sgt. Whitney Houston,
Office of the Secretary of Defense Public Affairs,
128th Mobile Public Affairs Detachment
U.S. Forces Afghanistan

DISPATCHES

NEW ADVANCED SYSTEMS + DEVELOPMENT DIRECTORATE @ SMC

While space officially begins at 62 miles above the Earth's surface, for the men and women of the Air Force, space starts near sea level at the Space and Missile Systems Center in El Segundo, California.

SMC's innovation to the operations mindset recently shifted into high-gear with the merger of two SMC directorates charged with charting the future for Air Force Space Command: the Space Development and Test Directorate and the Development Planning Directorate. The newly combined directorate, now known as the Advanced Systems and Development Directorate (AD), was officially activated October 7th and is led by Col. Troy Brashear, the new director and his deputy director, Col. Jeffrey Stutz.

SMC/AD is charged with the single mission to "drive future space capabilities through collaborative, innovative, developmental planning and demonstrations." This new directorate brings the science and technology, pre-systems acquisition, and developmental planning expertise resident at Los Angeles Air Force Base together with the advanced test, demonstration and launch capabilities located at Kirtland AFB in Albuquerque, New Mexico

AD's new mission is essential to SMC's goal of developing affordable and resilient space capabilities now and into the future.

MUOS CONNECTION COMPLETED BY GENERAL DYNAMICS C4 SYSTEMS FOR SRW MANPACKS

General Dynamics C4 Systems has successfully completed a series of radio-call tests using the AN/PRC-155 two-channel Manpack radios and the Mobile User Objective System (MUOS) satellite communications (SATCOM) system to connect General Dynamics' personnel located at Fort Bliss, Texas, Fort Benning, Georgia, and Fort Bragg, North Carolina., with the company's facility in Scottsdale, Arizona.

The radio tests validated that personnel using AN/PRC-154A Rifleman and legacy SINCGARS radios could connect with the PRC-155 MUOS-Manpack radio to access the MUOS SATCOM system. Test participants could talk to one another while hearing their voices with cellphone-like clarity. The test also included making conference calls connecting multiple participants at different locations, a thousand miles apart.

Funded by General Dynamics, the multi-site MUOS radio test included a number of realistic Army operations where a dismounted soldier, or group of soldiers, would need to contact commanders and other personnel located hundreds or thousands of miles away. Test scenarios used one or both MUOS satellites and included:

- ***Person-to-person radio calls***
- ***Group conference calls connecting multiple participants located at geographically dispersed locations***
- ***Mobile and stationary mission environments***
- ***The combined use of MUOS, SRW and legacy SINCGARS radio communication waveforms for each test***

Each test began with a radio call from a PRC-154A Rifleman or legacy SINCGARS radio using Soldier Radio Waveform (SRW) of legacy waveform. The outgoing call was received on one of two MUOS Manpack radio channels. In a fraction of a second, the MUOS-Manpack radio

MUOS ground site.
Photo courtesy of GDC4.

bridged the outgoing call to the second Manpack radio channel, converted the call into the MUOS waveform transmitting it directly to the MUOS satellite, down to the MUOS ground station, up to the second MUOS satellite and down to the Manpack radio receiving the incoming call on one channel and switching it back into the legacy or SRW waveform, routing the call to the intended recipient using the second channel in the MUOS-Manpack radio.

Chris Marzilli, president of General Dynamics C4 Systems, said, "The PRC-155 MUOS-Manpack radio is the only tactical radio to successfully connect and sustain voice and data communications using the MUOS satellite communications system. With the success of this test, the PRC-155 continues to deliver on the promise of the Army's tactical network-keeping soldiers informed and aware, from the most isolated foxhole to the Pentagon and back."

"With the PRC-155 radio, soldiers and special operators can stay in touch with headquarters, from anywhere on Earth, anytime," said retired U.S. Army General Scott Wallace, former commander of the U.S. Army Training and Doctrine Command and a consultant for General Dynamics. "The cellphone-like clarity demonstrated during each call, the communications consistency and ability to use different radios, with the PRC-155 MUOS Manpack radio acting as the communications bridge to the MUOS satellite communications system, is a significant step forward in placing the full power of the Army's tactical network in the hands of soldiers."

The MUOS satellite communications system offers smartphone-quality voice communications and more than 10x the data capacity of the legacy UHF satellite communications system. To connect to the MUOS satellite system, radios, like the PRC-155, must have the MUOS communications waveform that is based on commercial cellular networks technologies.

A part of General Dynamics' Soldier's Network, WIN-T Increment 2, the AN/PRC-155 Manpack and AN/PRC-154A Rifleman tactical networking radios work together with the company's cyber-defense devices including the TACLANE® family of in-line encryption devices and TACLANE MultiBook secure laptop computer.

These systems and products combine with General Dynamics-developed mission command software to connect soldiers at all echelons to the Army's secure backbone communications network and a top modernization priority.

More information about the Soldier's Network and tactical radios, visit ***ttp://www.thesoldiersnetwork.com***.

More information about General Dynamics C4 Systems is available at ***http://www.gdc4s.com***.

DISPATCHES

SMC'S AEHF PROGRAM WINS NOTABLE AWARD

The U.S.A.F.'s Space and Missile Systems Center's AEHF Program Team has won the 2014 David Packard Excellence in Acquisition Award.

The Space and Missile Systems Center is situated at Los Angeles Air Force Base and the infosite is located at ***http://www.losangeles.af.mil/***


An AEHF satellite.

The Packard Award recognizes DoD organizations for innovation and best acquisition practices.

The team was cited for its revolutionary Block Buy space acquisition strategy to procure the fifth and sixth AEHF satellites, saving $1.6 billion, while also operationally accepting the Increment 7 mission control segment and launching, checking-out, and transferring operations of the third AEHF satellite.

The AEHF Team is the first SMC team to win the award. It's DoD's highest acquisition team award and was first awarded in 1997 in honor of former Deputy Secretary of Defense and Hewlett-Packard co-founder David Packard.

The award is expected to be given to the team by Secretary of Defense Chuck Hagel at a presentation in Washington, D.C sometime in the near future.

DISPATCHES

AN INTERNATONAL TEAM SOLVES THE TUBESAT ENIGMA

A pair of Naval Postgraduate School (NPS) international exchange students from the University of Bundeswehr say they are the first to have ever successfully built an operational InterOrbital Systems Tube Satellite (TubeSat).

German Navy 2nd Lt. David Ohst and Germany Navy Ensign Sebastian Stoppe assembled the satellite at NPS' Center for Network Innovation and Experimentation (CENETIX) under the tutelage of CENETIX director, NPS Professor Alex Bordetsky, and NPS Research Associate and Team Lead Eugene Bourakov, in collaboration with the Space Systems Academic Group.

The kits cost about $8,000. According to their manufacturer, successful assembly includes a guaranteed launch into Low Earth Orbit on an Interorbital Neptune modular rocket. Designers intend to launch the first 36 TubeSats completed to standard at a date to be determined. The kits are fairly basic, they include printed circuit boards, a battery pack, solar cells, a power management control system, microcomputer, software, antennas, a power switch and an instruction booklet.

Stoppe and Ohst had to contend with a host of challenges before finally assembling the satellite. They noted a series of design challenges and the need to adjust schematics rewrite files and make adjustments to voltage, circuit board design and solar panels. But, by applying their previous electrical engineering skills and collaborating with the experts at the CENETIX lab and NPS' Space Systems Academic Group (SSAG), Ohst and Stoppe were able to do everything from recreate circuits boards to recalculate resistor values.

"We had to develop the rings, configuration and layout ... We even used a 3-D printer to produce some of the parts that made this possible," said Stoppe.

University of Bundeswehr students, German Navy 2nd Lt. David Ohst, front left, and Ensign Sebastian Stoppe, front right, built an operational TubeSat as part of their exchange program in the Naval Postgraduate School's CENETIX Lab. The inexpensive satellites will be used to further ad-hoc networking research by Department of Information Sciences Professor Alex Bordetsky, back right, and Research Associate Eugene Bourakov, back left.

"What made this an actual functional satellite is the injection of their and Eugene [Bourakov's] talent while incorporating 3-D printing technology... You have a seemingly simple thing, but it is actually the product of a highly-educated group of engineers," said Bordetsky.

The completion of the satellite is big news for researchers at CENETIX, who now hope to be able to use TubeSats in their continuing ad hoc networking and Maritime Interdiction Operation (MIO) experiments.

"With this completed TubeSat we can now incorporate the TubeSats into our MIO testbed," said Bordetsky. "This satellite, by virtue of being perishable, allows us to study how we bring these new network nodes into orbit without wasting expensive satellites."

As Ohst and Stoppe worked against the clock to complete their satellite, they received input from satellite enthusiasts from around the world. They are part of an online special interest group devoted to the inter-Orbital Company's TubeSat concept.

Ohst and Stoppe are not just the first to assemble an operational kit, they were able to apply their engineering backgrounds toward improving the finished product.

"We even created a small area for a payload, a lot of things are possible, we can use this space to house a GPS, camera, or an orbiting gyroscope for example," said Stoppe. "Now that a TubSat has been put together, those who come next can concentrate on payload development."

Despite its surface simplicity, Bordetsky insists that the TubeSat is a functioning satellite and that Ohst and Stoppe's work is a significant engineering achievement. Bordetsky is currently working on weighing the merits of different launch options, including the option of placing the TubeSat into low-Earth orbit by launching it from a fighter jet.

"Because it is so inexpensive [comparatively speaking], it is tempting to think about self-organizing networks in orbit working with ground networks ... The problem is, how do we launch it? We are currently working on different launch options," said Bordetsky. "[Including] launching by fighter jet or by surface and inflatable platforms."

"This is a perfect example of the success of our collaborative efforts, two German officers building a satellite, built upon the work done by a Greek officer from the Hellenic Navy, achieving a break through at CENETIX," said Bordetsky.

In the future Stoppe and Ohst hope to see their work continue through testing via stratospheric balloons, radio tests various payloads and the building of a second and third TubeSat.

Story by Kenneth Stewart, Naval Postgraduate School

DISPATCHES

HYBRID APPROACH MIGHT LAUNCH SATS

Scientists and science fiction writers alike have dreamt of aircrafts that are propelled by beams of light rather than conventional fuels. Now, a new method for improving the thrust generated by such laser-propulsion systems may bring them one step closer to practical use.

