

*SATCOM For Net-Centric Warfare*

*February 2016*

# ***MilsatMagazine***

**KRATOS: BRAVE NEW (SMALLSAT) WORLD**

**COMMAND CENTER: SKOT BUTLER, IGC**

**NSR: A NEW UAS PARADIGM**

**SATGOV: EMPOWERING UAS MISSIONS WITH HTS**

**AN INTERORBITAL SYSTEMS DOUBLE ROLL OUT**

**MOBILE METEOROLOGICAL TESTING MISSION**

**DISPATCHES**

*Image courtesy of Kratos Defense and Security.*



# MilsatMagazine

February 2016

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# DISPATCHES

## NROL-45 Launches Via United Launch Alliance Delta IV



**February 10th offered a beautiful early morning launch for the NROL-45 satellite.**

This was the second United Launch Alliance (ULA) Mission for the U.S. Air Force in only five days.

Launching from Vandenberg Air Force Base in California on February 10, a Delta IV rocket carried the National Reconnaissance Office (NRO) payload from Space Launch Complex-6 to orbit—this mission is in support of national defense.

This is ULA's second launch for 2016 and the 105th successful launch since the company was formed in December of 2006.

*"Congratulations to the ULA team and our U.S. Air Force and NRO partners on the launch of NROL-45,"* said Laura Maginnis, ULA vice president of Custom Services.

*"This is our second successful launch within five days for our U.S. government customer, a testament to our outstanding teamwork and focus on 100 percent mission success, one launch at a time. ULA is proud to be entrusted with safely and reliably delivering our nation's most critical space assets to orbit."*

This mission was launched aboard a Delta IV Medium+ (5,2) configuration Evolved Expendable Launch Vehicle (EELV) using a single ULA common booster core powered by an Aerojet Rocketdyne RS-68A main engine along with two Orbital ATK GEM-60 solid rocket motors.

The upper stage was powered by an Aerojet Rocketdyne RL10B-2 engine with the satellite encapsulated in a 5 meters in diameter composite payload fairing.

ULA's next launch is the Atlas V OA-6 Cygnus International Space Station resupply mission, flown for Orbital ATK under NASA's Commercial Resupply Services contract.

The launch is targeted for March 22 from Space Launch Complex-41 from Cape Canaveral Air Force Station, Florida.

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

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

ULA has successfully delivered more than 100 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.

Although the NRO keeps most details of its satellites and their missions classified, analysis of the information that is publicly available and comparison with previous missions often allows inferences to be made as to the nature of the spacecraft being launched.

### ***The Indispensable Orbital ATK Role***

Orbital ATK played a vital role in Wednesday's successful launch of a United Launch Alliance Delta IV rocket from Vandenberg Air Force Base, California.

The rocket launched a classified satellite, designated NROL-45, for the U.S. National Reconnaissance Office (NRO) in support of a national defense mission. Orbital ATK's contributions to the Delta IV include cutting-edge technologies from across the company.

Contributions include two Graphite Epoxy Motors-60 (GEM-60), large composite structures and the propellant tank and nozzle for the main engine.



*Orbital ATK's GEM-60.*

Orbital ATK provided two 60-inch diameter Graphite Epoxy Motors (GEM-60) for the Delta IV rocket. The 53-foot-long solid rocket boosters burned for 90 seconds and provided more than 560,000 pounds of thrust.

Orbital ATK produced the solid rocket motors at its Magna, Utah facility, where it has manufactured 76 GEM-60s for the Delta IV launch vehicle since the initial flight in 2002.

Starting in 2018, Orbital ATK will provide upgraded GEM-60 solid rocket boosters, designated GEM-63 and GEM-63XL, for ULA's Atlas V and new Vulcan launch vehicles, respectively.

Orbital ATK also supplied 14 Delta IV and GEM-60 key composite structures, which provide lower weight and higher performance. The largest composite structures are five meters in diameter, range from one to eight meters in length, and are produced using either

advanced wet winding or hand layup, machining and inspection techniques at Orbital ATK's manufacturing facilities in Iuka, Mississippi, and Clearfield, Utah.

Additionally, Orbital ATK manufactured the propellant tank for the Delta IV upper stage roll control system at the company's Commerce, California, facility, and designed and manufactured the nozzle for Delta IV's RS-68A engine at its Promontory, Utah, facility.

Orbital ATK also designed and produced the nozzle's thermal protection material, which is capable of shielding the nozzle from the extreme heat of launch, when external temperatures can exceed 4,000 degrees Fahrenheit.

*"Congratulations to the entire team on the launch of the NROL-45 satellite."* said Scott Lehr, President of Orbital ATK's Flight System

Group. *"Orbital ATK is honored to support the NRO and ULA with key technologies that enable the launch of critical national defense satellites."*

Orbital ATK has also now opened a regional office in Singapore to serve existing and new customers in Asia.

The office is the third international location opened by Orbital ATK in the past three months. The company is following a deliberate process of increasing its availability to and direct engagement with customers and industry partners.

The company has supplied space systems to regional customers, including commercial communications satellites; Earth-observation and remote-sensing spacecraft; space structures, components and pressure vessels; launch services; and ground stations.

The Singapore office will enable closer and more in-depth support for all Orbital ATK customers in the region.

The Orbital ATK office in Singapore will be led by Bill Rose, Sr. Regional Director Asia Pacific. Orbital ATK's international activities have recently grown to include country offices and permanent representation in England as well as both Saudi Arabia and the United Arab Emirates.

*"Each new Orbital ATK office outside the United States is intended to support a proven track record of significant sales in the region to support future growth by having a full-time*

*presence that our customers can rely on,"* said Tim Shephard, Corporate Vice President of International Business Development for Orbital ATK.

*"Already, about 20 percent of the company's sales are to international customers and we are seeking further growth in these important markets."*

*"Orbital ATK has a heritage of serving the greater Asian market and our new office allows us to provide focused support to our valued partners in the region,"* Shephard, added. *"Over the past five years, the military and commercial products and services we provide in Asia have totaled roughly three quarters of a billion dollars in new sales. This strong track record gives us confidence that the resources we are dedicating in the region are a wise investment in future growth. Our international footprint is rapidly expanding and Singapore is an important and logical next step in that process."*

**[orbitalatk.com/](http://orbitalatk.com/)**

## The Global Military Comms Market From 2015 to 2019 Is Examined

**Research and Markets has added the "Global Military Communication Market: Forecast and Research Analysis 2015-2019" report to their offering.**

The report provides a comprehensive overview of the market shares, market segmentation by system, and growth prospects by region (the Americas, APAC and EMEA).

The report also presents the market landscape and a corresponding analysis of the five major vendors in the market.

Access to broadband and Internet services while airborne is one of the crucial elements for the effective mobile command and control of aircraft, beyond ISR.

New developments in antenna and satellite technology, along with nimble and high-



According to the report, several countries are developing their defense units by manufacturing combat planes, helicopters, and transport aircraft.

The increase in the number of military aircraft will eventually boost the development of communication programs.

Further, the report states that the budget cuts and downsizing of army units prohibit any further developments in ongoing military projects, thereby limiting the growth of the market during the forecast period.

In addition, the report discusses the primary drivers influencing the growth of the market.

The report also outlines the challenges faced by vendors and the market at large, as well as the key trends emerging in the market.

Additional information is available at this link:

**[researchandmarkets.com/research/z4r6s6/global\\_military](http://researchandmarkets.com/research/z4r6s6/global_military)**



# DISPATCHES

## A Milestone For USAF GPS... ULA Completes The Final Launch For This Boeing-Built Satellite Series



Artistic rendition of the GPS IIF-12 satellite, courtesy of Boeing.

**Boeing and the U.S. Air Force today completed the GPS IIF constellation with the launch of the 12th Boeing-built satellite.**

Following on orbit tests, GPS IIF-12 will be formally declared operational in approximately one month.

This will make the 50th GPS satellite that Boeing has delivered on orbit to the US Air Force. Since the first launch on May 27, 2010, the GPS IIFs have advanced the Air Force's Global Positioning System modernization program by improving accuracy and security while introducing new civilian and military capabilities to a system used by millions of people around the world.

*"This GPS IIF milestone builds on our 40-plus years of GPS experience and a strong government-Boeing partnership,"* said Dan Hart, vice president, Boeing Government Satellite Systems. *"We continue investing in GPS innovation while driving down costs, keeping GPS prepared to meet current and future demands."*

Boeing has been the prime contractor for GPS satellites since the program's inception, providing multiple generations of satellites that have collectively accrued more than 540 years of on orbit operation.

GPS IIF-12 lifted off from Cape Canaveral Air Force Station aboard a United Launch Alliance Atlas V launch vehicle on February 5 at 8:38 a.m. EST from Space Launch Complex 41 at Cape Canaveral AFB. About three hours and 23 minutes later, the spacecraft was released into its Medium Earth Orbit (MEO)



of about 12,000 miles—signal acquisition was confirmed at 12:09 p.m. EST.

### **45th Space Wing Support**

The 45th Space Wing supported the U.S. Air Force's 12th launch of a Boeing-built Global Positioning System IIF satellite aboard a United Launch Alliance Atlas V.

*"Today's launch marks a momentous milestone in the history of the Global Positioning System. It is the twelfth and last GPS IIF satellite and closes out nearly 27 years of launches for the GPS Block II family of satellites,"* said Col. Shawn Fairhurst, 45th SW vice commander, who served as the Launch Decision Authority.



*The 45th Space Wing supported the U.S. Air Force's twelfth launch of a Boeing-built Global Positioning System IIF satellite.*

*Photo is courtesy of United Launch Alliance.*

*"As the nation's premier gateway to space, we are proud to be part of the team providing GPS and its capabilities to the world and look*

*forward to the future as we begin preparation for the next generation of GPS III satellites. Together with the Space and Missile Systems Center and our industry partners, we make up one team delivering assured space launch and combat capabilities for the nation."*

An Airmen-led processing team at CCAFS has processed every satellite of the series since GPS IIF-1 launched here in May 2010.

