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July / August 2015

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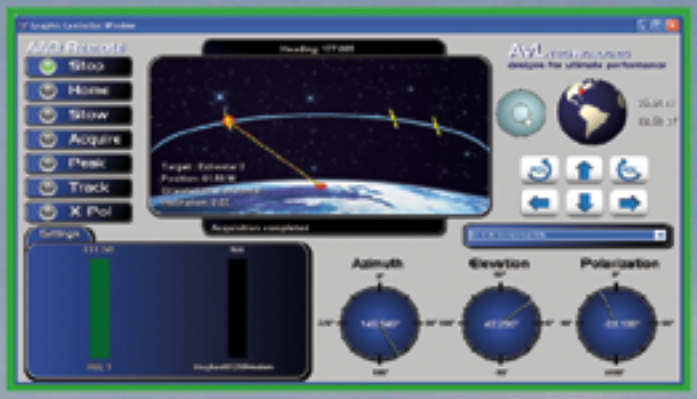

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BUILDING ISR NEEDS INTO SPEC OPS PLANNING

By Kathleen Jeffery, Director, Global Network Solutions, Intelsat General Corporation

The growing deployment of special forces continues to drive ISR demands higher, leading to greater reliance on more satellite bandwidth.

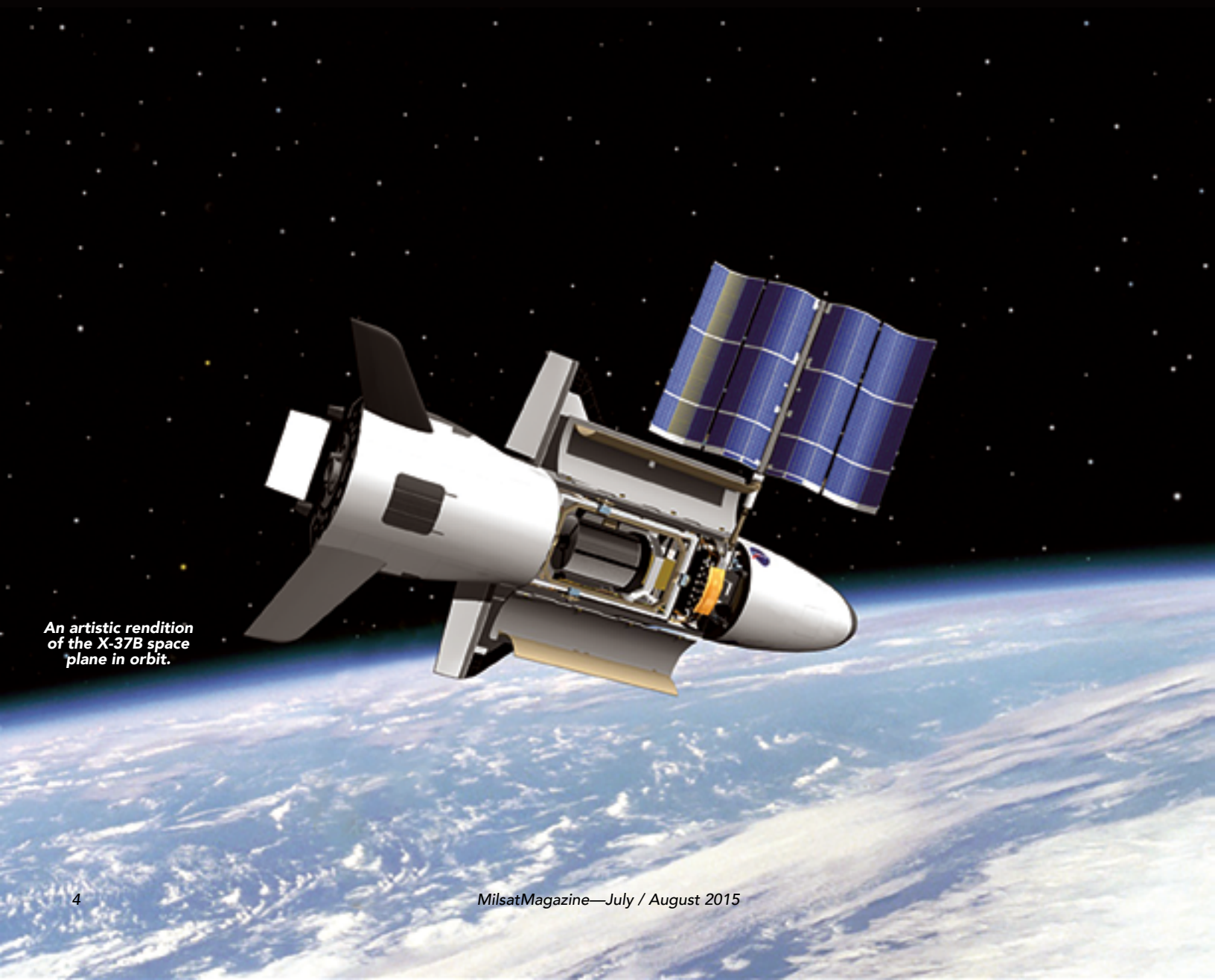
However, with the new budgetary climate, U.S. Special Operations Command (SOCOM) must plan more carefully for all of its missions, including how to ensure these critical communications move forward.

That was the clear message coming out of the NDIA's Special Operations Forces Industry Conference earlier this year. Col. Matt Atkins, head of SOCOM's intelligence capabilities and requirements division, called the demand for ISR "insatiable," while also saying more planning is required for how to best meet the need:

"In the post 9/11 environment there was really a dizzying investment in ISR, as folks rushed capabilities to the field in huge numbers and often with not a lot of foresight," Atkins said. "Now in the new, more austere fiscal environment, we sort of have to make sense of what's in the inventory.'"

Atkins also told SOFIC attendees that SOCOM is asking for industry input on how to best enhance the data transmission between ISR platforms and the warfighter on the ground. This requirement will see changes soon, where performance will dramatically increase thanks to next generation High-Throughput Satellite (HTS) systems such as Intelsat's Epic^{NG} becoming operational next year. The improvements will mean more throughput delivered to smaller antennas in the field, along with increased resilience and the opportunity for continuous technology refresh.

Beyond special forces, DoD clearly knows the vital role of ISR and has started to implement another ISR platform to greatly enhance situational



An artistic rendition of the X-37B space plane in orbit.

awareness. This highly advanced resource, the Air Force's X-37B space plane consumes huge amounts of satellite bandwidth.

Not much detail is available about this classified project beyond the fact that it can stay aloft for months and then land like a conventional aircraft. As explained in a recent Washington Post article, the X-37B is yet another example of how critical space has become to national defense:

"Space is so vitally important to everything we do," Maj. Gen. Tom Masiello, the commander of the Air Force Research Laboratory, Space and Missile Systems Center, said in a recent statement. "Secure comms, ISR [Intelligence, Surveillance and Reconnaissance], missile warning, weather prediction, precision navigation and timing all rely on it, and the domain is increasingly contested."

The article also quotes Air Force Lt. Gen John Raymond describing space as a "warfighting domain," with other countries actively working to erode the U.S. advantage in space.

As special operations continue to become a major military focus in the coming years, the commercial industry welcomes the opportunity to work with DoD and Allies to plan for maintaining current ISR superiority.

Kathleen Jeffery has been with Intelsat General for more than nine years and is responsible for sales to the company's large, integrator customers who support the DoD and civil agencies.

DISPATCHES

ISRO'S PSLV-XL LAUNCHES FIVE BRIT SATELLITES, INCLUDING SSTL'S DMC3/TRIPLESAT

The final assembly and build phase of the DMC3 Constellation satellites at SSTL's cleanrooms in Guildford UK.
Photo is courtesy of SSTL.

Surrey Satellite Technology Ltd (SSTL) announced that on July 10, 2015, three, 1 meter resolution optical Earth Observation satellites that will form the DMC3/TripleSat Constellation were successfully launched by ISRO.

The satellites were placed into a 651km sun-synchronous Low Earth Orbit (LEO) by a PSLV-XL launch vehicle from the Satish Dhawan Space Centre, Sriharikota launch site in India. The launch agency is ANTRIX and the Indian Space Research Organisation (ISRO).

Sir Martin Sweeting, Executive Chairman of SSTL, said, "These new satellites are the latest and the most advanced of SSTL's Earth Observation spacecraft mounted on a PSLV rocket dedicated to our mission—it was really exciting to be able to push the green button for launch and see them off into orbit!"

Following confirmation of separation of all three spacecraft from the launch vehicle, the ground station at SSTL's Spacecraft Operations Centre in Guildford, United Kingdom, and at Svalbard successfully established contact with the satellites.