The method, developed by physicists Yuri Rezunkov of the Institute of Optoelectronic Instrument Engineering, Russia and Alexander Schmidt of the Ioffe Physical Technical Institute in Saint Petersburg, Russia is described in The Optical Society's (OSA) journal Applied Optics. Currently, the maximum speed of a spacecraft is limited by the amount of solid or liquid fuel that it can carry. Achieving higher speeds means that more fuel must be burned—fuel that, inconveniently, has to be carried by the craft and hefted into space. These burdensome loads can be reduced, however, if a laser—one located at a remote location, and not actually on the spacecraft—were used to provide additional propulsive force.

A number of systems have been proposed that can produce such laser propulsion. One of the most promising involves a process called laser ablation, in which a pulsed laser beam strikes a surface, heats it up, and burns off material to create what is known as a plasma plume—a column of charged particles that flow off the surface. The outflowing of that plasma plume—essentially, exhaust—generates additional thrust to propel the craft.

In their Applied Optics paper, Rezunkov and Schmidt describe a new system that integrates a laser-ablation propulsion system with the gas blasting nozzles of a spacecraft. Combining the two systems, the researchers found, can increase the speed of the gas flow out of the system to supersonic speeds while reducing the amount of burned fuel.

The researchers show that the effectiveness of current laser-propulsion techniques is limited by factors including the instability of supersonic gases as they flow through the gas nozzle, as well as the production of shock waves that "choke" the inlet of the nozzle, reducing thrust. But those effects can be reduced with the help of a laser-ablation plasma plume that is redirected so that it will flow close to the interior walls of the nozzle. Coupling the ablation jet with supersonic gas flow through the nozzle, they find, significantly improves the overall thrust generated by the nozzle.

"Summarizing the data obtained, we can forecast the application of the supersonic laser propulsion techniques not only for launching small satellites to Earth orbits but also for additional acceleration of supersonic aircrafts to achieve Mach 10 and more," Rezunkov said.

DISPATCHES

SIGNAL BRIGADE IMPROVES COMMUNICATIONS FOR OUA IN LIBERIA

Spc. Gene Johnson, communication specialist, 50th Expeditionary Signal Battalion, grounds signal equipment for validation in Monrovia, Liberia. Upon validation of the incoming equipment, it will be sent out to JFC-UA remote areas of operation and will provide the communication necessary to accomplish their missions. Operation United Assistance is a Department of Defense operation in Liberia to provide logistics, training and engineering support to U.S. Agency for International Development-led efforts to contain the Ebola virus outbreak in western Africa. U.S. Army photo by Sgt. Dani Salvatore

The 35th Signal Brigade, Fort Gordon, Georgia, teamed up with the 50th Expeditionary Signal Battalion, Fort Bragg, North Carolina, to establish communications and networking to austere areas of operation in support of the Joint Forces Command – United Assistance in Liberia.

The JFC-UA is supporting the U.S. Agency for International Development-led comprehensive U.S. Government and international effort to contain the Ebola outbreak in West Africa.

The equipment the signal personnel are bringing in will improve mission capabilities of JFC-UA troops.

"The equipment will speed up communication and allow more users to access the network," said Chief Warrant Officer 3 Erik Averill, information service technician, 35th Sig. Bde.

Soldiers from the 35th Sig. Bde. and 50th Expeditionary Sig. Bn. are receiving equipment from the U.S. in Monrovia, Liberia. Upon arrival, the equipment is set up and validated.

"We validate it here so that when we get equipment to our sites we can run it as soon as possible," said Spc. Kaleb Stewart, satellite communications systems operator/maintainer, 50th Expeditionary Sig. Bn. "Everything can be done quicker with communication."

JFC-UA is responding as quickly and safely as possible to support USAID, and signal personnel are imperative to accomplish this task.

Before these communications are set up, personnel must rely on radios with short-range capabilities or transportation to relay messages, said Stewart. With the network, it would only take a simple email or phone call to communicate. The network and communication capabilities also make it safer for Soldiers and Department of Defense employees.

"Signal provides a tactical military network that allows secure communication to protect the information transmitted," said Averill.

Secure lines keep sensitive information protected from adversaries, keeping troops safel And Stewart agrees communication is key for everyone's safety.

Spc. Kaleb Stewart, right, satellite communications systems operator/maintainer, works with Sgt. Pierre Campbell, communications noncommissioned officer, both with the 50th Expeditionary Signal to validate signal equipment in Monrovia, Liberia, U.S. Army photo by Sgt. Dani Salvatore

"Connectivity could be a lifesaver if emergency services need to be called in," said Stewart.

Getting a medical evacuation using the lines signal provides can be more reliable and expedient, he added.

Upon validation of the incoming equipment, it will be sent out to JFC-UA remote areas of operation and will provide the communication necessary to accomplish their missions.

Soldiers in these isolated sites can look forward to conducting their missions faster and safer with the arriving signal personnel and equipment.

Story by U.S. Army Sgt. Dani Salvatore, 27th Public Affairs Detachment

DISPATCHES

LOCKHEED MARTIN BRINGS THE CLOUD TO THE NGA

The National Geospatial-Intelligence Agency (NGA) became the first intelligence agency to host an operational capability within Amazon Web Services' Commercial Cloud Services (C2S) environment after Lockheed Martin deployed the interactive map for NGA's Map of the World to the C2S environment.

The Map of the World initiative acts as an interface for NGA's most comprehensive and accurate geospatial intelligence data. Designed for novice users and geospatial-intelligence experts, it serves as a platform to explore constantly-updated content and link natural and man-made features on, above and beneath the Earth to intelligence observations. Users can search for objects like bridges or railroad depots and know where the objects are located, as well as intelligence embedded within each object. This cloud deployment is an early step in the transformation of the Intelligence Community's infrastructure and will not only cut costs and increase efficiencies for the enterprise, but will also provide the entire Intelligence Community access to the Map of the World, which is the single integrated environment where all analysts can examine data, record observations and share all known information about a threat.

Lockheed Martin's Geospatial-Intelligence Visualization Services (GVS) program helped NGA and the Intelligence Community achieve this milestone by migrating the Map of the World's interactive map and helping the community determine the processes to use the cloud environment. The deployment also consisted of the system's accreditation in-compliance with ICD-503 guidelines which establish policy for the intelligence community's security risk management for IT systems.

The Total Application Services for Enterprise Requirements (TASER) GVS contract vehicle, which was originally awarded in 2012, conveys geospatial visualization context and analytic capabilities to warfighters, intelligence officers and policy-makers through classified and unclassified computer networks.

Additional information:
http://www.lockheedmartin.com/us/products/geospatial.html

YEAR IN REVIEW: COMTECH SYSTEMS, INC.

By Richard Burt, President

A technology first introduced in the 1950's is now providing an important piece of the complicated communications puzzle for modern-day global situations.

Comtech Systems has spent over 40 years designing and implementing cutting-edge solutions for some of the toughest communications challenges worldwide.

Often used as a complement or replacement to microwave and satellite networks, troposcatter technology—or "tropo"—can be a cost-effective solution for point-to-point, beyond the line of sight data transmission. The tropo terminals scatter microwaves signals off the troposphere to create high-bandwidth communication links at ranges well beyond line-of-sight, and are especially suited for operations in areas with challenging terrain.

Comtech Systems is especially proud of the 2014 rollout of the world's first 50Mbps digital troposcatter modem, the CS67500A. The CS67500A provides a single modem capable of 50 Mbps links for the first time while incorporating Comtech's advanced troposcatter features including troposcatter-specific Forward Error Correction (FEC) with embedded Turbo Product Coding, Automatic Code Rate (ACR) and Adaptive Link Power Control (ALPC) to maintain performance under the most adverse conditions.

The first CS67500A modems in conjunction with the Comtech MTTS transit case tropo terminals were fielded by a U.S. Army Expeditionary Signal Battalion for test and evaluation as a replacement for the legacy TRC 170 troposcatter system. These tests demonstrated the interoperability of the Comtech Systems tropo with other communications equipment to be used by the U.S. Military going forward. The highly successful

Pictured: Comtech Systems Transportable Communications Terminal.

tests were conducted in networks using various baseband and wireless technologies including satellite, Wi-Fi and 4G.

Our troposcatter systems play a vital role in the U.S. Military C4I operations, providing intra-theater high-bandwidth range extension over beyond-line-of-sight distances. This not only reduces the demand on limited satellite bandwidth, but also provides additional capacity that may not be attainable utilizing other technologies. This allows satellite bandwidth to be allocated more efficiently, and provides service in situations where other terrestrial alternatives are not an option.

The very low latency characteristics of these troposcatter systems are ideal for the critical, time-sensitive information used in missile defense. The U.S. Army Integrated Air and Missile Defense program has purchased the technology for use with Patriot Missile Battalions during global deployments, allowing them to maximize the coverage of these systems by untethering them from the limitations of their previous line-of-site base communication links.

Working closely with our military clients to meet their requirement for a lighter weight, more maneuverable Troposcatter terminal as a replacement for the aging fleet of AN/TRC-170s has resulted in Comtech System's field proven Modular Transportable Troposcatter System (MTTS).

The MTTS is fully modular, rapidly deployable and provides the flexibility of configuring terminals to meet specific mission requirements. This helps save transport cargo space and reduces logistical support. As a result of our advancements, MTTS orders have reached in excess of 60 terminals and more orders are programed for fiscal 2015. Other countries are also recognizing the benefits of the new generation of tropo. In the past few years, modern tropo systems have been provided to customers in Europe, North Africa, the Middle East, and Asia.

Comtech Systems has built upon our experience in the design and development of troposcatter systems, to become a leading communications systems company. Many foreign government customers now rely on Comtech Systems to provide best-in-class communications solutions for all parts of the communications network. This is demonstrated in contracts to upgrade satellite systems for the Brazilian military, as well as continuing contracts for country-wide military communications networks in the Middle East and Asia oil field systems, we expect to continue this trend into 2015 and beyond.

The demand for reliable communications systems is rapidly increasing for commercial as well as government purposes. Comtech's commercial customers are enjoying the benefits our technology as well. In 2014, we filled large orders from major international oil companies one of which was to deploy the world's first over the horizon communication system to be used on a deep water, floating production system (FPS), and are in the process of providing a similar solution for a second floating platform.

Comtech was selected for the project because of the innovative antenna stabilization design which allows the offshore floating platform to be able to keep locked to shore located antennas in a variety of sea states. The high-speed digital modems enable both voice video and data traffic which is critical to the energy company's off-shore operations.

In the decades since it was first introduced, troposcatter technology has evolved from large, heavy, low capacity terminals to smaller, lighter, higher capacity network systems capable of transmitting digital voice, video and data over a secure link.