*"This is a significant milestone for GPS, the 50th GPS satellite to be delivered on orbit," said Lt. Gen. Samuel Greaves, Space and Missile Systems Center commander and Air Force Program Officer for Space. "The GPS IIF satellite performance has been exceptional and is expected to be operational for years to come."*

This mission proves the Air Force's dedication to deliver pre-eminent space-based positioning, navigation and timing service to users around the globe. GPS is the Department of Defense's largest satellite constellation with 31-operational satellites on orbit. GPS IIF is critical to U.S. national security and to

sustainment of the GPS constellation for civil, commercial and military users.

Originally designed for the military user, GPS has become a global utility depended upon by more than two billion users worldwide.

Even 45th SW personnel rely on GPS satellites currently on orbit to track most missions they launch from the Eastern Range at CCAFS.

Eastern Range instrumentation provides radar tracking, telemetry, communications, command/control sites, camera and optical sites, and other support capabilities such as

meteorology. Instrumentation is necessary to safely and successfully conduct civil, commercial, and national security spacelift operations and ballistic missile tests and evaluation.

Eastern Range assets are based on dependable designs and technology, and are arrayed in a highly efficient architecture designed to ensure safety of the launch environment and the public at large.

# DISPATCHES

## Northrop Grumman's NASA Global Hawk Checking Out El Niño



The NASA Global Hawk unmanned aircraft will help scientists discover how El Niño affects weather patterns.

Photo is courtesy of Northrop Grumman.

**The NASA Global Hawk will conduct several missions to collect detailed data over the Pacific Ocean from complex El Niño weather patterns resulting from variations in ocean temperatures across the equator.**

The Northrop Grumman Corporation-built NASA Global Hawk missions will take place from February to March as part of National Oceanic and Atmospheric Administration (NOAA)-led missions.

The multi-year missions, called Sensing Hazards with Operational Unmanned Technology (SHOUT), will provide detailed meteorological measurements from a region in the Pacific that is known to be particularly critical for interactions linked to West Coast storms and rainfall.

The NASA Global Hawk is one of several assets being used by scientists from NASA and NOAA to advance understanding and

predictions of tropical storms, winter storms and major floods.

The unmanned high-altitude, long-endurance NASA Global Hawk aircraft will work alongside air, land and sea platforms to gather data. Scientists will use this information to better understand El Niño's impacts on the U.S. and to improve NOAA's observational systems, models and predictions.

NASA and Northrop Grumman are partnered under the Space Act Agreement, which allows for shared use of the NASA Global Hawk system to conduct scientific experiments and explore new mission capabilities.

Previous NASA Global Hawk missions have included hurricane research, examining the effects of greenhouse gasses and conducting cutting-edge autonomous aerial refueling trials.

*"With the ability to fly at 65,000 feet for 30 hours, the NASA Global Hawk allows us to study intense and remote weather conditions that were previously unreachable,"* said Dave Aguinaldo, program manager, NASA Global Hawk, Northrop Grumman.

[northropgrumman.com/](http://northropgrumman.com/)

## Harris Digs Digital For Navigation Payload For GPS III SV 11 + Beyond

**Harris Corporation will offer a fully-digital navigation payload for the next round of US Air Force GPS III satellites (11 and beyond)—Harris already is providing a 70-percent digital navigation payload to Lockheed Martin for the Air Force's first eight GPS III satellites, including the first GPS III satellite.**

Harris' fully digital navigation payload will add value to the US Air Force's GPS mission by offering enhanced performance and enabling

on-orbit reprogramming. The all-digital payload expands on the advanced features of the current 70-percent digital solution Harris provides for Lockheed Martin's GPS III SV 1-8 satellites. The features provide greater flexibility, affordability and accuracy versus existing satellites and include an advanced modular design, atomic clock timing systems, radiation-hardened computers and powerful transmitters.

The payload leverages the mature Technology Readiness Level 9 legacy Harris reconfigurable

payload that is flying on the International Space Station and is incorporated on hosted payloads for the Iridium NEXT satellite.

Harris has more than 500 digital processors on orbit and another 150 awaiting launch. Harris navigation payloads have been on all of the 80-pl—with more than 750 years of on-orbit life without a payload-related failure. Harris has delivered more than 100 digital payloads, which have performed flawlessly on-orbit.

[harris.com/](http://harris.com/)



# DISPATCHES

## Tyvak Nanosatellite Systems To Support United Launch Alliance's CubeSat Ridesharing Program



**Tyvak Nanosatellite Systems, Inc., a subsidiary of Terran Orbital Corporation, has signed a Memorandum of Understanding (MOU) with United Launch Alliance (ULA) to serve as the primary Auxiliary Payload Customer on CubeSat Rideshare Initiative efforts through December 31, 2019.**

ULA's CubeSat Rideshare Initiative enables rideshare opportunities on its Atlas V launch vehicle and aims to tap into a growing market of small satellites with applications in education, scientific research, U.S. Government and commercial business.

CubeSats are miniaturized satellites originally designed for use in conjunction with university educational projects and quickly becoming a dependable tool for advance missions.



CubeSats are made of one or more units, called U's, measuring 10cm x 10cm x 10cm with a mass of 1.33 kilograms.

Under this MOU, Tyvak will provide low-cost access to space for both commercial and U.S. Government CubeSat customers, as well as no-cost access to space for Science, Technology, Engineering and Math (STEM) CubeSat customers for rideshares on ULA's Atlas V launch vehicles.

Tyvak is responsible for identifying, obtaining, and integrating CubeSat customers on the ULA Atlas V launch vehicle system.

In addition, as part of the agreement with ULA, Tyvak will provide up to three STEM CubeSat slots at no cost for each Atlas V 24U-capacity launch opportunity for education customers.

*"Tyvak is thrilled to have been selected for this opportunity with a world-class launch provider like ULA," said Tyvak President and Chief Executive Officer Anthony Previte. "This MOU brings key opportunities to Tyvak and to the entire nanosatellite community."*

*"As America's ride to space, ULA is transforming rideshares so that customers will now have predictable manifest slots for their payloads," said Tory Bruno, ULA president and CEO. "We are driving innovations like this program which will make space more affordable and accessible for all manner and size of payload customers."*

**[tyvak.com/](http://tyvak.com/)  
[ulalaunch.com/](http://ulalaunch.com/)**

## Kratos Unmanned Systems Gains New Mods Contract From US Army



**Kratos Defense & Security Solutions, Inc. has announced their Micro Systems, Inc. subsidiary of the Kratos Unmanned Systems Division (USD) recently received a series of contract modifications from the U.S. Army totaling \$2.0 million.**

The contracts is for additional engineering services option hours and hardware production in support of the Army Ground Aerial Target Control System (AGATCS), Target Vehicle Control Equipment and associated ancillary equipment.

These modifications further extend the impressive capabilities of the AGATCS control system which provides command and control of unmanned air, ground, and sea surface target vehicles.

Kevin Ferguson, Senior Vice President of Micro Systems, Inc., said, "Micro Systems is excited to have the opportunity to expand the already impressive capabilities of AGATCS and our unmanned vehicle product line.

*"We are very pleased to continue our long term relationship with the U.S. Army's Targets Management Office that has spanned 30 years. Lasting relationships such as this are an indication of the quality of our people and products and our focus on our customer's needs."*

**[kratos-msi.com/](http://kratos-msi.com/)**

# DISPATCHES

## EMC's Global X-Band Coverage To Be Enhanced By XTAR

**XTAR, LLC, renewed a long-term contract to supply EMC with high-throughput X-band to disadvantaged airborne terminals.**

As part of the contract, XTAR will continue to provide space segment to airborne intelligence, surveillance and recognition (ISR) platforms involved in border surveillance missions.

This contract signifies a renewal of a service that began in 2014 and XTAR's services provides EMC with seamless coverage and plays a crucial role in supporting airborne communications requirements.

*"Our work with EMC is another good example of how customers are finding X-band to be useful in Airborne ISR,"* said Philip Harlow, Chief Operating Officer of XTAR.

*"Applications using cameras and feedback capacity require double or triple the bandwidth on other frequency bands when compared to X-band. We work to effectively and efficiently fulfill objectives and provide users with unmatched mobility communications capabilities."*

*"Using XTAR-LANT allows us to maximize our abilities to support government customers' mission objectives and demonstrate our management of complex regulatory requirements,"* said Chris Ivory, president, Government and Enterprise Services, EMC.

*"X-band outperforms other frequencies in many of our government customers' most demanding scenarios. There are technical and operational advantages, including freedom from clutter of commercial users and interference, rain-fade resistance, maximized throughput, higher*

*power for mobility, and high data rates with existing government terminals. "In airborne operations such as this customer's, it also is valuable to have a partner who knows the technology, understands our goals and knows how to navigate potential obstacles. So we are pleased to continue working*

*with XTAR as we deliver mission-critical communications to this important on-the-move, aviation operator."*

**[xtar.com/](http://xtar.com/)  
[emccconnected.com/](http://emccconnected.com/)**

# DISPATCHES

## Signal + Cyber Connect To Validate New Equipment

**Mission success in the U.S. Army relies heavily on a balance of efficiency in equipment and personnel but is hardly achieved without both.**

Faced with upgraded equipment and unpracticed personnel, signal Soldiers of the 35th Signal Brigade (Theater Tactical) and cyber Soldiers of the Cyber Protection Team 152 connected for training at Forward Operating Base Ready, Fort Gordon, Georgia, earlier this year.

In order to test their new server stacks, both the CPT 152 and 35th TTSB network operations (NetOps) required an active link, which the 67th Signal Battalion (Expeditionary), 35th TTSB, was already scheduled to provide to a 442nd Signal Battalion's Basic Officer Leaders Course class.

The mission provided the conditions for the 67th ESB Satellite Transportable Terminal and Joint Network Node teams to experience something new as well.

*"It seems like this is going to be the way of the future as far as the cyber protection,"* said Staff Sgt. Kyle Jones, satellite communications operations noncommissioned officer, A Company, 67th ESB. *"It let us look into how our configurations are now and how we are going to have to change them in order to supplement the cyber protection teams."*

The 67th teams were faced with challenges at first while working to best accommodate the CPT 152's systems, added Jones, but all obstacles were overcome by his highly competent Soldiers.

