

SATCOM For Net-Centric Warfare

May 2015

MilsatMagazine

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Tracking
Sensors
and more...**



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May 2015

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DISPATCHES

SPACE + MISSILE SYSTEMS CENTER + UNITED LAUNCH ALLIANCE HAVE A LAUNCH SUCCESS



A United Launch Alliance (ULA) Atlas V rocket successfully launches the AFSPC-5 satellite for the U.S. Air Force from Cape Canaveral Air Force Station. Photos are courtesy of ULA.

A United Launch Alliance (ULA) Atlas V rocket in V 501 configuration with a 5.4 meter diameter payload fairing successfully launched the Air Force Space Command 5 (AFSPC-5) satellite for the U.S. Air Force at 11:05 a.m. EDT on May 20th from Space Launch Complex-41 located at Cape Canaveral Air Force Station.

The heart of the first stage is the common core booster, which is about 106 feet in length and more than 12 feet in diameter. The common core booster can provide thrust up to 850,000 pounds at full throttle.

This is ULA's fifth launch this year and the 96th successful launch since the company was formed in December of 2006, the sixth launch of the 501 configuration, and the 54th mission launched using an Atlas V rocket.

Also on board the Atlas V was the X-37B Orbital Test Vehicle—or OTV—a reliable, reusable, unmanned space test platform for the U.S. Air Force.

The primary objectives of the X-37B are twofold: reusable spacecraft technologies for America's future in space and operating experiments which can be returned to, and examined, on Earth.

The X-37B Orbital Test Vehicle is the newest and most advanced re-entry spacecraft. Based on NASA's X-37 design, the unmanned OTV is designed for vertical launch to LEO altitudes where the craft can perform long duration space technology experimentation and testing.

Upon command from the ground, the OTV autonomously re-enters the atmosphere, descends and lands horizontally on a runway.

The X-37B is the first vehicle since NASA's shuttle orbiter with the ability to return experiments to Earth for further inspection and analysis. However, the X-37B can stay in space for a much longer period of time.

Technologies being tested in the program include advanced guidance, navigation and control, thermal protection systems, avionics, high temperature structures and seals, conformal reusable insulation, lightweight electromechanical flight systems, and autonomous orbital flight, reentry and landing.

This was the fourth time that the X-37B has flown on an Atlas V launch vehicle. "Congratulations to the Air Force and all of our mission partners on this successful launch! The seamless integration between the Air Force, Boeing, and the entire mission team culminated in the successful launch of the AFSPC-5 mission" said Jim Sponnick, ULA vice president, Atlas and Delta Programs.



This Atlas V mission also included the Aft Bulkhead Carrier (ABC) carrying the National Reconnaissance Office's (NRO's) Ultra Lightweight Technology and Research Auxiliary Satellite (ULTRASat). ULTRASat is composed of 10 CubeSats managed by the NRO and NASA.

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 Evolved Expendable Launch Vehicle (EELV) program supports the full range of government mission requirements, while delivering on schedule and providing significant cost savings over the heritage launch systems.

The Atlas V vehicle also launched an Aft Bulkhead Carrier (ABC) that contained eight P-Pods, which released 10 CubeSats. Following primary spacecraft separation, the Centaur will change altitude and

inclination in order to release the CubeSat spacecraft which are sponsored by the National Reconnaissance Office (NRO) and the National Aeronautics and Space Administration (NASA).

The ten CubeSats were developed by the U.S. Naval Academy, the Aerospace Corporation, the Air Force Research Laboratory, California Polytechnic State University, and Planetary Society.

"This successful launch is the direct result of dedicated government/contractor teamwork and focus on mission success," said Lt. Gen. Samuel Greaves, the commander of SMC.

"This marks EELV's 83rd successful launch and we will continue our unwavering focus on mission success."

Air Force Space Command's Space and Missile Systems Center, located at Los Angeles Air Force Base, California, is the U.S. Air Force's center of acquisition excellence for acquiring

and developing military space systems. The Center's portfolio includes the Global Positioning System, military satellite communications, defense meteorological satellites, space launch and range systems, satellite control networks, space based infrared systems and space situational awareness capabilities.

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.

ULA's next launch is the Atlas V GPS IIF-10 mission for the U. S. Air Force, scheduled for July 15 from Space Launch Complex-41 at Cape Canaveral Air Force Station, Florida.

DISPATCHES

U.S. ARMY SELECTS HARRIS + THALES TO SUPPLY RIFLEMAN RADIO SYSTEMS



Thales AN/PRC-154A Rifleman Radio.

The U.S. Army has announced that contracts have been awarded to two vendors—Harris Corporation and Thales Defense and Security Incorporated—for Handheld, Manpack and Small-form Fit (HMS) Rifleman Radios.

The awards are part of the Army's full and open competition radio marketplace approach for the Full Rate Production (FRP) phase of the program. Each vendor will produce 50 radios, which will undergo laboratory tests to determine if threshold requirements have been met. If the vendor meets qualifications, then its radios will move to the next phase, an operational evaluation.

If the vendor does not meet qualifications, then the vendor will be off-ramped. Vendors that are found to be qualified through testing will then compete to fill delivery orders as needed by the Army.

The contract is structured as a five-year base ordering period, plus a five-year optional ordering period multiple award indefinite delivery, indefinite quantity (IDIQ). Under the competitive Non-Developmental Item (NDI) strategy, additional vendors will have an opportunity to on-ramp if their technologies mature after the initial competition and operational tests.

With each new generation, the Army plans to procure radios with better capabilities, including faster processors, increased power and battery life and decreased weight. FRP fielding is scheduled to begin in Fiscal Year 2017.

"By working closely with our requirements and contracting teams, these contract awards are a critical step in moving closer toward Full Rate Production of the Rifleman Radio. Using the non-developmental item strategy, we are hoping to procure superior radios at lower costs, relying on a competitive, innovative

radio marketplace," said Colonel Jim Ross, Project Manager Tactical Radios. "These radios are key in closing the information gap on the battlefield."

The Rifleman Radio is a lightweight, hand-held radio that transmits voice and data past terrain obstacles and beyond line of sight via the Soldier Radio Waveform (SRW). Carried by Soldiers at the platoon, squad and team levels, the Rifleman Radio uses the SRW to transmit information up and down the chain of command, as well as into the network backbone provided by the Warfighter Information Network-Tactical (WIN-T).

The Rifleman Radio can also be linked to the Nett Warrior, using a secure Android phone type device that enables Soldiers to send messages, access mission-related applications and track one another's locations with Global Positioning System (GPS) technology.

Through Low Rate Initial Production, the Army has already purchased 21,379 Rifleman Radios. The Army has been authorized to purchase up to 171,933 radios through the FRP phase of the program.

The Rifleman Radio is a critical component of Lower Tactical Internet (LTI) communication architecture, which is part of the Army's Capability Set (CS) fielding strategy.



Harris Rifleman Radio.

DISPATCHES

U.S.A.F.'S SBIRS GEO-6 TO PACK IN NAVIGATION SYSTEM FROM NORTHROP GRUMMAN

Northrop Grumman will provide its Scalable Space Inertial Reference Unit (Scalable SIRU™) for sensor pointing/stabilization and attitude control on the SBIRS GEO-6 space vehicle.

Northrop Grumman has also provided its Scalable SIRU™ for previous SBIRS GEO satellites, including GEO-5 following the 2014 contract award.

The SBIRS program delivers early warning of ballistic missile launches, missile defense, technical intelligence and battlespace awareness. The system's architecture features a mix of GEO satellites, hosted payloads in Highly Elliptical Orbit, and ground hardware and software.

"Northrop Grumman has been steadfast in providing Lockheed Martin with crucial components on SBIRS," said David Sheridan, Lockheed Martin vice president and SBIRS program director.

"Our team is assuring that SBIRS production will continue to yield vital capabilities for the Air Force's early warning missions."

Northrop Grumman's Scalable SIRU™ is the industry standard for high-precision, long-life attitude control solutions supporting commercial, government and civil space missions.

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.

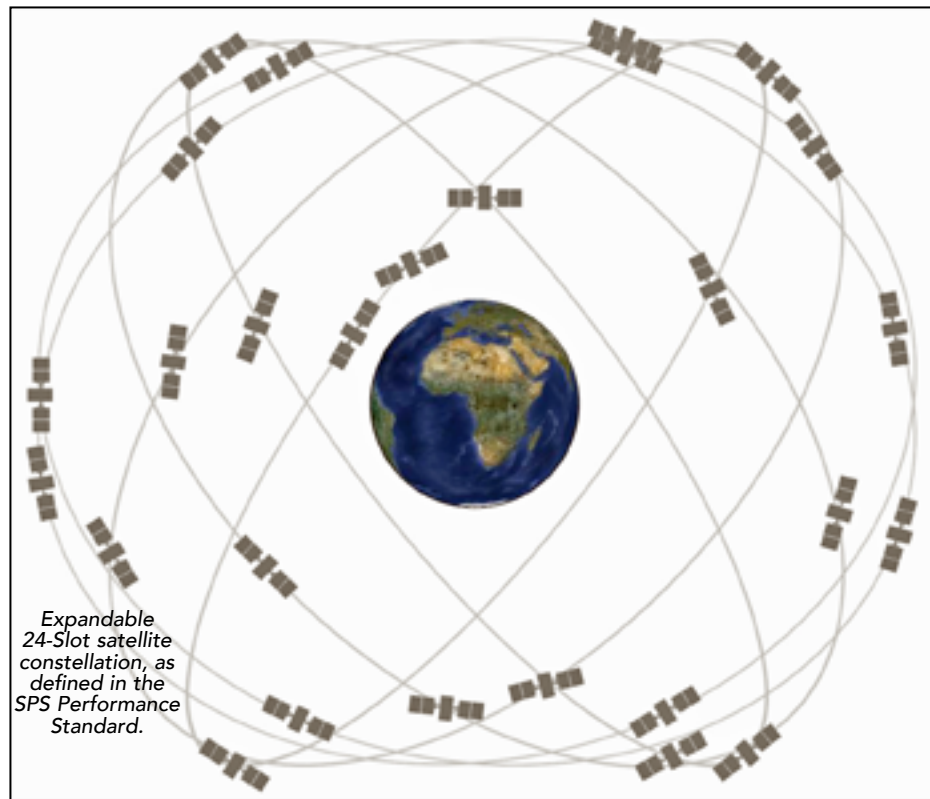


At the heart of the Scalable SIRU™ is Northrop Grumman's patented hemispherical resonator gyro, which has been used in space without a mission failure for more than 30 million operating hours.

www.northropgrumman.com/

DISPATCHES

U.S.A.F. HAS GPS III RFPS OUT + ABOUT



The U.S. Air Force has released a draft Request for Proposal (RFP) for GPS III Launch Services.

The launch service includes launch vehicle production, mission integration and launch operations.

This draft RFP marks a milestone in the Air Force's ongoing efforts to reintroduce competition into the Evolved Expendable Launch Vehicle (EELV) program. This is the first of nine space launch missions that the Air Force plans to compete in its EELV Phase 1A strategy.

"This is our first competition for EELV launch services in over a decade," said Lt. Gen. Sam Greaves, Air Force Program Executive Office for Space. "Our intent is to reintroduce competition while maintaining our focus on mission success in support of National Security Space launches."

MWR UPGRADES FOR GUANTANAMO BAY

Internet speed has always been a problem for service members at both U.S. Naval Station Guantanamo Bay and Joint Task Force Guantanamo, but those issues are progressively becoming fewer.

The recent installation of a new satellite dish signified the launching day for the new and improved Internet through iFONE, Inc. The process began approximately in September of 2014, when former Secretary of Defense Chuck Hagel heard concerns Troopers expressed here.

"He heard the feedback from troops in Guantanamo that slow Internet was a top morale concern," said Tara Culbertson the Morale, Welfare & Recreation director. "

From his direction, Defense Information Systems Agency sent a team of approximately a dozen staff to GTMO to truly understand the issues, barriers, challenges and opportunities to improve Internet speeds."

Culbertson said the improvement of Internet connectivity wasn't only for mission requirements but to help boost morale at MWR facilities, and provide service members the opportunity to improve their purchased Internet for housing.

Scott French, MWR Internet technologies director, said the new Internet at MWR locations has increased the capacity here by 10 times the amount of the previous systems here. The locations that will see the fastest speeds are the four MWR Liberty Centers.

The Liberty Centers are open to all unaccompanied active military members, and are located at Camp America, Tierra Kay Housing, Deer Point and Marine Hill.

"However, all other MWR facilities with Wi-Fi will also enjoy the new Internet bandwidth capacity—that includes the bowling alley/ Taco Bell, Windjammer, Bayview, Triple C Coffee Shop, the library and more," Culbertson said. "You will also see changes in

some of the bases internal functions, such as the length of time it takes to run your credit card when you pay for your dinner bill, or the time it takes to check out a book at the library," French said.

Culbertson said she couldn't be happier with the feedback she has received since the project was completed.

Although the upgrade won't have an immediate effect on Internet capabilities in living quarters, faster Internet is expected shortly for the housing units.

The increase in GTMO's Internet bandwidth by tenfold has already made people notice and is a welcome addition to the community.

*Story by U.S. Army Spc. Amber Bohlman,
123rd Mobile Public Affairs Detachment,
Joint Task Force Guantanamo Public Affairs*

DISPATCHES

AITECH DEFENSE SYSTEMS OFFERS MORE PORTS IN A STORM



Aitech Defense Systems Inc. now offers their rugged A661 with the largest number of GbE ports in a robust military qualified enclosure.

The new standalone, fully managed, Layer 2/3 IPv6 48-port Gigabit Ethernet switch efficiently and securely interconnects several subsystems to pass data across a rugged broadband network.

Durable and robust enough for use in several military, aerospace and LEO space environments, the radiation-tested and qualified A661 is ideal for interconnecting weapons platforms to multiple independent data servers creating large, compute clusters and interfacing to data archive drives.

For example, The A661 can provide control and data pathways to remote experiment Low Earth Orbit (LEO) platforms, including the International Space Station.

The compact 2 x 24 GbE switch unit is comprised of two of Aitech's Series 400 conduction-cooled C660 24-port Ethernet switches encased in a durable, lightweight, cold plate-cooled enclosure.

It is EMI/RFI-protected and housed in a rugged chassis to withstand severe shock and

vibration as well as exposure to environmental elements, such as altitude, humidity and temperature extremes.

Complete with its own operating system (OS) and Ethernet application, this new, managed switch requires no additional user code and functions and operates as a stand-alone unit.

An integrated, low-power, radiation-tolerant ARM Sheeva CPU core operates at 800 MHz, acting as a management and service processor and interfacing with a high-speed DDRII-320 MHz memory controller.

The C660 boards within the A661 support Layer 2 and Layer 3 routing and switching for all 48 ports via a Marvell Presara 98DX4122 multi-layer packet processor.

All ports support connections up to 1000Base-T and offer many features such as auto negotiation, auto MDI/MDIX, HOL blocking prevention and flow control (IEEE 802.3x).

To enhance reliability and serviceability, the A661 includes BIT (Built-In Test) and board management devices including a system power controller, elapsed time recorder, temperature sensors and a real time clock.

The system also provides full wire-speed non-blocking forwarding and advanced spanning tree algorithms to reduce data bottlenecks and minimize packet latency.

Additional management and configuration features include quality of service (QoS) prioritization, SNMP, VLANs, LAG, RSTP, VRRP, IGMP and traffic policing, providing customers the power and flexibility to meet their unique networking applications.

In place of harnessing, Aitech's proprietary solid-state transition module routes I/O signals between the backplane and the front panel connectors.

This significantly enhances signal integrity and increases reliability by reducing discrete wire harnesses. In addition, an input power line filter integral to the transition module reduces induced or radiated EMI/RFI noise associated with the power cable.

Rugged, military-grade MIL-STD-38999 connectors on the front panel provide system power and I/O connections. Radiation tested and qualified for LEO, lower power versions of this switch are ready for space flight.

Technical Specifications:

- **48-port (2 x 24) managed Gigabit Ethernet switch (all 1000Base-T ports)**
- **Rugged, compact, and lightweight construction; cold plate-cooled**
- **Stand-alone unit with internal OS and Ethernet application**
- **Layer 2 and Layer 3 management**
- **Port-level security via 802.1x**

Low Earth Orbit versions are also available

www.rugged.com/a661-2-x-24-port-rugged-managed-ethernet-switch-0

DISPATCHES

SMC + SPACEX AGREEMENTS



The Air Force Space and Missile Systems Center (SMC) and Space Exploration Technologies Corporation (SpaceX) have formally amended the Cooperative Research and Development Agreement (CRADA) between the two organizations for Evolved Expendable Launch Vehicle (EELV) Certification of the Falcon

9 Launch System.

These updates incorporated lessons learned from the on-going certification process and will streamline the execution of the certification process.