The resurgence in the use of tactical tropo has been dictated by situations that involve wider areas of operations, increased operational tempo and the growing importance of high bandwidth tactical networks.

Comtech Systems' ability to adapt the technology and make improvements to data throughput, antenna technology and innovative configurations make it a viable and increasingly sought out solution to network managers seeking a low cost, easy to deploy, high bandwidth system that can easily be integrated into an existing network of various technologies or as a standalone solution.

Troposcatter technology's proven record in a variety of military and commercial applications further elevates Comtech System's position as a global leader in this realm.

Richard Burt is the President of Comtech Systems and has held a number of senior leadership roles within the company over the last 30 years. A graduate of Iowa State University, Richard's career experience includes roles at Westinghouse, Page Communications, R.E.L., and Rockwell International preceding his current position as President of Comtech Systems. Under Richard's leadership, Comtech Systems has become a trusted brand in the international defense and commercial energy industries through strategic investment in R&D, acquisition of top industry talent, and the anticipation of end-user needs.

YEAR IN REVIEW: GLOBALSTAR LLC

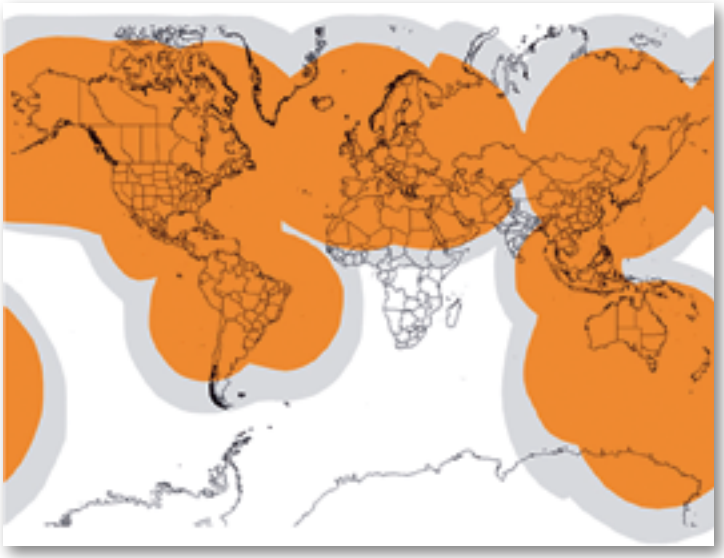
By Anthony J. Navarra, President, Space Operations

Globalstar had a breakthrough year in 2014. We continued to build on the momentum sparked by the completion of our second generation global network in 2013.

We launched several important products that included the Globalstar 9600, our new affordable hotspot for keeping groups of people online while in remote places. We also debuted Sat-Fi, our solution that enables people who find themselves outside of cell coverage to use our satellite network from their smartphones, tablets or laptops.

2014 was a year in which the company placed additional focus on providing our military customers with support and solutions for a more diverse range of missions and applications. We worked in close partnership with numerous branches of the U.S. military, namely the Army and the Navy, as well as international military groups and we gained further understanding of their needs.

We revised the features and settings of our consumer product offerings to create new solutions that fit these military missions. For example, we customized our SPOT and GSP-1700 menus, and reconfigured the functions and settings of buttons and displays.



SPOT Gen3 coverage map.

We changed the way our products present data to our military customers' command centers and headquarters, making the information more relevant and useful. We revised graphical displays, and made other software changes that enable faster, more precise use of our products and the Globalstar network, and enhance back-office functionality.

We also made modifications to the method in which transmissions take place which enable longer battery life for more in-field reliability.

The requirements of military customers are, for obvious reasons, our most demanding. We are proud of our successes in taking our already highly functional offerings and customizing them to meet the exacting needs of this group. The innovations and expertise gained in satisfying their requirements, like the smarter use of batteries, is feeding into our overall product development pipeline—all Globalstar customers, therefore, benefit.

We saw greatly increased usage of the Globalstar network within the military and government space in 2014. More military organizations are using the system, in more locations and to support new kinds of missions. A key development, and likely a contributing factor to the additional uptake of our network by military groups, was a much greater willingness for these organizations to share knowledge with each other.

For instance, we saw Army and Navy personnel sharing their experiences of how SPOT helped in various operations, and suggesting to their counterparts how features and bespoke modifications might assist in their operations, as well.

SPOT Gen3.

Obviously, they are not sharing exact details of how and where they are using the devices, as that's classified. However, they are proactively endorsing the solutions to one another, improving knowledge among all concerned. Thanks to this informal collaboration, they have also helped Globalstar better understand their needs which helps us provide additional innovations for them.

Globalstar is all about bringing satellite communications to the mass consumer market, with the lowest prices available. As you might expect, price has a somewhat different weight when a government procurement team makes their purchasing decisions. Nonetheless, even government departments have a ceiling as to how much they can spend. A couple of years ago, sequestration in the U.S. was the number one worry among SATCOM providers, as many are subject to the U.S. government's single-year supply contract term, which is standard in their RFPs. Our low pricing has certainly helped us win contracts.

The GSP-1700 phone.

Much more important to our longer term success in the military space, however, is our widely recognized willingness to listen to our customers and our flexibility to change the way our products work in order to satisfy their needs and help them carry out their missions. That is really embraced by the command structures.

Globalstar is not a big DoD defense contractor—we are not a Lockheed Martin, or an L3 or BAE Systems. As we are a small commercial organization, we can respond quickly to our customers' needs, both from an engineering and commercial standpoints. Estimating conservatively, we have expanded our international reach in the Military and Government market by more than 50 percent since 2013.

U.K., French, Spanish and other NATO forces have established mobile headquarters and command operations in new locations around the world. They absolutely need more mobile communication tools, for voice and data communications as well as for safety and security.

Europe and the Middle East have seen a lot of activity, but meeting the needs for African coverage and support from our sensor-based tracking products in all remote locations, will be a real focus for Globalstar in 2015. The company has broken ground on our Botswana teleport and we're also busy upgrading our gateway in Aussaguel to meet these growing needs.

In the latter part of 2014, we announced the latest milestone in our already successful relationship with Spain's Ministry of Defence. The Spanish MoD approved the use of the GSP-1700 satellite phone and procured additional SPOT Gen3 messengers.

On the first responders, fire and government agencies side, we garnered success in numerous missions and emergency operations.

Making predictions for 2015 is somewhat difficult in such a dynamic landscape, but we do foresee increased use of space-based technology, in general, by the military.

A few years ago, we began to see SPOT tracking products being sent into space, effectively enabling improved communications and tracking of assets in orbit, such as on cubesat research satellites.

Russia took the lead with this smallsat approach. Since then, the U.S. and other military research groups, as well as universities, have been actively exploring how the Globalstar network can be put to use for space-based tasks, such as on science rockets launched into low atmosphere and in reconnaissance missions, with communications directly back to field operation centers. Small Globalstar devices for tracking and communications, originally designed to be carried in backpacks or mounted in armored vehicles, are now being launched into space to manage the same functions there. That is definitely a trend I see continuing.

Working closely with our military customers in 2014 was highly satisfying. Whether it was to help locate soldiers for the Army, or track assets for the Navy with SPOT devices, or helping to optimize data transmission and management processes, we were entrusted with their needs and acted as a day-to-day resource for them.

We look forward to supplying product for, and increasing the scope of these crucial relationships during 2015 and beyond.

Anthony J. Navarra is President of Space Operations at Globalstar, the world's leading provider of mobile satellite phone services, offering high-quality voice and data communications in 120 countries.

Mr. Navarra has been working with Globalstar for over 20 years. Prior to his appointment to his current position in September 1999, Mr. Navarra was executive vice president of strategic development and acting chief operating officer for Globalstar. In this position, Mr. Navarra was responsible for the acquisition of partners for Globalstar, developing the business plan and marketing the company's satellite mobile services. He also oversaw functions of all corporate departments including international business development, marketing, engineering, corporate development and production, finance and administration, regulatory affairs and system applications.

YEAR IN REVIEW: HUGHES DEFENSE & INTELLIGENCE SYSTEMS

By Rick Lober, Vice President and General Manager

Today, many companies claim to support the military with commercial SATCOM solutions that are merely repackaged versions of their products that lack the capabilities necessary to satisfy government customers.

At Hughes Defense and Intelligence Systems Division (DISD), we are solving the government's toughest SATCOM challenges by delivering solutions rooted in our best commercial platforms and utilizing our most advanced technologies.

In 2014, much of Hughes DISD's success was derived from innovations in ground and terminal systems, waveforms/coding, and network management capabilities that collectively differentiate the Hughes name from the rest of the industry. For example, Hughes DISD engineers developed several key SATCOM technologies including VSATs, airborne-qualified modems, software definable modems and network management techniques for protected communications systems.

Two trends underpinned Hughes' defense business growth in 2014, and we expect them to remain key drivers in 2015. First, as the military landscape grows ever more reliant on broadband to turn data into actionable information, we saw the demand for intelligence, surveillance and reconnaissance (ISR) on manned and unmanned platforms continue to expand. Second, the United States and other nations continue to recognize and expand their need for protected, but affordable, satellite communications, including assets already in orbit.

To meet these challenges, Hughes DISD continued to advance the technologies that aligned with our customers' mission-specific, or requirement-specific, needs, focusing on ISR capabilities and affordable protected SATCOM:

- ***Advanced waveform technologies that can transmit effectively beyond the line-of-sight (BLoS) through rotary wing aircraft. In 2014, our team designed an airborne-packaged modem with an ARINC-style enclosure to qualify for airborne operations and developed some of the smallest terminals available for use on both fixed and rotary wing aircraft.***

- ***Announced development of the XeBRA terminal in partnership with Airbus. XeBRA terminals and services provide BGAN-like services and terminal size in a very small package capable of operating at X-band frequencies on satellites such as WGS at very low costs. We are also actively developing a Comms-On-The-Move (COTM) version at Ku-band that will use antennas much smaller than those used on current ground systems.***

- ***Successfully demonstrated advanced network management capability, highlighting dynamic resource allocation in conjunction with Space Systems Loral (SSL) for the U.S. Air Force Space and Missile Command (SMC) Protected Tactical System (PTS) study. SMC should be praised for its ongoing efforts to define requirements and develop solutions using the best technologies available – commercially-based or otherwise.***

- ***Continued our thrust into software-definable modems that will run our open standards-based waveforms. These modems are becoming the primary engine in our growing product line.***

Photo is courtesy of the Department of Defense.