*"They have a lot of programs and applications that need certain permissions within our network to actually run and look at the information coming across the network, so we've had to figure out the commands to input into our routers and switches to allow that to happen,"* said Jones. *"That's been the biggest thing here, making everything talk."*



*Spc. Brie L. Bentley, a satellite communication systems operator-maintainer, with A Company, 67th Signal Battalion (Expeditionary), 35th Signal Brigade (Theater Tactical), checks the status of connections on a Satellite Transportable Terminal while supporting a 442nd Signal Battalion Basic Officer Leaders Course class, and Cyber Protection Team 152 and 35th TTSB Network Operations' validation of new equipment at Forward Operating Base Ready, Fort Gordon, Georgia.*

*U.S. Army photo by Staff Sgt. Ashley M. Cohen, 35th Signal Brigade (Theater Tactical)*

The CPT 152 required live communication to use their scanners on an active network to scan check for vulnerabilities.

*"We've got a mission coming up in Europe so this is exactly what we will be doing; going out to a small little FOB or something like that and setting up and monitoring,"* said Chief Warrant Officer 3 Erik Averill, cyber planner, CPT 152 who had about 12 other CPT 152 Soldiers with him.

At FOB Ready, the CPT 152 team worked on their fly away kit, which is a server stack consisting of all of their required tools, and NIKSUN, Inc. equipment, added Averill.

*"I think one of the biggest lessons on the collaboration that took place was the discovery of the lack of support for a needed protocol on a piece of equipment,"* said Averill. *"We were testing for an upcoming mission and had we not discovered this now, it could have been a headache down the road."*

The training activity was the first time both the CPT 152 and the 35th TTSB worked together and provided unique experiences for both sides.

*"This really helped us figure out what we need to do in order to support the cyber teams when they come out and want to test their tools out,"* said Chief Warrant Officer 3 Siwatu Spikes, network manager and technician, 35th TTSB. *"It gives us an opportunity to see how they capture the traffic so that we can actually defend our networks."*

The CPT 152 team also familiarized with the new Tactical Network Operations Management System and their Battle Command Common Server that the 35th TTSB NetOps team was testing for the first after a month of in-class training.

*"It slices up all those hardware resources on that machine and allocates to the virtual machines,"* said Warrant Officer Kenneth Foringer, automations officer technician, 35th TTSB about the TNMS and BCCS.

*"So one machine that has the power of all those machines basically hosts all of those machines virtually."*

The server stacks nearly halve their equipment requirement and have subsequently cut power and environmental requirements, added Foringer.

*"It is an upgrade and a down size in equipment. You're not losing capability, you're reducing your footprint as far as physical hardware,"* said Spikes.

The equipment itself and the entire training experience served to represent the U.S. military's step into the future where less equipment does more and signal and cyber operate as one.

*Story by Staff Sgt. Ashley Armstrong, 35th Signal Brigade (Theater Tactical), US Army*

# DISPATCHES

## DARPA's RadioMap Enters Final Phase

**DARPA has awarded a contract for the third and final phase of its Advanced RF Mapping program, known as RadioMap, which seeks to provide real-time awareness of radio spectrum use across frequency, geography and time.**

Akin to smartphone maps that show color-coded current traffic conditions, RadioMap is developing technology that visually overlays spectrum information on a map enabling rapid frequency deconffliction and maximizing use of available spectrum for communications and intelligence, surveillance and reconnaissance (ISR) systems.

Lockheed Martin Corp. in Manassas, Virginia, was recently awarded an \$11.8 million Phase 3 contract to further develop technology from Phases 1 and 2 into a full system suitable for transition to the military services. Today's interconnected wireless world has led to congested airwaves, making Radio Frequency (RF) management a hot topic. For military members around the globe, efficiently managing the congested RF spectrum is critical to ensure effective communications and intelligence gathering.

"RadioMap adds value to existing radios, jammers and other RF electronic equipment used by our military forces in the field," said John Chapin, DARPA program manager. "This program doesn't require purchasing new spectrum-sensing devices. Rather, it uses existing radios and jammers that do double-duty. In the 'down' time when they aren't performing their primary function, the devices sense the spectrum around them and, through RadioMap technology, provide an accurate picture of what frequencies are currently in use and where."

RadioMap seeks to make spectrum management more efficient by giving operators the tools to see real and potential frequency interference and usage. For example, a forward-deployed unit might reserve a particular frequency for a communications link at a specific time, but due to the dynamic nature of the situation, the frequency ends up not being needed. RadioMap's real-time visualization of actual spectrum use helps spectrum managers detect the unused frequency and enhance mission effectiveness by quickly reusing it for other needs.

RadioMap can also support small units—such as squads or platoons, which rarely carry equipment for monitoring radio emissions—by identifying nearby RF Spectrum emitters that may indicate tactical threats or opportunities.

The base period of RadioMap Phase 3 is scheduled to continue through summer of 2016. If the Marine Corps test of the system in summer 2016 is successful, the program could transition to the Marine Corps after further operational testing in early 2017.

# DISPATCHES

## The 4th Space Launch Squadron Ensures Success

*The Mobile Service Tower (MST) is rolled back at Space Launch Complex-6 in preparation for launch of a United Launch Alliance Delta IV carrying the NROL-25 mission for the National Reconnaissance Office.*



**Throughout the launch process, a multitude of obstacles, whether they be logistical or economical, need to be hurdled before successfully entering space.**

To attain this success, the 4th Space Launch Squadron facilitates the process through its tireless efforts and particular focus on mission assurance.

*"The mission of the 4th SLS is to execute integrated launch operations to provide assured access to space - the ultimate high ground - by ensuring safe, secure, and successful launches," said Lt. Col. Eric Zarybnisky, 4th SLS commander. "We work hand-in-hand with members of the 30th Space Wing, Team Vandenberg, the Space and Missile Systems Center, United Launch Alliance, and our spacecraft customers to assure mission success."*

For the 4th SLS, teamwork is one of the key components contributing to its success.

*"Along with open communication and technical acumen, teamwork forms the foundation of our mission assurance role," said Zarybnisky. "Within the 4th SLS, my Technical Assurance Flight, Mission Integration Flight, and Mission Support Flight work together to*

*ensure the right people, with the right skills and training, are available to perform our vital mission assurance role. In addition, we forge relationships across multiple organizations to support the demands of the launch mission. We are fortunate to work with an amazing team of military, civilian, and contractor personnel who are all supremely focused on making the mission happen. It is this sense of teamwork that allows our nation assured access to space."*

Another important facet of the preparation is the open dialogue held between launch mission managers and commanders to ensure launch conditions are going smoothly.

*"There are several high-level reviews leading up to a launch, and launch mission managers brief the 14th Air Force commander and Space and Missiles Center commander on launch vehicle and infrastructure status on behalf of the 4th SLS," said Capt. Albert Vasso, 4th SLS launch mission manager.*

*"While we continue to relay information to all parties involved until liftoff, when the inevitable last-minute troubleshooting occurs, an LMM's importance intensifies as information needs to get out quickly, accurately, and to the right people."*

The LMM acts as a buffer to alleviate any concerns voiced by those involved with the launch, and with their expertise, solve problems that others won't have to stress about.

*"As an LMM, I'm an information broker tying together the key players in the launch campaign to make sure things don't slip through the cracks," said Vasso. "I'm the focal point for all issues affecting the launch vehicle and its support infrastructure, and I ensure concerns expressed by the launch vehicle contractor, payload customer, and the Air Force are understood by all parties.*

*"This requires judgment to determine which issues are important enough to elevate, a decent amount of personal networking, and a 'mile-wide, inch-deep' knowledge of launch vehicle and launch support systems. Without LMMs as a buffer, we'd have multitudes of engineers and commanders wasting valuable time trying to understand, communicate, and solve these problems on their own before launch."*

With a firm grasp on their various roles during launch operations, the 4th SLS maintains mission success and assurance - at all times.

*"The 4th Space Launch Squadron is the eyes and ears of the 30th Space Wing and the Space and Missile Systems Center," said Zarybnisky.*

*"Our mission assurance technicians oversee critical booster and ground support equipment procedures to ensure smooth processing and to report any anomalies. Our responsible engineers provide technical supervision, analysis of any deviations from nominal processing, and integrated risk assessments.*

*"Our launch mission managers and facilities and infrastructure team ensure all booster processing and launch operations are coordinated across the base and supported accordingly. Our Mission Support Flight ensures the other members of the squadron have the training and equipment they need to accomplish the mission."*

Story by Airman 1st Class Robert J. Volio,  
30th Space Wing Public Affairs, USAF