The amended CRADA incorporates all of the Independent Review Committee's recommendations, including clarification that the SMC Commander, as the Certifying Official, has the authority to grant certification based on a New Entrant's demonstrated capability to design, produce, qualify, and deliver their launch system.

Additionally, New Entrants will provide future mission assurance support required to deliver National Security Space (NSS) payloads to specific orbits on a specific schedule with a specific level of risk.

Among other things, these changes allow SpaceX certification with some open work, provided there are jointly approved handling plans in place for work to support potential NSS mission processing timelines.

"The updated CRADA captures important lessons learned along the way about the process and allows the flexibility to certify SpaceX when ready, while maintaining our 'laser focus on mission success'," said Lt. Gen. Sam Greaves, Commander, SMC.

Gwynne Shotwell, President & Chief Operating Officer, SpaceX, said, "We look forward to completing the certification process and competing for EELV missions."

Certification of the Falcon 9 Launch System (with the Falcon 9 v1.1 as the baseline configuration) is expected no later than June 2015.

Both SpaceX and the Air Force see these CRADA modifications as a positive step towards strengthening U.S. national security through continued competition in the Evolved Expendable Launch Vehicle program.

DISPATCHES

NANO-SATELLITES MAY SOON COMMUNICATE FROM SPACE TO BOOTS ON THE GROUND

Tiny Army satellites may someday provide Soldiers with voice, data and even visual communications in remote areas, which lack such communications—already some of that technology has been successfully tested, Dr. Travis Taylor said.

Taylor is the senior scientist for Space Division, U.S. Army Space and Missile Defense Command - Tech Center, or SMDC, at Redstone Arsenal, Alabama.

In many remote areas, where Soldiers operate today, Army radio Over-The-Horizon (OTH) communication from the field to higher headquarters like the brigade is nonexistent, Taylor said.

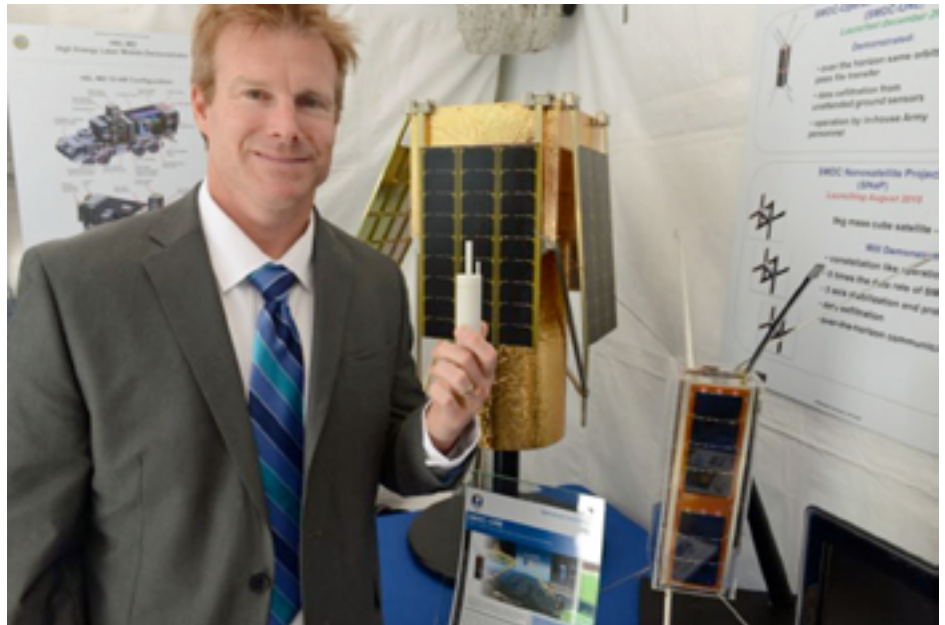
To address this gap in coverage, Army scientists and researchers built the SMDC-ONE nanosatellite, he said, the ONE standing for Orbital Nanosatellite Effect. "It's basically a cellphone tower in space, except it's not for cellphones, it's for Army radios," Taylor said.

SMDC-ONE is a technology demonstration, he said, adding that one has been successfully tested. The satellite is up in space right now, communicating. Three more are scheduled to launch this year and an undetermined number will be launched next year, as well.

"Hopefully, we're at a point in the process where the technology is proven and they're wanted, perhaps three to five years" from now, Taylor said.

"If we put five to 12 of these small satellites in orbit, it will cover most areas Soldiers are operating, providing them real-time, all the time" communications, he said. Once it has been proven it can be done, it will be time to start to deploy a "real constellation" of them, which the warfighters can use.

What if a Soldier not only wants to communicate, but wants to see if there is a threat or something of interest over the next hill or the other side of a city, Taylor asked rhetorically.



Dr. Travis Taylor, senior scientist for Space Division, U.S. Army Space and Missile Defense Command - Tech Center, at Redstone Arsenal, Alabama, discusses Army space satellites during Lab Day at the Pentagon, May 14, 2015. He is shown holding a plastic and liquid nitric oxide container, which propels the satellite into LEO after it leaves the mothership. Behind him is the imagery satellite and to the right is the smaller data and voice satellite.

Photo Credit: David Vergun

The answer is an imaging satellite, which is several times larger than SMDC-ONE, but still considered nano, he said. This satellite, which is still unnamed, will be given a space test-flight in February, launched from the International Space Station.

The imaging satellite will produce a ground resolution of two to three meters, he said. That is high enough resolution to inform a Soldier if he is looking at a tank or a truck. Or, if there is smoke in an urban area, the Soldier will be able to tell which building it's coming from. "This is capability the Army doesn't have right now."

Once the technology is successfully demonstrated, the next step will be to establish the process for how it works and provide training to the Soldiers.

"The first step is proving we can collect [the data] and the next step is disseminating it," he said. For example, a squad leader might need to ask [a] brigade for an image over the next hill. Someone at brigade would need to prioritize that request, because the satellite

can only process one image at a time, usually in about a minute.

Then, the data from that image or even the image itself would need to be pushed out to the Soldier on the ground, he said. The details are still fuzzy about how all of that would work, so the focus for now is getting through the demonstration phase.

The technology is already proven, Taylor said. The biggest challenge is getting the satellites hitched on a ride into space, where they would be in Low Earth Orbit (LEO). Most are launched now by piggybacking them as part of a larger payload of a spaceship.

One problem is, you cannot put rocket motors on these to change their orbits, because it is considered too dangerous for the mothership and the other payloads, he said, meaning it could inadvertently explode.

When the mothership drops off its payloads, the Army satellite might not be in an optimal position in space since the mothership cannot zigzag around dropping off each

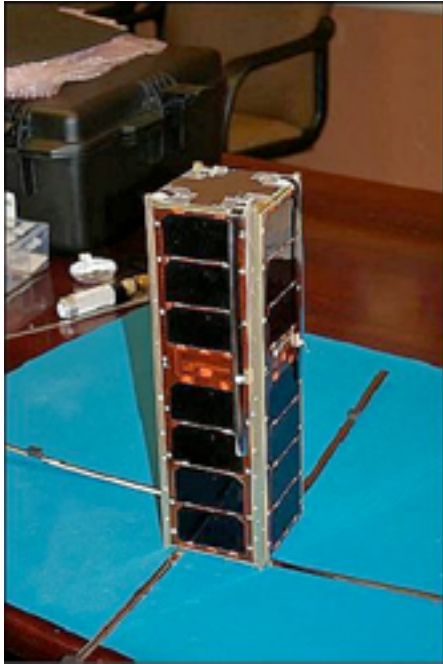
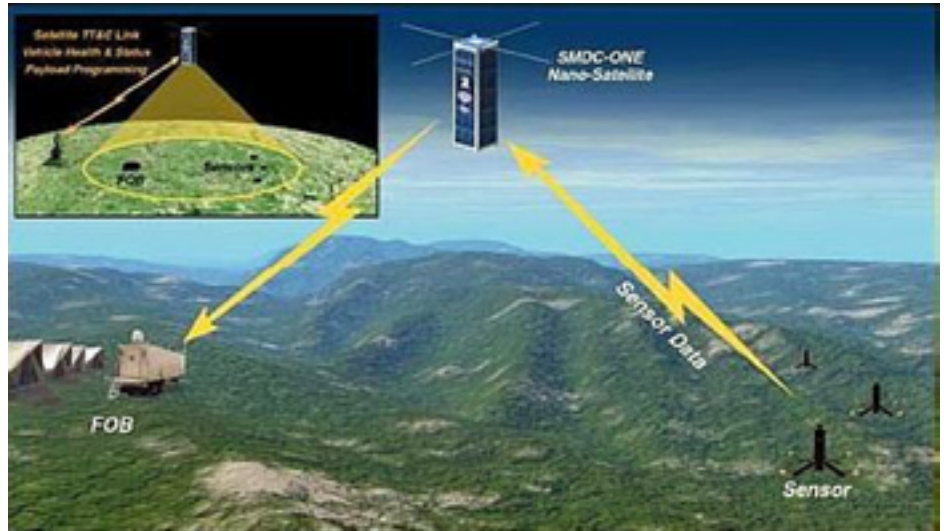


Photo of the SMDC-ONE nanosatellite. Photo is courtesy of Miltec.

payload in different places where their optimal orbits are located.

"So, we developed a clever way around that," Taylor said, holding up a plastic container about the size and shape of a fancy pill bottle.

"This is an actual rocket motor, made from a plastic printer," he said. "Inside is liquid nitric oxide and a sparker—just like a barbeque lighter inside—so the nitric oxide combusts with the plastic when the sparker is fired."



SMDC-ONE Operational View 1 (OV-1). Image credit: SMDC

"That's your rocket fuel. Then you have a very good rocket motor." Once the rocket motor puts the satellite in the correct orbit, the satellite still needs to orient its solar panel array so it is continuously tracking the sun and collecting energy, he said.

To do that, the satellite contains three wheels spinning in the x, y and z axis called momentum wheels, he said. They act like gyros and can be programmed by speeding or slowing each one to adjust the orbit or orientation of the spacecraft. There are also magnetic torque rods in the satellite that interact with the magnetic field of the Earth to help align it.

Once in space, the satellites are not completely immune from damage, Taylor said. In addition to space debris, there are solar flares and coronal mass ejections that could penetrate the satellite's shielding. "But we do everything we can to harden and ruggedize them."

These satellites are very inexpensive, he said, adding the biggest cost is the launch.

"It's exciting to work with spacecraft that can actually help warfighters in the field of the future," Taylor said. "We've had many would-be users tell us that if they had this, they'd use it tomorrow, so I think the odds are good this will be something we see in the future."

Story by David Vergun.

TACNAV SYSTEMS FROM KVH ORDERED TO THE TUNE OF \$1.5 MILLION

KVH Industries, Inc. has received a \$1.5 million contract for the delivery of tactical navigation systems for use by an international military customer in an armored vehicle application.

A variant of KVH's TACNAV TLS and TACNAV Light, the system is designed to help military vehicle crews maintain 100 percent situational awareness. The hardware shipments for this order are expected to be made in 2015. Program management and engineering services will be provided as part of this order.

All of KVH's TACNAV military vehicle navigation systems provide unjammable precision navigation, heading, and pointing data for vehicle drivers, crews, and commanders. TACNAV can also serve as a heading and position source for situational awareness. The TACNAV system ordered today combines characteristics of TACNAV TLS and TACNAV Light, and features a compact design, continuous heading and pointing data output, and a flexible architecture that allows it to function as either a standalone navigation module or as

the heart of an expanded, multifunctional TACNAV system. The system is designed to integrate with Battle Management Systems (BMS) and is a vital component for effective battlefield management.

TACNAV systems are currently in use by the U.S. Army and Marine Corps, as well as many allied customers.

www.kvh.com/

DISPATCHES

FIRST MODERNIZED ENTERPRISE TERMINAL COMMISSIONED @ WAHIAWA FACILITY



Capt. William A. Dodge Jr., commander, Naval Computer and Telecommunications Area Master Station, Pacific, speaks during the commissioning of the first operational AN/GSC-52B(V5) Modernized Enterprise Terminal (MET) April 16 at the Wahiawa Satellite Communications (SATCOM) Facility Hawaii. METs will support Internet Protocol and Dedicated Circuit connectivity within the Department of Defense Information Network (DoDIN), providing a significant increase in the ability to provide Joint Commanders in the Pacific with Command and Control of their forces. U.S. Navy photo by Ensign Denise Baumeister.

The Wahiawa Satellite Communications (SATCOM) Facility Hawaii held a ribbon cutting ceremony to mark the start of a new era with the commissioning of the first operational AN/GSC-52B(V5) Modernized Enterprise Terminal (MET) on April 16.

Commander, Naval Computer and Telecommunications Area Master Station, Pacific (NCTAMS PAC), Capt. William A. Dodge Jr., opened the ceremony by paying homage to Wahiawa's long history of providing satellite communications, which began three years before the Soviet Union launched Sputnik in 1957 through a program called Moon Relay.

"We are here today to begin to retire the aging workhorse of Department of Defense satellite communications, the AN/FSC-78 terminals, and commission the new AN/GSC-52B(V5) Modernization of Enterprise Terminal (MET)," said Dodge. "The AN/FSC-78 terminals operated in the X-band frequency range and were some of the first to provide

the Department of Defense with a man-made satellite global communications capability."

"Today, in partnership with the Army Enterprise Information Systems Program Office, this MET installation is the first of three to replace the 40 year old AN/FSC-78's here in Wahiawa, and will provide a significant increase in our ability to provide joint commanders in the Pacific with command and control of their forces," Dodge continued.

The MET program is intended to modernize fixed X-band Enterprise Terminals by eventually replacing all existing AN/FSC-78 X-band and AN/GSC-70 Ka STARS (Ka-band) terminals.

The AN/GSC-52B(V5) MET is capable of operating in both the X- and Ka-band frequency ranges and provides greater bandwidth capacity than both of its predecessors.

This allows Enterprise Information Systems to better support the expanding requirement for Earth terminals capable of interfacing with

both the Wideband Global Satellite (WGS) constellation and legacy satellite systems such as the Defense Satellite Communications System (DSCS).

"This project modernizes the existing AN/FSC-78 earth terminal by replacing it with a 12.2 meter Large Fixed Antenna (LFA), a new antenna group, and modernized fixed operating group," said Dodge. "These upgrades will significantly reduce the operating space and improves the power and cooling budget within the building.

"The Modernization Enterprise Terminals will support Internet Protocol and Dedicated Circuit connectivity within the Department of Defense Information Network (DoDIN), providing critical C5I reach-back capability."

Army Program Executive Officer for Enterprise Information Systems, Douglas K. Wilstie, also led the ceremony as part of the official party.

Wilstie commented that in addition to the state-of-the-art technology provided by the AN/GSC-52B(V5) MET terminal, "...the MET program provides the project manager of the Defense Communications and Army Transmission Systems with an advanced, strategic terminal architecture that allows for equipment commonality lowering acquisition, logistics, and life cycle costs."

The AN/GSC-52B(V5) MET will soon be installed at other teleport facilities around the world to include: Camp Roberts, California; Fort Buckner, Okinawa; Lago di Patria, Italy; Landstuhl and Ramstein, Germany; Northwest, Virginia; and Bahrain.

At ceremony's end, the DoD's first MET was thus officially commissioned, named "Wahiawa East MET-1," and immediately began operations supporting joint forces throughout the Pacific.

*Story by U.S. Fleet Cyber Command
U.S. TENTH Fleet*

DISPATCHES

PROVIDING CONNECTIVITY BETWEEN AFGHANISTAN + U.S. DEFENSE LOGISTICS AGENCY



Delivering food, fuel, and other vital supplies to U.S. military personnel operating in remote areas of Afghanistan is not an easy task.

An important first step is finding out which supplies are needed at what location and relaying that information back along the supply chain from Afghanistan to the point of shipment, often in the United States.

In most cases, such communications are only possible via satellite because a local infrastructure does not exist or has been damaged by war. And satellite connections to small in-country networks require on-site technicians to install and set up ground antennas.

For the past two years, Intelsat General and By Light Professional IT Services have teamed up to provide the U.S. Defense Logistics Agency (DLA) with connections between U.S. and allied supply officers in Afghanistan and the DLA's global network of warehouses and shipping facilities.