Looking forward to 2015, Hughes DISD will continue developing end-to-end solutions for its growing customer base. We have repeatedly heard of the need for affordable protected tactical SATCOM from our customers and fully expect to expand our work with the U.S. Air Force to deliver capabilities in this area, anticipating that other countries will follow suit whether via a consortium or individually. We hope that the new Congress supports PTS by removing any roadblocks to funding.

In summary, Hughes is proud to serve our country and is dedicated to applying our expertise to continue supporting defense-related missions. Our open, collaborative and highly responsive culture has proved an asset to our customers and partners alike, bolstered by a strategic, confident team of experts with unparalleled technical capabilities.

Looking into the future, Hughes will maintain its successful course to seek efficiencies in designing and building new and advanced ground segment and terminal segment solutions that utilize our most advanced waveform technologies that can be integrated with our proven network management techniques.

Rick Lober is the Vice President and General Manager of the Defense and Intelligence Systems Division (DISD) at Hughes Network Systems, LLC. In this role, he is responsible for applying the company's broad range of SATCOM technologies and services to the worldwide defense marketplace and intelligence community. This includes both fixed Ku-, Ka- and X-band VSAT and mobilesat products and systems. Applications cover satellite communications on the move for both ground based an airborne platforms along with numerous classified development programs. He has more than 25 years experience with both COTS-based and full MIL communications and intelligence products, systems and major programs starting as a design engineer and progressing to a P&L executive.

Mr .Lober previously worked at Cubic Corporation as Sr. VP/GM of the Communications Business Unit. In this role he led the company's development of the Tactical Common Data Link (TCDL) for application to both manned and unmanned military ISR platforms. Program wins included the U.S. Navy's Common High Bandwidth Data Link (CHBDL) for large deck ships, TCDL for the U.S. Navy's Firescout Rotary Wing UAV, the data link subsystem for the U.K. MOD's Watchkeeper Fixed Wing UAV and a miniature version of TCDL for the U.S.A.F. These programs resulted in total orders of over $150 million just a few years after the system's introduction. In addition, Mr. Lober's business unit managed the data link system for the U.S.A.F./U.S. Army's Joint STARS program, the Personnel Location System used in Special Operations search and rescue missions, high power HF amplifiers for military communications systems and a line of receivers and direction finders for signal intelligence applications.

YEAR IN REVIEW: INTELSAT GENERAL CORPORATION

By Kay Sears, President

Looking back at year's end to assess accomplishments and plan ahead seems to be human nature, and in business, measuring growth or contraction in neat 12-month blocks is certainly handy.

However, in fact, commercial activity is rarely that tidy. This is particularly true in the satellite industry, when business cycles last for many years and long-term planning looks ahead as much as a decade.

Thus, 2014 cannot be seen in isolation for Intelsat General and our business of providing satellite communication solutions to our customers, in particular, the U.S. and allied governments. In addition, measuring a year purely by the numbers ignores some major milestones such as progress on hosted payloads, acquisition reform, and ground control networks, as well as the quick restoration of service to the Navy after a disastrous wildfire.

This past year was part of a cycle that we anticipated as far back as 2008, when anyone paying attention understood that the United States would not continue military operations in Iraq and Afghanistan indefinitely. Three events dramatically shaped our business.

First, the troop drawdown reduced demand by military forces for satellite services provided by our company and many others.

Second, U.S. government deficit concerns and the accompanying across-the-board spending reductions required by "sequestration" led to efficiencies and reprioritization within the DoD.

At the same time, the U.S. military continued deploying its Wideband Global SATCOM fleet, bringing more of its own satellite capacity on-line.

While these factors have led to less government requirements for commercial satellite services when compared to a year ago, we think that 2014 was but a slight pause in the ever-upward demand curve for satellite services. From collecting data from unmanned aerial vehicles (UAVs) to delivering movies and email to crews aboard Navy ships, satellites are playing a larger and larger role each year in satisfying the communication demands of military forces and governments worldwide. Plus, there is widely accepted agreement that government-owned satellites cannot serve all of this demand.

Indeed, U.S. and allied government demand for commercial satellite capacity stalled a bit in 2014. However, the year might best be remembered for two steps taken by the U.S. Air Force to make better use of commercial satellite resources that will have long term implications:

- ***Awarding the first contracts under the Hosted Payload Solutions Program, known as HoPS. We have been advocating since 2006 that commercial satellites be used to host military payloads as a means of getting capacity into space quickly and affordably, and HoPS provides a contracting vehicle to do this.***

- ***Awarding Intelsat General a contract to study the viability of the U.S. government to leverage commercial infrastructure, processes and resources for the tracking, telemetry and command (TT&C) of certain government satellites. Using a company such as Intelsat, which supports approximately 75 spacecraft built by every major satellite manufacturer, could allow the USG to divert critical resources toward other space objectives and warfighting needs, while increasing reliability and diversity.***

We also made major strides in our on-going efforts to change government acquisition policies related to satellite services. Representatives from both the U.S. Congress and the DoD began actively supporting the use of multi-year contracts for these services, compared to the one-year-term contracts in use today. We will continue to work with the Congress and the DoD to ensure they have clear statutory authority to do so. Such a step would reduce the cost of these services to the government user and enable commercial companies to better plan how to meet government demand over the long term.

One specific and quite significant accomplishment in 2014 at Intelsat General, which didn't receive a great deal of publicity, began as a disaster and ended as a case study in how to quickly and effectively respond to emergency customer needs. The worst fire in Washington State's recorded history, known as the Carlton Complex wildfire, destroyed more than 300 homes over a two-week period. In the late night hours of July 17, the fire burned terrestrial cable connections to the USEI Teleport, which provided Commercial Broadband Satellite Communications Program (CBSP) services to the U.S. Navy, which was in the midst of a large-scale, multi-national exercise far out in the Pacific.

As the lead company on the CBSP contract, we quickly put our response plan into action. The recovery solution involved adding more satellites, transferring ground services to other teleports, and developing new link budgets for this entirely new network.

One particular challenge occurred at our Paumalu, Hawaii, teleport, where one of the antennas needed for restoration of service had been disassembled in preparation for a scheduled overhaul and upgrade. This antenna had to be reassembled in the dark—it was 3:00 a.m. in Hawaii—and tested to support the transition.

Engineers restored service to the first ship within about five hours, and service to the other vessels soon followed. The team provided all restoration services and link budgets to the Navy in less than 15 hours, allowing shipboard technicians to make an orderly transition to the new services well within the expected timeframe of everyone involved.

Looking ahead, Intelsat will reach a major milestone in 2015 with the launch of our first high-throughput Intelsat Epic^{NG} satellite, set for the second half of the year. The Epic^{NG} satellites will use tightly focused spot beams and high power to deliver data at rates never before seen in the satellite industry.

A thorough analysis conducted jointly by engineers at our company and at L-3 Communications – Communication Systems West found that the Epic^{NG} satellites will significantly outperform existing Ku-band satellites in AISR communications. The study also provides further evidence that the government can avoid the time-consuming and expensive task of installing Ka-band terminals on the nation's fleet of unmanned aircraft as they can achieve their desired data rates and performance well into the future at Ku-band.

The Epic^{NG} spacecraft now being built are larger and more powerful than any Ku-band satellites ever put into orbit. In addition to the higher throughput, the Epic^{NG} satellites offer a number of other advantages over existing Ku- and Ka-band, such as higher protection against intentional, as well as unintentional, jamming. The Epic^{NG} satellites will be fully integrated into the Intelsat fleet—a user will be able to easily transition from a wide-beam Ku- signal to an Epic^{NG} narrow beam.

Our industry is on a long, upward trajectory of providing more capable and secure satellite services to governments worldwide—2014 was part of that trend. As with all businesses, we will experience dips in the road—some of which we can predict and others which we can't.

Our job at Intelsat General is to continue providing the best service we can under any circumstances, as we did with the Brewster fire. We look forward to continuing that standard in 2015.

Kay Sears, President of Intelsat General, is responsible for implementing the company's strategic and operational plans and for the overall mission of providing a range of sustainable, cost-effective and secure communications solutions to government and commercial customers. She has worked more than 25 years in the satellite communications industry, including extensive experience in rapid-response solutions for both military and civil agencies of the U.S. government. Ms. Sears has spoken widely on how commercial satellites can be utilized by the military to solve mission-critical needs and she has worked over the past several years to advance the commercial / DoD partnership.

In 2009, Ms. Sears was appointed to the President's National Security Telecommunications Advisory Committee (NSTAC) to provide information, technical expertise, advice and guidance regarding issues that may affect national security telecommunications capabilities. Before joining Intelsat, Ms. Sears helped launch government services business units at both G2 Satellite Solutions and Verestar. Ms. Sears has also held sales and product development positions with Intelsat and Comsat World Systems.

YEAR IN REVIEW: IDIRECT GOVERNMENT TECHNOLOGIES (IGT)

By John Ratigan, President

The year started with a bit of a challenge as iGT and the rest of the government industry continued to recover from one of the hardest congressional decisions ever—"The Sequester."

This is a word that still causes me to wince as though someone was striking an out-of-tune piano key. The effects of the sequester, the furloughs and the government shutdown can still be felt today as we prepare for the new Congress to take office. The biggest lingering effect, from my perspective, has been the slow-down of the entire government contracting process, causing a delay to most of the companies on contract awards and subsequently revenue. As I anxiously await the arrival of the 114th Congress, I can only hope that Congress enters with an improved attitude of cooperation on both sides of the aisle and is ready to take on the challenges ahead.

While 2014 will end a little light on our revenue side, the one element that remains crystal clear is that both the government satellite market and the satellite industry will remain solid and strong. This was a wonderful year in terms of market development, product development and technology improvements.

At iGT, 2014 saw the release of our new software that will allow for the use of adaptive coding and modulation (ACM) on all of the Evolution products currently fielded. We have used ACM for many years on the outbound channel from our hub, and we finished the software to allow the remote terminal on the inbound side to use this feature.

The great advantage of this feature is that it allows for tremendous flexibility and efficiency in the entire network. No longer do we have to design the network for the most disadvantaged terminal. Each terminal can stand on its own and use the inbound channel that is most efficient for its geographic place in the satellite footprint and environmental conditions, allowing for the maximum data rate at any given moment.

As with most companies, we are constantly looking to improve our products and utilize the next generation of technology for the benefit of our customer base. While it always seems to take a little longer than we'd like, the results are always amazing, and the developments we have undertaken throughout 2014 are no exception.

iGT has three new modems under development, and we hope to have two of those products out by mid-2015. The first development is our new 950mp (man-portable) modem, which is our replacement product for our tremendously successful e850mp. The e850mp was designed specifically to be integrated into a very small man-portable terminal for rapid deployment. The original development of the e850mp was impressive, but the new 950mp will take the technology to an even more amazing height.

