

SATCOM for Net-Centric Warfare

MilsatMagazine

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USAF SMC

Rebecca Cowen-Hirsch, Inmarsat Government

Drew Klein, C-COM Satellite Services

Robert Rigsby, SES Government Services

Craig Gravelle, General Atomics-EMS

Dispatches



A United Launch Alliance (ULA) Delta IV Heavy rocket carrying a critical payload for the National Reconnaissance Office (NRO) denoted NROL-71 lifted off from Space Launch Complex-6 on January 19 at 11:10 a.m. PST. Photo is courtesy of United Launch Alliance.

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Giles Peeters, Track24 Defence
Koen Willems, Newtec

This issue's authors

Staff Sergeant Matthew Coleman-Foster

Craig Gravelle

Drew Klein

Rebecca Cowen-Hirsch

Robert Rigsby

DISPATCHES

USAF Protected Tactical Enterprise Service Program Contract to Hughes

Hughes Network Systems, LLC (HUGHES) has been awarded a contract from Boeing to develop mission management, system control, networking and ground hub capabilities in support of an anti-jam satellite communications capability for the U.S. Air Force's Protected Tactical Enterprise Service (PTES) program.

The PTES program will provide tactical warfighters with a joint ground platform designed to deliver protected communications services through the Wideband Global Satcom (WGS) satellite constellation, commercial satellites and in the future, the DoD's Protected Tactical Satellites running the Protected Tactical Waveform (PTW).

Hughes will design PTES sub-systems to support these tactical capabilities in the first phase of Protected Anti-Jam Tactical Satcom (PATS).

The PTES technology developments will use an Agile Project Management approach required under the PTES contract.

The contract work was initiated in late 2018 and is expected to run through 2025.

Dr. *Rajeev Gopal*, VP and Hughes program manager for PTES, said the company is developing a state-of-the-art, containerized software design for PTES data, control and management functions with scalable architecture to enable the use of advanced artificial intelligence and machine learning techniques.



Rick Lober, VP and GM of Hughes Defense and Intelligence Systems Division (DISD), reported that the company looks forward to working with Boeing and the USAF in applying the firm's more than four decades of experience in developing SATCOM networks and management systems for commercial and government enterprise applications.

Lober added that Hughes is committed to building and supporting secure global communications networks, and their team is dedicated to helping provide the DoD a highly resilient, tactical network that will enable mission success in contested environments.

www.hughes.com

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DISPATCHES

The Competitive DARPA Launch Challenge is... Launched



DARPA has announced the DARPA Launch Challenge, designed to promote rapid access to space within days, not years.

The U.S. space architecture is currently built around a limited number of exquisite systems with development times of as much as 10 years. With the launch challenge, DARPA plans to accelerate capabilities and further incentivize industry to deliver launch solutions that are both flexible and responsive.

The commercial small-launch (10 to 1000 kg.) industry has embraced advances in manufacturing, micro-technologies, and autonomous launch/range infrastructure. DARPA

seeks to leverage this expertise to transform space system development for the nation's defense. Frequent, flexible, and responsive launch is key to this transformation.

In late 2019, qualified teams will compete for prizes, with a top prize of \$10 million. Teams will receive exact details on the payload in the days before each of the two launch events, with only a few weeks' notice about the location of the first launch site.

Once they successfully deliver their payload to LEO, competing teams will get details of the second launch site. Teams again will have just days to successfully deliver a second payload to LEO, for a chance at a prize. Final ranking for the top three prizes will depend on speed, payload, mass, and orbit accuracy.

DARPA is coordinating closely with the Federal Aviation Administration (FAA), which is responsible for granting licenses for commercial space launches and will be involved throughout the challenge. Competitors participating in the DARPA Launch Challenge are required to obtain FAA licenses for all launch activity conducted under this effort.

A competitors' day with representatives from DARPA and the FAA will be held in Los Angeles on May 23, 2018. To register to attend or for additional guidelines on how to participate in

the challenge, please visit www.darpalaunchchallenge.org.

Todd Master, the DARPA Launch Challenge program manager for DARPA's Tactical Technology Office, said current launch systems and payload development were created in an era when each space launch was a national event. DARPA wants to demonstrate the ability to launch payloads to orbit on extremely short notice, with no prior knowledge of the payload, destination orbit, or launch site. The launch environment of tomorrow will more closely resemble that of airline operations — with frequent launches

from a myriad of locations worldwide.