As the prime contractor, By Light has established and maintained the connection, while Intelsat General has provided the link between Afghanistan and the DLA network via two Intelsat satellites and two teleports.

The DLA provides the U.S. military and its allied forces with a full spectrum of logistics, acquisition and technical services, from food, guns, uniforms, and medical supplies to construction equipment and vehicles.

The agency also supports humanitarian relief efforts at home and abroad, including the 2011 Japanese earthquake and hurricanes Isaac and Sandy in 2012 in the United States.

The agency processes nearly 100,000 requests every day from troops and federal agencies around the globe asking for supplies and other materials.

To help the DLA communicate with supply officers stationed in Afghanistan, By Light sent technicians there two years ago to establish ground services at multiple sites located around the war-torn country.

The technicians set up the ground equipment to establish small virtual private networks that were then connected to the Intelsat satellites. Requests for equipment and other support go over the Intelsat network to the DLA enterprise network.

By Light has set the DLA up as a virtual network operator so that the agency can receive the requests and communicate directly with personnel in Afghanistan.

"Once we got the network set up, we haven't had any problems," said Jeff Adelman CS2-SB Program Manager of By Light. "Intelsat General's end-to-end solution and capacity to meet surge requirements coupled with By Light's operational support has exceeded DLA's expectations."

By Light provides comprehensive end-to-end satellite systems engineering to Federal and State Governments, as well as a variety of commercial clients. The company's solutions consist of various strategic and tactical satellite services, including design, integration, installation, operations, maintenance, and training.

In addition to the company's work with Intelsat General, By Light is a Professional Services and Certified Training Partner for iDirect Technologies and iDirect Government Technologies (iGT). By Light provides certified iDirect and Global VSAT Forum (GVF) training as well as custom SATCOM/VSAT training for industry personnel and deploying War Fighters and contractors.



www.intelsatgeneral.com/

www.by-light.com/



DISPATCHES

RPA PILOT MISSION RELIEF IS NOW UNDERWAY FOR THE U.S. AIR FORCE



The Air Force is pursuing a range of options that will, in combination with a reset in the number of sustainable combat air patrols, help alleviate long-term stress on Remotely Piloted Aircraft crews.

Initial efforts were announced by the Air Force Secretary and Chief of Staff earlier this year; new initiatives include incentive pay increases and bonuses for crews, directing additional funds to the mission, augmenting current crew manning, increasing the number of RPA pilot graduates, and increasing the use of Guard and Reserve Airmen as well as contractors to bring relief to a community in high demand.

Air Force Secretary Deborah Lee James says the Air Force will continue to support Combatant Commanders with RPA missions while also focusing on initiatives that reduce stress on personnel and build readiness that is sustainable over time.

"Balancing ISR capability across the range of military operations with finite resources remains a challenge," said Secretary of the Air Force Deborah Lee James. "In order to best meet mission demands and sustain the force, the SECDEF has approved a CAP reset to improve RPA pilot operations tempo. We needed to do this to ensure the long-term viability of this capability."

After spending much of the last decade in surge mode, the Air Force is looking to put into place measures to bring additional relief to the high-demand remotely piloted aircraft community.

"What our Remotely Piloted Aircraft professionals are doing in today's fight and in preparing for future conflicts is simply incredible," said Gen. Hawk Carlisle, Air Combat Command commander. "RPAs fulfill critical demands in every theater 24 hours a day, 365 days a year."

Operating at a surge capacity for nearly a decade has taken a toll on the force.

In order to meet combatant commander requirements, and in response to SECDEF direction, the Air Force surged MQ-1/9 combat air patrols nine times in the last eight years, and has sustained those operations to date, according to Air Force officials.

In April, Secretary of Defense Ash Carter approved the reset of the CAP planning guidance to reflect a drop in CAPs from 65 to 60.

This initiative was designed to alleviate the state of constant surge experienced by the RPA community.

Air Force leadership recognizes the stakes of not properly balancing mission demands against the needs to develop



the force and the potential risk assumed in areas such as retention, training, manning, and combat capability.

"Maintaining operational success and fulfilling combatant command requirements for a sustained period of time has impacted our ability to train the force and risks the health and long-term viability of the enterprise," said Gen. Mark A. Welsh III, Air Force Chief of Staff.

"Current demand put requirements for active-duty RPA pilots at about 300 per year. However, our current active-duty training production output is only 180 pilots per year. The new plan aims to add more than 100 additional pilot graduates per year."

To address concerns, the Air Force launched several initiatives in January 2015 to deal with the growing strain on RPA capacity and continues to explore options to fix manning challenges.

In January, Secretary James took immediate action to increase RPA pilot Aviation Pay from \$650 to \$1,500 a month. Now the service is developing plans for a longer-term RPA pilot retention bonus for Fiscal Year 2016 release and is actively advocating for new incentives.

"We've improved the Aviator Retention Pay bonus for traditional pilots flying RPAs, making their bonus consistent with other stressed rated officer communities," said James. "We are also committed to improving Aviator Retention Pay bonuses for traditional pilots electing to fly RPAs."

In order to enable force development and necessary training the Air Force will make use of an array of resources.

"In an effort to further improve the health of the force, we will leverage the Air Reserve Component (ARC) and contractor support to bring relief to the active-duty force. This will allow manning to be reinvested into the RPA training pipeline," said James.

Additionally, to bring relief to the active-duty force, the Air Force plans to mobilize reserve component forces to take on three combat air patrols.

The service is also working on funding actions to relieve stress across the RPA enterprise.

The Air Force recently moved \$7.8 million into the RPA program to grow school house capacity, increase reserve component manpower augmentation days and contract some downrange and recovery efforts.

"We're redirecting funds into the RPA community and will request support from within the Department of Defense to cover additional requirements," said James. "This is an absolutely critical mission set and investment is required to ensure its long-term viability. We're committed to getting this right."

The service recognizes the demand for ISR and RPA pilot skills will remain.

"The demand for ISR capability will always exist," said James. "We are focused on developing and managing ISR assets to be agile and responsive enough to support global and theater requirements in a seamless manner while at the same time, managing the stress on Airmen. We are taking action to provide near-term

operational relief while addressing quality of life concerns."

Story by Secretary of the Air Force Public Affairs

DISPATCHES

IN-FLIGHT COMMS + EXPEDITIONARY COMMAND POSTS SUPPORTED BY NEW ARMY TECHNOLOGIES

The Army is delivering new technologies to the Global Response Force, or GRF, that will help transform the concept of a command post from a stationary, tented shelter to a mobile enabler for expeditionary mission command—including during operations in flight and early entry into developing situations.

"No matter where we're going in the world, enabling us to maintain situational awareness en route, and even do [it] in-stride changes, is invaluable," Army Vice Chief of Staff Gen. Daniel B. Allyn said. "And likewise with our early entry forces—the ability to immediately expand their mission command capacity upon initial entry, and eventually build to a network that's mature to fight the follow-on phases, is critical."

The Global Response Force, or GRF, of the XVIII Airborne, or ABN, Corps, supports that unique early entry mission, with the ability to rapidly deploy a brigade combat team on a very short timeline to any hotspot as called upon by the president. Because they are first in, they need as much situational awareness as possible.

Due to the high-profile nature of the GRF mission, the Army has validated a number of operational needs statements, or ONS, for the unit's communication requirements. These ONS led to two groundbreaking capabilities—an en route mission command capability and small tactical network satellite terminals that support early entry operations.

These technologies enable Soldiers to connect to the Army's tactical communications network backbone, Warfighter Information Network-Tactical, or WIN-T, before the heavier WIN-T satellite terminals and networked combat vehicles can be flown in to support larger scale operations.

Before the paratroopers even get near the drop zone, the new Enroute Mission Command Capability, or EMC2, enables commanders of GRF units to plan missions and maintain situational awareness in the air. Now, as the situation develops in the destination target area, commanders will receive updates, understand changes on the ground and adjust their plans to accommodate for those



changes, all while in flight. This can eliminate hours of on-the-ground planning at the drop site so Soldiers are more effective immediately upon landing. Not only does EMC2 enable the airborne task force commander to better understand the situation, but it increases awareness for all of those service men and women aboard the aircraft.

"The amount of bandwidth we can provide on the aircraft is roughly equal to what a brigade command post would use in the field, so commanders can use mission command applications and communication capabilities just like they would do on the ground in the command post," said Lt. Col. Joel Babbitt, product manager for Warfighter Information Network-Tactical, or PdM WIN-T, Increment 1.

EMC2 provides a broadband connection that allows commanders to tap into command and control applications like the common operating picture, secure video teleconferencing, Secure Voice Over Internet Protocol calls, and full motion video using intelligence, surveillance and reconnaissance, or ISR, feeds from unmanned aerial vehicles, which can be displayed throughout the aircraft on LED screens. Commanders and their paratroopers can see the target drop area, gain an understanding of the battlefield before arriving, and see enemy positions and disposition in the target area.

"The GRF are not just seeing a three dimensional picture of where they are going, they are actually seeing the fourth dimension—time," Babbitt said. "They are watching their objective over time, watching the enemy and the disposition of forces and how things change just before they jump in to assault that objective."

EMC2 provides access to intelligence products and collaborative planning along with a full office suite of computers, workstations, and chat—all onboard an airplane to a force that had previously been without robust en route communications or had exceptionally little bandwidth. In essence, the aircraft becomes a high capacity command post with commanders and Soldiers receiving the same level of information as they would on the ground, said Cpt. Mindy Brown, WIN-T Increment 1 project lead for EMC2.

The EMC2 initial operational capability will be fielded in May, with the full operational capability fielding expected in 2017.

In response to an ONS, PM WIN-T fielded the 82nd Airborne Division several very small "jumpable" satellite dishes. As with EMC2, new technology that reduces size, weight and power requirements enabled those dishes to provide early entry units roughly the equivalent amount of bandwidth as an established brigade command post would use in the field.

Just as EMC2 transforms the aircraft into an in-flight command post, these small satellite capabilities transform the drop zone into a "tent-less" command post. The Army is looking at commercial technology to field for these early entry operations, along with slightly larger dishes that would support follow-on operations at the edge of the battlefield.

EMC2 and early entry SATCOM, provides robust anytime situational awareness and increases the expeditionary nature of Army forces. If the Army can communicate anytime, anywhere and shed that traditional command post infrastructure when needed, it can rapidly and successfully conduct a wider range of missions throughout the world.

Babbitt added, "Constant connectivity is key to situational awareness and the ability to flexibility and dynamically change the plan. Winning in a complex world means getting all the information you can to make good decisions in a constantly evolving and changing environment."

DISPATCHES

TECHNOLOGIES FOR NEW UAS CAPABILITIES @ SEA TO BE SHARED BY DARPA

DARPA is aiming to share breakthrough, low-cost technologies to improve launch and retrieval of unmanned aerial systems and maritime situational awareness

Tern, a joint program between DARPA and the U.S. Navy's Office of Naval Research (ONR), seeks to give forward-deployed small ships the unprecedented capacity to serve as mobile launch and recovery platforms for medium-altitude, long-endurance unmanned aerial systems (UAS).

These systems would provide long-range intelligence, surveillance and reconnaissance (ISR) and other capabilities over greater distances and time periods than helicopters and would require far less dedicated infrastructure resources than conventional fixed-wing manned and unmanned aircraft. As part of its individual investment in Tern, DARPA has launched

two successful technology demonstration efforts that grew from Phase 1 research and are separately approaching potential transition to the Services:

SideArm: DARPA's SideArm effort seeks to create a self-contained, portable apparatus able to horizontally launch and retrieve UAS of up to 900 pounds from trucks, ships and fixed ground facilities. The small-footprint system is designed to enable rapid setup and controlled decelerations and adapt to current and future UAS. Based on subscale tests last summer, DARPA will conduct further risk reduction and hardware testing this year, and then plans to test recovery of two different aircraft types at full scale.

Towed Airborne Lift of Naval Systems (TALONS): DARPA's TALONS effort seeks to develop a low-cost, fully automated parafoil system to extend small ships'

long-distance communications and improve their maritime domain awareness. Towed behind boats or ships, TALONS could carry ISR and communications payloads of up to 150 pounds between 500 and 1,500 feet in altitude—many times higher than current ships' masts—and greatly extend the equipment's range and effectiveness. Following successful ground-based tests, DARPA will conduct at-sea testing this year and potentially transition the technology to the U.S. Navy.

"Through SideArm, TALONS and other projects, DARPA aims to make it much easier, quicker and less expensive for the Defense Department to deploy persistent ISR and strike capabilities almost anywhere in the world," said Dan Patt, DARPA program manager.

CONSIGNMENT INTELLIGENCE

By Giles Peeters, Senior Contributor + Defence Sector Director, Track24 Defence



When a country goes to war, instruction is passed from the highest serving public minister, to government, and then to a unit or department responsible for preparing for the ensuing engagement.

Back in 2001 in the United Kingdom (UK), it was The Permanent Joint Headquarters (PJHQ) and the Chief of Staff (Operations) who were responsible for the planning and execution of operations. Requirements are divided between nine divisions—J1 through J9—who oversaw requirements ranging from personnel (J1) through to logistics (J4) and communications (J6).

Being a communications specialist, I attended/participated as part of the J6 community and was involved in preparations for the British participation of the International Security Assistance Force (ISAF) in Afghanistan.

Each J division has an important role to play and none more so than J4, responsible for logistics. Preparing for operations; organizing and transporting everything required to engage is a huge undertaking. Getting logistics correct the first time is vital from a monetary perspective, but even more important from an operational one.

Traditionally, some militaries have used commercial container tracking technology to manage logistics; radio frequency identification (RFID) tags attached to assets enable teams to track them in controlled areas such as ports or storage depots, as long as consignments stay within the RF bubble, piping the information back to a central logistics system. Once the cargo moves outside of the radio bubble, tracking systems typically rely on GSM/GPRS and send geotag data and status as, and when, they enter areas of coverage. This could mean days without updates as ships en-route to war zones cross vast distances carrying thousands of ISO containers full of equipment.

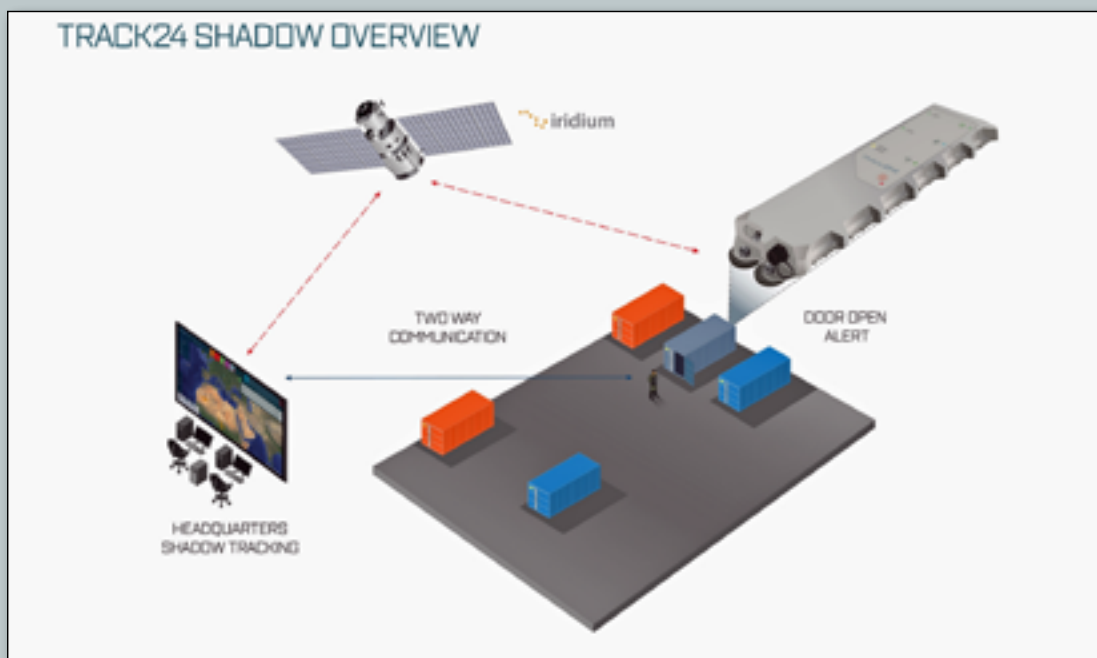
However, military logistics has traditionally been problematic. The distances involved, often through austere environments and the complexity, can cause delays—this is an operational headache.