I didn't believe it was possible, but the engineering team has been able to cut the size of the board in half, all the while simultaneously cutting the power consumption in half, cutting the weight in half and more than doubling the device's performance. The benefit of this reduction in size, weight and power is that our integration customers will now be able to design smaller, lighter terminals for our government customers—they will be able to operate at a higher speed while requiring less power and generating less heat. Additionally, the new modem will operate over all commercial satellites, WGS, the new Inmarsat GX constellation, as well as other high throughput satellites.

2014 saw the rapid development of another new piece of hardware for iGT, the 9350. The 9350 will become the replacement product for our rock-solid e8350 rack-mount modem. The 9350 comes with a host of new features and capabilities, as well as the addition of a second demodulator. Like the 950mp, the speed and throughput of the 9350 have been improved dramatically over the e8350, and our customers will benefit from an immediate packets per second (PPS) improvement on their current networks at their current settings.

Additionally, the 9350 will, for the first time, allow a customer to operate a full-duplex time division multiple access (TDMA) network running their normal traffic while simultaneously receiving a fully encrypted GBS data stream on a second demodulator. The benefit of this dual capability is the flexibility of having one modem manage both functions. Additionally, the 9350 will be compatible with all commercial satellites, from WGS to the new Inmarsat GX constellation as well as other high throughput satellites (HTS).

The third product under development is part of the fastest-growing segment of our market, and that is the 980 airborne modem. The 980 eventually will replace our e8000AR/AE modems in early 2016. The airborne market has been growing rapidly in both the commercial and the government space. If any of you have taken a commercial flight lately with Internet access in the air, it is most likely you are using an iDirect modem.

iDirect is by far the largest provider of in-flight Internet access in the world commercially, and we are rapidly becoming the same in the government space. The U.S. government uses airborne assets a bit differently than the commercial world, however, and iGT has developed two current products (e8000AR and AE) to ably satisfy the government's current needs while developing the new 980 airborne modem to satisfy future requirements.

The 980, when complete, will be designed for operation as high as 55,000 feet (pressurized or unpressurized) and will allow for a monumental increase in data off of the aircraft. As with all of our products, it will be able to operate on all commercial satellites.

I expect 2015 to be another exciting year for iGT, and I remain hopeful that the new Congress will be able to overcome the remaining challenges that developed from sequestration and get the government operating at a more pragmatic pace. If so, then we can continue the success of iGT and our partnership with the U.S. government.

John Ratigan is the president of iDirect Government Technologies (iGT). He started the federal group for iDirect Technologies in 2003 and then established iGT as a wholly owned subsidiary in 2007. Under his leadership, the group has enjoyed tremendous growth, deploying thousands of terminals in support of Operation Iraqi Freedom and Operation Enduring Freedom, as well as many civilian networks.

Ratigan brings more than 20 years of experience in the satellite communications arena. Prior to joining iGT, Ratigan ran the East Coast operations for both Fairchild Data and EFDATA, and eventually partnered in his own company that helped EFDATA grow from $20 million to $120 million in revenue and up to 700 employees in 2000. EFDATA became the preeminent leader in SCPC satellite technology in the late 1990s and provided the baseline knowledge and expertise that would later benefit his role with iGT and the migration of technology into TDMA. In addition to starting his own company, he held the position of senior vice president of North and South American sales for the start-up, Broadlogic, as companies started to run IP directly over satellite.

YEAR IN REVIEW: MTN GOVERNMENT

By Peg Grayson, President

Commercial companies offering satellite capacity to the U.S. government had a challenging year in 2014, with budget cutbacks and military force reductions overseas combining to reduce demand for bandwidth and end-to-end services.

MTN Government (MTNGOV) felt this slackening of demand as well; however, we used the year to incorporate a number of major shifts in our business to better serve government customers as we move forward into 2015.

First, we positioned our company as a provider of a wider range of services by rolling out new offerings. These included a professional staffing initiative; a social media threat intelligence service; and an innovative portable secure operations center. We also completed certification of our new X-band antenna at our Santander, Spain, teleport, with our joint venture partner there to better serve military units operating in Africa and the Middle East.

Second, we formed new partnerships that will enable us to compete more effectively in the future with the large global satellite operators. These firms are increasingly expanding beyond offering only transponder capacity to also providing a range of end-to-end network services that have historically been the sphere of the smaller service integration companies.

Finally, we began offering more pricing options to our government customers so that they could pay for just the bandwidth they use. As our parent company, MTN Communications, purchases large volumes of satellite capacity around the world for its commercial maritime customers, we at MTNGOV have a large "inventory" that we can draw upon to suit the shifting needs and requirements of our government users.

Our new offerings in 2014 centered on the growing threats to secure government communications by outsiders. We launched a new professional staffing business for the purpose of supplying cyber and intelligence experts to key government contractors. By offering experts in cyber and intelligence, we are able to help companies provide stronger secured communications and better intelligence analysis for government agencies.

In 2014, we searched the market place for best of breed small companies and became a distribution partner for ZeroFox, allowing us to offer social media threat intelligence services to our customers. As social media threats become more advanced and extremist groups devise ways to infiltrate social media conversations, detecting and analyzing emerging threat vectors within social media is a major concern.

Through this relationship, ZeroFox's software programs enable us to support our government customers to better detect and respond to potentially threatening social media misinformation campaigns. A key U.S. government customer is in the process of implementing the service now and several others are considering adding the service as part of their overall system of risk management.

We also began offering customers our scalable Redeployable Secure Operations Center (RSOC). These stand-alone, portable units enable varying levels of information protection, allowing users to confidently exchange sensitive and classified information.

We are now establishing a reseller network for the RSOC in order to make this product more widely available to federal, state, and local government agencies. We had multiple RSOC sales in 2014 supporting several classified government programs. Each installation passed multiple accreditations including the Sensitive Compartmented Information Facility (SCIF) standards and Special Access Programs (SAP).

We also enjoyed a number of contract renewals in 2014, including those that provide satellite services in support of intelligence, surveillance, and reconnaissance (ISR) for overseas military operations and for certain domestic activities of the Department of Homeland Security.

Our 10-year relationship with the National Oceanic and Atmospheric Administration (NOAA) was also extended, this time as subcontractor to the small business prime contract holder, Knight Sky LLC. Under the contract, we provide satellite capacity to NOAA's fleet of oceanic research and exploration vessels via Knight Sky. One of the ships, the Okeanos Explorer, conducts operations around the globe, mapping the seafloor and characterizing largely unknown areas of the ocean. To help map the roughly 95 percent of the sea bottom that is still unexplored, MTNGOV's satellite, terrestrial, teleport and global MPLS backbone capabilities enable transmissions of video from the ocean floor to NOAA research centers.

NOAA Ship Okeanos Explorer uses satellite technology to transmit data and video in real-time from the ship and ROVs working at depth, to a shore-based hub where the video is transmitted in high definition out on Internet2 to a variety of receiving stations on shore

We believe that the shifts we have made in our pricing model will help us secure new government business as we move into 2015. Government demand for commercial satellite services is an expanding need, a function of the ever increasing size of data files, such as high-definition video, that have to be moved via satellite from remote locations to distant command centers.

At the same time, the launching of more powerful, High-Throughput Satellites (HTS) is driving down the price per bit. In addition, new Ka-band constellations are coming on line in Medium Earth Orbit(MEO) and Geosynchronous Earth Orbit (GEO), offering the government customer an alternative to GEO Ku-band satellites.

At MTNGOV, we are orbit and bandwidth "agnostic" because we contract for capacity from many satellite operators. MEO, GEO, Ku-, K-... the only difference to us is what is best for our customers. We are working with a number of satellite terminal manufacturers who offer hybrid terminals, capable of operating on any bandwidth the government user needs. By offering flexible, on-demand pricing, we will be able to better serve government agencies constrained by budget limitations.

MTN Government-owned teleports in New Jersey and Spain provide a look angle to roughly 60 percent of all geostationary satellites in all bands

One of our goals in 2015 is to provide more aeronautical services and other ISR-suited airborne communications. Factors driving demand for these services include the rise of ISIS in the Middle East, increased vigilance along national borders worldwide, and the growing use of unmanned aerial vehicles for a broader range of government activities.

We also feel that cyber threats will continue to grow, with risk management tools playing an increasing role in securing data. The convergence of secure communications and cyber/physical security fits well with our diversified portfolio of solutions for the government customer.

Peg Grayson brings more than 30 years' experience in the telecommunications industry to MTN Government. A presidential appointee to the National Infrastructure Advisory Council (NIAC), she actively participates in the development of policy recommendations and guidance to the White House through the Department of Homeland Security.

Appointed to the NIAC by President Bush in 2002, Grayson is currently serving at the request of President Obama. An expert in cybersecurity and information sharing, she has participated in several comprehensive studies advising the president on the security of the nation's critical infrastructures and information systems.

Prior to MTN Government, Grayson held leadership roles at technology companies, focusing on finance, policy, regulatory compliance, and risk management.

YEAR IN REVIEW: NEWSAT

By Diego Paldao, Vice President, EMEA and Americas

Comprised of multiple nations, the unique Asia Pacific (APAC) region has become a significant driver of global economic growth—2013 saw the global economy expand by 2.4 percent, of which 45 percent originated in the East Asia Pacific, while growth for the entire region in 2014 and 2015 has been projected at 5.4 and 5.5 respectively (IMF, 2013).

With resilient, growing and emerging economies and a rising middle class, progressive trade agreements, increased deregulation and globalization as well as being home to the world's busiest international sea and air routes, Asia Pacific is a center of global activity.

This activity has paralleled with military expansion from countries further abroad having a military presence in the region; whether for border protection, disaster relief, or supporting international peacekeeping and humanitarian action. In spite of decreasing military expenditure which has been felt across the entire satellite industry, the need for innovative communications solutions remains with an increased reliance on voice, data, and Internet connectivity to perform day-to-day tasks as well as enhance activity, such as navigation signaling and unmanned aerial vehicles (UAV's).

Connectivity is an essential element of daily tasks and mission critical operations, increasing bandwidth requirements for military. In NSR's *Government and Military Satellite Communications, 11th Edition, Northern Sky Research*, the forecasts for demand from the global government and military market will reach more than 750 transponders by 2023, an increase of 54 percent from 2013. Transponder and capacity revenues will more than double, reaching $2,120 million in 2023, from $850 million in 2013. Driven by evolving bandwidth-hungry applications, as well as rising demand for ISR applications, UAVs, VoIP and video conferencing, NSR forecasts a return to overall market growth by the end of 2016.