SSTL's engineers will now start the commissioning of the platform systems on board the three satellites, with commissioning of the imaging payloads commencing once platform commissioning is complete.

The three spacecraft use the 450 kg. SSTL-300S1 series platform. The agile SSTL-300S1 platform provides 45 degree fast slew off-pointing and is capable of acquiring multiple targets in one pass using multiple viewing modes.

The very high resolution imager on board the satellites was designed and manufactured by SSTL and will provide 1 meter ground sampling distance (GSD) in panchromatic mode, and 4 meter GSD in multispectral mode, with a swath width of 23.4 km.

The final assembly and build phase of the DMC3 Constellation satellites will be at SSTL's cleanrooms in Guildford, United Kingdom.

The three satellites will be phased 120 degrees apart around the same orbit using their on board propulsion systems within three months after the launch; thus, with off-pointing capability, the DMC3/TripleSat Satellite Constellation will be able to target any location on Earth once per day.

In addition, the wide swath width of the satellites provides the best combination of spatial resolution and time resolution—aiming at stimulating operational monitoring applications, such as urban planning and intelligent management, based on changes detected by timely and regular cloud-free, very high-resolution imagery.

The Twenty First Century Aerospace Technology Company Ltd (21AT), a commercial Earth observation satellite operator based in Beijing, has bought the imaging capacity of the three satellites.

The cooperative contract for the DMC3/TripleSat Constellation was signed in London in 2011 and witnessed by the UK Prime Minister and China's Premier.

Mme. Wu Shuang, CEO and President of 21AT, said, "This is the first step of our long march and we are looking forward to the commencement of our BJII data services following the completion of the commissioning of the DMC3/TripleSat Constellation."

isro.org/

sstl.co.uk/

DISPATCHES

MOBILE CLASSIFIED CAPABILITY FROM THE DOD NOW OPERATIONAL

The Defense Department's classified mobility capability, delivered through a partnership between the Defense Information Systems Agency and the National Security Agency, has moved out of the pilot stage and is now operational, said Kim Rice, DISA's Mobility Portfolio Manager.

Defense Mobile Classified Capability – Secret (DMCC-S) enables users to access classified voice and data, up to the secret level, from anywhere in the world. The latest release, version 2.0.5, builds on the previous service offering by providing improved call interoperability, failover, and the introduction of a mobile device management (MDM) system for an enhanced security posture.

DMCC-S is the replacement capability for the Secure Mobile Environment Portable Electronic Device (SME PED) system, which DISA will shut down July 30 as part of DISA's commitment to achieve fiscal efficiencies by eliminating legacy and duplicate services. The agency started replacing SME-PEDs and first-generation DMCC-S devices with the second generation DMCC-S devices and will continue this transition, along with supporting new customer requests, through the end of this year.

The agency's goal is to have 3,000 DMCC-S users by second quarter of fiscal year 2016.

"We're also providing a new secure mobile device, which features enhanced graphics, improved sound quality, and a longer battery life than earlier pilot devices," said Rice. DMCC-S secure mobile devices are commercial smartphones with some features, such as the camera, GPS, and Bluetooth, disabled. "The operational mobile classified capability brings us one step closer to the Joint Information Environment vision, where our warfighters and national level leaders can access a secure infrastructure and applications from any device, anytime, anywhere.

"This release is a big step toward being able to deliver secure mobile capabilities faster than we have ever seen before. In the near future, we expect to triple the number of active DMCC-S users."

OPTIMIZING THE MILSATCOM DOMAIN

By Rob Patterson, Vice President, Sales and Strategic Development, BraxtonTechnologies, LLC

When attempting to plan and optimize the allocation of scarce or expensive resources, the situation can be viewed as a problem of supply and demand. This perspective applies to many domains that include satellite tracking, transportation, energy, and, of course, one with which everyone can relate, the supply and demand of healthcare resources.

Delivering communications to the warfighter should also be viewed as a supply and demand problem: creating efficiencies and cost savings while supporting the warfighter's mission. Braxton Technologies has considered this problem, in concert with subject matter experts in several domains, and offers a unique perspective to address the supply and demand problem within the Military Satellite Communications (MILSATCOM) domain.

No matter how simple the concept seems, supply and demand must first be defined within the domain, as the variations of allocable assets quickly becomes complicated. At the macro level, MILSATCOM and Commercial Satellite Communications (COMSATCOM) supply equates to the space and ground assets available to support communication needs.

Various types of communications, protection levels, frequency bands, bandwidth, and a plethora of other aspects that are understood by most *MilsatMagazine*, must be addressed. In many cases, ground infrastructure resources are tightly coupled with the space segment. Demand refers to the requirements or requests for tactical or strategic communications, and includes voice, data, or video. Literally thousands of requests at any moment can represent the demand on the MILSATCOM infrastructure and, when considering COMSATCOM as an option, those commercial systems have other customer demands to manage, as well.

Organizing the resource structure is tricky with a domain this complex but is a critical step toward achieving optimal allocation of those resources. Ideally, the intent is to create a resource tree structure with the basic type of communication at the top of the tree (i.e., Wideband, Protected, Narrowband, and even Commercial).

Figure 1. MILSATCOM Resource Structure

The second level includes the specific systems: Wideband Global SATCOM and Defense Satellite Communications System under Wideband; Milstar and Advanced EHF (AEHF) under Protected; and MUOS under Narrowband.

Under the Commercial tree, the orbital regime at the next level (Geo vs. Leo) with the level after that organized by the owner-operator's constellations may be considered. The structure continues to the point where a specific

resource is allocated (a transponder for example, or even a channel). Each of the lowest level resources is further defined by the effect they provide (voice, messaging, data, and even big data). However, what can make this structure powerful is to create categories and subcategories of allocable resources that cross over between constellations and major communication types.

For example, an approach that crosses DoD and commercial constellations requires an understanding of the assets available for a specific request or requirement. Therefore, when a request is presented for a communications type, all available assets which meet the request are considered.

Tasks to which the resources are allocated represent the demand side of the equation, either through a persistent/strategic requirement or an immediate/tactical request for communications. On the surface, tasks within the MILSATCOM domain may appear simple: a user needs to communicate with another entity from time A to time B.

However, the task request can get complex as a system considers the basic type of communications needed to complete the mission. Such communications can include the level of security, the equipment available on the ground or within the weapon system, and even the location, altitude and speed of the warfighter requiring the communications. To ensure that the proper demand of all resources is presented and the correct resources are allocated, the specific request must be detailed, directly down to the exact constraint within the request.

Constraints generally align with the task request and include the details specific to the MILSATCOM domain to allow allocation of an exact resource type, including bandwidth, frequencies and more. There are two constraint types that apply to nearly every resource domain, including MILSATCOM: the window constraint and the time-specific constraint.

The window constraint allows the system some flexibility to allocate the resource while considering other requests—for example, a warfighter needs specific communications but can actually use the communication any time during a specified window.

A time-specific constraint, on the other hand, could involve a submarine surfacing or a ground mission occurring at a specific time—in this case, the allocation of exact resources is essential when considering all the demand for the resources across the MILSATCOM enterprise.

In a nutshell, the appearance is that every aspect of the resource allocation process within the MILSATCOM domain is "complex"—but far worse is ahead. Defining the relationships between resources and the tasks (say, the user on the ground) is especially complex when considering the allocation of orbiting space resources.

Compounding the problem is the orbiting space asset that often has a direct relationship with another ground asset (for instance, a Globalstar satellite and a gateway). Resource allocation is significantly impacted by the geometrical relationships between the resources and the targets.

These relationships limit the availability of a resource to perform the required task. Referred to as the "feasible region," the system performs allocations across the enterprise while calculating the relationship of a resource to the target.

Orbiting objects and fixed ground assets present one problem, but what if the communication resource moves in a sub-orbital fashion (e.g., an aircraft), eliminating the use of pure math and known models to predict the exact location of the resource? This is a complex, but critical, aspect of the planning, whether long term or real-time.

Another key component of the resource allocation problem is to consider the objectives that need to be solved within the MILSATCOM domain. Flexibility is essential, but the system's ability to solve for more than one objective also enhances the system's effectiveness.