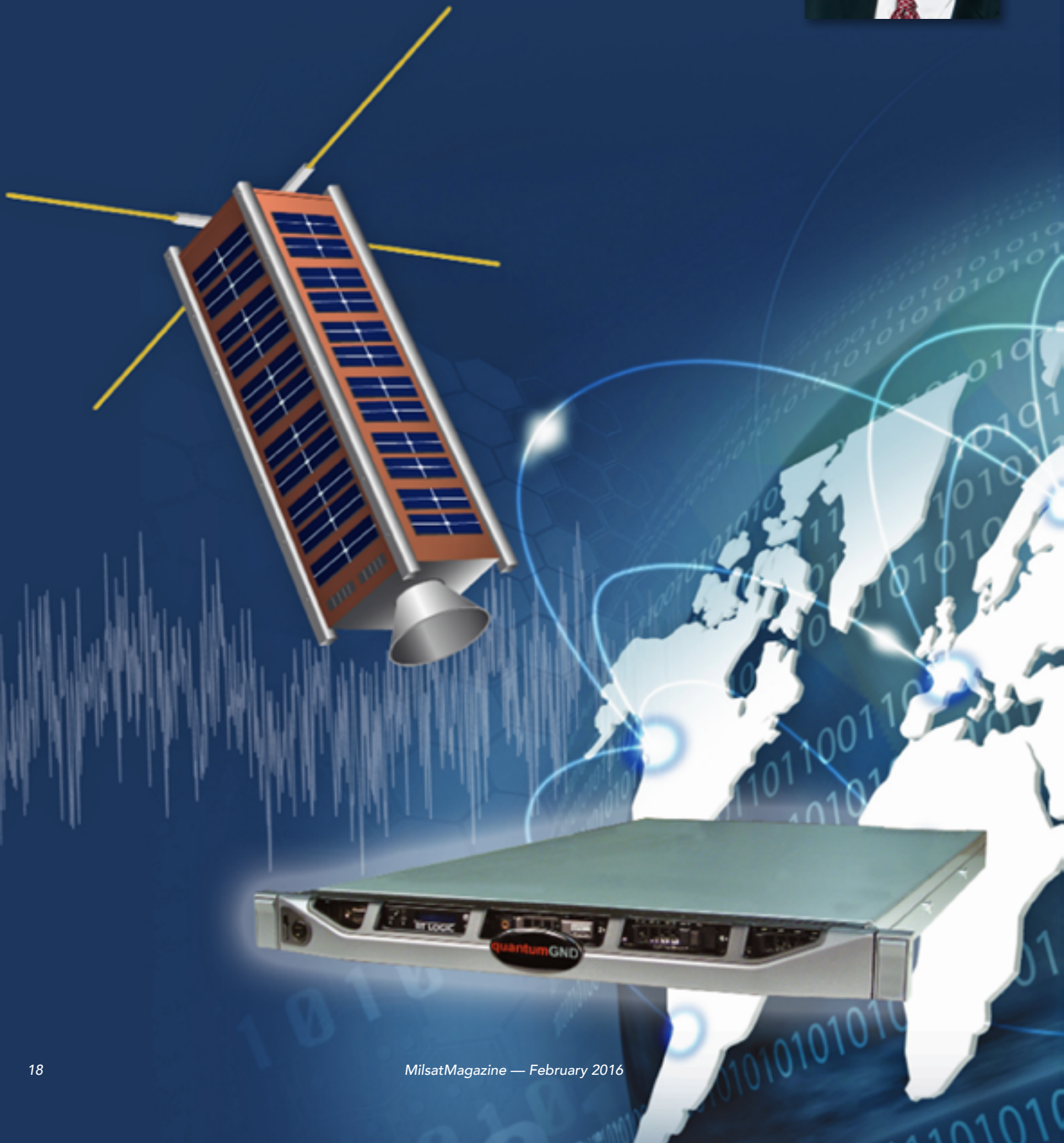


# BRAVE NEW (SMALLSAT) WORLD

By Stuart Daughtridge, Vice President of Advanced Technology, Kratos Technology and Training Solutions

**S**mall satellites (smallsats), from single satellites to constellations, demand new and innovative methods of manufacture, launch and control.

The growth of the smallsat industry for the military/agency/government and commercial market segments has been driven by design and manufacturing advances that have reduced



satellite size, production costs and time by orders of magnitude and by new and cutting-edge launch technologies that are driving down launch costs.

Now, with a new and consolidated approach to smallsat Command and Control (C2) and RF Signal Processing, ground costs and complexity are being driven down.

### **SMALL VS. LARGE SATELLITES...VIVA LA DIFFERENCE**

Similar to larger, traditional satellites, smallsats require command and control software, data processing, networking and RF signal processing. The primary difference between smallsats and larger satellites, as related to the satellite control system, is the value of the asset in space.

A smallsat might have an in space value of \$500k to a couple of million dollars—a larger satellite can have an in space value of \$100M million to \$500M for commercial satellites and more than \$1 billion for some government satellites.

How one manages a <\$1M asset that can be replaced within 12 months is quite different from how one manages an asset that costs >\$100M and will require two to four years to replace.

Additionally, large satellite ground systems are usually procured as a program, with requirements, design reviews, formal acceptance test programs, and so on.

Smallsat ground systems, on the other hand, are procured much like commercial software—acquirers evaluate what is available on the market, purchase the product that best meets their needs, install that product, get trained and start using it.

If the ground system does not fulfill all their requirements, they can use the product APIs to add the required features to address the smallsat's needs. This is a different model and approach and, as a result, a most noticeable different price point.

Initially, early smallsat operators would build their own satellite C2 systems. However, as the industry matured, smallsat operators came to understand that the effort required was more complex and time-consuming than they had initially imagined.

They began to realize they could buy Commercial-Off-The-Shelf (COTS) C2 systems for a fraction of the cost of developing their own product, with significantly lower recurring maintenance and support costs.

### **AUTOMATION CRITICAL TO SMALLSAT SUCCESS**

Smallsat operations are more open to automation as their business models require significant automation of their satellite operations.

First, smallsat operators are less risk adverse and are much more willing to push the boundaries on automation, as the risk is much smaller and easier to recover from should such not offer success.

Second, because of the relatively low cost of smallsats, their business models often cannot even afford a 24/7 operations team to manage the satellites—this absolutely requires a viable level of lights out automation. For most of them, their satellite operations are simple enough to make automation relatively easy to implement and manage.

Stovepipe systems are less of an issue for smallsat owners/operators as they have leaner and more automated infrastructures, at least as related to the satellites and their operations. As many smallsat operators are new to the market, they are not burdened with legacy systems and procurement policies. As a result, everything is integrated by design from the start, because everything needs to be automated and must work as a single system.

### FROM SINGLE SATELLITE TO FLEET OPERATION

Ground system selection takes on an even greater importance for companies that plan to grow from a single satellite operation to a smallsat fleet, and even more so as their fleets grow larger.

With larger satellite fleets, satellite management becomes far more complex and satellite operators will continue to look for ways to improve operations through virtualization, centralization, and automation to keep recurring system and operations costs controlled and manageable.

With this in mind, Kratos leveraged the company's extensive history in satellite command and control (C2) systems to develop an end-to-end C2 solution specifically for smallsats, whether for military/agency/government or commercial operations. This solution, quantumGND, is comprised of the satellite C2 system and software based TT&C modems that include the ground radio processing as well as Front End Processors (FEPs).

The result is a solution that digitizes the signals at the antenna and performs all the signal and data processing in software applications running in highly automated, self-contained virtual environments. Additionally, Kratos has integrated a virtualized flight dynamics application and an advanced Monitor and Control (M&C) system for managing the ground equipment, network and enterprise management.

A fully integrated product stack results, one that delivers a fully integrated, highly virtualized, fully automated low cost end-to-end fleet management solution.

The smallsat boom will help mainstream new technologies and will also help to drive greater automation into the satellite ground infrastructure business.

For example, the smallsat market is an area where we have been able to push and get faster adoption of new technologies, such as software modems, higher levels of automation and a fully virtualized ground infrastructure.

These new technologies/products have been proven in the smallsat market and are getting interest from some larger satellite operators, as they can clearly see the cost and operational advantages of:

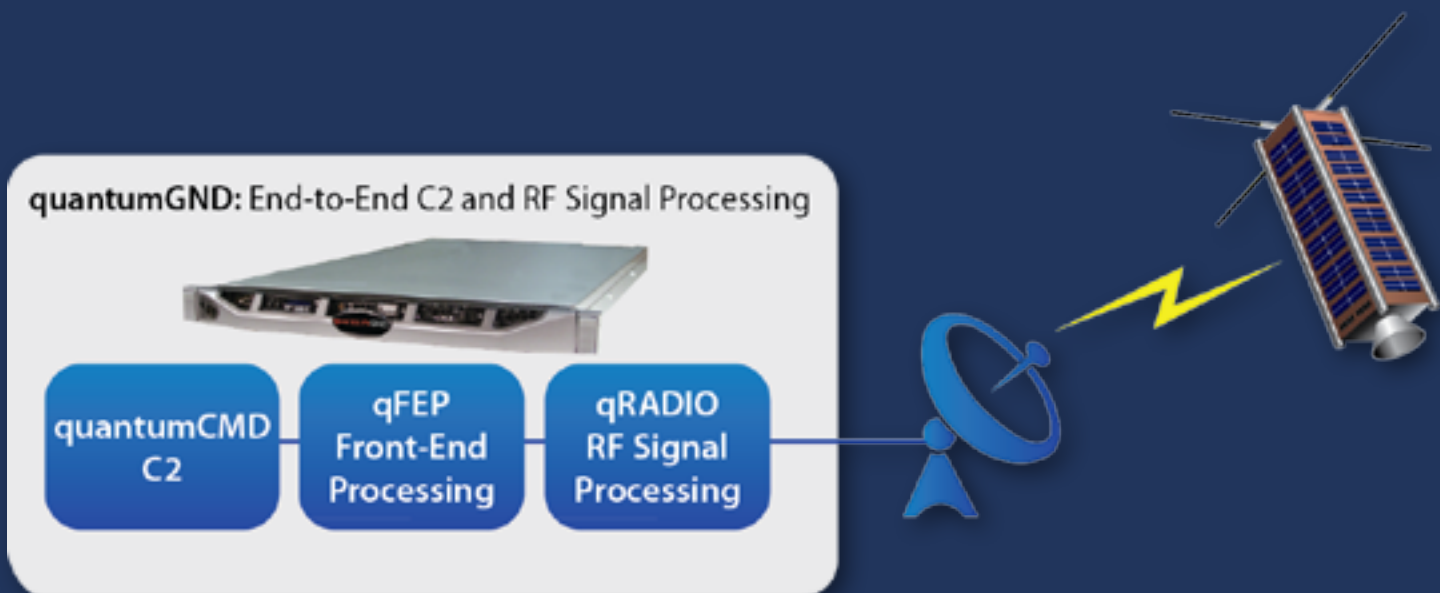
- Digital IF ground systems infrastructure
- Software only TT&C modems
- Virtualization of ground infrastructure
- HTML5 Web based clients workstation
- Greater integrated automation

Finally, it is important to understand that new smallsat companies don't necessarily consider themselves satellite companies. They consider themselves imaging companies, data analytics companies, weather companies, but not satellite companies. To them, the satellite is a sophisticated sensor maneuvered and used to capture data from a unique vantage point. The smallsat businesses and their business identities are built around what they can then do with that acquired data.