"The military's focus on mobility applications, especially using UAVs and manned aeronautical platforms for ISR missions, will boost demand for both FSS and HTS COMSATCOM capacity. Revenues from various mobility applications will represent 90 percent of the managed service market and 50 percent of leased capacity totals over the next decade," said Brad Grady, Senior Analyst at NSR.

Grady also stated that the ubiquitous nature of satellite over an area as geographically diverse as APAC means this is the preferred platform in the delivery of fast, reliable and secure communications and this will only intensify, highlighting the vital role of satellite communications and the importance of available satellite capacity.

Carolyn Belle, also a NSR Analyst, added, "...governments will be more reliant on their own MILSATCOM satellites moving forward, but they lack sufficient capacity to meet demand—compatible commercial capacity will remain a necessary component of solving that disparity." As such, the satellite industry is evolving to provide new capacity and developing associated technologies to do so in today's growing markets.

The push for more capacity in the sky is driving change on the ground, as operators aim to meet the unique requirements of the sector. NSR forecasts that multiband equipment and interoperable terminals

NewSat's Adelaide, Australia, teleport.

NewSat's Jabiru-1 and Jabiru-2 coverage map.

that allow users to switch to military capacity when necessary will be sought after as well as UAV command and control links for secure communications, which will constitute a larger market as more units enter service (NSR, 2014).

However, an essential element is the teleport selected to support the network. Teleports that were once basic satellite uplink facilities are now more likely to be the hubs of dozens—or even hundreds—of overlapping complex networks. Many pieces of the network are now connected from the ground, increasing the importance of having a secure teleport. This is especially true for military communications which must be secure, a vital element necessary to ensure the success of critical missions.

Uniquely situated in regard to technological, geographical and skill based standpoints to provide world-class commercial and operational support services, as well as being a secure partner in APAC, NewSat owns and operates two Australian teleports that are located in Perth and Adelaide. These two teleports offer a full range of teleport and satellite services, with coverage to 75 percent of the globe; from Australia, Asia, the Middle East, Africa, across the Indian Ocean extending into Europe and across the Pacific Ocean, reaching into the West Coast of the USA.

NewSat's teleports already support crucial elements of government and military global communications and will provide further support with the company's first satellite, Jabiru-1, Australia's first commercial Ka-band satellite. Jabiru-1 will deliver more than 7.6GHz of "new" capacity, providing high-powered Ka-band coverage to meet the growing demands from government and enterprise sectors across the Middle East, Asia and Africa.

NewSat has started the expansion of the Adelaide teleport which will host the Jabiru Satellite Control Facility and Jabiru Customer Support Centre for Jabiru-1.

Jabiru 1 will have flexible Ka-band capacity that can support both land and littoral missions in and around East Africa and will enable additional connectivity to Diego Garcia. This capacity was specifically designed to be used by ally nations, including the U.S. [As a strong U.S. ally the Australian Defence Force (ADF) has a long standing relationship of cooperation with the U.S. Armed Forces , which includes the use of ADF facilities around Australia.] Further, the U.S. Navy's Triton UAV platform which will use Ka-band capacity to provide real-time ISR over vast ocean and coastal regions, which will be particularly applicable for the Gulf and the horn of Africa where Jabiru-1 will provide coverage.

With the changes in government and military requirements, the need for satellite capacity availability remains a constant. NewSat partnered with MEASAT to host their Jabiru-2 payload, which launched in September of 2014. The Ku-band satellite provides fresh capacity to satisfy the increasing communication requirements in and around Australia, as well as Papua New Guinea, Timor Leste and the Solomon Islands, with highly concentrated bandwidth enabling high-quality communications to support mission critical communications.

Other satellites include SES 9, set to launch in 2015, which features expansive mobility beams designed for airliners and ships traveling through the APAC region. Particular focus will be for the Indian Ocean, while SES 12, which is scheduled to launch in 2017, will address government markets in Asia and will include the first SES HTS payload.

HTS will play an important role in the government and military uptake of commercial satellite capacity. Driven by the lower cost per bit and enhanced throughput availability, the expected capacity demand for HTS will reach 75.5Gbps, up from 1.3Gbps in 2013, with a CAGR of 51 percent (NSR, 2014).

Fresh capacity from such satellites will ensure the connectivity required for innovative and bandwidth heavy applications is available upon demand across government and military sectors. The availability of high-powered satellite capacity to provide more efficient solutions is essential for the continued military presence and future government requirements within the region.

Looking ahead, secure, cost-effective and managed services over bulk leasing will be essential in addressing the evolving operating constraints. As the APAC region continues its global dominance across a number of sectors and economic growth, government and military sectors, satellite communications will play a most crucial role in ensuring the safety and security of the region.

Diego Paldao has more than 14 years' experience in the satellite industry. His initial exposure to satellites was with UUNET providing IP transit services. His team worked closely with satellite operators to provide connectivity via satellite for areas that were lacking in sufficient or stable fiber connectivity. Following this role, Diego joined global teleport operator, Verestar, which was acquired by SES Americom (USA). He has held various positions within SES' multiple business units, supporting enterprise and government clients based in North America. Diego joined NewSat in January 2012 and is responsible for supporting all commercial and government clients in the Americas and EMEA regions.

YEAR IN REVIEW: NORSAT INTERNATIONAL

By Dr. Amiee Chan, President and Chief Executive Officer

Norsat is a leader in providing innovative customizable communications solutions for the military and government sectors through our three business units: Sinclair Technologies, Satellite Solutions and Microwave products.

During 2014, Norsat launched several new products ideal for military applications including land-based and airborne Communications-On-The Move (COTM) and unmanned aerial vehicles. In April, Norsat launched the ATOM series Ku-Band Block Up converters (BUCs) and Solid State Power Amplifiers (SSPAs). These BUCs and SSPAs are among the industry's smallest, lightest, and most power efficient available in the market, making them ideal for portable applications.

Throughout 2014, we completed deliveries of the new line of ATOM products to Harris Corporation and other customers in the defense sector. Norsat has achieved several design wins for airborne terminals, manned and unmanned vehicles in 2014 and our ATOM series of BUCs and amplifiers are flying in multiple UAVs today. Norsat will continue to expand the ATOM product line in 2015 offering additional bands and power capabilities.

With growing world challenges, we are seeing a higher demand for increased data rates and rapid communications in the theater of operation. The military has been engaged in discussions about the use of Ka-band for some time given its high throughput capabilities.

Satellite programs such as the WGS constellation, O3b and Inmarsat Global Express are proof that the market is ready for Ka-band for military and commercial communications. In the course of 2014, Norsat delivered several new Ka-band products, both LNB's and BUC's, to help our customers take advantage of the Ka opportunity.

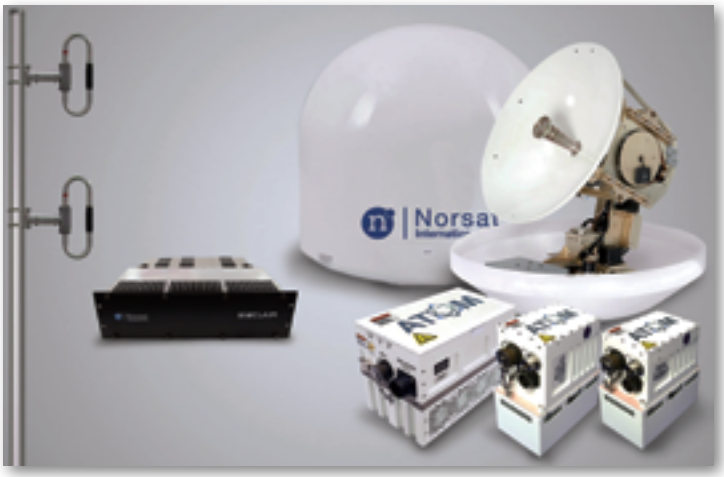
From our satellite terminal line, a significant design win to note is our recent award to provide X-Band marine VSAT (very small aperture terminal) units for use in a naval fleet. The units are built to withstand high impact shocks and vibrations that occur on military vessels. Throughout 2014, Norsat was also awarded contracts from several of our customers from around the world to design and deliver custom portable terminals from our leading edge GlobeTrekker, Rover and SigmaLink design platforms.

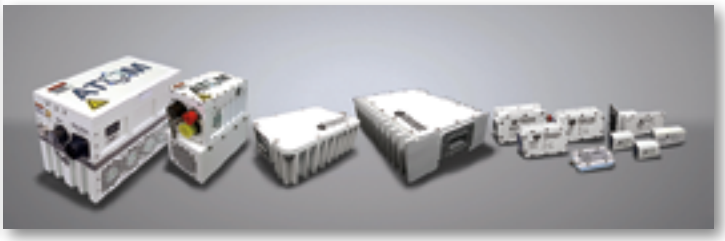
Norsat continues to execute a balanced growth strategy that incorporates new product development, continued enhancement of existing product lines, greater diversification by geographic region as well as by industry verticals. Specifically we are investing in research and development and testing to ensure that our products meet the stringent military specifications, such as RTCA-DO-160, MIL-STD-810 and MIL-STD461, required for robust, reliable communications.

Operationally, we continue to maintain a strict cost discipline across our operations while ensuring we invest in R&D for future growth. To drive ongoing efficiencies, we balance cost reductions with strategic investment throughout our operations. We have also ramped up our LEAN manufacturing initiatives in order to streamline our material process and to continually improve our operational efforts, which aids in quicker delivery times.

Our recently announced third quarter financials are showing solid revenue growth with a 20+ percent increase in sales of our microwave components, which is mainly driven by deliveries of our new ATOM series of products. We continue to receive strong interest in the ATOM product line and believe it will continue to provide long-term growth for years to come. We are extremely pleased that Norsat ended the third quarter with a net positive cash position; the company's first in nearly four years. We anticipate that we will finish strong in the fourth quarter and our revenue is on track with our expectations.

Norsat will continue to work closely with our military customers to ensure that new products we launch can be tailored to meet their specific needs and will operate long term in military-type applications.





In Afghanistan, pictured are the Dual-band Auto-acquire Rapid-deployable Terminals (DART).

Norsat continues to diversify its business by broadening its product portfolio and the pursuit of strategic acquisitions, as well as expanding its customer base on a geographic basis in order to lead growth for the company in the future.