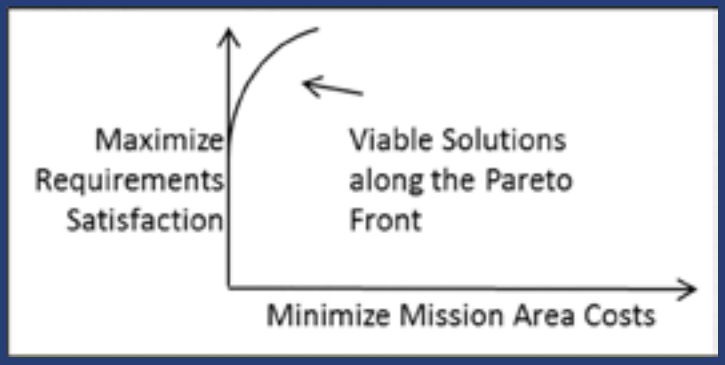


Figure 2. Example1 Objective Functions

For example, one valuable objective is to satisfy as many communications requirements and requests as possible, or even to satisfy all requirements or requests placed on the MILSATCOM enterprise at any point in time. Another objective is to reduce the cost or allocate the resources in the most affordable manner possible. Affordability could mean the system allocates more (or less) commercially available resources.

Use of more than one, or even several objectives at a time, allows the analyst, planner or commander to address many higher-level requirements, including objectives that appear to be in direct conflict with each other. Therefore, is a system that can perform such a function suitable for long-term planning and real-time decisions? The answer is… partially.

For long-term planning, the MILSATCOM enterprise can facilitate decisions such as the use of commercial versus DoD assets, repositioning a specific asset to a new orbital slot (while considering the cost of the maneuver), or even planning for a new constellation (quantitatively providing information on the exact effect needed and where it should reside). All of these decision types are applicable to such a system, providing a unique picture for the planner.

For real-time operations, today, there are terminal limitations that constrain a user's flexibility to cross the domains between wideband, narrowband, and protected… and commercial… resources for specific tasks. Given that, in the short term, significant benefit could be gained instead from optimization among MILSATCOM's major resource types. This would likely result in more efficient allocation of resources and would also free up scarce resources in a single domain where another, more abundant domain can fill the specific mission requirement, enabling far more cost-effective optimization.

In the longer term with greater terminal flexibility, space operators and combatant commanders could have immediate awareness on the stress within the MILSATCOM enterprise, in whole or in part. For example, if an anomaly occurs, operators and commanders could have real-time situational awareness and the system could even automatically provide a reallocation of the resources in response to the anomaly. Additionally, the operator and the commander could see the identical picture at the exact same time as the systems could be networked together, synchronizing the data.

Imagine a system that can provide such visibility and power to the MILSATCOM enterprise. Imagine such is not a custom system, requiring no new software code, but only data consumed by a powerful optimization engine. Imagine if decisions required only seconds, or even less, to complete.

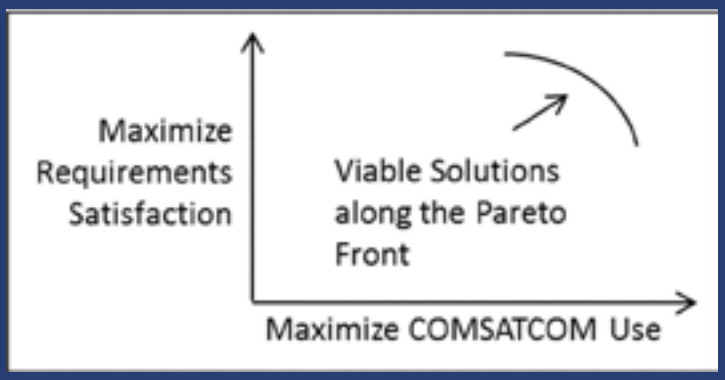


Figure 3. Example 2 Objective Functions

As part of an Air Force Research Laboratory (AFRL) Small Business Innovation Research (SBIR) Phase I contract, Braxton Technologies developed this very technology, which has been added to the company's existing product suite, Advanced Control Equipment (ACE) Premier™ (ACE Premier™). The product is called Intelligent Resource Optimizer (AceIRO).

Taking advantage of modern computing technologies, the AceIRO architecture provides for distributed operations and is an excellent candidate for parallel processing. At the core, and what provides the resource optimization, AceIRO uses a powerful multi-objective genetic algorithm.

Braxton designed AceIRO as a data-driven system and implemented a patent-pending resource domain translator, which allows even the most complex domains, such as MILCOM, to be translated to this powerful optimization engine. Today, Braxton Technologies is working with a number of subject matter experts within several domains to demonstrate the power and versatility of AceIRO.

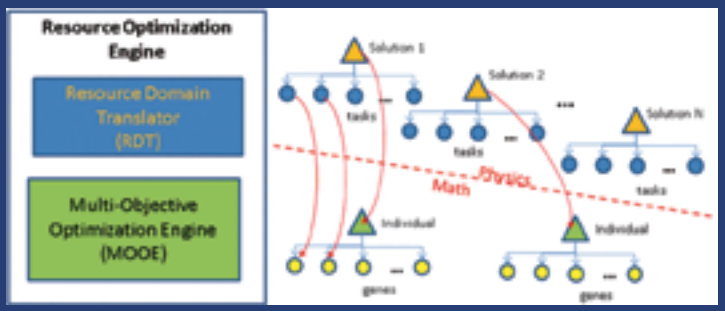


Figure 4. Braxton's Resource Domain Translator Separates the Physics and the Math

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DISPATCHES

A TRIO OF NEW SERVICE LEVELS FOR WARFIGHTERS

A new portfolio of scalable welfare SATCOM services for UK military personnel has been introduced by Airbus Defence and Space.

The focus of the new Wel2Go portfolio is to provide reliable, value for money and is easy to transport, deploy and operate private communication channels in the field.

The new mobile connectivity suite is part of the WelComE (Welfare Communications Everywhere) services provided to the UK Ministry of Defence (MoD).

The Wel2Go portfolio features three core services for various levels of deployments that will succeed in satisfying the future requirements of the UK MoD.

The Wel2Go Small solution is carried in a single lightweight backpack and features a small deployable node for reliable private VoIP, satellite and data network.

The system can be deployed and configured in less than five minutes and is an ideal solution for deployments of up to 60 people that require quick, flexible communications.

The Wel2Go Medium solution is a quick deploy VSAT (Very Small Aperture Terminal) system transported in aircraft hold approved cases.

Comparatively compact and lightweight, the system provides significant throughput for up to 300 users and is simple to setup and operate. It is perfectly suited for providing private VoIP and wireless connectivity for personal communication in temporary camps and can be moved easily to the next base of operations.

The third solution, Wel2Go Large is a full fixed VSAT connectivity for semi-permanent and permanent bases of operation. It provides high levels of bandwidth and network functionality meeting the requirement for personal communication for almost 1000 people via Internet Café facilities and Wi-Fi.

The Wel2Go Large solution is transported as a complete system in shipping containers, making it straightforward to deploy a camp-wide network almost anywhere in the world.

"Scalability is key to the WelComE concept," said Steve Kelly, WelComE Service Manager, Airbus Defence and Space. "Welfare communication is vital for military operations and humanitarian missions, but it's impossible to have a one-size-fits-all system. We have designed WelComE to provision voice and data connectivity for any requirements, supporting the welfare of troops and other personnel working away from home by offering a reliable connection with family and friends wherever they are based."

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REAL TIME ISR COMMS DEBUT

Global satellite bandwidth provider SES Government Solutions unveiled a comprehensive Netcentric communications solution for field-deployed units during a demonstration for U.S. Government customers last month.

By combining O3b's satellite broadband connectivity and RIVA Network's field deployable 4G nanoLTE solution, the SES solution delivers real-time HD video feeds and imagery files stored in the Cloud to individual members of remote field teams. The same link also allows those deployed teams to collect and send raw sensor and video data back to off-site data analysis and command centers.

During the demonstration, U.S. Government customers were able to use mobile phones and tablets outside of WiFi range and transport real-time video through the LTE bubble and stream the footage without delay over O3b satellites back to a cloud server located in Ashburn, Virginia. This setup allows for high bandwidth and broadband IP communications which include standard and HD video, ultra HD video, voice and teleconferencing. This mission-critical technology is compatible with any smartphone and paves the way for an increased use of mobile devices for military operations. In essence each Soldier, Sailor, Airman and Marine can be a sensor providing vital information to deployed units through the O3b system.

The RIVA Network addition to this demonstration provided another key capability to support U.S. Government forces. The sphere of connectivity is scalable with multiple nanoLTE nodes and ranges up to 22 miles, depending on the exact network configuration. All RIVA components for this particular demonstration are easily transportable. The solutions featured in the demonstration are available on SES GS's and RIVA Networks' GSA Schedule. The demonstration was attended by more than 50 U.S. Government guests and is the third consecutive successful demonstration of SES GS applications leveraging O3b's high throughput and low latency capabilities.

www.ses-gs.com

DISPATCHES

LOCKHEED MARTIN HAS MORE WORK AHEAD ON AEHF

Lockheed Martin Space Systems Co., Sunnyvale, California, has been awarded a $53,505,013 modification (P00680) for Advanced Extremely High Frequency (AEHF) system capability augmentation.