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DISPATCHES

USAF's Space Defense Ops Center to be modernized by Raytheon and AFLCMC

The U.S. Air Force Life Cycle Management Center (AFLCMC) and a consortium of tech firms led by Raytheon (NYSE: RTN) are modernizing and simplifying the legacy Space Defense Operations Center, a 1990s-era system that tracks and monitors space debris.

The SPADOC system reached the end of its planned service life. The U.S. Air Force is planning to replace it with modern systems that will simplify operations and provide greater space situational awareness and collision avoidance capabilities. However, the new system won't come online for several years.

Raytheon and AFLCMC decided to emulate SPADOC's capabilities with modern computer hardware. The new emulated environment, SPADOC Emulation Analysis Risk Reduction, known as SPEARR, is designed to provide a more sustainable system that requires less maintenance.



The new hardware will provide the same functionality as today's system, making it easy to learn and operate.

Additional benefits are significant reductions in power and cooling consumption. Most of these reductions are because all of SPADOC's capabilities are now integrated into two small server racks instead of spread over 1,000 square feet of an aging, analog computer system.

Dave Fuino, program director for Raytheon Intelligence, Information and Services, said that within just a few months, the company brought together a team, developed the technology to modernize it, got it on contract and held a series of demos to prove it worked.

He added that the company went from concept to proving the solution in less than a year, which is really remarkable. Between the experience of the company's NORAD teammates, a.i. solutions,

Zivaro and E&M Technologies, and leading emulation companies Fundamental Software and M2 Technologies, Raytheon addressed the aging SPADOC system — this is a game changer.

Bob Taylor, U.S. Air Force Legacy Space Branch chief, added that at the same time, the obsolescence risk of an aging SPADOC system be addressed, so a really innovative, modern solution to this problem was developed. Proven emulation technology was used to help solve this challenge, significantly reducing obsolescence risk. Innovations in programmatic and technical approaches drove a smarter, better and faster solution. The next step is to evaluate options for fielding SPEARR.

www.raytheon.com/

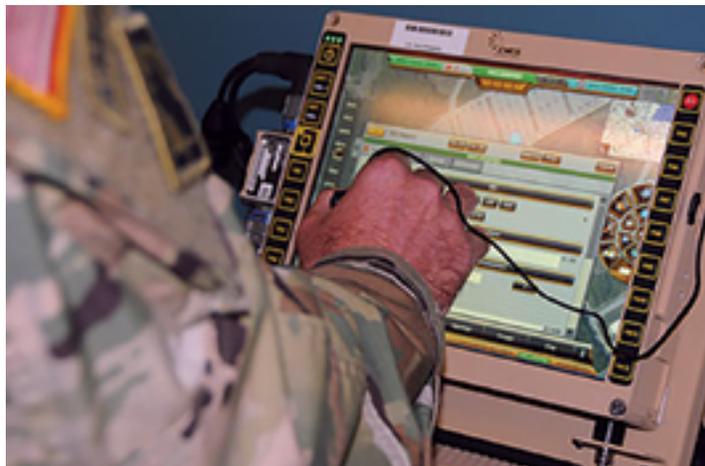
www.wpafb.af.mil/aflcmc/

Hughes Network Systems working on U.S. Army's Blue Force Tracking modernization

Hughes Network Systems, LLC (HUGHES) has been awarded a two-year Cooperative Research and Development Agreement (CRADA) by the U.S. Army for the third phase of the Blue Force Tracking (BFT-3) program.

Under the agreement, Hughes and other industry participants will conduct research studies to deliver a series of recommendations for modernizing the BFT system architecture to improve interoperability and resiliency, as part of an Open System Architecture (OSA) consortium working to achieve more flexible network tracking of friendly force locations.

Hughes will present recommendations to bolster operational resiliency with emphasis on maintaining communications in contested environments.



The Army is beginning a long-term initiative to significantly upgrade its key situational awareness network Blue Force Tracking, commonly known as BFT, which provides friendly force tracking information and is integrated on more than 98,000 platforms across the Army and joint services.

Photo is courtesy of the U.S. Army.

The OSA results under the CRADA will include modular network architecture recommendations for the U.S. Army to integrate various military and commercial

networks and services using new standardized interfaces. This approach is expected to foster innovation through increased competition, eliminating single-

vendor dependence on closed networks and yielding truly best-in-class technology solutions for the military.