Being a long-time satellite industry person, that was a really interesting revelation for me. This is a good change that will benefit the entire industry.

[kratostts.com/products/satellite-and-space/quantumgnd](http://kratostts.com/products/satellite-and-space/quantumgnd)

*Mr. Daughtridge has been with Kratos-Integral Systems since 1999, and in the satellite and aerospace industry since 1986. Prior to his current role, he held several senior management positions, including SVP & GM of the Integral Systems Products Group, SVP & GM of the Integral Systems Commercial Group, as well as Program Manager of several major commercial programs. Before joining the Company, Mr. Daughtridge held various management and engineering positions with Orion Satellite Corporation, Intelsat, and Spacecom. Mr. Daughtridge holds a Bachelor of Science from Lafayette College.*





## COMMAND CENTER: SKOT BUTLER, VICE PRESIDENT, SATELLITE NETWORKS & SPACE SERVICES, INTELSAT GENERAL CORPORATION

Skot Butler is responsible for managing an integrated sales, marketing, and business development organization which serves all of Intelsat General's customers, including the U.S. Department of Defense, NATO, various civil agencies and commercial enterprises within the United States and Europe.



Mr. Butler brings to the position two decades of experience in the commercial satellite communications and telecom industries. He joined IGC in 2006 as Director of Hosted Payload Business Development and was most recently Director of Solutions Development. Preceding IGC, Mr. Butler held sales, business development and strategy roles at satellite services companies DRS, Spacelink, and Verestar.

Mr. Butler holds an MBA from the Smith School of Business, UMD-College Park. He stays active in the industry, serving as the President of the Mid-Atlantic Chapter of SSPI and representing IGC on the Commercial Space Engagement Forum (CSEF), the Satellite Industry Association Comsatcom Operations Working Group and other assignments.

### MILSATMAGAZINE (MSM)

Mr. Butler, what initially drew you into the satellite communications industry and how did that lead you into the MILSATCOM market segment?

### SKOT BUTLER

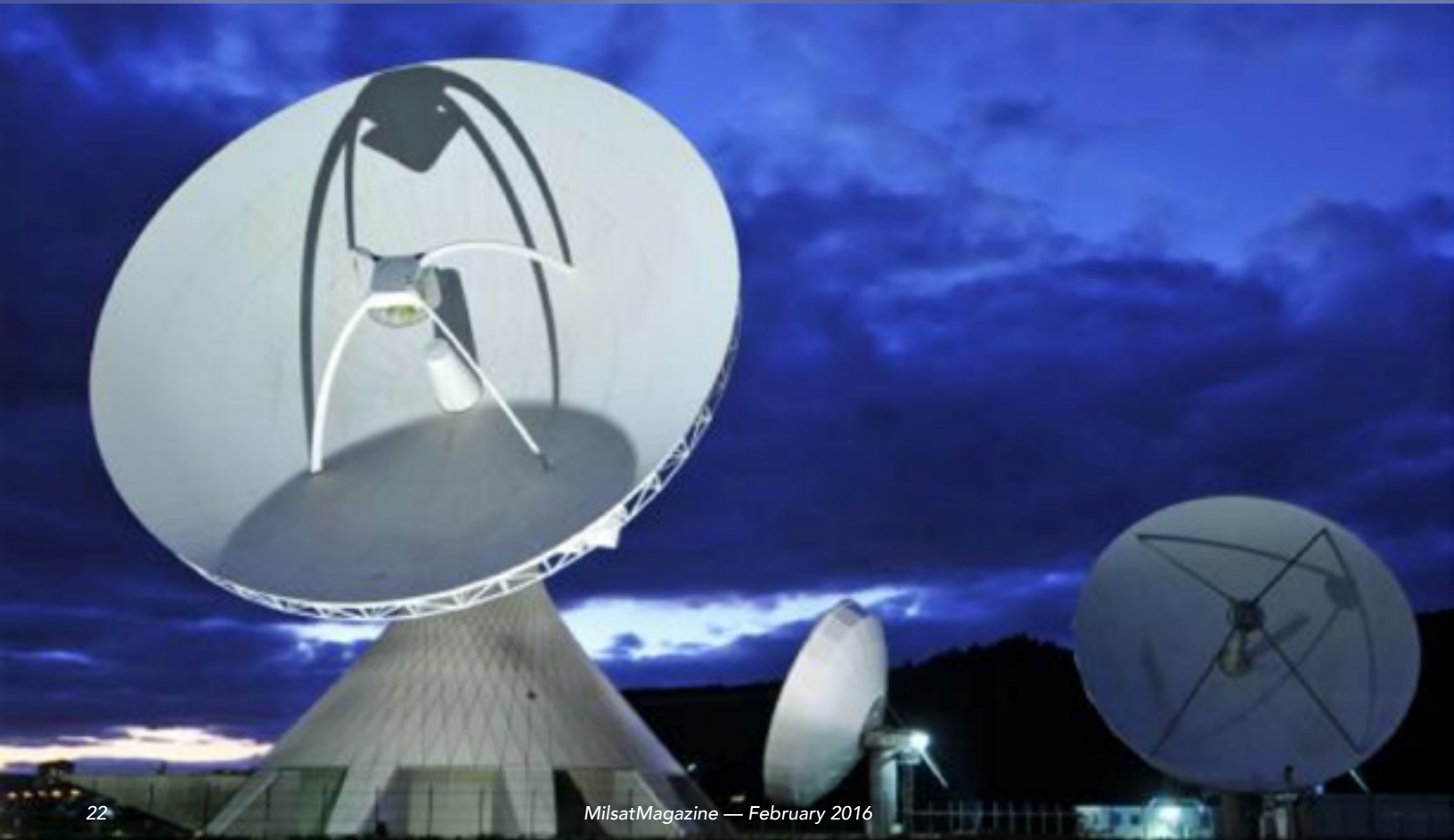
I had personal friends in the industry and what they were doing seemed more exciting than other opportunities I was investigating at the time. Satellite and space seemed sexy. These friends made an introduction that led to the start of my satellite career at a teleport operator and space segment reseller, Verestar. At first, we were almost exclusively serving commercial customers such as Sprint and MCI. After 9/11, we assembled a dedicated government team to focus on the specific needs of the military and other agencies.

### MSM

Why did you decide to continue your career with Intelsat General?

### SKOT BUTLER

Coming to Intelsat General gave me the opportunity to work with people I knew and respected from across the commercial satellite industry. This was also a chance to work for a satellite operator, a good way to round out my previous experience with a teleport operator, capacity resellers, and integrators.



I have stayed with Intelsat General because of the tremendous opportunity here and the exciting changes in the commercial satellite sector and in the space industry generally. From high-throughput satellites to LEO constellations, to reusable launch vehicles and the Internet of Things, the satellite industry is an inspiring place to be right now.

#### **MSM**

*Given your senior company role in working with the DoD, civil as well and commercial agencies/enterprises, and with international organizations such as NATO, how do you ensure these various and sometimes confusing entities have the necessary information and benefits regarding IGC to competently make their best decisions as far as your firm's products/technologies are concerned?*

#### **SKOT BUTLER**

I often say that serving a large, diverse customer like a government agency, or a multi-national corporation can be like serving a board of directors of the Fortune 500. There are just so many recommenders and influencers and there is not always agreement on whom the decision maker is in the end.

That said, we build a focused campaign around the key stakeholders, making the rounds to be sure that all of their concerns are addressed, if possible. Our customers and end users can't physically touch most of what we provide, so our employees truly are our most important asset. They need to really uncover their customer's needs, sometimes by challenging long-held assumptions.

We also do a pretty good job of making certain we have the correct blend of satellite industry experts and former government agency employees who, as former customers, can provide important insight into user needs. These smart and talented people, combined with industry-leading marketing outreach—through our blogs, demos and white papers—ensure that the various customer groups have ready access to the information they need to make smart decisions.

#### **MSM**

*What are the most significant challenges you face in bringing your product to the military/agency/government (MAG) Environments?*

#### **SKOT BUTLER**

For a long time, the government looked at commercial satellite communications (COMSATCOM) as a last resort for their communication needs. We weren't really thought of as a partner and our satellites were not considered part of the government's space architecture.

While we still have further to go, there certainly has been significant improvement and commercial satellites are now a big part of the day-to-day operations of the government's communications network.

I think the real turning point will come when commercial satellite capabilities are incorporated into the U.S. government's space architecture. Satellite communications—particularly wideband—is the most obvious mission area where our industry can make a significant impact, but there are others such as Space Situational Awareness, satellite bus operations, and hosted weather sensors, to name a few. A unified infrastructure would allow both the government and industry to make long-term plans and investments.

#### **MSM**

*What do you see as the key ways that the US government can best benefit from working with the commercial satellite industry in the coming year?*

#### **SKOT BUTLER**

We had good news at the end of last year as the Pathfinder II program survived the budget process and I understand the Air Force is targeting spring for an RFP.

Also, an RFI to operate the WGS satellites was submitted in late 2015 and we are hoping to see an RFP for the commercialization of WGS bus operations in the first half of this year.

Next, the fate of the Air Force Satellite Control Network (AFSCN) continues to be debated. Current thinking seems to be leaning toward a commercial augmentation of the network, rather than a commercial replacement. We would be happy to participate in either of those projects.

#### **MSM**

*What is the commercial industry doing to ensure the DoD's information security standards are met?*

#### **SKOT BUTLER**

Intelsat made information security a top company focus over a decade ago, creating a Chief Information Security Officer position before many other companies had even thought of security as an issue. We have generally been ahead of where the government wants industry to be in this area.

Our new high-throughput Intelsat Epic<sup>NG</sup> satellites have a technologically advanced digital payload that increases efficiency as well as mitigates jamming and unintentional interference. These satellites will use powerful, narrow spot beams with smaller footprints that are harder to exploit as well as wider—125 MHz—bandwidth segments that support a greater range of protected waveforms, including those being developed by the U.S. military.