The contractor will provide mission planning functionality to support the AEHF transition from initial operational capability to full operational capability.

Work will be performed at Sunnyvale, California, and is expected to be completed by June 30, 2017.

Fiscal year 2015 research, development, test and evaluation funds in the amount of $30,824,748 are being obligated at the time of award.

Space and Missile Systems Center, Los Angeles Air Force Base, California, is the contracting activity. (F04701-02-C-0002).

Additionally, Lockheed Martin Space Systems Co. will also provide technical refresh of obsolete hardware and software of the AEHF mission control segment to support the post-initial operational capability transition to sustainment.

Work will be performed at Los Angeles, California; Colorado Springs, Colorado; and Philadelphia, Pennsylvania, and is expected to be completed by June 30, 2017.

Fiscal year 2015 research, development, test and evaluation funds in the amount of $31,802,865 are being obligated at the time of award. Space and Missile Systems Center, Los Angeles Air Force Base, California, is the contracting activity. (F04701-02-C-0002)

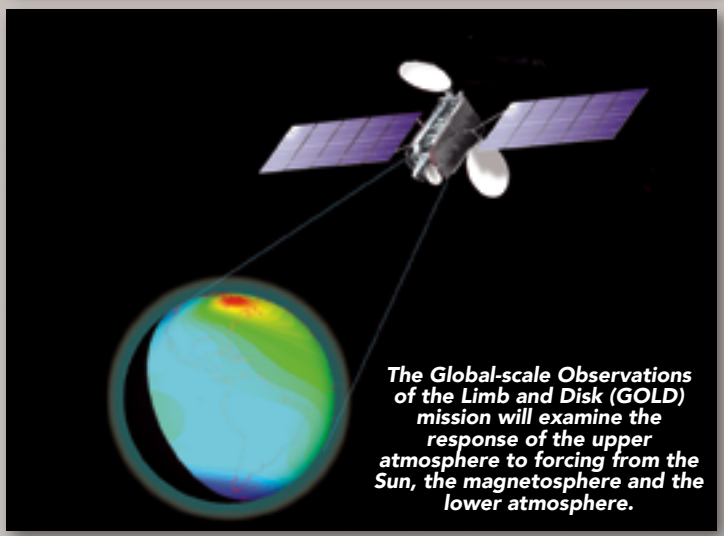
lockheedmartin.com/

HPA CORNER: THE HOPS ID/IQ CONTRACT

By Rich Pang, Senior Director, Hosted Payloads, SES Government Solutions

The concept of hosting government payloads on commercial satellites is gaining wider acceptance, as has been demonstrated by the recent announcements of two upcoming hosted payloads on two separate commercial communications satellites.

Those satellites are the Federal Aviation Administration's (FAA) Wide Area Augmentation System (WAAS) payload on SES-15 and the NASA-funded, Global-Scale Observations of the Limb and Disk (GOLD) payload on SES-14.



The Global-scale Observations of the Limb and Disk (GOLD) mission will examine the response of the upper atmosphere to forcing from the Sun, the magnetosphere and the lower atmosphere.

In July of 2014, the Space and Missile Systems Center (SMC) made a significant decision to begin regularly including hosted payloads as an option in all future mission architectures by awarding 14 companies with ID/IQ contracts to host government payloads on commercial satellites.

However, the first fully funded mission being competed on the contract is not an Air Force payload, but NASA's Tropospheric Emissions: Monitoring of Pollution (TEMPO) mission. Although TEMPO is a fairly large payload with strict orbital location requirements, many government-funded science missions are finding commercial hosting as a viable and cost-effective method for achieving their objectives.

Competed for and selected in 2013 under NASA's Explorer announcement of opportunity, the primary purpose of the GOLD mission is to modernize the understanding of the space environment by filling the critical gap in knowledge of Sun-Earth connections. The hosting contract for GOLD includes integration, test, launch and two years of on-orbit operations, with options to extend operations on an annual basis.

Although not released through the HoPS contract, the buzz generated by the activities before, during, and after have led to other hosted payload contracts as well. The FAA has contracted to host WAAS payloads on Eutelsat 117 West B (formerly SatMex-9) and SES-15 through its prime contractor, Raytheon Integrated Defense Systems.

The WAAS hosted payloads will serve as air navigation aids to augment the Global Positioning Systems (GPS), with the goal of improving its accuracy, integrity and availability. Both of these contracts include construction, integration, and test of the WAAS payload, launch, and eleven (11) years of on-orbit operations with options to extend on an annual basis.

This column's question for HPA Members is…

From your perspective as members of the Hosted Payload Alliance, how have SMC and HoPS facilitated the advancement of hosting government payloads on commercial satellites? What more can be done?

"SMC has taken an important first step by providing a contract vehicle that any U.S. Government entity can use to procure hosting services from a list of pre-qualified providers, overseen by a talented group of space professionals. The HoPS standard contract structure and deliverable set creates an excellent framework to expedite the acquisition and contracting process. It is incumbent upon the mission program offices to include hosted payloads as an alternative in their architecture trades and be prepared to have funding in place to take advantage of the cost, schedule and risk benefits hosted payloads offer, much like NASA is doing with the TEMPO payload.

"The HoPS contract vehicle is an enabler for deploying space assets for pennies on the dollar but its long term success will be measured by the number of actual missions flown. This is a new way of doing business, so a slow start is not unexpected."—***Allen Lindsay***, Vice President, Responsive Solutions, National Business Unit, **Harris Corporation.**

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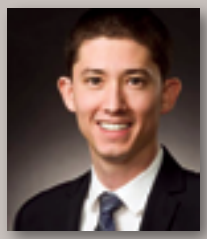
"Standing up the Hosted Payload office and issuing the HoPS IDIQ was an important and forward-thinking step in increasing the visibility of commercially hosted payloads for government missions. In order to more fully utilize the HoPS program and commercially hosted opportunities, I would like to suggest two ideas.

"First, the government needs to include commercial hosts when conducting Analysis of Alternatives (AoA) for future space-based missions. This means engaging commercial owner / operators early and often throughout the AoA studies, and selecting commercial hosts at least as a partial solution to the overall space-based architecture for a space mission. This will enable the government to leverage the benefits commercial space can provide, such as space access and operations at a fraction of the cost of a mission architecture that's designed to use only dedicated satellites, and re-purpose limited O&M dollars for other USG space mission priorities.

"Second, the timelines at which commercial industry drives new satellites and capabilities to space, and the accompanying processes to support these activities, are not necessarily aligned to match government acquisition strategy decision points. Ideally, USG space-based missions that plan to leverage commercial hosts should plan to finalize requirements and have funding to begin six-to-nine months prior to commercial owner/operator contracting for a new satellite build. This may require more flexibility in Congressional funding and acquisition policy as opportunities for commercial space access are driven by a dynamic market.

"Quarterly discussions with commercial satellite owner/operators would be an excellent way for the HPO to understand the commercial space business case process and contracting timelines to leverage commercial opportunities, as more space missions adopt hosted payloads into their architectures. Commercial industry wants to be part of the solution and regular dialogue will help the government anticipate and leverage tremendous opportunities in commercial access to space."—***Eric Moltzau***, Senior Principal Director, **Intelsat General Corporation**.



"The SMC HoPS program has provided a vehicle to help standardize contracting and contractor performance measurement for hosted payload LEO, MEO and GEO programs. It is the most comprehensive effort to date to establish this type of standardization. As the Government and Industry move on the learning curve, more will be done to define requirements early and minimize design impacts to the commercial spacecraft."—***Chris Jewell,*** Business Development Manager, **Lockheed Martin.**

"The HoPS office has successfully brought a number of hosted payload opportunities to industry's attention, maximizing their chances for successful hosting. Additionally, the existence of the HoPS contract has established credibility to the Government's commitment to hosted payloads, incentivizing investment on the part of industry partners—both service providers and manufacturers alike—to make hosted payloads part of our product line approach.

"Although some great work has been achieved though HoPS study tasks, contracts for host rides have been slow to materialize, particularly with military users. An influx of studies are being done for government program offices on alternative solutions, but none as of yet have resulted in a clear path forward on mission architectures. This is slowing the uptake on HoPS because these payloads have yet to be defined.