The final CRADA reports are expected to precede competitive procurements of the next generation BFT system in 2020 or 2021.

Rick Lober, VP and GM of Defense and Intelligence Systems at Hughes said the company will define the open architecture of next generation systems and looks forward to providing a unique perspective to the effort as one of the world's largest commercial suppliers of satellite communications equipment and services.

www.hughes.com

DISPATCHES

NSR report focuses on commercial SATCOM services for government and military markets

NSR's Government & Military Satellite Communications, 15th Edition, focuses on commercial satellite connectivity services for government and military markets.

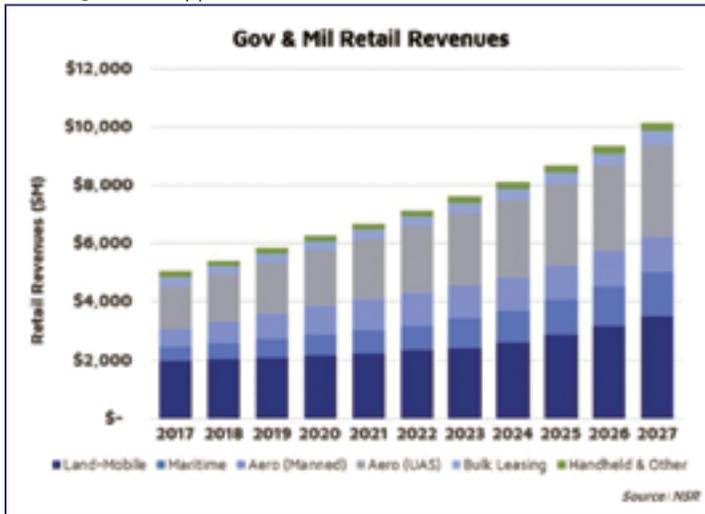
In this 15th edition, this report continues to provide definitive insights into this rapidly changing market.

Covering all core opportunities,

clear picture of the opportunities within government and military SATCOM markets.

As consolidation occurs among service providers, the U.S. Government is exploring streamlining satellite connectivity acquisition, and commercial sectors are preparing for the Non-GEO HTS revolution.

All these trends have real-world



the report explores the interplay of MILSATCOM vs. COMSATCOM acquisitions, the role of X- and Ka-bands, and other core trends impacting players in the sector.

Cutting across bulk leasing to the latest Unmanned Aircraft Systems (UAS), this NSR report offers the

impacts across the value-chain, from where to spend R&D resources to what capacity to consider leasing.

With spending on defense on the rise across the globe, satellite connectivity services will be a key component of a sensor-fused, highly connected operational environment



Segments Covered

- Bulk Leasing
- Land-Mobile (COTP / COTM)
- Aeronautical (Manned)
- Aeronautical (UAS)
- Maritime
- Handheld & Other Form Factors



Regions

- North America
- Latin America
- Europe
- Middle-East and Africa
- Asia
- Atlantic Ocean Region
- Indian Ocean Region
- Pacific Ocean Region
- Arctic Region



Capacity

- FSS
- C, Ku, Ka, X-bands
- HTS
- GEO-HTS C/Ku/Ka-Bands; Non-GEO HTS
- MSS
- Broadband, Narrowband, Handhelds, Other Form Factors

of tomorrow.

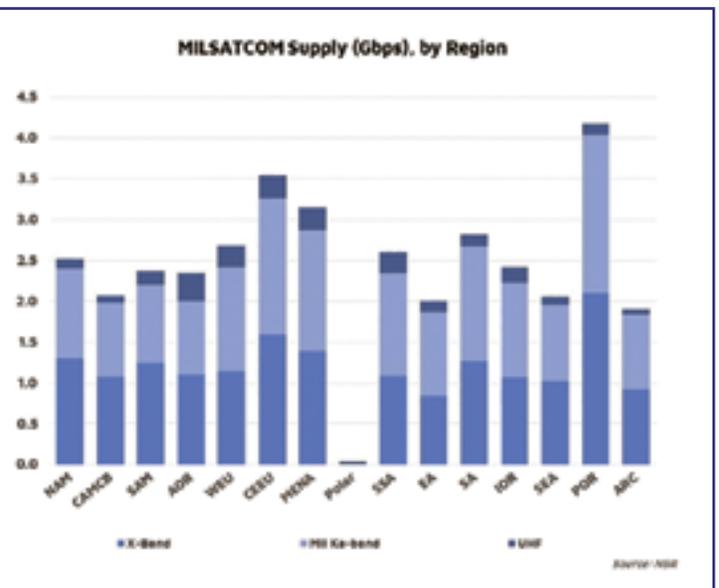
This NSR report offers analysis on eight unique segments, across 12 capacity types and 8 major regional splits.