Founded in 1977, Norsat International Inc. provides innovative communication solutions that enable the transmission of data, audio and video for remote and challenging applications. Norsat's products and services include leading-edge product design and development, production, distribution and infield support and service of fly-away satellite terminals, microwave components, antennas, Radio Frequency (RF) conditioning products, maritime based satellite terminals and remote network connectivity solutions.

The company's products and services are used extensively by telecommunications services providers, emergency services and homeland security agencies, military organizations, health care providers, news organizations and Fortune 1000 companies. Customers include NATO, the United States Department of Defense, Marine Corps, Army, Navy and Air Force; FOX News, CBS News; Boeing, Reuters, Motorola, TESSCO, General Dynamics and others.

The company's corporate office is located in Richmond, British Columbia, Canada and has offices in Aurora, Ontario, Canada, Hamburg, New York and Lincoln and Somersham, England.

Dr. Amiee Chan has more than 15 years of experience in executive management and research & development in the telecommunications industry. Offering a rare blend of technical and corporate strength, Dr. Chan's strategic vision has driven Norsat's innovative product development program and resulted in consistent revenue growth since her appointment as CEO in 2006.

Prior to joining Norsat, Dr. Chan worked at Creo Inc. where she guided the company through multiple product developments, beta programs, rollout strategies and product launches. Her strategic approach to business was reflected in the growth of Creo's $80 million consumables product division. Dr. Chan currently holds three U.S. patents in satellite technologies and has been involved in high level research teams such as the NASA ACTS Terminal Program.

Dr. Chan holds an Executive MBA from Simon Fraser University where she majored in Strategy & New Ventures, as well as an Electrical Engineering Ph. D. in Satellite Communications from the University of British Columbia. Dr. Chan currently serves on the Dean's External Advisory Board for the Beedie School of Business at SFU, the Science World Board of Directors and the UBC Engineering Advisory Council. Dr. Chan currently resides in Vancouver with her husband and two children.

YEAR IN REVIEW: NORTHERN SKY RESEARCH (NSR)

By Carolyn Belle, Analyst

Within the diversity of space-based activities and services, the interplay between commercial industry and the government/military forms a collection of relationships and evolving roles. As we reach the end of 2014, communications services stands out as the most challenged of these commercial—government relationships and associated markets.

Many governments rely on commercial operators for communications capacity when they do not have access to, or have exceeded, proprietary supply. Except in cases when the state cannot be clearly delineated from commercial activities, commercial players do not use government space communications assets. Yet the communications market is far more inter-connected than this fact suggests: due to the high ARPUs and relative market size of government and military communications, commercial industry has an established reliance on government and military revenues. This reality has hardly been more apparent than in 2014. Indeed, this year many operators and service providers made public their lowered financial performance forecasts as a result of weak U.S. government SATCOM markets.

Balancing Demand: The government and military communications market is governed by an intricate array of supply and demand elements. Not only must two sources of supply be considered (MILSAT and COMSAT), but inconsistency in demand complicates hope for a stable market. NSR sees three primary factors impacting government/military COMSAT acquisitions:

1. *Sustained demand: The prioritization of remote communications capabilities, both in the scope of overall distribution of government spending and in military spending. This element controls the total amount and type of procurement.*
2. *Spiking demand: Geopolitical events that draw nations into conflict and/or assistance in distant regions of the globe.*
3. *Throttle: Government and military budgets related to the macroeconomic situation and internal policies.*

While the first factor remained strong in 2014, waning geopolitical drivers for capacity demand and generally worsening budgets hampered market performance. On balance, 2014 was a weak year for the government and military COMSATCOM market—the second year of decline in what is expected to be a multi-year slump.

2014 Challenges: First and foremost, the ongoing budget decrease—especially in the U.S., traditionally the largest COMSATCOM market—impacted the ability of government and military agencies to follow through on desired equipment and commercial capacity procurements. Commercial players fought to maintain profits in the resulting absence of few new programs or orders and more re-competition on previously won contracts for existing programs. Further, the evolving move of satellite operators into sub-markets traditionally the niche of service providers heightened competition. Such an environment led to reductions in transponder pricing to win contracts, meaning tight and in some cases negative margins. Over the 2013-2014 period, workforce reductions and restructuring were implemented as a means of countering the impact of such revenue declines on the bottom line.

Meanwhile, the U.S. government's ability to address their own demand with proprietary satellites rose: MUOS-2, AEHF-3, WGS-5, and WGS-6 were all launched in 2013, coming into general use in 2014. Space segment additions extended to Europe in 2014, with the launch of Italian-French Athena-Fidus and Sicral 2/Syracuse III c satellites. Given the perception of proprietary satellites as providing "paid-for" capacity, and in the context of limited budgets, the pressure to prioritize use of such assets and turn to commercial capacity only as a secondary source increased. Especially as compatible terminals are fielded and remaining WGS satellites are launched, NSR sees this as a consistently growing dynamic over the next 5 years.

The continued withdrawal of U.S. and NATO forces from Afghanistan directly reduced demand for capacity in the Middle East with an associated negative impact on commercial players. Yet just as U.S. and NATO engagement in Iraq and Afghanistan spiked demand for COMSATCOM in the early 2000s, the eventual withdrawal of such forces and a corresponding drop in demand was anticipated. While maintenance of foreign presence through the September 2014 Bilateral Security Agreement will generate enduring demand over the next couple years, it will not be more than a fraction of the peak demand seen in 2011 and 2012.

2014 Successes: The most notable successes in 2014 have been a willingness to leverage advancements in technology and growing acceptance of varied commercial roles in the formation of diversified space architectures.

The extension of high bandwidth services to lower levels of command (company level in addition to brigades and battalions) opened the door to new sources of equipment and service demand. Complemented by the establishment of new programs of record such as the U.S. Transportable Tactical Command Communications, and the ongoing fielding of smaller on-the-pause terminals (e.g. SNAP-Lite) and on-the-move terminals, this reaffirmed the importance of SATCOM connectivity in tactical military operations.

Long awaited services debuted with government and military user tests in 2014, including Ka-band GEO-HTS through Inmarsat-5/ Global Xpress and MEO-HTS through O3b. The appearance and expanded availability of new products, including Wi-Fi hotspot devices from multiple MSS operators and L-TAC from Inmarsat, has broadened the utility of satellite services for military, civil government, and NGO markets.

Industry has long advocated for an extension of leasing periods to beyond one year in duration, and the June 2014 award of the first multi-year U.S. Air Force Pathfinder contract to SES Government Solutions heralded preliminary results. While questions regarding the utility of the inclined Ku-band capacity leased for regional military users remain, an RFP for a second Pathfinder contract was announced several days later. The pace at which this, and the future 4, Pathfinder contracts are awarded and implemented will determine the true impact of this program on the procurement process as a whole.

The associated hope and concern of disaggregation remained an industry buzzword in 2014. The July 2014 Hosted Payload Solution (HoPS) contracts signaled a willingness to explore potential mission advantages and cost savings through a streamlined approach. U.S. and foreign militaries also continued to experiment with nano satellites as communications platforms to complement existing assets. Nonetheless, and while such actions are positive, sweeping changes to the current space architecture and mode of operation will be complicated and time-intensive to implement – in essence, unlikely to impact the market materially in the near-term.

2015 Expectations: NSR believes that 2015 will not be a significant or watershed year in the COMSATCOM market. The restraints of 2014 will continue nearly unabated. The impact of ongoing budget restrictions will be amplified by further launches of military satellites and associated leaps in available proprietary capacity. Far fewer troops will be actively deployed in Afghanistan in 2015, though emerging hostilities against Islamic State/ISIS and potential for escalating conflict in Eastern Europe could augment demand; as a commercial capacity play, the associated use of UAV and manned aeronautical platforms in such arenas will drive demand to commercial operators.

Ka-band GEO-HTS and MEO-HTS services are expected to progress to operational use following testing.

In 2015 and beyond, the market will experience a rising focus on applications and services—ISR, VoIP, and video conferencing—as well as mobility. While these areas are not anticipated to cultivate market growth in 2015, the ongoing development of demand and diversification of available solutions will provide a foundation for market upswing in 2016.

Uncertainty Lingers: Given the series of key demand variables identified above, it is critical to consider the government and military SATCOM market through the lens of several possible futures. Potential for a shifting political balance in key countries, emergence of unexpected geopolitical crises, and still fluctuating budgetary levels could all impact the amount and distribution of overall SATCOM procurement worldwide.

Will NATO engage in a third ground-based military intervention in the Middle East, with a consequential demand for surge capacity? Might the 2016 U.S. election raise the Republican Party to Executive and Legislative power, bringing with it a stronger focus on defense-related spending? Or, could U.S. sequestration worsen and force even deeper spending reductions than expected?

Following the 2013-2014 declines, the government and military satellite communications market is approaching a crossroad. The many factors at play in the kinds and amounts of commercial SATCOM procurement could go in several of many directions, reinforcing NSR's belief that the state of this market is far less certain than many commercial players might like.

Bottom Line: Overall, 2014 was a down year for the government and military commercial satellite communications market and an exacerbation of the negative trend noted in 2013. While the government and military appetite for remote communications capabilities is not expected to decline moving forward, financial resources to procure such capacity are lacking in the near-term. As government budgets increase, new services are adopted, and methods of procurement are modernized to increase efficiencies, there is more hope that the government and military SATCOM market will return to growth.

Ms. Belle joined NSR as an analyst with several years of experience in the space industry, ranging from atmospheric chemistry to education outreach and market research. Her main focus is satellite manufacturing and launch markets, and in particular the trends surrounding creation of diversified space architectures. She also contributes to research in government and military communications markets in addition to participating in the diverse tailored consulting projects undertaken at NSR.

Ms. Belle comes to NSR from the Research and Analysis team at the Space Foundation, where her research efforts primarily addressed new and emerging space products and services as well as the policy considerations and efficacy of international space endeavors such as the International Space Station. Ms. Belle received a Master's degree in Space Management from the International Space University.

POINT OF VIEW: AUTOPILOT IS NO WAY TO RUN A COUNTRY

By Elliot Holokauahi Pulham, Chief Executive Officer, Space Foundation

Some important, horrifying, costly lessons have been learned in the past several months, about the dangerous world we live in. These lessons teach us that no country, especially the United States, can place its affairs on autopilot and blithely hope to wish away events that do, in fact, affect every person on the planet.

This failure to lead in our grotesquely destabilized world is not, of course, a uniquely American problem. But most of the free world still regards the U.S. as a super power, and its economic and political interests around the globe are larger than most. The world still expects America to lead, even if some in Washington, D.C., have grown comfortable with the idea that the nation no longer should.