"Plus, there are actually excellent payload candidate payloads available for hosting, but currently no channel exists for industry to suggest these concepts and designs.

"HoPS should be expanded to include contractor-furnished payloads, where industry can propose the build of both the payload and the host ride. This would get the Government closer to the one-bellybutton approach it desires by adopting commercial practices. It also would transition Government architectures more quickly to the diversity and resilience that is needed in this current budget and threat environment."—***Hayley McGuire***, Deputy Director, **Boeing Advanced Government Space Systems.**

The Benefits Of Hosted Payloads

A hosted payload is a portion of a satellite, such as a sensor, instrument or a set of communications transponders that are owned by an organization or agency other than the primary satellite operator. The hosted portion of the satellite operates independently of the main spacecraft, but shares the satellite's power supply, transponders, and in some cases, ground systems. The concept of a hosted payload was developed in order to enable government organizations to make use of commercial satellite platforms in order to save costs and create a more distributed architecture for space assets.

About the HPA

Established in 2011, The Hosted Payload Alliance (HPA) is a satellite industry alliance whose purpose is to increase awareness of the benefits of hosted government payloads on commercial satellites. The HPA seeks to bring together government and industry in an open dialogue to identify and promote the benefits of hosted payloads. The HPA:

- ***Serves as a bridge between government and private industry to foster open communication between potential users and providers of hosted payload capabilities***
- ***Builds awareness of the benefits to be realized from hosted payloads on commercial satellites***
- ***Provides a forum for discussions, ranging from policy to specific missions, related to acquisition and operation of hosted payloads***
- ***Acts as a source of subject-matter expertise to educate stakeholders in industry and government.***

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DISPATCHES

LINES OF COMMUNICATIONS ARE OPENED BEHIND THE SCENES

U.S. Marines, Cpl. Shea P. Nolan and Lance Cpl. Edward Y. Cho, stand in front of a Secure, Mobile, Anti-Jam, Reliable, Tactical-Terminal during exercise Talisman Sabre 2015 at Robertson Barracks, Australia, July 6. The exercise is designed to improve U.S.-Australian combat training, readiness and interoperability. Nolan, from Wallington, New Jersey, is a tropospheric scatter radio multi-channel equipment operator. Cho, from Dix Hills, New York, is a satellite communications operator and maintainer. They are with 7th Communication Battalion, III Marine Expeditionary Force Headquarters Group, III MEF, currently attached to 3rd Marine Expeditionary Brigade. U.S. Marine Corps photo by Lance Cpl. Mandaline Hatch.

Few plans survive contact with the enemy. No plan survives without a group of men and women standing behind the scenes tying all units together into a cohesive whole.

In order for Exercise Talisman Sabre 2015 to adhere to the commanders' plans, U.S. Marines with 7th Communication Battalion established communication channels in Australia before the majority of the personnel arrived.

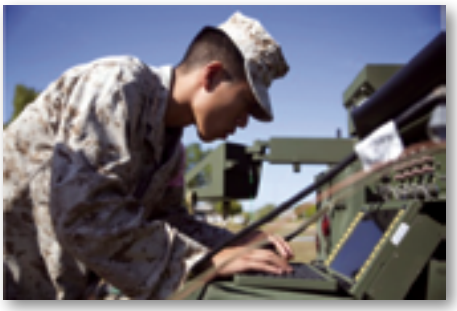
Talisman Sabre is a bilateral training exercise between the U.S. Armed Forces and the Australian Defence Force designed to improve interoperability and readiness. More than 33,000 personnel are involved in the biennial exercise.

While the role of Marines in the communication battalion is often overlooked during exercises, there is no doubt communication is vital for any exercise. The main goal of communication specialists is to create a real-time transfer of data.

"You can't do anything without communications," said Cpl. Shea P. Nolan, a tropospheric scatter radio multi-channel equipment operator and maintainer with 7th Communication Battalion from Wallington, New Jersey. "If communications are down, then everyone else isn't able to do their job, so we are the vital link that keeps everybody together and keeps everything going."

In a military activity as large as Talisman Sabre, which includes a full gamut of ground, air, sea, intelligence, cyber and practically every military asset the nations control, communication becomes exponentially complex.

Talisman Sabre has units across the Pacific in Australia, Okinawa and Hawaii with more than 13,000 miles separating the locations. Communication specialists are using ground mobile force terminals to send data signals on multiple frequencies to a satellite located 30,000 miles in space. Transmissions are received through carriers on the satellite and repeated to other ground locations.



Lance Cpl. Edward Y. Cho, from Dix Hills, New York, performs maintenance operations on a Secure, Mobile, Anti-Jam, Reliable, Tactical-Terminal during exercise Talisman Sabre 2015 at Robertson Barracks, Australia. U.S. Marine Corps photo by Lance Cpl. Mandaline Hatch.

"We, as a communications battalion, allow everybody to join together to do their part in a cohesive manner," said CWO2 Robert M. Childree, an operations officer with 7th Communication Battalion.

During Talisman Sabre, time is essential. Vital information needs to be readily accessible at all times and communication makes that possible.

"We're not running letters by horse anymore. It's all about speed," said Childree from Hattiesburg, Mississippi.

In this day and age, the world is dependent on technology. Establishing a secure and ready to use network is a necessity. Without communication specialists, military commands would not be able to effectively lead their troops.

7th Comm. Bn. is with III Marine Expeditionary Force Headquarters Group, III MEF, currently attached to 3rd Marine Expeditionary Brigade for the exercise.

Story by Lance Cpl. Samantha Villarreal, III Marine Expeditionary Force / Marine Corps Installations Pacific

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TO SERVE + PROTECT: AUTONOMOUS SPACE DRONES?

By David Williamson, Director Strategic Systems, Tyvak Nanosatellite Systems, A Terran Orbital Company

Despite the events of September 11, 2001, the goals of the U.S. Air Force Long Range Plan 2020 still remain a high priority in defending the U.S.—perhaps even more so, as access to space has increased for our adversaries around the globe.

The Plan states, "the first priority is to protect our vital national space systems" so that they will be available to all warfighters when and where they are needed. Protection requires warning of possible threats (natural and man-made) to U.S. and ally space systems, receiving reports of possible attacks against satellites, cross-cueing other owners and operators, and directing forces to respond to a threat.

This need for protection also encompasses the ability to detect faults, assess, and repair space systems while on orbit due to a variety of anomalies. Force Enhancement, Space Control, and Space Support are key requirements for implementing this Vision and include the ability to effectively locate, identify and track space objects.

BACKGROUND

A concept article entitled, "*On-Demand InfoBot Companions for Autonomous Space Operations*", published in *Air Force Technology Horizons* (February, 2004), identified components of an architecture that leverages small space vehicles or 'companions' to services and protect larger space systems with this U.S.A.F. Long Range Vision in mind.

While technologically challenging at the time of publication, the concept was based on projected trending of picosatellite (pico) and nanosatellite (nano) capability advances. In particular, key technology enablers have advanced over the decade enabling precision pointing accuracy and control, high data-rate communications, substantial available power, and advanced on-board processing running lock step with Moore's Law.

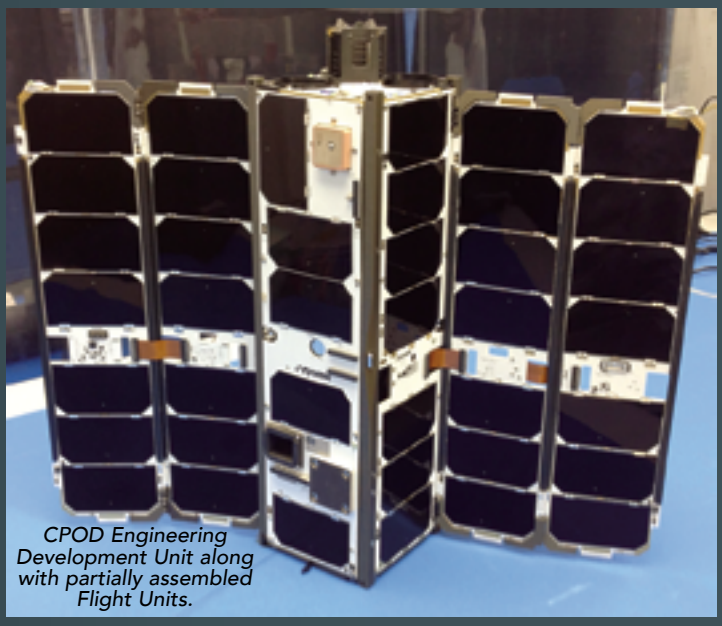
The culmination of these advancements, along with incremental on-orbit demonstrations (both successes and failures), led to capabilities hosted on a nano space vehicle previously held exclusively in the domain of larger spacecraft. One specific example is the CubeSat Proximity Operations Demonstration (CPOD) mission led by Tyvak Nano-Satellite Systems (a Terran Orbital Company) developed to demonstrate rendezvous, proximity operations, and docking of two 3U CubeSats on behalf of NASA's Small Spacecraft Technology Program, and Space Technology Mission DIrectorate.