I witnessed many situations in Joint Helicopter Command where critical helicopter parts either got delayed or, worse still, were lost. This had serious operational consequences in providing air capability. We had limited real-time consignment information in those days; therefore, the risk and operational effect was difficult to evaluate—there were no life or death situations, but this may not always be the case.

And that wasn't in a new territory, that was a war zone in which we'd had a ten year presence and logistics had been set up and running for some time. With little real-time visibility into the location and status of cargo, militaries struggle to run efficient operations.

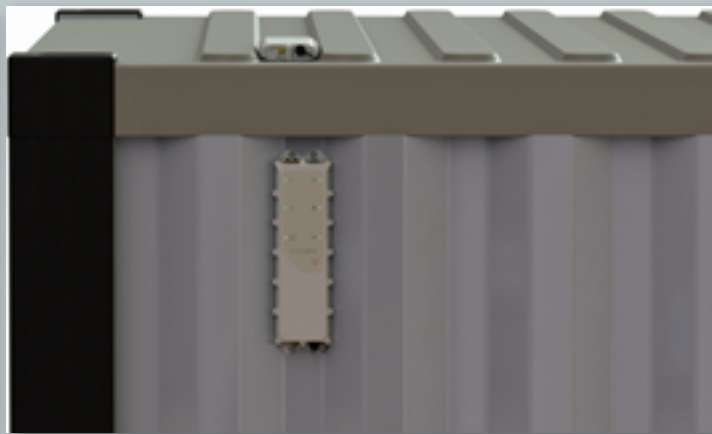
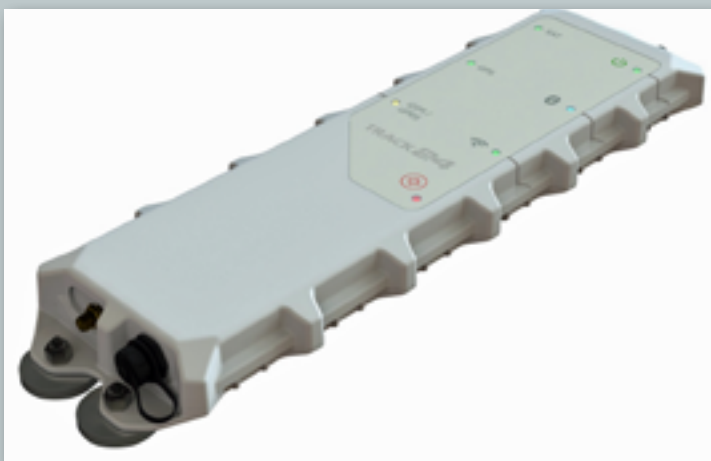
Once a conflict is over and a military force is faced with shipping everything back home, they typically face a different problem—interference. Huge container shipping yards are often guarded by local skeleton security teams who have no chance of effectively patrolling and securing thousands of ISO containers. Even worse, it may be in their financial best interests to let third parties into the yard to open crates and investigate their contents.

As far as the military is concerned, its last good intelligence indicates the container hasn't moved and is where it should be, so all is good. The first they know of any foul play is when they receive the container, open it up, and find the multi-million dollar Apache engine on the manifest has been replaced with sand and rocks. Sounds too ridiculous to be true, but it happens.



And it's not just theft that needs to be addressed. Insurgents will look for any opportunity available to attack an allied base—tampering with cargo and concealing an incendiary device within an ISO container for example, is a way into a secure compound and could have disastrous consequences once it reaches its destination.

The incumbent military force you're working alongside in a foreign territory should also be factored into logistics planning. Maybe a local security outfit decides that if 90 percent of the equipment reaches its final destination, then that'll be good enough. They are used to



Left: Track24 Defence Shadow Device — Right: Shadow Device Attached to container

working alongside different allies on a regular basis and will naturally look out for themselves. That interference is costly from a monetary perspective and, once again, could have severe operational ramifications.

Effective and secure consignment tracking is, therefore, an essential operational requirement for modern day militaries. Unfortunately it's not as easy as procuring tracking technology straight from the commercial sector—systems typically fall short in two main areas: real-time intelligence and security.

Conventional RFID and GSM/GPRS tracking devices attached to ISO containers report on location and speed when in areas of coverage. But that intelligence is of limited value if it is not in real time or you don't know the status of the cargo inside the ISO.

Instead, militaries are turning to advances such as secure M2M satellite, ZigBee mesh networks and sensors to provide beyond line-of-sight data visualization for logistical intelligence. In the instance of an ISO container, sensors can report on the temperature, levels of light, door open/closed or movement within the container. This information is then encrypted and sent via commercial satellite back to HQ, where it becomes part of the overall common operational picture.

Military grade consignment tracking technology also enables users to change the configuration of the sensors with firmware updates that are managed from the HQ. These are not maintenance patches like the ones you'd periodically download on your smartphone, but instead live telemetry updates to solve operational problems—for example, thresholds in a container with refrigeration units can be configured to provide real-time alerting if temperatures rise, this provides valuable information about a possible faulty cooling unit.

Another critical feature is the ability to send the sensor within the container a geofence or map area that triggers an alert if the container is moved outside of this area: this updates the J4 operations staff of consignment movement in real-time. This feature is also used as way points for journey management. With live firmware updates configurable anywhere in the world, these geofences can be updated at any time and anywhere.

However, commercial solutions often lack the military grade command and control backend required to run an effective operation. The device itself is only ever part of an overall blue force tracking solution giving commanders the opportunity to integrate logistics intelligence with information from other devices assigned to assets in the field.

Seamless compatibility is required to run efficient operations; being able to align assets with cargo is essential, especially in the face of insurgent disruption. This could be as simple as setting up geofences to alert nearest responders if consignments stray off course, or messaging and coordinating friendly forces to accompany convoys transporting cargo as they move through high risk areas.

Commercial devices also fall short on security. The most common ones don't encrypt their signals before transmission which leaves them open to interception. In a physical sense they also aren't that secure as they are attached to the outside of the cargo itself—instead, militaries need covert solutions designed to avoid detection, therefore reducing the chance of interference. In the instance when the device is discovered or compromised or detached, the mesh network capability allows other devices in the local area to automatically send alerting signals to predetermined assets.

Ultimately, the benefits of Commercial Off-The-Shelf (COTS) solutions are affordability, ease-of-use and allied compatibility (if you're part of an engagement with multiple partner states you need to command and control all consignments at the same time regardless of origin or destination). In order to ensure cost savings as well as operational efficiency it's necessary to consider the satellite capability, telemetry, security and overall solution the device sits within, otherwise it's just a dot on a screen.

track24defence.com

Giles Peeters commenced his military communications career in the UK's Royal Air Force (RAF) in 1989. He worked in the MoD's Defence Communications Security Agency (DCSA) as operations officer and procurement manager in the Satellite Service Delivery team, before moving to the UK Government Communications Headquarters (GCHQ) Cheltenham in 2001. From 2004 to 2007 Peeters' significant expertise in commercial satellite communications proved invaluable in Iraq and Afghanistan as he provided front line tactical communication and deployment capability for Joint Helicopter Command. Peeters' final rank was RAF Squadron Leader. In 2007 Peeters moved to the private sector and provided blue force tracking to NATO and the EU. Now Defence Sector Director at Track24 Defence, Peeters is the driving force behind the company's commercial-off-the-shelf (COTS), beyond line-of-sight, blue force tracking solution, Situational Command & Control (SCC) TITAN.

AN OPEN ARCHITECTURE ISR SOLUTION

By Brad Truesdell, Director of Strategy, Harris Government Communications Systems Division



In a time of fiscal austerity, open architecture systems provide a means to integrate varying systems and enable warfighters to leverage the full capabilities of these systems.

Spectrum awareness will play a crucial role in future intelligence, surveillance and reconnaissance (ISR) missions. Open architecture software that allows end-users to connect to a network and use real time data from multiple battlefield sensors provides a revolutionary step forward in improving force protection posture and targeting capabilities.

An example of this approach is the recent collaborative effort between U.S. Special Operations Command (SOCOM) and Harris Corporation to field an integrated battlefield networking capability that provides sensor information to tactical users. When SOCOM approached Harris, the plan was to make it possible for a number of sensors to interact with each other and deliver real-time sensor data to tactical users, using a system that employs an open architecture framework.

Special Operations Research, Development and Acquisition Command (SORDAC) selected this approach due to the mix of equipment currently in-use by SOCOM personnel. SOCOM has been highly effective in deploying a range of Commercial Off-The-Shelf (COTS) and developmental technologies to support the ISR needs of SOCOM's warfighters.

Recently, SOCOM identified the requisite to network these technologies in order to improve C2 and automate the exchange of ISR information for tactical users. The decision to work with Harris Corporation, a seasoned veteran in the world of tactical communications, has led to the expedient creation of an open architecture routing software solution that can reside on current network elements—tablets, laptops or sensors.

This effort, named SteelShadow, has enabled SOCOM to successfully address one of the principal needs identified by SORDAC's Special Reconnaissance Surveillance and Exploitation Program Office: the requirement for networked tactical signals intelligence systems. The result of this effort has enabled improved spectrum awareness, improved situational awareness and ultimately an improved set of tools to execute SOCOM missions.

STEELSHADOW SOLUTION

SteelShadow is an open architecture routing software that enables remote C2 and secure distribution of mission-critical information from sensors to a range of other sensors and display devices. It is a solution that requires no new hardware, no additional devices. Leveraging readily available technology, SteelShadow works as a network plug-and-play option for many of the COTS intelligence, surveillance and reconnaissance technologies that SOCOM acquired in recent years. "It's a lightweight routing applications that can reside on existing equipment," said one Harris executive.

This software enables connection to a range of sensors, making current SOCOM radio and sensor capabilities in the SOCOM portfolio able to distribute situational awareness data to Windows or Android-based devices. Using a framework compliant with SOCOM's platforms, existing tools are allowed to view information from devices and sensors in a way they could not have previously managed, such as multiple simultaneous sensor inputs.

The software will allow SOCOM to display information on varying output formats, including RaptorX, Google, and Mobile Map. "One of the key goals of the program was to provide options for end-users, enable them to select the sensors, the communications medium or the display devices that best support their mission profile."

Due to the security requirements identified by SOCOM, Harris optimized the software for the Adaptive Networking Wideband Waveform (ANW2). SteelShadow software uses this wireless mobile ad-hoc networking waveform, which provides flexible architecture and is ideally suited to meet SRSE's requirements for a secure type 1 network.

When SOCOM initially laid out the requirements, the software objectives included automatic exchange of sensor information, device status, collaborative solutions, as well as chat and file transfer support, including the networking capability needed to be compatible to sensors currently in SOCOM's inventory, and to support future variants that SOCOM intends to field. To this end, an interface control document was created for industry to support future sensor integration.



Harris ANW2 (IP Net) diagram.

Because of the nature of SOCOM's need to field capabilities quickly, off-the-shelf technologies come into play. This can lead to complications when varying technologies are unable interface due to differences in hardware and software standards.

Software that enables collaboration among these COTS products will improve the value derived from these acquisitions. SOCOM and Harris' work on SteelShadow is a prime example of what open architecture can do to reduce costs and time to deployment and enable the full benefit of existing technologies.

BENEFITS

SOCOM's approach to SteelShadow enabled the command to quickly assess the ability of Harris to deliver the solution. As Harris has significant domain experience, and many of the software elements required by SOCOM already developed, the company was able to demonstrate these capabilities quickly—and at a low cost.

The initial demonstration occurred after just 90 days and at a fraction of the cost that SOCOM might have spent to develop this initial capability without leveraging existing software and hardware. Since the initial technology assessment, Harris and SOCOM have built upon these capabilities to further enhance this solution. Through this creative and cost effective approach, SOCOM and Harris were able to address a significant technological gap.

The benefits of the SteelShadow program are plentiful. Through it, SOCOM will be able to leverage existing training and knowledge of chat, file transfer and other radio programs—meaning operators already have the necessary knowledge to employ the software. This solution also has the advantage of Harris' IP management tools, which have proven effective after industry-based investment in research and development. Additionally, the ability to leverage sensor equipment that is already in-use enhances the operational life span of these technologies, thereby furthering cost efficiency.

INDUSTRY IMPLICATIONS

SOCOM has significant flexibility enabling the procurement of necessary technologies far more rapidly as well as capitalizing on the ability to reach out to partners in industry, academia, and the services to translate a wide array of equipment and technologies into robust warfighting capabilities. This is the sort of resourcefulness that the Pentagon expects as a result of the Better Buying Power 3.0 program.

On April 13, Chief of Naval Operations, Adm. Jonathan Greenert, said that the Navy and Marine Corps need to get better at repurposing and reusing existing capabilities instead of looking to field new ones every time a requirement changes. The decision made by SOCOM to seek out industry's readily available technologies is a route that all the services should consider as such is highly cost-effective and takes significantly less time to produce the desired end-results.



COMMAND CENTER: MICHAEL ZALLE, GENERAL PARTNER + V.P., SQUIRE TECH SOLUTIONS

Michael Zalle has been the driving force of Sales and Marketing for Squire Tech Solutions since May of 2008.

He began his career in the satellite communications industry in 2001, having previously worked in terrestrial communications during the early years of the commercial Internet. As a top 1 percent sales account executive at age 20, his success was driven through his focus on international fiber optics, with a specialty of selling access to the United States Internet backbone in 1995.



During that time, Mr. Zalle sold access to PanAmSat (now Intelsat), American Tower Corp. (New Skies Satellite), Hughes Network System, PacAm Tel, Vyvx and over a dozen international transport consortiums, including Southern Cross Cable Networks and Global Crossing.

As an early/founding stage Sales Director of IP Access International Inc., Mr. Zalle was responsible for strategic business development, data transport sales vision, execution of data services to teleport uplinks and executive oversight of data centers, peering exchanges and fiber backhaul networks. Mr. Zalle was also responsible for international and domestic Internet network feeds enabling teleport and vsat hub owners and operators connection to the public Internet exchanges and voice over IP switching centers. Data Services responsibilities focused toward negotiating contracts, seeking high value services for resale, and finding partners/sales agents who offered value to the edge.

Today, Squire Tech Solutions is driven by market demand—Michael's extensive experience in the satellite communications industry now sees him focused on transportables and trailerized, mission-critical communications systems (satellite, cellular networks and backhaul) for the military, Homeland Security, and local / federal public safety agencies. Mr. Zalle aims to continue to grow in the transportable arena as technologies continue to become smaller and more efficient. Michael will be helping Squire Tech to open pCom™ and core networks to new areas of opportunities throughout North America and the world.

Mr. Zalle has also been a founding Board member of a local bank, advisor/investor in several startup companies and private equity investments and has engaged as a mentor to young amputees with physical disabilities. Michael ranks himself as an incredibly poor golfer and a perhaps an even worse tennis player.

MILSATMAGAZINE

Mr. Zalle, what made you decide to enter the Satellite Industry? Was there something that you thought was missing?



MICHAEL ZALLE

I was immediately drawn to this satellite industry from the first time I walked through the gates at the PanAmSat teleport (now Intelsat Napa) in 1997 and saw the massive antennas pointing toward the Pacific. Come on, it's rocket science, who doesn't think it's pretty darn cool?

I've spent my career attempting to simplify complex concepts and make functionality accessible to the industries and personnel who aren't rocket scientists. That is where we focus every day. I feel the industry has come a long way over the past decade, but there remains long way to go.

MILSATMAGAZINE

Mr. Zalle, How does your 14 plus years of experience in the satellite communications industry bring value to this market? Particularly in the homeland security, local/ federal agencies and remote commercial industry?

MICHAEL ZALLE

I believe this industry is driven by the space frequency operators and the users are subject to a broker/ dealer type mentality. Don't get me wrong, space absolutely wags the dog. Without the right orbital location, footprint, frequency, power, technology, etc., this industry couldn't exist.

The challenge I see is that, customers more often than not, are left to "figure it out" after the boxes are delivered, components are mounted and the big money frequency sale is done. Developing product packages, to owning the customer experience, is often a short term money losing proposition... that fact is painful to swallow and you must have a plan or it will bury you.

The rewards, though, are vast if you can systematically support an industry by acknowledging industry shortcomings and develop product that fill the gaps. As the proverb goes "Necessity is the mother of invention"...

The majority of Squire Tech customers are those in Homeland Security, local/ federal agencies and remote commercial industries. We work quite closely with our customers and our approach is to work with them as partners.