This current lack of "active rudder control" certainly affects space programs. For the first time since the Space Foundation began tracking the data, U.S. government investment in space programs declined significantly in 2013, down almost 10 percent from 2012. This retreat from leadership in space was in notable contrast to most other national space programs, which saw increased investment—the rest of the space faring world essentially heading north while the U.S. went south.

The chart below, from *The Space Report 2014,* details America's divergence from both the strategies of its allies and its adversaries. While it is true that the United States continues to invest more in space than all other countries combined, it will not be true in just a few years if the downward trend is not arrested.

This autopilot, or lack of active rudder control, approach is painfully apparent in both the executive and legislative branches. In the former, it has manifested as a foreign policy mantra of "***Don't do Stupid S---***", which is a bumper sticker, not a policy or plan.

In the latter, it has taken the form of the Budget Control Act. In both cases, it is hands off flying that ignores headwinds, tailwinds, storm systems, the importance of the capabilities and condition of the ship you are flying and the fact that other people may be trying to shoot you out of the sky.

I'm not a military analyst or foreign policy historian, so I'm not going to attempt to parse the complex situation brewing in the Syria-Iraq deserts, except to say this: a huge, radicalized army has been building, largely unchecked, with the expressed, clearly stated purpose of destroying the United States and its allies. This is not the time for U.S. defense policy, or budgets, to be on autopilot, or for its defense and national security space capabilities to be drawing down.

Of course it is space capability that concerns us at the Space Foundation. With U.S. space budgets down 9.4 percent from 2012 to 2013, how much lower can they go before the nation's intelligence, surveillance, reconnaissance, command, control and communication capabilities begin to atrophy? The answer is, not much. The same is true for the country's civil space programs, which are already on razor thin margins because of a different kind of autopilot, the "flat-lining" of budgets at artificial levels that forces program managers to trade capabilities and schedules in order to live

Government Space Budget Growth, 2013

Country/Agency	Currency	2011 Funding	2012 Funding	2013 Funding	2012-2013 Change
United States	U.S. Dollar	47.250 B	$45.560 B	$41.257 B	-9.4%
European Space Agency*	Euro	€3.994 B	€4.020 B	€4.282 B	6.52%
Brazil*	Real	R$0.346 B	R$0.369 B	R$0.350 B	-5.15%
Canada*†	Canadian Dollar	C$0.366 B	C$0.323 B	C$0.453 B	40.07%
France*†	Euro	€0.761 B	€0.743 B	€0.742 B	-0.15%
Germany*†	Euro	€0.543 B	€0.586 B	€0.604 B	3.07%
India*	Rupee	₹44.47 B	₹48.95 B	₹68.10 B	39.13%
Italy*†	Euro	€0.434 B	€0.251 B	€0.236 B	-5.98%
Japan	Yen	¥309.4 B	¥298.0 B	¥322.1 B	8.09%
Russia*	Ruble	руб115 B	руб140 B	руб180 B	28.57%
South Korea*	Won	₩229.557 B	₩237 B	₩348 B	46.35%
United Kingdom*†	Pound	£0.059 B	£0.029 B	£0.057 B	96.55%

*Civil space budget only
* CNES only
† National budget only (Excluding ESA contributions)

within funding profiles that change little from year to year, and, thus, are unresponsive to actual program needs.

Thus, NASA, as an example, gets about $18 billion a year, every year, because that is what the agency always gets, regardless of what it is trying to actually do at any point in time. That $4,500 I gave you to buy a car back in 1972 was good enough then, and it ought to be good enough now. Of course, it doesn't even pay the sales tax on the car all these years later.

If you have any question about the discrepancies between what the administrative and legislative branches have asked NASA to do, and the woefully inadequate resources that have been provided in recent years, go ahead and read the report of ***The Review of Human Spaceflight Plans Committee***, or, for that matter, almost any report from any of the committees that have been charged with reviewing the U.S. space program in recent decades. The math just doesn't add up.

But political math is simple math. It doesn't hurt the head and you don't have to sit down with your colleagues, collaborate across party lines, and figure out complex programs. And it gets the country a federal budget that does respond to politics, if not to actual national requirements.

To make matters worse, most of the public has already forgotten that both national security space programs and civil space programs are further imperiled by something called the Budget Control Act; Which really should be called the Budget Out of Control Act, because it places the federal budget on an automatic, across the board, forced reduction that is absent any kind of prioritization, periodic review or adjustment that might reflect actual requirements, economic realities, or what is going on in the world around us.
See previous paragraph on autopilot or lack of active rudder control.

At the time of this writing, most elected officials in Washington, D.C. appear focused on mid-term elections, not the Budget Out of Control Act. (Although, in fairness, not all politicians are focused on the mid-term elections. Two-thirds of the Senate is not up for re-election in November, and still other politicians are focused on the 2016 Presidential election.) But the Department of Defense, the U.S. Air Force and the other uniformed services, NASA, NOAA the NRO and others are keenly focused on the Budget Out of Control Act, because it remains the law of the land and will shortly be hitting American space capabilities like a ton of space debris at a time when the country can ill afford it.

World events, you see.

ISIS, ISIL, or whatever they're called. Russia in Ukraine. A civilian jetliner shot from the skies. Radicalized Jihadist armies forming. Americans, and Britons, being ceremonially beheaded on the news. Rockets raining on Israel. Israel shooting back. Hurricanes in Hawai'i, fire and drought in California. Chemical weapons in Syria (again). Beloved leader off his nut in North Korea. More Jihadists at the gates of the Golan Heights. Ebola.

These things are kind of important. A federal budget on autopilot cannot respond to them. The Department of Defense needs to be able to defend the nation's citizens and interests, and space systems are a bedrock of that defense. NASA needs to help keep U.S. technical capabilities sharp in the face of increasing competition. We have a global pandemic to respond to that's simply not in the "autopilot" budget.

It just doesn't feel like a great time to go into some kind of cost-cutting death spiral.

Now, I'm no War Pig (yes, I grew up listening to Black Sabbath). Truth be told, I'm actually quite liberal, but don't quote me on that. As a sometimes advisor to the U.S. Air Force, I know the toll that more than 20 years worth of daily combat air operations has taken on our air men and women. Right now, most Americans are tired of battle and would like to keep our warriors home. I'm one of them.

But whether the combat is economic or military, I do realize that you cannot always pick your own battles. Sometimes the fight comes to you. And you'd better be ready.

A federal budget on autopilot is no way to run a country. It places key national means and capabilities, including space means and capabilities, at risk. It is time to apply positive rudder control and actively manage our way through these unfortunately dangerous times.

This article is courtesy of Space Foundation's ***Space Watch*** *newsletter and is repurposed with full permission received.*

Named chief executive officer of the Space Foundation in 2001, Elliot Pulham leads a premier team of space and education professionals providing services to educators and students, government officials, news media and the space industry around the world. He is widely quoted by national, international and trade media in coverage of space activities and space-related issues. Before joining the Space Foundation, he was senior manager of public relations, employee communication and advertising for all space programs of Boeing, serving as spokesperson at the Kennedy Space Center for the Magellan, Galileo and Ulysses interplanetary missions, among others. He is a recipient of the coveted Silver Anvil Award from the Public Relations Society of America—the profession's highest honor. In 2003, the Rotary National Awards for Space Achievement Foundation presented him with the coveted Space Communicator Award, an honor he shares with the late legendary CBS News Anchor Walter Cronkite and former CNN News Anchor Miles O'Brien. Pulham is a former Air Force Civic Leader and advisor to the Chief of Staff and Secretary of the Air Force and a recipient of the U.S. Air Force Distinguished Public Service Medal. He serves on the editorial board of New Space Journal.

The Space Foundation will be hosting and producing the 31st Space Symposium, April 13- 15, 2015, in Colorado Springs, Colorado, at The Broadmoor Hotel. For further information, or to register, please visit ***http://www.spacesymposium.org/***

NROL-35's Eye Spy in the Sky for National Defense Launched by ULA

Photo credit: United Launch Alliance

A United Launch Alliance Atlas V rocket carrying a payload for the National Reconnaissance Office lifted off from Space Launch Complex-3 on December 12 at 7:19 p.m. PST. Designated NROL-35, the mission is in support of national defense.

Jim Sponnick, ULA vice president, Atlas and Delta Programs, said, "This mission was launched on the most powerful Atlas ever launched from California with more than two million pounds of liftoff thrust. This was enabled by the addition of the four solid rocket motors, providing additional performance as required to meet our customer's needs."

The launch was carried out by an Atlas V Evolved Expendable Launch Vehicle (EELV) 541 configuration vehicle, which includes a 5-meter diameter payload fairing, along with four Aerojet Rocketdyne solid rocket motors attached to the Atlas booster. The Atlas booster for this mission was powered by the RD AMROSS RD-180 engine and the Centaur upper stage was powered by the inaugural flight of the Aerojet Rocketdyne RL10C-1 engine.

ULA's next launch is the Atlas V Mobile User Objective System (MUOS-3) satellite for the United States Navy scheduled for January 20, 2015 from Space Launch Complex-41 at Cape Canaveral Air Force Station, Florida.

The EELV program was established by the United States Air Force to provide assured access to space for Department of Defense and other government payloads.

The commercially developed EELV program supports the full range of government mission requirements, while delivering on schedule and providing significant cost savings over the heritage launch systems.

With more than a century of combined heritage, United Launch Alliance is the nation's most experienced and reliable launch service provider.

ULA has successfully delivered more than 90 satellites to orbit that provide critical capabilities for troops in the field, aid meteorologists in tracking severe weather, enable personal device-based GPS navigation and unlock the mysteries of our solar system.

For more information on ULA, visit the ULA infosite at ***http://www.ulalaunch.com*** .

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Colonel Thabo Ntoni, Senior Staff Officer Product Systems Management of the Command and Management Information Systems Division, **South African National Defence Force (SANDF)**

OTHER CONFERENCE SPEAKERS INCLUDE:

Saeed Al Mansoori, Senior Engineer, **Emirates Institution for Advanced Science and Technology (EIAST)**

Yahaya, Isah Akor, Legal Adviser, **National Space Research and Development Agency**

Her Excellency Mrs Nicole Bintner-Bakshian, Ambassador of the Grand Duchy of Luxembourg in the UAE

Maria Mateo Iborra, Project Manager, Ground Segment Solutions, **SES**

Dr Ayman Ahmed, Satellite System Engineer, **National Authority for Remote Sensing and Space**

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