CUBESAT PROXIMITY OPERATIONS (CPOD) DEMO

The CPOD mission uses a pair of identical 3U CubeSats as a proof of concept for maturing advanced rendezvous and proximity operations (RPO), docking, and propulsion technologies for nanosatellites. The mission is tailored to validate and characterize a suit of sensors for RPO that include visible imagers, infrared imagers, GPS, and radio ranging.

CubeSat Proximity Operations Demonstration (CPOD) Engineering Development Unit undergoing Qualification Testing. Photo is courtesy of Tyvak Nanosatellite Systems.

CPOD also uses enabling techniques including onboard image processing (bearing, range, and pose), magnetic docking, cold gas propulsion, and autonomous maneuver planning.



CPOD Engineering Development Unit along with partially assembled Flight Units.

CPOD will demonstrate the ability of the two small spacecraft to remain at determined points relative to each other (called station-keeping) as well as precision circumnavigation and docking using imaging sensors and a multi-thruster cold gas propulsion system. Docking will employ a novel universal docking mechanism.

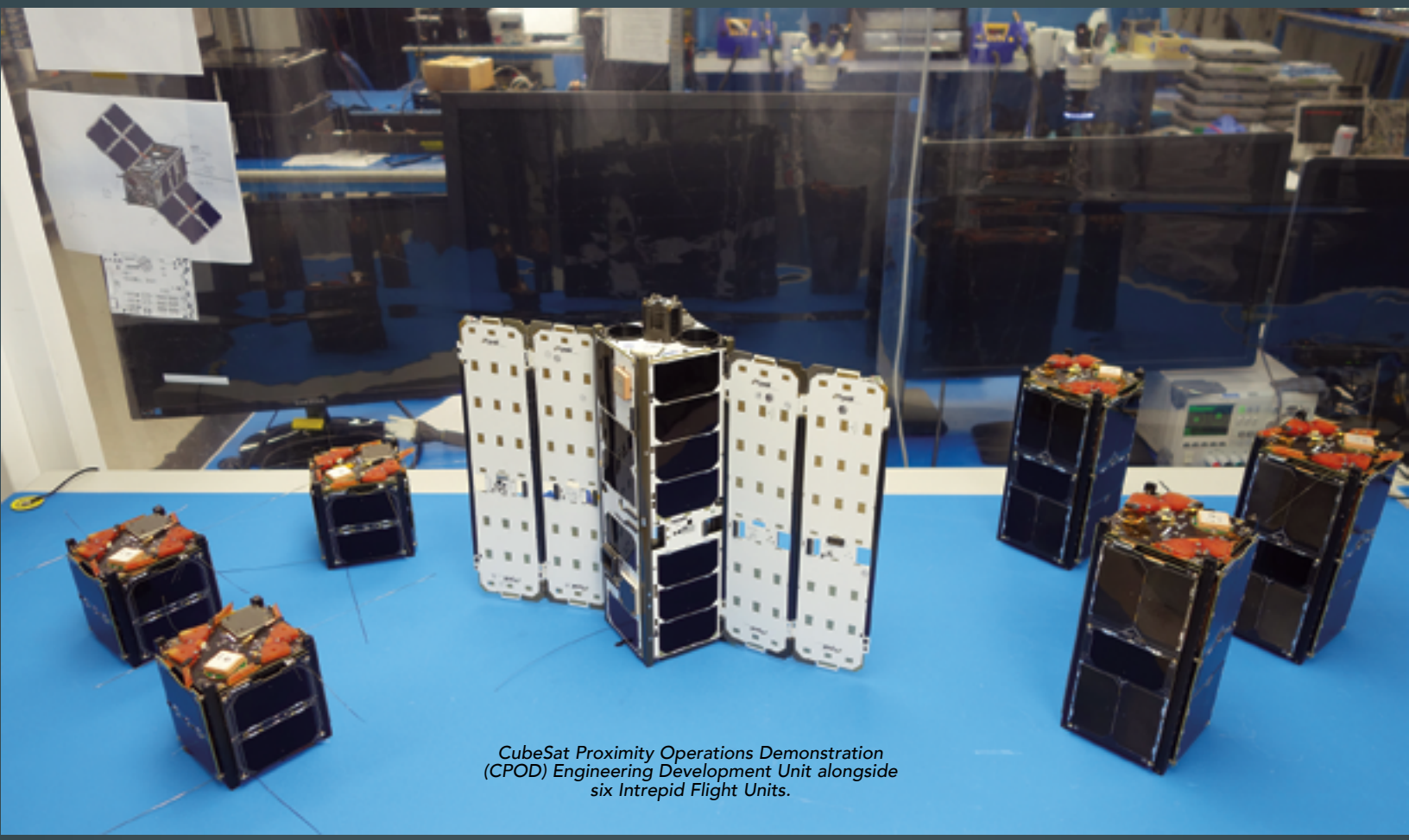
The ability of satellites to operate in close proximity to each other is an important capability to enable on-orbit inspection and servicing of satellites and allows multiple satellites to operate together in space. This capability also applies to a spacecraft maneuvering near a host spacecraft or other object on a science or exploration mission.

After a manifested 2016 launch, the two CPOD CubeSats will be released simultaneously into a common orbit and undergo checkout to ensure proper operation and maneuvering capability. Each satellite will use its space-to-ground data link to transmit visual images of the other satellite.

An inter-satellite link will share GPS and other data between the two spacecraft. Many of the proximity operations test scenarios will be performed autonomously using on-board processors and flight software for guidance, navigation and control. Using on-board navigation systems, one CubeSat will perform a series of circumnavigation maneuvers relative to the

second CubeSat in order to validate and characterize the sensor systems. After completing these maneuvers the two spacecraft will approach and dock using a unique mechanism to join the satellites together. Several docking maneuvers may be attempted during the mission including possible attachment to an uncooperative (*i.e.*, tumbling) satellite. The CPOD mission is currently in the final integration and testing phase.

Moving away from the domain of space situational awareness and control, the system performance enabled by CPOD allows for enhancing military Intelligence, Surveillance and Reconnaissance (ISR) services by incorporating payloads supporting tactical communications, data exfiltration, and EO imaging among others.



CubeSat Proximity Operations Demonstration (CPOD) Engineering Development Unit alongside six Intrepid Flight Units.

WHAT'S NEXT?

The CPOD mission demonstrates the key technologies envisioned in the "On-Demand InfoBot" article, mentioned earlier. In this capacity, a CPOD enabled space vehicle can operate as an autonomous space drone, or controlled by a user (also, operation in a "hybrid mode" is supported). This space drone can support debris inspection/removal, resupply, and spacecraft inspection, along with formation flying activities as an extension of the host satellites sphere of awareness.

For example, they can work in conjunction with their host's onboard autonomous threat warning and health assessment systems to provide on-demand (on the order of minutes to hours) servicing operations (*e.g.*, satellite awareness, anomaly isolation and resolution, and launch acquisition and deployment), protection (*e.g.*, natural and man-made threats), processing augmentation, and other space operations.

The future of space utilization for military purposes is bright, but there are concerns as well. Sovereignty for one. The exploding number of satellites on orbit will bring competition for orbit parking locations, frequency allocation and "basing rights" to distribute uplinks and downlinks to/from ground stations.

We must develop appropriate responses if others interfere with U.S. satellites. Today, enemy nations that can track satellites and fire significant payloads into space can place important satellites at risk using inexpensive direct-ascent weapons.* Emerging technologies, such as Tyvak's Nanosatellite systems used in NASA's CPOD program, will undoubtedly be a key to maintaining space-based superiority in high-risk scenarios for U.S. armed forces.

(*Source: ***fas.org/spp/military/docops/usspac/lrp/ch01.htm***)

Further information: ***tyvak.com/***

David Williamson is a leading subject matter expert in government system applications that leverage small satellites. He has more than 26 years of experience in supporting the Department of Defense, Intelligence Community and Civil sectors. He serves as the Director of Strategic Systems for Tyvak Nanosatellite Systems, a Terran Orbital Company.