We deliberately and continuously ask for feedback on our products and services throughout the entire customer interaction process. The valuable feedback we gain, are then incorporated in the development and design of our satellite antenna systems (whether it is fixed, mobile, portable or the communications trailer). As a result, we are providing a satellite communications solution our military and government agencies, as well as, enterprise customers truly want.

MILSATMAGAZINE

What makes Squire Tech different from other companies?

MICHAEL ZALLE

While I believe that the majority of the satellite equipment and network providers offer a decent product and service, I think that Squire Tech provides something distinctly different. Our primary objective is to develop asset-based solutions that last many years beyond a project's completion and to continue to provide the best quality satellite services, as we take painstaking measures to develop our offerings around long term, user operational success.

Squire Tech goals are simple: develop well-constructed and integrated customer assets that work for many years, all the while reducing customer downtime and improving network performance. We strive to eliminate customer acquisition and performance issues that are present due to a lack of ownership by some suppliers. Our company's goal is to have customers not needing to know our support number and to lower their downtime and our costs.

Squire Tech has been selected by agencies, carriers, and Fortune 10 companies generally after they have left other (and often perceived at lower cost) providers of 'satellite Internet' or mobile response satellite trailers that on paper may look like Squire Tech's pCom® XL.

What makes Squire Tech unique? We learn from every data point we can, which in our case are customer questions. We strive to implement these requested features and that's why the market has rewarded us.

On the pCom® XL communications trailer, this means a significant impact to customer operations. Items such as re-engineering the center of gravity and structure for a dual axle (we had single axle in 2008 to 2010), developing a "closed" data center environment for critical coms that need to be well cooled and secured, or the ability to increase up to 60 foot towers or a 2.0 meter VSAT system without any 'off line' structural reinforcement or 'welders special' type of modifications, these are all examples of features that offer a better total solution for our clients.

On the Mobile Responder IP over Satellite offerings, satellite antennae products are based on our experience of more than 1,000 remote site deployments. These are products with which we've experienced the lowest failure rates. Although the decision to work with the best quality in satellite equipment can sometimes hurt us in the short term, especially in this 'lowest cost bid' environment, our focus is to build IP Satellite access systems that will last, even if moved from vehicle to vehicle over many years. That means we want coms to outlast mobile command vehicles/ trucks.

What makes Squire Tech different? Every employee takes the time to understand customer operational goals for our products before and during the build. We have high quality satellite Internet products; however, our focus is not solely on the equipment, but the communications solution as a whole.

The focus is on the goals of the customers and the assembly of the correct satellite communication system based on their specific requirements. Whether such is a satellite backup, mobile 9-1-1 Center on wheels, a radio, microwave, or Cell on Wheels pCom® sat trailer, or a simple backup of a manufacturing facility or hospital, Squire Tech teams are experts in helping military, government and private organizations access the Internet they need for their missions.

MILSATMAGAZINE

Squire Tech is best known for the pCom® XL communications trailer, but does this product benefit operations in remote locations? How is this trailer different from all the other satellite and other tower trailers seen at trade shows and throughout the industry?

MICHAEL ZALLE

After hurricane Katrina in 2005, the State of Louisiana (now a Squire Tech Solutions customer) asked us to help source a communications trailer. The Louisiana Governor's Office of Homeland Security and Emergency Preparedness (GOHSEP) had a trailer they were building themselves. This was a box trailer, basically a toy hauler with a VSAT antenna on the roof, an RV roof Air conditioner, a telco room type 19-inch rack, and a generator that was mounted in the same enclosure. This was a Frankenstein trailer and these relics can still be observed throughout the industry around the globe.

The equipment inside was worth \$100 to 200k and trailer itself was maybe \$5,000 when GOHSEP made their purchase. By the time we met with them, they had sunk another \$50k into the trailer, which leaked, was overweight, and was not solving the agency's objective. They needed a complete solution that was highly reliable.

A solution could not be located to meet their long term and current needs (3, 5, 10 year goals). So, we built our generation 1 pCom® trailer's in 2008 for the State of Louisiana. These trailers were the best in the market at the time; they are still on the road and continue to function well.

Over the past decade while in working closely with customers, Squire Tech continues to build and improve the best satellite communications trailer on the market. The pCom® XL communications trailer offers the highest quality engineered platform on the market, all with a comprehensive 12 month comprehensive warranty. The warranty covers any repair or replacement of components which fail under normal use that are due to a defect in materials or workmanship.

Additionally, our 36 month extended bumper to bumper warranty plan offers even more coverage... one of the best in the industry. The competition does not and cannot offer anything comparable, as their units are built in box or are Universal Trailers, which results in a voided warranty and reduced structural integrity.

MILSATMAGAZINE

Who are some Squire Tech partners currently using the Mobile Responder Systems?

MICHAEL ZALLE

As providers of satellite communications equipment and networks to many industries, including the military and the government, reputation is vital to ongoing success. We are constantly impressed by partner companies as they find new and better ways to improve their customers experience. They are the driving force of Squire Tech built, state-of-the-art, mobile command centers/units. Their focus on customer satisfaction takes the mobile communications market segment to new levels.

We carefully select who we work with, based on their experience in the industry, their reputation and a track record of positive results. A few of Squire Tech's partners include Farber, LDV, EVI, Shook, ATF, National Guard, Major Oil and Gas operators.

MILSATMAGAZINE

How do you see the North American market developing or expanding in the future?

MICHAEL ZALLE

I see different opportunities developing across North America. The pCom® trailer is being embraced today by government programs such as First Net and Emergency Management at the state and local level due to its low cost.

The other thriving area of our business are the Oil and Gas remote drilling operations, as the pCom® communications trailer is rugged and environmentally controlled (-30C/-34F to + 60C/140F). We see this market continuing to expand as equipment gets footprints that smaller and more powerful. What required a 53 foot big rig trailer and three engineers to support 15 years ago now requires but half the number of available communications racks in the pCom® and a single, non-technical operator.. We do not see this changing.

The second hottest markets today are the Cell on Wheels (COW) tower and corporate disaster recovery opportunities, as the core cellular networks still have coverage gaps and population/user load issues for large use shifts (emergencies, events, corporate remote operations such as Oil & Gas rig operations). Long term, I see corporate and government customers distributing small/light pCom® communications trailers throughout various regions to compliment and backup existing fixed assets. We do not see fiber or cellular as a competing product.

We see market expansion in areas where traditional infrastructure investment is not cost justified or, due to various other reasons, performance is not consistent. We are quite comfortable with the position of the pCom® for these target markets as well as our satellite integration efforts—resale partners continue to reinforce this belief.

MILSATMAGAZINE

What is Squire Tech doing to capitalize on the current market opportunities?

MICHAEL ZALLE

Our focus has always involved working closely with our customers and partners. We listen to suggestions on future "what if" improvements that they would like to have in order to make their job easier. As a result, we've put a lot of time and effort into product engineering.

An example of this is the pCom® satellite communications trailer. Because we listen to our customers, we built something truly different from what the market had to offer. Instead of the bare bones, "Frankenstein" type of communications trailer platform, where everything is custom built within a box, we provide a unit that is built to last, can endure tough environments and is engineered using today's state-of-the-art technology.

As a technology driven company, Squire Tech will continue to work closely with partners and customers to adapt and change product offerings to be more than what the market expects, but be a solution the market is wanting and needing. We aim to develop the best satellite products as well as services that offer real value to clients and partners.

SquireTechSolutions.com

PROPERTY INTEREST¹ IN SPACE: RECENT U.S. POLICY DEVELOPMENTS

By Elizabeth H. Evans, Partner, Dentons

Who owns space? All of us? None of us? These questions are becoming increasingly relevant.

Once considered solely the subject of science fiction, technology has progressed to the point that there is now a distinct need for further regulation of property interests in space. Today there are private companies with plans to set up lunar bases and human colonies on Mars.

Energy companies are being established to invest in technologies to mine asteroids and the moon. China and Japan have completed successful missions to the moon.² One of the China missions was to successfully launch technology to return lunar samples, potentially in contemplation of future extraction.³

The existing international legal convention with respect to the ownership of interests in space is the United Nations Outer Space Treaty of 1967 (the "Outer Space Treaty").⁴ The treaty, signed by more than 100 nations, and ratified⁵ by the United States, was designed to ensure that space would be used for peaceful purposes and that no

nation could assert a sovereign claim over assets and properties discovered or known to be existing in space.

The United Nations Moon Treaty of 1979 (the "Moon Treaty")⁶ states even more specifically that ownership of the moon or other celestial entity by a sovereign nation or a private entity is prohibited. The Moon Treaty also prohibits the harvesting of natural resources from the moon, unless done in accordance with an international regime established to govern the extraction of such resources.⁷

Unlike the Outer Space Treaty, the Moon Treaty was ratified and acceded to by only 13 nations. None of the three primary space faring nations, the United States, People's Republic of China or Russia, signed or supported the treaty; therefore, the Moon Treaty is not legally enforceable against those nations.

Because the Moon Treaty speaks directly to the private ownership of extraterrestrial property and the Outer Space Treaty does not, some



commentators suggest that, by failing to sign or ratify the Moon Treaty, the United States has not relinquished private ownership rights in respect of the moon and other space assets (i.e., ownership claims without national sovereignty).⁸ The Outer Space Treaty, however, specifically provides for the regulation by the sovereign nations of the outer space activities of its private entities: "The activities of non-governmental entities in outer space, including the moon and other celestial bodies, shall require authorization and continuing supervision by the appropriate State Party to the Treaty."⁹

While it is clear that this international framework is completely inadequate for the future commercial landscape, recent legislative and federal agency action evidences that the process of regulating, and incentivizing, private companies to explore and profit from resources in space has begun in the United States.

On July 10, 2014, H.R. 5063, the ASTEROIDS¹⁰ Act, was introduced to the 113th Congress. The ASTEROIDS Act specifically directs the President through the National Aeronautics and Space Administration (NASA), the Federal Aviation Administration (FAA) and other appropriate federal agencies to: (i) facilitate the commercial exploration and utilization of asteroids resources to meet national needs, (ii) discourage government barriers to the development of economically stable industries for the exploration and utilization of asteroid resources in outer space in a manner consistent with the existing international obligations of the United States, (iii) promote the right of United States' commercial enterprises to explore and utilize resources from asteroids in outer space and to transfer or sell such resources and (iv) develop the frameworks necessary to meet the international obligations of the United States.

Once introduced, the bill was referred to the House Committee on Science, Space and Technology and a hearing was held, where the ASTEROIDS bill was considered along with appropriations for the national space program.. Congressmen considering the bill made comments evidencing that they are ready to pass the baton from national, sovereign programs to private programs, as "the private sector and scientists" represent the "best way to maximize limited resources."¹¹ HR 5063 died in the 113th Congress with no further action, but it has been reintroduced into the current Congress as HR 1508 on March 19, 2015.

In December of 2014, the FAA took additional action with respect to the regulation of private commercial space activities. In response to a launch request by Bigelow Aerospace, a company which is developing inflatable habitats for outer space, the FAA issued a policy letter in which the federal agency made statements recognizing "the private sector's need to protect its assets and personnel on the moon or on other celestial bodies."¹² The letter permitted Bigelow Aerospace to proceed with its contemplated commercial activities on a "non-interference basis."¹³

While the FAA policy letter does not purport to grant ownership rights on the moon, the FAA has bestowed upon Bigelow Aerospace certainty of knowing, as the founder, Robert Bigelow, explained, "that somebody else isn't licensed to land on top of you or land on top of where exploration and prospecting activities are going on, which may be quite a distance from the lunar station."¹⁴ Prohibiting others from landing on Bigelow's licensed portion of the moon (whether or not adjacent to the lunar stations) gives

Bigelow de facto ownership of that lunar land (at least in respect of other U.S. companies).

Both the ASTEROIDS bill and the December FAA policy letter have tremendous implications for international space law. They show that the United States is ready to support (and allow) private companies to invest in, and profit from, space assets¹⁵ in a manner that is directly contrary to the provisions of the Moon Treaty. While the Moon Treaty is not binding on the United States, and does not have the force of international law, it is important to remember that the Moon Treaty is not binding on China or the Russian Federation or many other countries which may sponsor private companies seeking properties on the moon or in space.

Accordingly, other sovereign nations could grant licenses and incentives directly in conflict with those established by the United States, and it is easy to see how messy it could get. We can only hope that these proposed U.S. regulations and policy statements in support of commercial space companies will be the catalyzing ingredient to establish a much-needed international dialogue with other sovereign nations with respect to reworking the international treaties currently governing property interests in space.

The need for unified, international regulation is immediate, before the technology to mine and inhabit space is fully achieved and the conflicts become acute.

Footnotes

¹ This article will speak only to legal property interests that are not intellectual property interests. Another article will need to address intellectual property rights for items constructed and created in space.

² ASTEROIDS Act: Who Owns Space?, Monica Grady, <http://www.science20.com>.

³ Id.

⁴ Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies, 27 January 1967, 610 U.N.T.S. 205.

⁵ Once an international treaty is ratified, the treaty has the same force and effect as a federal law. Like federal law, the treaty remains in effect unless Congress passes a statute to negate it, if the United States officially withdraws from the treaty or the treaty is determined to be unconstitutional by a federal court.

⁶ Agreement Governing the Activities of States on the Moon and Other Celestial Bodies, 18 December 1979, 1363 U.N.T.S. 3.

⁷ The Moon Treaty: Failed International Law or Waiting in the Shadows?, Michael Listner, The Space Review, <http://www.thespacereview.com/article/1954/1>

⁸ Could Legal 'Loophole' Lead to Land Claims on Other Worlds? Cosmic Log, NBCnews.com, April 9, 2012. The loophole for private companies could not, however, apply to companies organized in, or citizens of, countries which had ratified or acceded to the Moon Treaty.

⁹ Article VI, The Outer Space Treaty of 1967.

¹⁰ The full name of the act is the American Space Technology for Exploring Resource Opportunities in Deep Space Act.

¹¹ Id.

¹² One Small Step for Man, One Giant Step for the Commercialization of the Moon, Dominic Basulto, February 12, 2015, The Washington Post.

¹³ To the Moon! FAA Boosts Commercial Lunar Ventures, NBC News.com, March 11, 2015

¹⁴ Id.

¹⁵ In furtherance of this goal, NASA also signed a Space Act Agreement with Bigelow Aerospace to encourage private ventures to contribute to human missions in space and on the moon. See To the Moon? Bigelow Aerospace and NASA Look at Private Exploration, Cosmic Log, NBCnews.com, April 19, 2013.

UPHOLDING U.S. SPACE SUPREMACY

By Kay Sears, President, Intelsat General Corporation

In organizations around the world, “studying” a problem is often just a way of postponing a difficult decision.

One of my key takeaways from the 31st Space Symposium in Colorado Springs was that the U.S. Air Force Space Command wants to focus less

on conducting studies of “what” will best serve the DoD’s global communications requirements, and more on executing “how” the command can best meet those needs.



General John Hyten, Command, AFSPC

This change in direction is being fueled by factors beyond tighter budgets. General John Hyten, the new Commander of Air Force Space Command (AFSPC), has taken charge at a time when American supremacy in space is being challenged as never before.

Space technology is proliferating, with many nations now having the capability to launch and operate satellites. The same missile technology that can launch a satellite into space can also be used to destroy the spacecraft of adversaries. Ground stations that communicate with satellites can also be used to jam spacecraft operated by other nations.

Lt. Gen. Samuel Greaves, head of the Space Command’s Space and Missile Systems Center, summed this up forcefully in a talk at the Colorado symposium by highlighting language from the 2010 National Space Policy





A third is the plan to place commercial representatives inside the Air Force's Joint Space Operations Center (JSPOC) in California in order to improve operations and space domain awareness for the U.S. government and commercial companies.

A fourth is an initiative to move towards a common ground enterprise for command and control that achieves the right mission effects at an affordable cost.

General Hyten said at the symposium that he is concerned about the rapid advances being made by other nations in electronic warfare and anti-satellite weapons systems. His office recently released a detailed five-page memo laying out the long-term science and technology challenges faced by the Space Command.

In the short time he has led the Command, he has become a fierce advocate for the Air Force using all means at the armed service's disposal to assure that the United States stays at the lead in the new space "arms race" because, like he said on 60 Minutes, "I'm not NASA."

General Hyten clearly knows what needs to be done—I believe he won't be spending much time on studies!

www.intelsatgeneral.com/

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.