We also participate in government-industry forums like the Commercial Space Information Security (INFOSEC) Working Group to ensure we are compliant and to make certain that we help shape the policy to achieve the desired results with the least amount of business disruption. Overall, we are very well positioned to meet, and in many cases exceed, security requirements mandated by the DoD and our other customers.

#### **MSM**

*What acquisition reform steps are still needed for the USG to save as much money as possible when using commercial SATCOM?*

#### **SKOT BUTLER**

We would like to see government customers making pre-launch and longer-term commitments when they acquire satellite services. By leasing commercial satellite bandwidth in this way, the government would not only save significant amounts of money, they would also reap the benefit of having the most up-to-date technology available to them.

Whereas the WGS system is now using technology that is 10 to 15 years old, commercial satellites are designed and built in three-year timeframes, making our technology much more advanced, particularly important in today's contested environment.

owned and operated wideband government constellation, that would be a positive message to the commercial satellite operators that we are now thought of as part of the long-term architecture.

We are already considering USG needs in our technology roadmap. Being designed into the architecture from the start provides an opportunity to accelerate enhancements that might be more interesting or applicable to government users than commercial customers, such as additional protection features.

#### **MSM**

*With the first Epic satellite coming on line in 2016, how will this help Intelsat General provide better service to the USG?*

#### **SKOT BUTLER**

The key benefits of Intelsat Epic<sup>NG</sup> over traditional communications satellites are increased performance, better economics, and increased accessibility. Serving the government end user means driving more throughput and satisfying more bandwidth-intensive applications with ever smaller terminals that are more mobile.

Intelsat Epic<sup>NG</sup> can meet those needs extremely well and also brings additional security, as outlined above. Another important benefit is that by enabling the use of smaller terminals, Intelsat Epic<sup>NG</sup> can accommodate a smaller class of UAVs with Beyond-Line-Of-Sight (BLOS) SATCOM.

#### **MSM**

*How do you see the role of smallsats supplying MAG needs in the future and will Intelsat General be working within this technology sector?*

#### **SKOT BUTLER**

Intelsat's investment in OneWeb will allow customers to seamlessly switch from the Intelsat GEO satellites to the small LEO spacecraft operated by OneWeb. This interoperability will give our government customers broadband connectivity through the polar regions that are not accessible to GEO satellites.

Similarly, OneWeb will be able to hand off traffic to Intelsat capacity over the equatorial zones—the region where GEO spectrum has priority, and a hurdle otherwise difficult for other LEO constellations to overcome. We think this will be an exciting complementary service and will greatly benefit our government customers.



*Artistic rendition of the Intelsat-35e satellite. Image is courtesy of Boeing.*

#### **MSM**

*The role of Hosted Payloads continues to be a most crucial discussion. Would you please discuss Intelsat General's approach to hosted payloads and how you believe the growth of hosted payloads acceptance by the MAG community will bring relief to comms support factors?*

#### **SKOT BUTLER**

We have provided three hosted payloads for different government agencies over the past decade. But significant growth in the use of commercially hosted payloads for the government has been somewhat constrained for a couple of reasons.

Hosted payloads require advance planning and funding. And, getting a hosted payload into space is tied to commercial satellite launch schedules. The timing and the funding have to synch up pretty precisely and that is difficult, though clearly not impossible.

Returning to my previous theme, an architecture that included some combination of free-flying government assets, hosted assets, and commercial capacity would help solve the planning and funding problem and would provide additional incentive on the timing issue.

#### **MSM**

*Is Intelsat General working on some new hosted payload missions and, if so, could you tell us about those projects?*

#### **SKOT BUTLER**

IGC is one of several companies that won a follow-on study contract for the NASA Tropospheric Emissions Monitoring of Pollution (TEMPO) hosted payload. The purpose of the study is to provide NASA with additional information to refine the TEMPO instrument's spacecraft interface and mission design.

We are actively exploring multiple hosted payloads opportunities that are now at various stages of maturity, but I am not ready to discuss those details at this time.

#### **MSM**

*Given your wealth of experience in our industry, when you review your career, what project or projects truly bring a smile of satisfaction to you?*

#### **SKOT BUTLER**

From a personal perspective, the work I did as part of the team working with the Australian Defence Force on the UHF payload was satisfying. We brought a lot of value to our customer that can and should be replicated by the U.S. government.

Another high point occurred when we were able to move a satellite halfway around the globe for the DoD to support the war in Afghanistan. This is where owning and controlling assets really provides the ability to make an impact. This was gratifying to make such a significant contribution to our country's defenses.

[intelsatgeneral.com/](http://intelsatgeneral.com/)



## NSR ANALYSIS: A NEW UAS PARADIGM

By Prateep Basu, Analyst, NSR India

**U**nmanned Aerial Systems (UAS) have been utilized for more than three decades, but only recently has their diversity increased, with explosive growth in small UAS (sUAS) sector.

The impact of these sUAS on satellite services such as Communications and Earth Observation (EO) is difficult to assess, and even more so with the increasing technological sophistication in both satellites and UAS.



### UAS INDUSTRY VALUE PYRAMID BY AIRFRAME TYPE

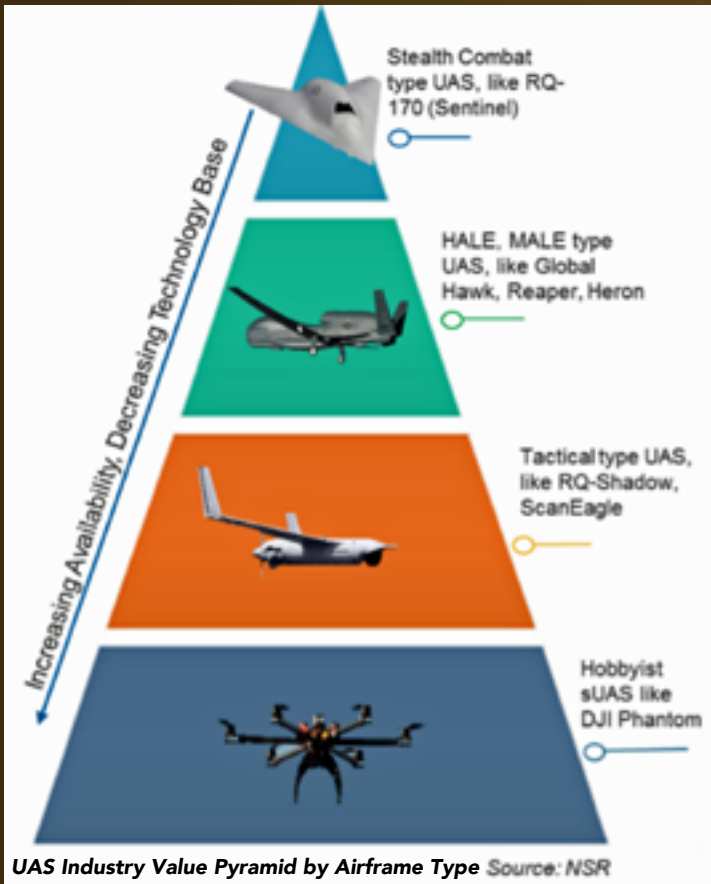
In NSR's *UAS Satcom & Imaging Markets, 2nd Edition* (<http://www.nsr.com/research-reports/satellite-communications/uas-satcom-imaging-markets-2nd-edition/>), UAS markets were analyzed and two segments were assessed: UAS for SATCOM and UAS for Imaging.

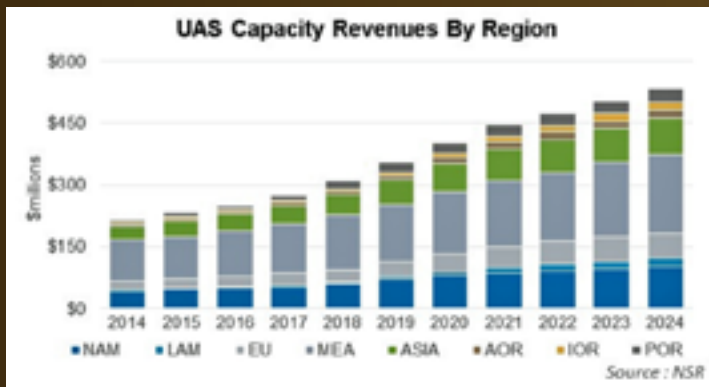
With the mainstream media focusing on these UAS and other High Altitude Platforms (HAPs) due to the involvement of tech-giants such as Google and Facebook (who want to provide Internet to the unconnected), along with a booming sUAS market that has seen acquisitions and investments by established companies like Intel and Amazon, NSR believes the UAS industry will be an externality for satellite industry growth.

### UAS HELPS SATCOM MARKETS

HALE and MALE UAS like the Global Hawk and Reapers use SATCOM Common Data Links (CDL) for Beyond Line-Of-Sight (BLOS) communications, and have been a steady source of revenues for GEO communication satellite operators. However, with payloads such as SAR, EO/IR cameras, and applications such as full-motion video (FMV), the bandwidth needs of UAS have risen tremendously, though the airframe designs haven't evolved to take advantage of HTS services as of yet.

The usage of inclined satellite capacity, especially over regions where demand is high (like Africa and the Middle-East) has alleviated costs for the U.S. DoD, which operates the largest fleet of such UAS.





In the same UAS report, NSR found that photogrammetry applications (like creating a 3D point cloud or ortho-mosaics) have advanced rapidly and the turnaround time for image processing has decreased, which reduces the competitive advantages of satellite-based Earth imaging.

However, cost of sUAS imaging can be prohibitive for large corridor mapping and NSR sees a mixed approach being gradually taken by both sUAS and the satellite-EO industry, with image fusion creating layered maps for vertical markets, such as agriculture, energy, and resource management. Thus, sUAS imaging can be expected to push the satellite industry's penetration into new markets, but to also act as a pull for growth due to the competing nature of the technology.

**BOTTOM LINE**

UAS have revolutionized the way wars are fought and now sUAS are commoditizing imaging and consumer data analytics. Some have touted this decade as "the one" for UAS, given explosive growth in all types of airframes, avionics, and associated software.