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GLOBAL SPACE ENDEAVORS CONTINUE TO GROW, ENTHUSE + EXCITE

By Elliot Holokauahi Pulham, Chief Executive Officer, Space Foundation

You don't have to be a space geek to know that these are exciting times in the space community.

Hardly a day goes by without some cool story popping up in your online news feed, showing up in your email or being shared on social media. Even if you're a digital troglodyte, sifting through the ink and paper of your favorite newspaper or magazine, you can't avoid the daily stream of news and information about space.

The maturity and diversity of the industry, the degree to which commercial endeavors are driving new investments, the plethora of nations involved in space, and the infinite variety of business models, program designs and problem solving approaches, have come together to fuel a global space endeavor that continues to grow, enthuse and excite.

In its most gross measure—global space revenues—the industry has continued to grow as it has done every year since the Space Foundation began publishing *The Space Report: The Authoritative Guide to Global Space Activity (TSR)*. Although some years were better than others, the industry, as a whole, demonstrated a compound annual growth rate (CAGR) of seven percent from 2005 to 2014, nearly doubling in size over the course of the decade.

Our 2015 report delves into the details of an industry that grew to $330 billion in 2014. (In this, our 10th year of publishing TSR as a book, we are migrating all of the data going back to 2005 into a searchable, online database that will be updated continually, instead of once a year. (Subscriptions to the database will prove one of the best investments the space-data-hungry public can make.)

But you don't have to be a data hound to sense the changing landscape of space, particularly the megatrends of internationalization and commercialization, just in recent weeks.

PEOPLE @ THE TOP

Two of the most important space agencies in the world welcomed new leaders.

- *Johann-Dietrich Wörner, former head of the Deutsches Zentrum für Luft-und Raumfahrt (DLR), took the helm of the European Space Agency (ESA) from long-time Director General Jean-Jacques Dordain.*
- *Germany, which is a leading contributor to ESA and boasts a large space industrial base, confirmed Pascale Ehrenfreund as the new head of DLR.*
- *In Washington, D.C., the U.S. Senate confirmed Dr. Dava Newman as Deputy Administrator of NASA.*
- *Significant changes in leadership and structure are also under way in China's space enterprise, part of the larger, overall government reboot of President Xi Jinping.*

DEEP SPACE

- *The New Horizons spacecraft is presently speeding toward its closest encounter with the dwarf planet Pluto and every day brings new images revealing previously unknown features of Pluto and its near neighbors. A project of the Southwest Research Institute and NASA, New Horizons carries instruments from a variety of U.S. and international partners.*
- *Meanwhile, the plucky little Philae lander has awakened on the surface of comet 67P/Churyumov-Gerasimenko. Part of ESA's Rosetta comet exploration mission, Philae was built by DLR.*
- *NASA signed new agreements with international partners that will facilitate the development of the follow-on to the Mars rover, Curiosity.*
- *In Abu Dhabi, at the official launch of the UAE Space Agency, details on the new agency's first mission, a spacecraft called Hope that will journey to Mars, were shared with the world.*

NEAR SPACE

There's almost too much to keep up with in near-Earth space.

- *SpaceX won U.S. Air Force certification for its Falcon 9 launcher.*
- *The one-year ISS mission of NASA's Scott Kelly and cosmonaut Mikhail Kornienko passed the three-month milestone, and ISS crew members Anton Shkaplerov (Russia), Samantha Cristoforetti (Italy) and Terry Virts (USA) safely returned to Earth, even as Russian space agency Roscosmos investigates the loss of a Progress resupply module that was unsuccessfully launched on April 28.*
- *Another X-37B spacecraft was launched from Cape Canaveral, and India (ISRO) moved ahead with a reusable spacecraft of its own design.*
- *The launch of satellites small, medium and large for civil, commercial and national security operators continued at record pace. Despite the trumpeting of nanosats and cubesats as a panacea for virtually any application, smallsat pioneer Sir Martin Sweeting warned of a coming small sat "bubble" ala the housing and dot-com bubbles of the past.*

COMMERCIAL SPACE

- *The U.S. Air Force made significant moves toward more sustainable and affordable procurement of commercial satcom capacity, first by establishing a pilot program to embed commercial satcom expertise within the Joint Space Operations Center (JSPOC), second by taking over commercial satcom procurement from DISA and placing it in the hands of space procurement professionals at the Space & Missiles Systems Center (SMC) at Los Angeles Air Force Base.*
- *XCOR Aerospace entered into new payload contracts with Nanoracks, while construction of the new XCOR headquarters and operating site at the Midland, Texas, Commercial Spaceport draws closer to completion.*
- *Orbital Outfitters' new facility in Midland, which includes a spacesuit design and fabrication center, vacuum chambers for both payload sized and crew compartment sized testing and a fab center for mockups and other structures, also nears completion.*
- *A key component of NASA's commercialization plan, Commercial Crew, passed easily through the House of Representatives, but, at this writing, remains under-funded in the Senate.*

MORE COMMERCIAL SPACE

- *Underscoring the different approaches being taken by different space agencies, the UK Space Agency is girding for its biannual conference, this time in Liverpool, and with a keen focus on the UK's strategy of investing in space applications. I'm excited to be chairing a panel discussion on inland investments for export markets.*
- *Meanwhile the intersection of entrepreneurship and space technologies continues to grow by leaps and bounds—however, a big caution here: just as Sir Martin is cautioning about the Small Sat "bubble," a number of well respected investment gurus are also now warning of a larger "IT and Tech Bubble," including Mark Cuban, Bill Gurley of Benchmark Capital, and Marc Andreesen of Andreesen Horowitz. The Space Foundation will be bringing a sharp focus to these opportunities and challenges at our Space Technologies & Investment Forum, to be held in the San Francisco financial district September 30 and October 1. The event will bring together technologists and start-ups with angel investors, venture capitalists, and public and private institutional investors. See* ***www.spacetechforum.com*** *for details, or to request an invitation—this is a "by-invitation-only" event).*

ACCESS TO SPACE

- *Airbus Space took the wraps off its concepts for an Ariane 6 follow-on that will feature a recoverable propulsion and avionics module.*
- *The Airbus announcement follows in the wake of SpaceX testing its recoverable Falcon 9 core stage.*
- *United Launch Alliance (ULA) at the 31st Space Symposium announced that its new launcher will be called Vulcan and will rely upon a new engine being developed by Blue Origin, which will lead to a Vulcan model with recoverable propulsion and avionics.*
- *The Pentagon is pressing Congress to allow it to complete the purchase of Russian RD-180 rocket engines that are already contracted for, in the U.S., and partially paid for, to assure near team national security access to space.*
- *In the very heavy lift world, fabrication of Space Launch System (SLS) core stage components is under way at the Michoud Assembly Facility, booster stage components in Utah, and testing of the R-25 engine at the NASA Stennis Space Center.*
- *The challenges of assured access to space came sharply into sober focus on June 28, when a SpaceX Falcon 9 launcher, lifting a Dragon resupply capsule to the International Space Station, became the third different ISS supply vehicle in the past year to fail.*

OTHER NEWS

- *The Air Force and Lockheed Martin announced a satellite procurement, basing the service's newest infrared surveillance and missile warning satellites on the company's modernized A2100 spacecraft, an update that improves system affordability and resiliency and adds the flexibility to use future payloads -- all at no additional cost to the existing fixed-price contract.*
- *NASA and the U.S. Department of Energy signed a protocol that will speed their collaboration on potential planetary defense systems.*
- *The Planetary Society deployed its pathfinder solar sail satellite LightSail; the two-cube small sat successfully deployed its mylar solar sail.*
- *At the Paris Air Show, the Ukraine Space Agency announced a profound turn to the west, seeking to reduce its involvement with Russian space programs and develop new programs and partnerships with Europe and the U.S.*
  In Washington, D.C., the U.S. and China announced bilateral agreements including initiatives to collaborate in civil space, and in reducing debris and other threats to the space domain.

Not bad for the first month of summer, not bad at all. Of course, this is just a stream of consciousness, off-the-top-of-my-head, tip-of-the-iceberg kind of inventory. I haven't even attempted to cover the annual meeting of the United Nations Committee on the Peaceful Uses of Outer Space, which has just wrapped up in Vienna, or the GLIC event in Munich. If I've neglected to mention your favorite space development, program or milestone of June 2015, just let me know, and we'll include it in the next edition of *Space Watch* (***www.spacefoundation.org/media/space-watch***).

Until then, the *View from Here* is that the global space endeavor continues to grow, enthuse and excite. At the Space Foundation, we are excited about the future, and invite you to join us in our mission *To Advance Space Endeavors to Inspire, Enable and Propel Humanity*.