Ms. Sears has a Masters in Business Administration from George Washington University and a Bachelor of Science from the University of Richmond. Ms. Sears is currently serving on the Board of the Space Foundation, an international non-profit organization and the foremost industry advocate for all sectors of the space community, and she is a board member of the Virginia Commercial Space Flight Authority, serving at the request of Governor Terry McAuliffe.

on how the global spread of space technology is creating an environment that is "congested, contested and competitive." And a recent AFSPC initiative on Space Mission Force describes an environment that is "contested, degraded and operationally limited."

Another factor contributing to the change from studying to doing is that Space Command and others have developed a much greater appreciation for how quickly and inexpensively its communications needs can be met by the commercial space industry. Just one example of this was driven home to the audience at a symposium panel by Craig Cooning, President of Boeing's Network and Space Systems Group.

Cooning told the story of a visit to Boeing's satellite assembly facility by Dave VanBuren, the Assistant Secretary of the Air Force for Acquisition. Cooning said that Boeing had two satellites being built side by side: one a Wideband Global SATCOM (WGS) spacecraft for the Air Force, the other a wideband satellite for a commercial customer.

Cooning said the satellites VanBuren saw were identical in almost every respect, except that the WGS satellite was costing the Air Force over \$400 million and taking five years to build, while the commercial spacecraft cost the customer \$250 million and will only take three years. The disparity, Cooning told the audience, grew out of a difference in buying practices, with the Air Force having far more people involved in the review and approval process every step of the way, leading to regularly changing requirements.

Examples such as this have made Space Command's leadership focus on changing procurement practices as well as on a number of new initiatives that are designed to deliver the same, or better, service at less cost. One of these is the Pathfinder program, designed to test new ways of buying satellite bandwidth in different regions of the globe.

Another is the notion of shifting the in-flight operations of the Space Command's fleet of wideband satellites to a commercial operator.

MOBILE DEVICES MAKE EVERY SOLDIER + EVERY WORKER A SENSOR

By Mike Gundling, V.P., Product Management, TerraGo Technologies

Only eight years ago, iPhone3

and Android devices debuted with Global Positioning System capabilities and leveraged the U.S.

investment in location-based satellite technology for the benefit of commercial industry and consumers.



And the entire GPS industry was born... iPhone3 and Android devices equipped with GPS chips enabled all users to know where they were at any given time, and how to navigate to exactly wherever they needed to go.

Today, GPS-enabled smartphones are being used to perform surveys, maintain electric utilities, to inspect oil and gas pipelines, to direct shoppers around a mall and let the stores deliver ads to them, to dispatch emergency services, to... the list goes on and on and more uses are being added to smartphones every day.

Every worker is now a sensor, just as every soldier is a sensor.

CHANGING A JOB DESCRIPTION

The “every worker is now a sensor” is a spinoff from “every soldier a sensor,” a mantra developed just after the millennium. Then, the adage was primarily a mindset because, while training focused on a soldier’s awareness of change that could turn into intelligence, technology had yet to be developed that could channel that awareness into an actionable endeavor, and all in a timely manner.

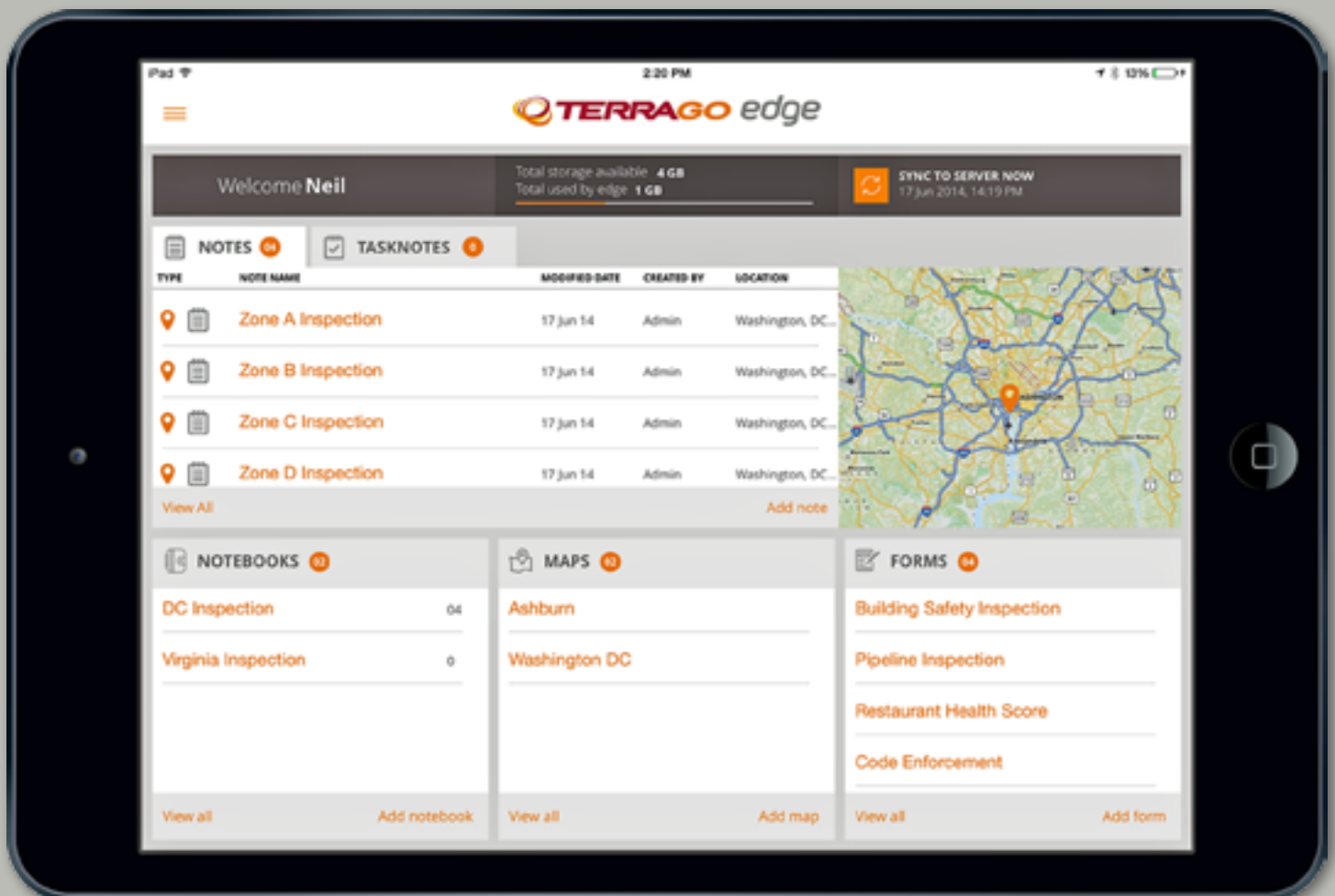
Since the advent of the smartphone, more than two billion have been sold worldwide—that number is forecast to grow to six billion by the end of the decade. A large number of smartphones are going to a military that is turning on to the idea that “every soldier a sensor.” This mantra is becoming rather prophetic, thanks to the linkage of mobile devices that are able to send geospatial data to command and, in return, receiving a fused-data picture of situational awareness in near real-time from signals intelligence, Unmanned Aerial System (UAVs), satellite images and full-motion video (FMV), all on a platform that includes history to provide even further context.

This amalgamation of capabilities is saving lives. Every soldier is now a sensor, with the help of ruggedized derivatives of the devices children use to call home when they’re going to be late, and their parents use to make dinner reservations.

The military is coming late to an understanding in a fast developing industry: iPhone and Android devices, along with tablet computers, offer economies and efficiencies of scale in making data gathering data wider spread. They are turning field workers into roaming sensors, capable of exchanging geo-referenced notes, images and video with a headquarters organization and, in return, acting upon decisions that the data drives. Those economies come in using devices that are holding their low price because competition in the industry demands they do so—efficiencies get more pronounced with every iteration of the smartphone.

GPS antennae get better. Russia’s 24-satellite GLONASS system has been added to improve the availability and accuracy on smartphones. Europe’s Galileo will be fully onboard by 2019. China’s BeiDou and India’s Regional Navigation Satellite System sit on the horizon. With each addition to the overall GPS infusions, location-based capabilities will continue to grow, as will the phones’ value as a GPS data collectors for users across the globe.

While phones typically are capable of 3 to 5 meter accuracy, they can achieve higher precision, even centimeter accuracy, when linked with a Bluetooth GPS receiver, such as SXBlue and EOS, to name but two. Accuracy in the centimeter range is getting closer and organizations are facing decisions about their needs, decision that can involve millions of dollars: What data is required to make the decisions that must be made, and what accuracy is required to get that data in quality sets that EW meaningful?



ANSWERING THE PHONE

Companies, such as TerraGo, have seized the initiative from old-line, dedicated GPS firms to create software and applications that take advantage of the growing smartphone and tablet computing capability as a data-collection and decision-dissemination device.

For example, TerraGo's Edge was developed to reduce data collection and field operation costs by syncing what happens in real time. Administrators and field workers experience updates while they work, in a similar manner as the military's intelligence Grail provides real-time situational awareness.

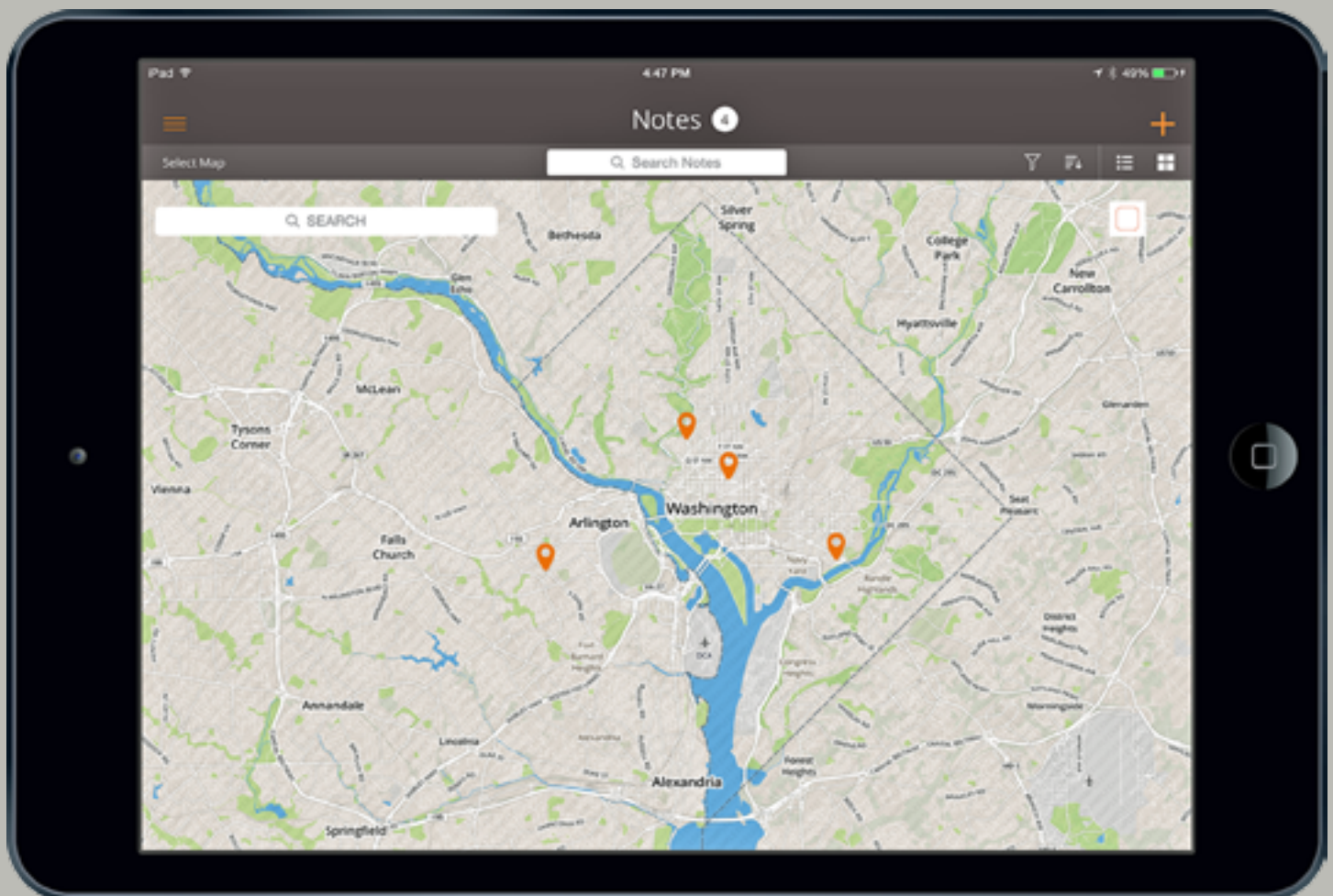
At one time, companies had to buy expensive, dedicated GPS devices to mine data, smartphones and tablet computers are generating cost savings—so much so that smaller companies are joining their bigger brethren in finding ways to use more data in their operations and decision making. They learn that, where once they saw only expense, a closer examination reveals value and return on investment from more and better location intelligence.

More enabling technology is shortening the time to “every worker a sensor” as geospatial companies use web-based mapping and location services to enable smartphones and tablet computers to become extensions of the home office. That has brought the two entities closer together, operationally.

Where once data went one way, headquarters is now sending information back to mobile devices, bringing field workers into the decision-making process. Team- and consensus-building improves, fostering a climate of information transparency that lends itself to faster, more collaborative decision making. The remote aspect of the field operation becomes less remote. And companies and customers benefit as costs drop, often without exactly knowing why a field force has become more efficient.

Efficiency arrives from the nature of the devices that make the worker a sensor. The devices are bringing industry a workforce that requires less training, as 58 percent of American adults already own smartphones, 42 percent own tablets and both sets have an average of 41 applications on their devices. Seventy-five percent of those apps are location-based.

Managers sometimes have to catch up with the knowledge their new workers possess regarding the ins and outs of mining data—these new workers have been mining data since they were children. A generation raised with the PC is learning from a generation that is using the smartphone to replace the PC. Smartphone sales will be six times that of PCs by 2018, according to an International Data Corp. (IDC) report.



Where once data and intelligence was available only to “the cool kids,” one executive quipped, formerly hierarchically driven organizations find greater success in getting more workers involved at both ends of the data-decision making continuum. That’s because both ends are at the same place and on the same page.

The worker becomes more involved, which equates to a greater possibility of job satisfaction. Organizations that support “Bring Your Own Device” (BYOD) found workers five percent more efficient—those with “Create Your Own Device” (CYOD) logged in at nine percent, according to research done by the Aberdeen Group.

WHAT’S AHEAD

An industry that began the democratization of GPS satellite data is already starting to look toward future benefits from space, even beyond Navstar-GPS, GLONASS and other constellations. Google’s recent \$500 million purchase of SkyBox is a sign that predictions of a 14 percent increase in the commercial Earth imagery market over the next five years may well be at the low end—the market is already resident at \$2 billion.

Technology is evolving and more faithful maps are being rendered from UAVs, satellite imagery and video. The military continues to contribute, with nanosatellites launched by U.S. Special Operations Command being tried as communications relays for a number of far-flung operations.

Other nanosatellite firms are springing up to offer commercial imagery with increasingly vivid resolution. This competition will keep prices low, though some thought must be given to competition that can also inhibit investment.