Forecasting In-Service Units, Revenues and Capacity demand, the report provides a complete assessment of the Bulk Leasing, Land-Mobile (both COTP and COTM), Maritime, Aeronautical (both Manned and Unmanned

platforms), and Handhelds & Other Form factors.

With comprehensive, historical comparisons plus a 10-year outlook, the report provides key insights on major trends, drivers and restraints impacting the market.

www.nsr.com/research/government-military-satellite-communications-15th-edition/



DISPATCHES

U.S. Army depot assists National Guard and provides urgent satellite terminal repairs



Four technicians from Tobyhanna Army Depot worked with the Pennsylvania National Guard to assess, troubleshoot and repair 14 Satellite Transportable Terminals required for upcoming deployments. Photo by Thomas Robbins.

Urgent depot-level repairs needed by the Pennsylvania National Guard 28th Infantry Division warranted Tobyhanna Army Depot make a trip to Ft. Indiantown Gap, Annville, Pennsylvania during the first week of March.

Four technicians worked with soldiers from across three brigades to repair, troubleshoot and test 14 Satellite Transportable Terminals (STT) with the goal of having as many functional systems as possible by the end of the week, using the Divisions spare equipment.

Team Tobyhanna provides comprehensive services at sites around the world. A total of 12 systems were repaired throughout the week. The systems were prioritized based on upcoming operational missions.

Some systems were required for overseas deployments immediately while others are needed for Joint Overseas Training events in Europe by the end of the month. The remaining systems were assessed to

identify parts the unit would need to order and install at a later date. By having agile teams to support units with urgent needs, Team Tobyhanna is effectively driving readiness to the field by keeping the fleet fully mission capable.

"We've been attempting to pull this off for a while; but with our missions developing overseas, these STTs needed to get taken care of right now," said Maj. Jeremy Coleman,



Joe Czech, Electronics Mechanic, works with a soldier to complete one of the satellites. Photo by Thomas Robbins

State Surface Maintenance Manager and Commander of the 328th Brigade Support Battalion at Fort Indiantown Gap.

During missions like these, Tobyhanna technicians also have the opportunity to leave a lasting impression on the soldiers. As they work with them to repair the systems, they develop skill sets that can be transferred to the field, which can help to extend the period

before the system will need this level of repair again.

"The team always enjoys missions like this. We get to directly affect the units C4ISR readiness and prepare them for their upcoming missions," said Tony Brandi, Electronics Mechanic supervisor of the Tactical Satellite Communications branch. He also noted that this mission was particularly special to him because he was assigned to this Division for 11 years before retiring in 2016.

Going forward, Tobyhanna Army Depot plans to continue supporting urgent depot level repairs, ensuring units and systems are postured for current and future operational missions.

Tobyhanna Army Depot is a recognized leader in providing world-class logistics support for command, control, communications, computers, intelligence, surveillance and reconnaissance systems across the Department of Defense.

Tobyhanna's Corporate Philosophy, dedicated work force and electronics expertise ensure the depot is the Joint C4ISR provider of choice for all branches of the Armed Forces and industry partners.

About 3,200 personnel are employed at Tobyhanna, which is located in the Pocono Mountains of northeastern Pennsylvania.

Tobyhanna Army Depot is part of the U.S. Army Communications-Electronics Command. Headquartered at Aberdeen Proving Ground, Maryland, the command's mission is to research, develop, acquire, field and sustain communications, command, control computer, intelligence, electronic warfare and sensors capabilities for the Armed Forces.

Story by Alexandria Soller.

DISPATCHES

Curtiss-Wright procures Tactical Communications Group

Curtiss-Wright's Defense Solutions division has added Tactical Communications Group (TCG), LLC, a global provider of tactical data link (TDL) software and hardware solutions to military operating and training units, government testing organizations and prime defense contractors.

TCG's proven Commercial-Off-The-Shelf (COTS) TDL software solutions minimize the time and effort required to build, integrate, test, train and deploy effective and affordable military communications systems.