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.

Editor's note: Thanks to Space Foundation for allowing us to republish Elliot's column from their Space Watch infosite.

DISPATCHES

HARRIS MNVR TESTING COMPLETED DURING THE U.S. ARMY'S NIE EVENT

Harris Corporation's Mid-tier Networking Vehicular Radio (MNVR) has completed testing at the Army's Network Integration Evaluation (NIE) 15.2 held at Ft. Bliss, Texas.

The MNVR Limited User Test (LUT) was conducted to test the ability of Soldiers at the company level to effectively use the MNVR to talk and send data, images and video to the battalion and brigade levels.

Harris will review the results and incorporate changes as necessary before the Initial Operation Test and Evaluation in the spring of 2016.

The Harris MNVR, which uses the Wideband Networking Waveform (WNW) and Soldier Radio Waveform (SRW), operates as a node in a mobile network, so information can hop from one MNVR system to another until it reaches its destination.

At the LUT, battlefield conditions were used to determine how the WNW and SRW waveforms would perform with regard to message completion rates, latency and voice quality. Testers evaluated the radio using 23 different cases that ensured the network routing was properly configured.

"These tests are important because they subject the radios to a wide range of operational and environmental conditions that Soldiers may face during real-world missions," said George Helm, president, Department of Defense Business, Harris RF Communications. "The MNVR LUT is a great example of the benefits of defense marketplace competition because it demonstrates the value of private sector innovation to quickly bring better solutions from concept to fielding."

"MNVR meets the need of getting data down to the Soldiers," said Lt. Col. Stephen Dail, communications officer, of S6, 2nd Brigade Combat Team, 1st Armored Division (2/1 AD). "The fact that you have the ability to push out data from locations in the field and graphically get that information back to higher headquarters—which has the expertise to examine it and potentially get information back to the Soldiers while they're still on the ground so they can react—is a game changer."

www.harris.com/

GENERAL DYNAMICS IS IMPROVING THE WIN-T TECHNOLOGY

General Dynamics has received the first full rate production order from the U.S. Army to build additional Warfighter Information Network - Tactical (WIN-T) Increment 2 systems.

The $219 million order includes the production of more than 300 vehicle-based network communication nodes along with related equipment and materials. WIN-T Increment 2 is the Army's communications backbone providing secure, on-the-move communications, mission command and situational awareness for commanders and their Soldiers.

The order allows the Army to continue fielding WIN-T Increment 2 to Army units currently scheduled to receive the system.

WIN-T Increment 2 is integrated into Mine-resistant Ambush Protected (MRAP), High Mobility Multipurpose Wheeled Vehicles (HMMWV) and Stryker vehicles. To date, four division headquarters and 12 brigade combat teams have WIN-T Increment 2. The system successfully served Army units supporting the Security Force Assistance Brigades in Afghanistan by replacing the fixed communications infrastructure that was dismantled when the U.S. military closed its operating bases. Last summer, WIN-T provided the 'communications grid' for humanitarian operations responding to the Ebola epidemic in West Africa.

Production of the WIN-T system takes place primarily at General Dynamics' facility in Taunton, Massachusetts, and supports hundreds of jobs at General Dynamics and supplier locations nationwide.

More information about WIN-T, tactical radios, satellite communications and the cyber-defense products that make up the Soldier's Network is available at ***http://www.thesoldiersnetwork.com/***.

"WIN-T Increment 2 puts the power of the Soldier's Network into Soldiers' hands down to the company level, which is vitally important as the Army evolves into a more expeditionary force," said Chris Marzilli, president of General Dynamics Mission Systems. "As full-rate production begins, our engineering teams will continue working closely with the Army to upgrade technology and human-factors design, giving Soldiers a decisive information advantage wherever they are called to serve."

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Colonel Frank Scher, Chief Space Capabilities, Joint Space Command, **French Ministry of Defense**

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A GENERATION OF SERVICE TO THE WORLD… GPS

By Tech Sergeant Mike Slater, Air Force Space Command Public Affairs

Twenty years ago, the United States Air Force announced the Global Positioning System (GPS) had achieved Full Operational Capability (FOC).

As of July 17, 1995, a total of 24 satellites were on orbit, providing global 24-hour coverage. In the two-decades since, GPS has been woven into nearly every aspect of human activity, from military operations to sports.

At the time FOC was announced, GPS had already proved itself during Operation Desert Storm, allowing ground forces to navigate the featureless desert terrain. This was managed even though the system had only 16 satellites that provided about 19 continuous hours of coverage per day. Today, roughly two-thirds of all munitions being used to combat ISIS rely on some form of GPS guidance.

Artistic rendition of GPS III satellite. Image is courtesy of GPS.gov.

Artistic rendition of Navstar IIF satellite. Image courtesy of U.S.A.F.

Nearly 40 years ago, the Air Force launched the first Global Positioning System satellite, dubbed Navstar. However, even the most visionary of those involved with that first launch probably could not have guessed how much GPS would eventually impact the world.

"It is amazing how people continue to find new and innovative uses for the GPS signal," said Micah Walter-Range, Space Foundation Director of Research and Analysis. "GPS can be used on a personal level for summoning a taxi or ridesharing service to your precise location, or for letting your 'smart home' devices know when you are near your house so they can be ready and waiting for you. Businesses also rely heavily on the precision timing of the GPS signal, which enables companies to capitalize on the reliability and accuracy of an atomic clock for a relatively low cost," he said.

PART OF LIFE

GPS technology is woven into nearly every area of modern life, from banking to farming, from complex military operations to how athletes train. According to the Global Navigation Satellite Systems Agency, there are four billion GPS-enabled devices worldwide, a number that is expected to double in the next five years. A recent study by research firm Markets and Markets estimates the global GPS market will reach more than $26 billion by 2016.

GPS precision timing allows a business to time-stamp transaction, regardless of location. A company knows their time-stamp will be the same in New York as in Tokyo. This synchronization is critical for keeping global telecommunications and financial networks from grinding to a halt.

Recreational users are creating art or messages using GPS tracking, making the world their canvas.

"Recently a man in Japan used GPS tracking to create a marriage proposal that spanned more than 4,300 miles," said Walter-Range. "We expect individuals and businesses to keep coming up with new applications that the creators of GPS would never have imagined."

A MILITARY TOOL, A CIVILIAN UTILITY

With the proliferation of GPS uses, it is easy to forget it started as a military technology, one that remains integral to military operations.

"Using GPS on the battlefield goes beyond navigation and precision timing," said Lt. Col. Todd Benson commander, 2nd Space Operations Squadron, which maintains the GPS constellation. "From troops on the ground, ships at sea and aircraft over targets, today nearly every military operation has some type of GPS tie-in and support. The Joint Direct Attack Munition, or JDAM, is GPS-aided. That's the weapon of choice for precision guided munitions. Some people might know it as a smart bomb; GPS is what makes it smart."

GPS is also making parachutes smart. The Joint Precision Airdrop System, or JPADS, can steer itself to a drop zone a significant distance from its release point. JPADS can keep the aircraft and the troops on the ground safer as neither has to move through dangerous areas to make the drop. JPADS can also deliver to multiple ground targets from the same airdrop.

GPS is also used heavily in air operations, from basic, three-dimensional positioning to enabling aircraft to find each other for refueling operations, performing precise maneuvers in three-dimensional airspace. GPS is indispensable to Search and Rescue crews, for both military and civilian operations.

BROUGHT TO THE WORLD BY AIRMEN

How many people does it take to operate a system that many people rely on, both civilian and military? Hundreds? Thousands?

"If you go to Schriever Air Force Base today and you walk into the 2nd Space Operations Squadron, in a little room you'll find seven Airmen," said General John Hyten, commander, Air Force Space Command, in a recent speech. "(Their) average age will be about 23 years old. Those Airmen are providing everything that is GPS for the entire world. Everything," he said.

"If you're on a bass boat in the middle of Alabama; if you're on a golf course in the middle of Scotland; wherever you happen to be using GPS, those seven Airmen, average age 23, are providing those capabilities. That's pretty amazing," the general added.

Air Force Space Command continues to enhance the GPS signal through technology upgrades. GPS III is scheduled to launch in 2017 and will be a more robust, reliable vehicle with a longer mission life, complete with multiple signals to support both military and civilian users.

Technical Sergeant Mike Slater is the Non-Commissioned Officer (NCO) in Charge of Air Force Space Command Public Affairs Current Operations. He has been in the Air Force for 16 years with assignments that have included two tours in Afghanistan, the Pentagon and Air Combat Command Headquarters Public Affairs.