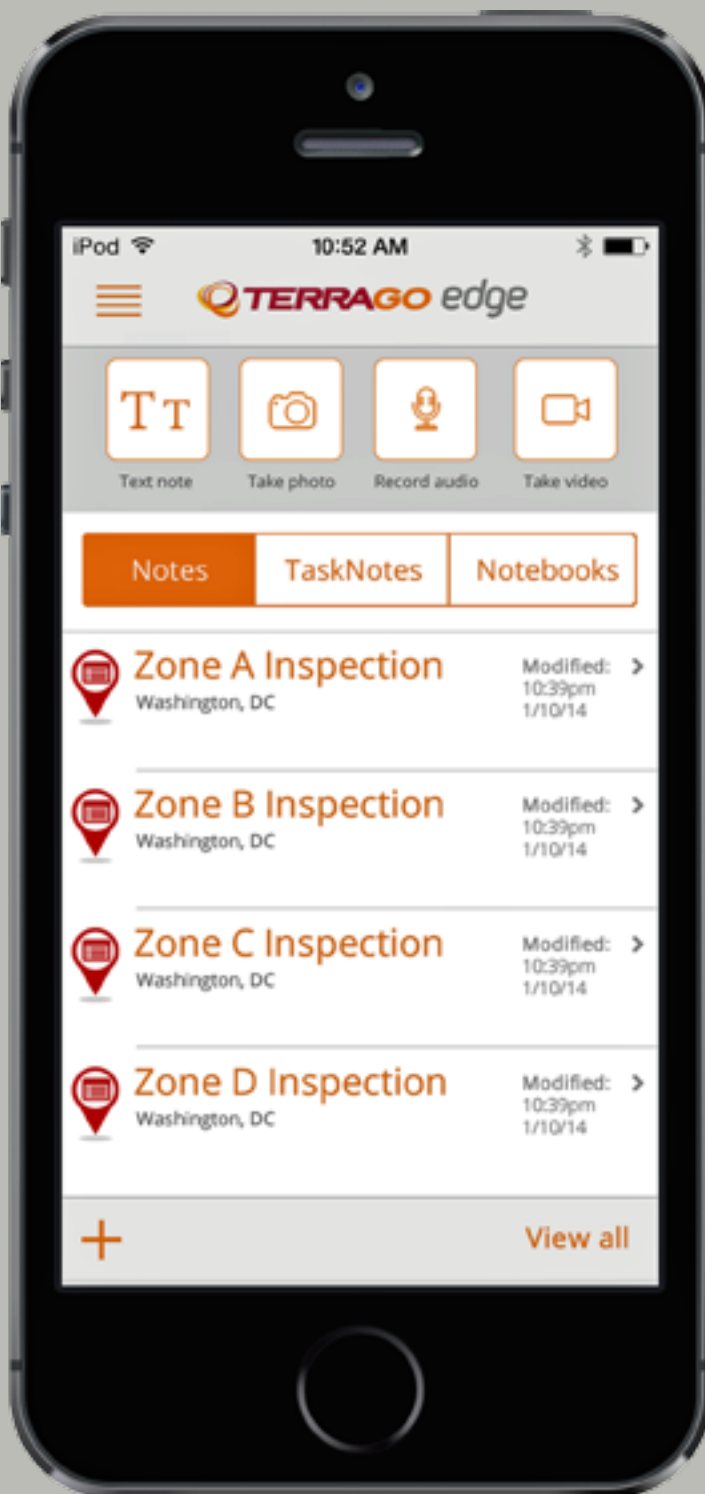
Nanosats and other satellites already create a data and image deluge that is taxing technology, a problem the military has wrestled with for more than a decade. Small satellites, built more quickly and inexpensively, also present crowd sourcing possibilities that can make data more available and of better quality—however, they must be launched more efficiently and economically in order for the metrics to become more realistic.

More efficient mobile devices... more and better apps... more resources in space... more trained workers... and all are tapping into public and private cloud networks in order to share information from any location on the planet.

This is a race that started eight years ago—so far, this is a sprint that has every sign of becoming a marathon.

Editor’s note: The photo that opens this article is courtesy of the U.S. Army and Sgt. Edward A. Garibay. Shown is Sgt Justin Brady, who was a team leader in 2nd Platoon, Company A, 1st Battalion, 35th Cavalry Regiment, 2nd Heavy Brigade Combat Team, 1st Armored Division, as he checks battlefield locations on a combat smartphone located on his chest, during a Network Integration Evaluation 12.2 exercise at White Sands Missile Range in New Mexico. The system enables Soldiers in combat situations to track the position of friendly forces, mark important locations and to communicate with others.

Mike Gundling is Vice President of Product Management and Marketing at TerraGo. Gundling is a dynamic, high-tech product executive with more than 20 years’ experience in launching market-changing products in the radar, satellite-based navigation, air traffic management and enterprise mobility software industries. To learn more, please visit www.terragotech.com.



A KEYSIGHT TECHNOLOGIES FOCUS: USING COMMERCIAL BEST PRACTICES FOR SUCCESS IN NEWSPACE

History has seen many different industries make the transition from low volume and high cost to high volume and low cost. Ensuring product quality through such a transition is a difficult task.

When combined with the additional requirements imposed by space this transition becomes even more challenging. The space industry is in the midst of dramatic change. NewSpace is driving disruption that we haven't seen since the original space race in the 1960's. Business models are completely new. This article describes the challenges these unique business models place on electronic design, test strategies and processes. Presented are ways to enable much higher volume with far lower cost, all the while maintaining high quality.

This happens to be a most exciting time in the space business. The industry is energized and changing rapidly. The term NewSpace has emerged to describe these changes.

What is NewSpace?

NewSpace is an emerging global industry of private companies and entrepreneurs who primarily target commercial customers, are backed by risk capital seeking a return, and profit from innovative products or services developed in or for space.

A huge number of Military, Aerospace and Government (MAG) entities as well as commercial companies are entering the space business. When NewSpace Global started in 2011, about 125 companies were being tracked. Now that number is well over 800, about 700 of which are privately held.

Most have seen the press coverage of SpaceX, OneWeb, Google and Facebook and their "change the world scale" plans for space. These companies will certainly drive disruptive change on a massive scale, but they are far from the only ones. Hundreds of other companies are getting into space with an amazingly wide variety of business models and mission types—from communications to earth imaging to weather forecasting to mining asteroids to interplanetary human existence.

However, the NewSpace movement is not limited to new entrants. Many established, traditional commercial space companies and MAG organizations are adapting and working to understand how best they can take advantage of the opportunities that all of this excitement presents. Alliances have been, and continue to be, formed between new entrants and established space players.

In many ways, NewSpace is not a new industry—this is a major disruptive force in the space industry, as a whole.

Electronic design and test are integral elements of spacecraft development. As NewSpace drives change in the space industry, the philosophies,

strategies, processes and requirements associated with electronic design, development, production, test and measurement change as well.

This article describes NewSpace, contrast it with traditional space, and explore the implications for electronic design and test.

INDUSTRY TRENDS + CHARACTERISTICS OF NEWSPACE

This is not your father's space industry. NewSpace is a combination of Silicon Valley startup mentality meets space visionaries meets a good measure of traditional space experience.

Several business characteristics distinguish NewSpace from traditional space:

- **Primary objective is to make a profit from an investment**
- **Commercial business and funding models**
- **Willingness to take risk**

As these companies are primarily targeting commercial enterprise, commercial business principles apply. Accordingly, most NewSpace endeavors construct business models based on a level of investment, on-going cost structure, and revenue stream that results in a profitable outcome. Funding in NewSpace is coming from sources that historically have not been a part of the space industry.

The past several years have seen substantial venture capital investment in NewSpace endeavors. Crowd funding and angel investment are also playing a significant role. One of the most telling attributes of NewSpace is risk tolerance. Historically, with traditional space ventures risk is considered bad. As such, tremendous amounts of time, effort and expense are employed in an attempt to eliminate risk. Risk profiles in NewSpace are far different from those of traditional space. NewSpace companies are not foolhardy, but they understand that risk is something to be considered, assessed and managed.

The level of risk tolerance varies significantly across companies and business models. The key is that risk is part of the business model to be managed - not some evil thing that must be eliminated at all cost. Many market and technical trends are enabling, or are associated with, NewSpace:

- **Rapid growth in the number of relatively low cost satellites**
- **Numerous deployments of satellite constellations**
- **Satellites with short orbital life expectancies**
- **Prolific use of commercial off-the-shelf (COTS) components**
- **Lower launch costs**
- **More frequent launches**
- **Increasing global competition**
- **Joint developments**
- **Hosted payloads**

"What is NewSpace?", NewSpace Global, LLC., last accessed March 5, 2015, www.newspaceglobal.com

A critical attribute of the NewSpace movement is less expensive access to space. Lower launch costs are integral to many NewSpace business models.

For example, a company considering a satellite constellation may say, "If we can build N satellites for \$X and launch them for \$Y, our business model closes and we can make a viable business."

Ride-sharing has emerged as a relatively low cost launch method for small satellites. While ridesharing is relatively inexpensive it does subject the secondary payload to the priorities of the primary. If the primary payload schedule slips, the secondary also slips.

Conversely, the primary is going to go... when it goes. If the secondary is not ready, the chance for launch is missed. Further launch cost reductions are in the works. SpaceX and others are championing the use of reusable boosters.

At the time of this writing, SpaceX had twice attempted landing the main stage booster of a Falcon 9 on a floating barge—close, but not quite. Certainly, they will eventually be successful.

Consistent reusability has the potential to reduce launch cost by an order of magnitude or more. Another trend focused on reducing launch cost, while eliminating the ride along issues, is dedicated small launch vehicles. A number of companies are developing launch vehicles specifically designed to deliver smaller payloads at lower price and higher launch frequency.

NewSpace has driven the emergence of low cost spacecraft, including the rapid growth of relatively low cost, small satellites (SmallSats). These range from extremely small (e.g., PocketQube at 150 g) to 500 kg. This is a wide range leading to further classification.

Table 1 shows the most common sub-classification of SmallSats. Specifically, the CubeSat has become a very popular standardized form-factor in the NanoSat class. Business models vary significantly across the classes.

Sub-Classification	Mass Range (kg)
MiniSat	100 - 500
MicroSat	10 - 100
NanoSat	1 - 10
PicoSat	0.1 - 1
FemtoSat	< 0.1

Table 1: Small satellite sub-classifications

While the trend is certainly to lower the cost of satellites, an opposing trend is that engineers are coming up with new, exciting and more complex missions for these satellites to attempt. In many cases, while costs need to go down, complexity is going up.

In addition to smaller size, the number of satellites associated with many NewSpace business models or missions is much larger than traditional space norms.

Many SmallSat businesses are planning to deploy large constellations—10's, 100's even 1000's—of satellites. The majority of these are in Low Earth Orbit (LEO).

Intended mission lifetimes are much shorter than has historically been the case, where 15 years of life was common for most traditional satellites. For NewSpace, lifetimes of two to five years is becoming common and others possess even less of a lifetime.

These business models are based on the on-going presence of the constellation, so in order to sustain the business, the constellation needs to be regularly replenished. The large number of companies deploying constellations, the size of the constellations, and relatively short orbital lifetimes are combining to drive dramatic volume growth in SmallSat production. Industry estimates range from 2,500 to 4,000 new SmallSats on orbit between now and the close of this decade.

As many of these spacecraft are designed for shorter orbital lifetime and intended for LEO operation, where the radiation environment is relatively mild, the designs typically can be less robust than traditional satellites, particularly as compared to a geosynchronous satellite intended for a 15 year lifetime. This drives another key enabler of cost reduction for NewSpace—the use of commercial off-the-shelf (COTS) parts.

Historically, the space industry used predominantly (of-ten exclusively) space-qualified parts. COTS parts intended for terrestrial industries are far less expensive, more available, and typically further advanced in performance than space qualified parts.

Of course, the use of COTS parts also introduces risk. This is a key area where NewSpace calculates an acceptable level of risk to reduce cost and leverage advanced technologies.

NewSpace developers generally apply some level of qualification of COTS parts consistent with their mission, risk profile and business model. This effectively makes a COTS part "somewhat space qualified." Similarly, automotive and industrial parts are widely used, as they are subject to a more rigorous qualification process than consumer electronics, but they are still far less expensive than space qualified.

Agile development processes have been widely used in the software industry. Agility has proven to be an effective approach, enabling rapid time-to-market processes. However, traditional space development much the antithesis of agile.

A number of NewSpace companies are employing agile methods to spacecraft development—develop, release, learn and iterate on quite short cycles—months rather than years. Several companies have extended agile methods into orbit—launching prototype capability, learning from the prototype on orbit, and feeding what has been learned back into the next revision.

Agile provides the opportunity to test elements of functionality and technology earlier than may be practical otherwise. For any given NewSpace mission and business model, agile methods may or may not be the best approach, but is certainly something worthy of consideration.

BUSINESS CHALLENGES

The elements above provide great opportunity, but significant business challenges exist:

- **Effective risk management**
- **Time-to-market and schedule pressure**
- **Expense and cost management**
- **Delivering volume in an industry not accustomed to it**
- **Need to continuously innovate**
- **Finding, attracting and keeping technical talent**

With risk tolerance comes the requirement for an effective approach to risk management. A critical aspect of any commercial enterprise is understanding, assessment, analysis and management of risk including mitigation and contingency plans. NewSpace companies need to establish what risks they are willing and are not willing to take.

Schedule and time-to-market pressure are ever-present in the commercial and MAG worlds. This drives a shorter development lifecycle and creates pressure to deploy product sooner.

In NewSpace, schedule pressure is driven by the market as well as the desire to best the competition and may also be driven by the necessity to meet a specific launch window, or the need to push a new group of satellites into orbit to replace those that are approaching end-of-life in order to prevent disruption of the revenue stream.

Rockets and satellites have traditionally been a low volume business with a high per unit cost. Many NewSpace business models are driving volumes several orders of magnitude higher than traditional norms.

The challenge is to be able to effectively scale and still maintain quality. Business models are built based on certain cost estimates—typically ranges of cost estimates. In order for the business model to work, cost targets must be achieved. This drives the need to control development, product, and deployment costs across the enterprise.

The consumer electronics industry has certainly shown that in order to sustain a strong business model companies must continuously innovate. One of the great elements regarding relatively short orbital lifetimes is that they provide the opportunity to update technology much more often than has traditionally been the case in space.

However, that same advantage is also provided to competitors—companies must continue to innovate in order to ensure your business model remains compelling and competitive. All of this innovation must be delivered while controlling costs and maintaining schedules. Further, in most cases, the task is fundamentally difficult. Space is difficult. This IS rocket science. Adding commercial and MAG business goals compounds that challenge.

Overcoming these challenges and delivering continuous innovation requires high quality technical talent. Experienced technical professionals and new graduates are in extremely high demand. Attracting and retaining good engineers and technicians is a big challenge across all segments of high technology. In many cases, this will dictate geographic business locations and often impacts key decisions.

ELECTRONIC DESIGN + TEST STRATEGY CONSIDERATIONS

Electronic design and test are integral elements of spacecraft development and deployment. As NewSpace drives change, the philosophies, strategies, processes and requirements associated with electronic design, development, production, test and measurement change as well.

In particular, the volume, cost and schedule challenges of NewSpace drive a different approach than traditional space. Use of best practices from the commercial electronics sector, efficiently aligned with the unique needs of space, is essential to a successful and sustainable NewSpace business model, whether in the MAG or commercial environs.

The basic construct of the electronic product development cycle is quite common across industries:



Figure 1: Typical electronic product development cycle.

Key elements that distinguish different industries are the definition of each stage, the criteria for moving between them and the rigor with which the process is followed. In low volume conditions such as traditional space, the lines between development, validation and production are often somewhat blurred.

Conversely, with the volumes of many NewSpace businesses, the lines need to be more defined in order to scale volume efficiently. As volumes increase it is particularly important to have clearly defined criteria for release to production.

Debugging design problems in production impacts cost and schedule and slows down the primary function of production, which is to ship products. Additionally, varying industries and companies have different approaches as to how much they use innovation cycle feedback. This loop is integral to meeting the business challenge of continuous innovation. Simulation and measurement tools to support this feedback mechanism are key.

In order to achieve business success, specific design and test strategies as well as the processes consistent with your business model and business realities must be defined. Business considerations drive design and test objectives which dictate the attributes of the design and test process required to meet those objectives and, ultimately, drive a specific implementation approach.



Figure 2: Flow for design and test process definition.

Many of these items may seem obvious, while others may not be as clear. Even some of the more obvious ones can be overlooked in a challenging schedule-and cost-constrained environment. Several of the less obvious items and some that often get overlooked follow...

BUSINESS CONSIDERATIONS

Many factors impact the success of a given business model. Some of the key considerations relevant to the design and test strategy are:

- **Functional, performance and physical requirements**
- **Timeline and market window**
- **Cost requirements**
- **Volume and throughput requirements**
- **Risk profile**
- **Future plans**
- **Core versus context**

Documenting and tracking requirements may seem obvious, but oftentimes in schedule-driven developments, this critical element gets overlooked or pushed aside. This typically creates confusion between the designers and test developers and often results in schedule slippage.

A critical part of achieving business success is having a design and test process that aligns with your risk profile. Historically, the design, validation and test approach employed in the space industry was very different from that of the commercial electronics industry. Far and away, the highest priority of the process in traditional space was to beat the risk down as much as possible, often at the expense of schedule and cost—test everything, and test it a lot.

Almost by definition, NewSpace is willing to accept some level of risk. A key element of the test strategy is to define what risks are and are not acceptable—establish and document a risk profile.

For example, perhaps you are willing to accept a 5 percent failure rate over a two year period, and plan to mitigate this risk in the system design. A detailed assessment of risk will help drive the test strategy and process. The

test process targeted at a 5 percent failure rate is quite different from one that targets 1 or 20 percent. Of course, one that targets 1 percent would achieve the 5 percent target, but may exceed cost and schedule targets.