As the fastest growing sector in aerospace, NSR expects the UAS segment to act both as a 'push' and a 'pull' for the satellite industry, with SATCOM for UAS generating the bulk of the revenues and sUAS imaging leading the innovation on the technological front.

[nsr.com](http://nsr.com)

*Based in Bangalore, the silicon-valley as well as the space city of India, Mr. Basu joined NSR as an analyst in 2014. He has authored the first edition of NSR's Unmanned Aircraft Systems study and has been a co-author of the fifth edition of Satellite Manufacturing & Launch Services report. His area of expertise and interest include launcher and satellite manufacturing, UAVs, Earth Observation, and Fixed Satellite Services markets.*

*Mr. Basu comes to NSR after completing a 'Masters in Science' from the International Space University, Strasbourg, in the area of 'Space Studies.' Prior to attending ISU, Mr. Basu had a two year term with the Indian Space Research Organization (ISRO) as an engineer at the spaceport of Sriharikota, where he worked on six launch missions of the PSLV, and as a system engineer for the GLSV MK-III project. He has also worked closely with ISRO as an intern in the areas of launch vehicle engineering and business development at various centers across India, like the Vikram Sarabhai Space Centre (VSSC), Liquid Propulsion System Centre (LPSC), and the commercial wing of ISRO, Antrix, while pursuing his 'Bachelors in Technology' in the field of 'Aerospace engineering' from the Indian Institute of Space Science and Technology (IIST), Trivandrum.*

*Mr. Basu has collaborated with research labs in India and abroad in varying capacity, and has published his works in international journals and at conferences on subjects ranging from computational fluid mechanics to space policy and climate change. He holds international certifications in the field of Supply chain management and project management, and has been a speaker at various industry organized user meets.*

However, NSR expects a transition to GEO-HTS for these UAS from the mostly FSS Ku-band equipment and, in particular, to GEO-HTS Ku-band due to the easier retrofits required.

Apart from lower cost/bit and more bandwidth, GEO-HTS is naturally resilient to signal jamming as there are multiple beams that need to be jammed and that, too, from within an HTS beam's coverage area, which is only a few hundred kilometers wide, making such an attractive proposition for carrying UAS.

Additionally, the advancements in low profile, bandwidth efficient, and lightweight electronically steered antennas, combined with the nexgen of satellite modems, will bring about paradigm shifts in the way UAS are operated.

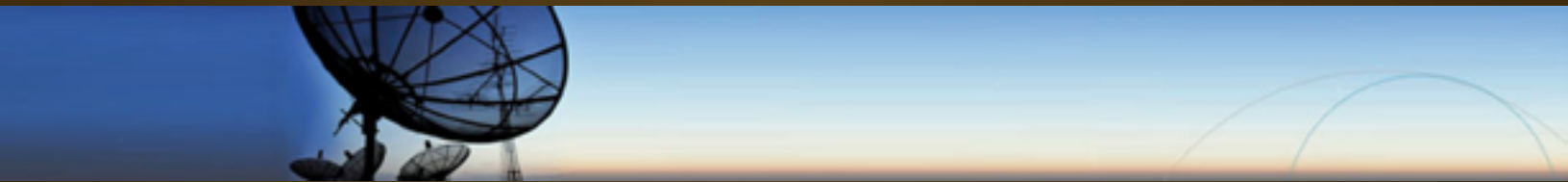
NSR expects satellite capacity to UAS revenues to grow to \$534 million by 2024, at a CAGR of 9.4 percent, largely driven by such changes in UAS operations on SATCOM.

**UAS IMAGING COMPETES WITH SATELLITE**

NSR analyzed the sUAS sector imaging applications market and noted opportunity in this industry resides in the software and services, which even the industry leader DJI understands by launching its operating system.

The biggest contribution of this upcoming sUAS industry has been the integration of technologies and the rate at which its refresh puts Moore's law in the backseat.

Recently, Precision Hawk, Verizon, Digital Globe, and Harris announced completion of phase 1 testing of an UAS airspace management system, using Digital Globe's high-resolution Earth images, Verizon's LTE network, and Harris' satellite-based surveillance (ADS-B) for safe UAS operations in civilian airspace. Such seamless integration and commercialization of satellite and terrestrial technology opens the gates for a multitude of applications, specifically those related to Internet of Things (IoT), by using the UAV as a sensor.





# GOVSAT INSIGHTS: EMPOWERING UAV MISSIONS WITH HTS



By Larry Simon, Senior Director of Government Satellite Solutions, SES GS.

**T**he United States military is most effective and successful when it can accomplish missions that ensure the security of the country and its people while sustaining as few casualties to American service personnel as possible—this is the reason that Unmanned Aerial Vehicles (UAVs) are so widely used in the military today.

The United States military owns thousands of UAVs. This includes UAVs manufactured by General Atomics, such as the Predator, Grey Eagle, and Reaper.

One element all of these UAVs have in common is the ability to conduct tactical military operations in theater without exposing American military personnel to danger. Another common thread is a need to be connected to a remote pilot—something that’s accomplished in many instances through commercial satellite communications (COMSATCOM).

Since WiFi or line-of-sight communications aren’t available, or simply won’t work for piloting and transmitting the data from UAVs (for obvious reasons), satellite is the best and most effective option. As sensor performance improves and customer requirements increase, transmission rates for UAV data is rapidly growing, driving up the amount of satellite bandwidth being consumed as well as the cost for these communications.

However, with a new generation of satellites being launched, the military could be poised to more effectively meet the growing data transmission requirements of the UAVs at an even lower cost than what is available today.

The next generation of satellites—known as High Throughput Satellites (HTS)—use tens to hundreds of small spot beams instead of the one large coverage beam of traditional geosynchronous (GEO) satellites. While these HTS beams are smaller in coverage area, they are grouped together to cover large areas, and each smaller beam delivers significant benefits over traditional GEO satellites.

This new technology enables frequency reuse and thus higher capacity for the satellite. This is a more efficient use of spectrum and increases the number of users per satellite. That, in turn, reduces the cost per bit for the COMSATCOM operator and effectively slashes the cost to enable the communications between a UAV and the unit’s operator.

Cost efficiency is essential for these missions for several reasons.

First, the federal government is seeking ways to save money whenever and wherever such can be accomplished, all due to shrinking budgets. This savings can be reinvested into the UAV programs and missions to effectively deliver increased performance without an increase in cost.



This means that, for the same budget, the military can receive higher quality video and images and more accurate intelligence, which can enable better and more informed decisions.

Secondly there's the issue with security. As many of the speakers at the SatCon Conference shared—including Lt. Gen. John "Jay" Raymond—space is no longer an uncontested environment. There are many threats to satellites and to satellite communications that can drastically impact the military's ability to conduct operations and even threaten UAV missions.

Luckily, HTS satellites can assist in this area.

HTS satellites, by their very nature, are more resilient. Instead of a jamming single satellite beam, there are many separate beams that need to be jammed—not such an easy task. Also, jamming needs to be done from within a beam's coverage area, which is only a few hundred kilometers wide for an HTS satellite.

Jamming a beam is much easier to accomplish when the coverage area includes 10 to 20 countries instead of a half of a country. With HTS satellites, being in the coverage area effectively means that bad actors looking to jam the communication will be geographically close to military forces.

Another advanced feature of many HTS satellites is a digital signal processor that replaces the waveguides and RF switches of older satellite designs. This processor is often called a Channelizer or a Digital Transparent Processor (DTP). This technology enables HTS satellites to quickly and effectively reconfigure the satellite to meet customer demands, to nullify jamming signals through nulling of the interfering signal or to quickly relocate the operational users to other frequencies.

With their ability to operate more effectively, efficiently and securely, HTS satellites are clearly the future for UAV operations. Unfortunately, current UAVs are not designed to take advantage of HTS satellite features. However, this enabling technology is advancing rapidly and it won't be long before the military is able to take advantage of these new communication capabilities.

As discussed earlier, HTS satellites don't use large, single beams that cover significant geographic areas. Instead, they use multiple spot beams that are smaller in coverage area and overlap slightly with one another to form a continuous coverage area. As the beams overlap, each beam needs to use a different frequency or polarization to prevent interference with the adjacent beams.

As ISR platforms, manned or unmanned, cover great distances in a single mission, they travel through several HTS beams. As ISR platforms move from beam to beam, they must change frequencies or polarization. This creates a challenge for today's UAVs, as they are not outfitted with modern SATCOM equipment that enables them to do this.

Many of the UAVs that make up the military's current fleet were procured a decade or more ago with SATCOM equipment optimized for wide area coverage beams. At the time, there was no need to change SATCOM frequency or polarization in flight. As a result, today's UAVs simply are not capable of switching from spot beam to spot beam and cannot take advantage of the efficient and resilient capabilities of HTS.

Although not a simple or inexpensive fix, upgrades can be applied to existing UAV fleets in order for them to work with HTS. To accomplish this capability, modems aboard UAVs and their associated ground systems can be upgraded to today's advanced, frequency agile, terminals.

Unfortunately, the military has yet to pull the trigger on upgrading their UAV fleet to embrace this cost saving, higher efficiency satellite technology. This delay limits their ability to take advantage of the improved performance and higher value HTS capabilities offer.

With HTS coming online, the increasing need for high-performance UAVs, in combination with the challenged government fiscal environment, now is the time for the military to take the first steps towards embracing HTS for UAV missions. Thankfully, this is a process that can be done incrementally, over time.

HTS that are coming online today for COMSATCOM operators are hybrid satellites that offer both traditional GEO wide-area coverage and HTS spot beams. This ensures that traditional GEO satellite connectivity will be available for UAV missions as the upgrade process occurs, while providing flexibility to the military moving forward.