Future planning is an important consideration as part of the process definition. Assess short, medium and long-term goals—do you plan to grow in volume? Do you plan to expand your product portfolio or increase complexity? If you expect your needs to change in the future, make these important choices now to help you adapt and upgrade over time.

A second key element that is not necessarily obvious, and is often overlooked in process definition, is the concept of core versus context. Core is that content which your organization is uniquely capable of executing better, faster or cheaper than an outside source. Context is everything else that is necessary for business success, but is not part of the core. The more you are able to focus on your core, the higher likelihood you will have for a successful and sustainable process.

Your process may be best served by outsourcing context items to enable more focus on core. For example, equipment calibration and maintenance is essential for business success in electronic design and production, but for many companies it is not part of their core. What is core and what is context, and what may change over time, is important to determine. The review of core versus context should be completed on a regular basis in order to maintain a tight focus on key differentiators as business conditions change.

PROCESS OBJECTIVES, ATTRIBUTES + IMPLEMENTATION

The objectives, attributes and specific implementation approach of a design and test process are tightly linked. As such, they often become blurred together. Critical is that attributes align with objectives and that the implementation aligns with the attributes and achieves the objectives. *Table 2* below lists primary objectives, attributes and implementation elements.

No single implementation approach will fit every NewSpace business model. However, focusing on the items discussed above will provide the context to make the best implementation choices for a given business model. All of the items in *Table 2* have some level of impact across the business model. However, each has primary impact in one of three broad categories—design robustness, volume enablement and cost management.

Objectives	Attributes	Implementation Elements
<ul style="list-style-type: none"> – Predictable performance from proposal through operation – Identify and eliminate problems as early in process as possible – Identify and understand weak points/potential points of failure early – Sustainable quality – Continuous process improvement – Minimize test system setup time – Maximize yield – Maximize uptime – Ensure throughput targets 	<ul style="list-style-type: none"> – Effective modeling of product and system performance – Design for manufacturability, test and cost (DFx) – Consistent, common and repeatable measurement science throughout the process – Data consistency to support trending and prediction – Clear criteria for “production ready” – Robust validation testing – Efficient production testing – Minimize use of hand-crafted products – Clear delineation between forward and reverse flow – Minimize probability of operator error 	<ul style="list-style-type: none"> – Model and measure early to understand weak points – Start testing early on - breadboards and early prototypes – Detailed and inclusive DFx reviews – Utilize methods for accelerated testing to ferret out weak points quickly and effectively – Focus test resource on areas of greatest concern – Test what needs to be tested – not what doesn’t – Test enough – don’t test too much – Eliminate rework in the forward flow – Failed units move immediately to reverse flow – Automation – Parallel test – Outsourcing

Table 2.

Design Robustness

Effective and accurate modeling is necessary in order to be confident that a given product or system concept will meet the requirements and align with the business model. The simulation tools used should support margin analysis and the ability to incorporate measured data. Improperly managed margins can add significant cost and risk to a program.

If margins are too tight, unnecessary costs are pushed down to subsystems and components. If margins are too loose, they could stack up unfavorably, leading to poor system performance or failure.

Simulation and models help properly manage margins for optimum performance and cost tradeoffs. Simulation and test data consistency throughout the process also enables trending and improved prediction over time. It's key that the measurement science employed at each stage is repeatable and consistent with other stages.

Modeling will also provide early insight into the problem areas and potential weak points in the design. Problems caught early in the process are far less costly, both in terms of money and schedule, than problems found late in the process. Start testing early. Build breadboards and early prototype assemblies, particularly of the highest concern parts of the design, and perform rigorous testing on them.

Hardware-in-the-loop integrated with your simulation software and models increases fidelity of your system simulations. This enables higher confidence in advance of first "turn on" of the system as to whether the pieces are going to work or not.

Highly accelerated life testing (HALT), or highly accelerated stress testing (HAST), can be a most effective approach for early detection of design problems and infant mortality. The level and formality of HALT/HAST that is used should be consistent with the product and business model.

For example, in order to test the lifetime quality of electrical connections, a combined thermal and vibration environmental test can be done to add additional stresses. This may lead to the detection of fatigue or fracture that would normally take years to manifest itself as a failure. By doing a rapid test that might constitute some percentage of the lifetime number of cycles expected, you can catch issues without the need for extremely long test cycles.

Volume Enablement

Design for manufacturability, design for integration, design for test, design for quality, and design for cost are essential for a profitable business model. These DFX techniques are tightly related—consideration and review of these elements is critical early in the process. The reviews should include all of the key stakeholders—R&D, test engineering, production and quality. Early feedback on DFX issues will pay off in production with improved throughput and yield.

Clear and aligned criteria for "production ready" is also critical. Rigorous and broad testing and debugging of the design should be focused in development and validation phases. As you move into production, focus on the areas of greatest concern. Consider not testing or only sample testing the areas that have little cause for concern.

For example, if modeling and early testing has shown sensitivity to low temperature, but not high temperature, consider mainly testing at low temperature. Be certain, however, to test at a level that is consistent with the risk profile and potential failure modes.

In the production test process, there must be a clear distinction between forward flow and reverse flow. If a unit fails in forward flow, that unit must be removed and transferred into reverse flow in order to achieve throughput objectives.

When failed units remain in forward flow for debugging, they create a bottleneck that slows, or even stops, product shipments. Process automation is a powerful tool in a volume test process.

Automation brings significant advantages:

- *Reduced test system setup and measurement time*
- *Reduced risk of test operator error*
- *Utilization—maximize usage of capital equipment*
- *Improved yields, reduced rework and re-test*
- *Reduced human attended test time*

However, automation will typically incur additional up-front expense and initial setup time. The level of automation that is sensible will be dictated by several factors. Assess and determine what level of automation best delivers the target metrics defined above.

Parallel testing can take several forms—multiple channels, multiple measurement types, multiple units under test (UUTs), etc. The primary objective is to ensure throughput and asset utilization objectives are achieved.

Cost Management

Outsourcing is widely used in the commercial electronics industry. As discussed earlier, core versus context is an important consideration.

For those elements that are deemed to be context, outsourcing may be a viable alternative as such can provide advantages in process efficiency and overall cost. Additionally, outsourcing can help address the challenge of attracting technical talent, as contract resources may be available where permanent hires are not so readily accessible. Outsourcing is certainly not to be taken lightly, but should be considered as part of an effective business model.

When aligning the design and test process with the business model, one of the primary factors to understand is how they impact cost.

Primary contributors to cost include:

- **Yield**
- **Test time and throughput**
- **Utilization**
- **Equipment cost**

When computing the equipment cost, take a view of the total cost of ownership (TCO) of the process and the associated value delivered. Oftentimes, the equipment cost is viewed only in terms of the initial purchase. TCO is key to understanding the real cost and associated

impact on the business model. TCO is defined to be the total cost to own and operate a piece of equipment over its useful life.

Keysight has developed a TCO model for the industry that is comprised of the two core elements of capital expenses (acquisition costs) and operating expenses. Refer to reference [1] for detailed information on TCO.

As you define your electronic design and test process, work with a partner that can support your business as well as technical needs. Keysight offers the broadest portfolio of electronic design and test services and products to assist you from early design through production, deployment, operation and maintenance.

A KEYSIGHT DIFFERENTIATOR

Keysight has been the leading provider of electronic design and test solutions to the space industry throughout its history—initially as Hewlett-Packard and then as Agilent, and that tradition now continues as Keysight. Throughout that time, the company has also been the leading provider of electronic design and test solutions to the commercial electronics industry.

Keysight has a strong history of successfully applying lessons learned in the commercial electronics industry to the Aerospace industry, with a commitment to delivering electronic design and test products, solutions and services to meet the changing needs of the industries served. Leveraging the best practices from the commercial electronics industry to address the unique challenges of NewSpace is a key component of Keysight's services, which include:

- **Process analysis**
- **Calibration and repair**
- **Asset management**
- **Custom applications engineering**
- **Test system and process design and implementation**
- **Resident professional program—Keysight experts embedded with your team**
- **In-depth technical training**

Enabling clients to receive the solution that best aligns with their business models is Keysight's charter.

The firm's EEs of electronic design automation software portfolio spans from low-level circuit design with industry leading Advanced Design System (ADS) to complex system level modeling with SystemVue. Keysight is the leading provider of electronic measurement instruments and software in nearly every significant category and a broad array of application specific test systems and automation solutions are offered.

Keysight is best known for high performance bench-top box instruments, with products offered over a wide range of price-performance: from basic products to fit tight budgets, to the highest performance to meet the most difficult measurement challenges. A broad portfolio of hand-held instruments, including the Field Fox hand-held combination network and spectrum analyzer, are available.

Modular instrumentation is also a major focus area, with a rapidly expanding portfolio in PXI, AXIe and USB form factors. Keysight's software portfolio offers solutions that support our broad hardware offering with applications across industries and throughout the product lifecycle.

Industry-leading measurement science is employed across Keysight's portfolio, delivering measurement and data consistency throughout the design and test process, regardless of product choice. For example, the same measurement algorithms are used in basic class CXA spectrum analyzers as in the highest performance class UXA. Those same algorithms are also employed in the PXI vector signal analyzers, 89601B vector signal analysis software and SystemVue system level design software.

Keysight is committed to enabling NewSpace business models including cost management. We offer a broad array of tools to enhance affordability and deliver superior total cost of ownership. Comprehensive upgrade capability and trade-in programs enable your Keysight solution to grow as your needs change.

Keysight software is downloadable expertise. From first simulation through first customer shipment, tools are delivered to your team whose needs range from acceleration of data to information to actionable insight.

- » **Electronic design automation (EDA) software**
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- » **Programming environments**
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NewSpace is creating tremendous excitement in the MAG and commercial space industry. New companies are entering these various market segments and traditional companies are adapting to the changes.

Many completely new business models are emerging. Ensuring quality while dramatically increasing volume and reducing cost is difficult and requires a strong balance of commercial electronics and traditional space industries, combined with completely new discoveries, to realize the promise of NewSpace.

Keysight is ready to help you realize the promise of your NewSpace business model by bringing together the best of commercial and aerospace electronic design and test.

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www.keysight.com/

SPACE FOUNDATION'S SPACE WATCH: TIME TO BE BULLISH ON SPACE, ONCE AGAIN

By Elliot Holokauahi Pulham, Chief Executive Officer, Space Foundation



There was no mistaking the excitement in the air all throughout our recent 31st Space Symposium.

There were exciting announcements, such as ULA's unveiling of its new Vulcan launch vehicle, and moments of daring-do, like SpaceX's nearly successful attempt to land a Falcon 9 first stage on an autonomous ocean platform.

There were stimulating presentations from the heads of 13 different space agencies, ranging from the newly formed United Arab Emirates space agency to the venerable vanguards such as NASA and ESA. Landmark accomplishments were marked in military space with the recognition of the X-37B program, civil space with the recognition of Exploration Flight Test-1 and in space exploration with recognition of the Rosetta-Philae comet mission.

However, more important than any single point or program during the Symposium—our largest ever—were two trends throughout that were admirably captured in my favorite news headline of the week: "Diversity and Youth drive 31st Space Symposium." When the space industry begins to be characterized as diverse and youthful, we have certainly turned some kind of existential corner.

That's exciting!

The numbers are easy enough to factor: more than 1,200 different organizations, from nearly 40 countries, with young professionals engaged in the New Generation Space Leaders Program, SGAC Fusion Forum, or working on-site as booth personnel or business development staff made up a larger percentage of attendees than ever before. What is less easy to put your finger on is the heightened pulse, enthusiasm and optimism for the future that characterized virtually every aspect of the gathering.

Simply put, people are bullish on the space industry again. This excitement for the future is becoming contagious. From veteran program managers and seasoned government officials, to young engineers and designers, entrepreneurs and start-ups, even insurers, financiers and the legal community, there is a sense of restored momentum and promise.

Part of the reason is the positive performance of the industry over the past year. In raw numbers, the global space economy grew from \$314 billion in 2013 to \$330 billion in 2014—with every indication that the industry will continue to grow to at least \$600 billion by 2024.



The numbers tell only part of the story. In the year gone by, a staggering 92 rockets have been launched, putting more than 250 payloads into space. The first new, human rated, deep space exploration vehicle since Apollo was launched. ISS servicing has been successfully transitioned from the government to the private sector, and the commercial companies who will soon take over flying astronauts to the International Space Station have been selected.

The solar-electric propulsion capabilities that will take us to Mars are being mastered, even as the bending of metal has been started on the new, heavy-lift launchers that will take us farther than we have ever gone before. This is heady stuff—and it does not stop there.

Ground has been broken on new commercial spaceports, military space collaborations have been strengthened and reinvented the Joint Space Operations Center and its systems have been reinvented—the first steps toward true space domain awareness have been taken.

The successful replenishment of our crucial GPS satellite systems marches ahead, as does the mostly successful deployment of Europe's complementary Galileo system. A comet has been chased down and landed upon and humanity's first-ever encounter with Pluto and its neighbors in the farthest reaches of our solar system is about to be experienced.

Simultaneously, the explosion of space applications continues. New players are emerging with new technical approaches, and the capital to get them rolling and brought to market is being managed by a diverse mix of angel, venture, institutional and traditional banking interests.

Even the ITAR-weary are picking themselves up, dusting themselves off, and learning to run with a new and improved U.S. regulatory framework.

Of course, there were setbacks in 2014, including the loss of an Antares vehicle and Cygnus payload as well as the loss of an experimental suborbital spacecraft by Virgin Galactic. There remains work to be done on ITAR as such relates to human space systems. The behavior of a traditional space powerhouse, Russia, has become problematic for the west and jeopardizes many international space partnerships.

However, on balance, 2014 was one hell of a year in space.

And the future only looks brighter...

2015 will witness even more launch vehicles and spacecraft lofted than 2014, and by 2016, the volume becomes even crazier. Looking out just a few years to 2018, a tidal wave of huge, new, important space projects will be occurring: the next launch of Orion; first flight of the heavy lift SLS system; launch of the James Webb Space Telescope; flights of commercial crew vehicles Dragon 2 and CST-100; the orbiting of next generation satellites in the LEO, MEO and GEO belts; further improvements in space domain awareness, and coalition space operations; and, almost certainly, the commencement of commercial, suborbital, space tourism flights. Commercial companies, universities and non-profit organizations will be landing spacecraft on the moon. SpaceX will be routinely recovering Falcon 9 first stages from pinpoint barge landings.

Going even further out on a speculative limb, I personally believe we may even start seeing mobile phones with satellite-direct backup capabilities—eventually turning every cellular device into a satellite capable device, either through dedicated chipsets or augmented external cases ala the Thuraya slip-on satellite case for iPhone. I also think there is a better than 50-50 chance that the first spacecraft built entirely by students will be heading to Mars.

There are certainly potential bumps in the road ahead. ITAR needs to be further refined so that spacesuits, commercially developed spacecraft and other items can be freely traded among spacefaring nations. For a whole host of reasons, the U.S. and China need to normalize space relations. The global economy needs to remain strong enough to provide capital for new investment. We also need to work diligently to prevent the NASA program of record from being completely derailed as a result of the 2016 U.S. presidential election.

Overall, the technology, regulatory framework, march of progress, spirit of innovation and capital markets are all coming together in a way that could sustain a remarkable new era in space exploration, development and utilization. In light of this bold and exciting era, The View from Here is: It's Time to be Bullish on Space Again.

In recognition of this bold and exciting era, this fall, the Space Foundation is holding a small by-invitation gathering of some of the most innovative, insightful and visionary professionals from the entrepreneurial and investment sectors of space and technology. The Space Technology and Investment Forum, slated for September 30 to October 1, is the only boutique investment conference that brings together top venture capitalists, international angel investors, founders of new space startups, and tech savvy space enthusiasts with business and legal gurus, insurers and successful space industry CEOs, to the heart of the San Francisco financial district.

The in-depth dialog, expert briefings, analysis of risks and opportunities, informal discussions and networking activities, will provide participants with a better understanding of the global space industry, current trends, emerging technologies and the economic benefits and challenges that lay ahead. From long-term market watchers and high net worth space enthusiasts to the champions of disruptive innovation and architects of new tech applications, the Space Foundation is known for bringing together the very people who shape the future of the space industry, create new markets and value networks, and influence the way people think and work in the years ahead.

Building the future, because we're bullish on the future.

www.spacefoundation.org

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.