For additional details on the differences between traditional GEO satellites and HTS, and to learn more about the use cases for HTS in the federal government, download the HTS briefing entitled, "High Throughput Satellites for U.S. Government Applications" at this direct link: [ses-gs.com/govsat/resources/high-throughput-satellites-u-s-government-applications/](http://ses-gs.com/govsat/resources/high-throughput-satellites-u-s-government-applications/)

*This article is republished, courtesy of GovSat Report ([ses-gs.com/govsat/](http://ses-gs.com/govsat/)), and Executive Editor Ryan Schradin. He is a communications expert and journalist with more than a decade of experience and has edited and contributed to multiple, popular, online trade publications that are focused on government technology, satellite, unified communications and network infrastructure. His work includes editing and writing for the GovSat Report, The Modern Network, Public Sector View, and Cloud Sprawl.*

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# AN INTERORBITAL SYSTEMS DOUBLE ROLL-OUT

By Randa Milliron, Co-Founder and Chief Executive Officer, Interorbital Systems

**A**fter its successful first commercial launch in 2014, Interorbital Systems' CPM TV has been refitted and repurposed as the CPM-G (Common Propulsion Module-Guided) to carry out in-flight guidance system testing.

The CPM functions as both a stand-alone sounding rocket/test-bed and as the basic construction unit for the company's NEPTUNE orbital launcher: Interorbital's bundled modular launch vehicle.

With a planned spring 2016 launch, Interorbital Systems (IOS) will meet the second of three pre-orbital launch milestones prior to conducting its third flight-trial: a space-altitude suborbital flight projected for mid-year. In addition to serving as the main in-flight guidance system test, the March/April launch will carry 11 commercial smallsat units, all running hardware and comms tests for their Q4 2016 orbital launch on IOS' NEPTUNE modular rocket system—which itself is undergoing testing against the rigors of launch in the rocket series' first orbital mission.

Each of the remaining 2016 test flights has been booked to capacity, as have IOS' first five orbital launches. The current orbital manifest includes 125 small satellite payloads from around the world. Rather than relying strictly on computer simulation, in-flight testing is a superior method of proving the functionality and robustness of launch vehicles, first in suborbital mode, then in full orbital mission flight configuration.

This methodology provides the actual performance data that will verify Interorbital's NEPTUNE NanoLauncher has past the technology milestones that will make it fully operational and will initiate the company's goal of lowering orbital launch costs ten-fold.

Payloads on-board the 2016 Q1 suborbital guidance-test launch include...

- A 3U CubeSat from Boreal Space WayFinder II carrying a set of hosted materials-science and electronic equipment payloads
- A 3-U CubeSat from UNAM National Autonomous University of Mexico
- A 1U CubeSat the University of Zacatecas, Mexico
- A 1U TubeSat from Mexican Space Collective carrying ULISES I music project
- SpaceBooth's SpaceSelfie Project (Belgium)
- NASA CubeQuest Challenge TEAM MILES / Fluid&Reason, LLC
- GLXP Team SYNERGY MOON's 1U TubeSat

The current IOS orbital launch manifest includes 125 TubeSats and CubeSats; many of these builders are flying multiple spacecraft:

- Advanced Media Arts and Sciences/  
The Science Project, Inc., Japan
- University of Sao Paulo, Brazil



Interorbital Systems' engineers complete work on the reusable rocket testbed, IOS CPM-G (Common Propulsion Module-Guided), for its upcoming launch.

Photo is courtesy of IOS.



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- NASA CubeQuest TEAM MILES/Fluid & Reason
- Naval Postgraduate School: TubeSats as ad-hoc orbital communication nodes
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- *The Golden iPod, spaceweather.com, Bishop, California*
- *Pakistan's I CUBE-1 Series, Islamabad Science and Technology Institute*
- *Boreal Space, California / Wayfinder III*
- *Space Lion RUFs, Sweden*
- *Solarex (UK)*
- *Ars Technica/Ars Orbital; and MITRE Corporation*

## **THE INTERORBITAL WAY**

To adequately test guidance system software and control hardware in action before launching a full-scale rocket in a flight test, IOS is using its Google Lunar X PRIZE Lunar Lander, VIRUS-1, to prove systems' performance and

vehicle control in tethered and low-altitude flights.

The test flight program provides Interorbital with real-time, in-flight data as well as allowing customers to test their spacecraft against G-forces and vibration in a real-world launch scenario, rather than through the second-best and questionable choice of simulation only.

Flight opportunities on the spring 2016 launch are sold out. IOS' final test-flight before orbital launch services begin will be a mid-year space-altitude suborbital launch testing the rocket's telemetry and deployment systems in an actual space environment.

More than a dozen smallsats are already booked for the flight above the Karman Line, with 70 kg of space available for smallsat payloads up to 4U in size. This launch will provide approximately 8 minutes of good quality microgravity.

Additionally, the IOS' Moon Launch contract list includes the SYNERGY MOON GLXP Lunar Mission and the LUNAR BULLET Ranger-style lunar impact mission in collaboration with Princeton researcher/space artist Ed Belbruno, founder of Innovative Orbital Design, Inc.

Plus, by popular demand, a private-sector lunar sample/return mission that will also deposit the first cargo of building materials on the Lunar surface intended for use in establishing Interorbital Systems/ Trans Lunar Research's first corporate Moon Base.



**[interorbital.com/](http://interorbital.com/)**



# MOBILE METEOROLOGICAL TESTING MISSION UNDERWAY



By Tina Stillions, U.S. Navy, Space and Naval Warfare Systems Command

**T**he testing comes in advance of delivering the capability for operations with the U.S. Marine Corps Reserves.

Ten fielded systems have provided Marine Corps units with time-sensitive battlespace awareness in multiple operational missions already, including the Global War on Terrorism.

The Meteorological Mobile Facility (Replacement) Next Generation (METMF(R) NEXGEN) system is helping to ensure that coalition warfighters have the weather information they need to make tactical battlefield decisions.

As part of the Marine Reserves' materiel arsenal, METMF(R) NEXGEN systems provide the necessary meteorological information at the fidelity required for military operations.

Unlike weather prediction in the civilian world—that focuses almost exclusively on making accurate forecasts in data-rich environments—weather experts in the military must contend with areas of operations that have sparse data while they maintain a strong cybersecurity posture.

Military meteorologists have to consider the cybersecurity aspects of all their incoming sensor data streams, their internal processing of software databases and applications, and their outgoing information products disseminated to the warfighters.

Corrupted or compromised weather information could cause leaders to make incorrect choices that would adversely affect the safety and performance of people and their equipment.

By providing authoritative, accurate weather data, the METMF(R) NEXGEN system reduces the uncertainty factor associated with the dynamic nature of weather conditions in the operating area, while simultaneously offering decision makers assured, secure information that directly contributes to promoting and maintaining confidence in their ability to monitor the weather conditions in the battlespace.

The METMF(R) NEXGEN system includes its own set of tactical weather sensors that detect and measure various types of weather phenomena that affect troop movements on the ground or in the air in the combat zone.

Thunderstorms, dust storms, precipitation, winds and cloud cover often influence mode and route of travel for both friendly and enemy forces.

Capabilities inherent in the system allow Marines in combat or humanitarian assistance/disaster relief scenarios to immediately sense and obtain the physical environmental data they need.

*"The challenge for PEO C4I/PMW 120 is to provide our Navy and Marine Corps customers with equipment that helps them quickly determine, in a dynamic combat environment, if Mother Nature is a friend, a foe or a neutral*

*bystander,"* said Tom Piwowar, the meteorology and oceanography (METOC) capabilities lead in PEO C4I's Battlespace Awareness and Information Operations Program Office (PMW 120).

Though weather might seem to be a factor outside the normal warfighting realm, METOC data significantly contributes to one of the three information warfare pillars: battlespace awareness. (Integrated fires and assured command and control are the other two.)



*U.S. Marines establish a weather radar system that supports a metrological mobile facility.*

*U.S. Marine Corps photo by Sgt. Anthony J. Kirby*



*The Mobile Meteorological Facility (Replacement) Next Generation (METMF(R) NEXGEN) is a U.S. Marine Corps mobile tactical meteorological system designed in a sheltered HMMWV in support of the Marine Air Ground Task Force (MAGTF).*

Navy Capt. Mike Roth, who also works in PMW 120's METOC program, explained that giving decision makers the most *accurate current and predicted state of the physical environment, regardless of the region in the world* "gives us a home field advantage even at an away game."

METMF(R), the previous system, saw extensive use in Operation Iraqi Freedom with five systems dispersed at various locations across Iraq. It also saw limited action in Afghanistan with one deployed system that was replaced when the current NEXGEN came online.

Special Purpose Marine Air-Ground Task Force operations in Kuwait are currently supported by the more modern NEXGEN system.

*"Both generations of these systems have been deployed and placed primarily as aviation assets in support of tactical airfield operations. But now they are used more in support of the Marine Air-Ground Task Force operations throughout the theater for ground forces and air assets,"* said U.S. Marine Corps Maj. Jack Morgan, Jr., who works in PMW 120 as the METMF(R) NEXGEN system assistant program manager and has used the system in combat zones.

Accurate weather information also plays a vital role in humanitarian assistance/disaster relief.

The METMF (R) NEXGEN was deployed in support of several such efforts, including the 2011 Japan earthquake and subsequent tsunami and nuclear disaster; the Philippines' devastating Typhoon Haiyan in 2013; and the earthquake that hit Tibet in April 2015.

Accurate environmental data allows response teams to choose the best times for certain actions, helping them avoid putting more people in harm's way.

The current system undergoing the GAT is the 11th and final of the systems scheduled for delivery to the Marines. Ironically, one of the biggest benefits of the next generation system, compared to the METMF(R), is its smallness.

Over time, the system has evolved to increasingly smaller configurations. What once required five Conex vans now fits into a single Humvee-based shelter.

"The primary differences between our previous system, METMF(R) and the METMF(R) NEXGEN have to do with mobility, scalability, ease of setup, size and its first in self-power capability," said Morgan.

"Both the new and old systems offer a unique capability in otherwise data-sparse areas by providing organic weather satellite, Doppler weather radar, upper air sensing and remote and local weather observation collection capabilities."

Once the system completes the GAT process, PMW 120 will ship it to the U.S. Marine Corps Reserves onboard Naval Air Station Joint Reserve Base in Fort Worth, Texas.

That transition is scheduled to occur in the second quarter of fiscal year 2016.