Curtiss-Wright Corporation announced the acquisition of TCG on March 18, 2019.



The acquisition strengthens the Defense Solutions division's technology offering, enabling it to expand into the complementary TDL training and testing market and apply TCG's communications expertise across its entire catalog of embedded hardware solutions.

Curtiss-Wright's Flight Test Instrumentation (FTI) customers are expected to benefit from the addition of TCG's TDL communications software into

Curtiss-Wright's industry leading data acquisition hardware products.

Additional market growth is expected to result from the combination of TCG's and Curtiss-Wright's worldwide military customer base, increasing opportunities to provide TDL and FTI solutions with higher levels of integration, all from a single supplier.

The acquisition will also provide an opportunity to broaden Curtiss-Wright's Aerospace Instrumentation product offerings by expanding the application of its FTI solutions beyond test programs into operational bases.

Lynn Bamford, SVP and GM, Defense Solutions division, reported that TCG's unique position as a leading supplier of software for the test, simulation and operational training of Tactical Data Links adds world-class data analytics and

visualization capabilities to Curtiss-Wright's Aerospace Instrumentation product offerings.

Further, the combination of Curtiss-Wright's complementary U.S. military customer base is expected to provide excellent growth opportunities for the company's existing Flight Test technologies and TCG's software applications.

www.curtisswrightds.com/

DISPATCHES

New Wavestream BUC enters the market

Wavestream has introduced an innovative, high reliability, 60W Ku-band GaN Block Upconverter (BUC) that meets the stringent military and environmental market requirements — Wavestream's solution provides customers more linear power and less power draw.



in a variety of ground applications.

Bob Huffman, GM at Wavestream, said the company's proven technology, reliability and high-volume production capabilities are now engaged in responding to customers' needs for an

Huffman added that Wavestream products draw less power when backed off to help save valuable energy resources, generating less heat, ensuring a higher MTBF for greater reliability and lower lifecycle costs.

www.wavestream.com

According to the company, the new 60W Ku-band GaN BUC offers unmatched efficiency and performance answering changing market demands.

This next generation of GaN BUC follows the shipment of thousands of Wavestream's Ku BUCs with GaAS technology setting the benchmark for Ku-band BUCs used

innovative high output power, 60W GaN solution for the military market.

Kubos receives SBIR award from the U.S. Air Force



rapidly evolving threats require the U.S. to more swiftly develop and evolve space technologies.

Culpepper then added that this low-risk solution is designed to help the U.S. Air Force, government agencies, and commercial satellite operators accomplish that need.

Dean Hawes, VP of Programs at Kubos, added this is an exciting opportunity for Kubos to work directly with the U.S. Air Force. The company is looking forward to demonstrating a capability that will enable rapid technology refresh, greatly enhancing mission flexibility and spacecraft utility for government and commercial customers.

www.kubos.com/

Kubos Corporation (Kubos) has received a Phase I Small Business Innovative Research (SBIR) award from the U.S. Air Force to validate a Kubos solution to securely host third-party applications on spacecraft already in orbit.

This capability will reduce the time it takes to develop advanced software technologies for space applications from years to just months.

This will also increase the utility of spacecraft on-orbit and improves space system resiliency.

Kubos has developed a spacecraft software framework and development infrastructure using a tailored version of Kubos commercial products.

This framework enables spacecraft already in orbit to be used as an operational platform to prove and deploy software capabilities.

The capability to run hosted software applications in parallel with the spacecraft primary mission software allows new technologies to be advanced more rapidly without impacting or adding risk to the primary mission.

Kubos is also offering this solution to commercial customers to help them create innovative business models and new revenue streams. **Marshall Culpepper**, CEO of Kubos, said that in today's environment,

DISPATCHES

ManTech engages in collaborative development for DoD cyber platform



Over the tenure of this program, prototype work involves multiple “Cyber Innovation Challenges” conducted at the Army’s PCTE DevOps Center in Orlando, Florida.

In this latest phase, *Cyber Innovation Challenge #3*, ManTech and its partners will collaborate with the Product Manager – Cyber Resilience & Training (PdM-CRT) to develop cyber training event control capabilities for the PCTE platform.

www.mantech.com

ManTech (Nasdaq: MANT) has been selected as one of three companies to continue collaborative development of a prototype for the Department of Defense’s Persistent Cyber Training Environment (PCTE) platform.

This phase of the program will be conducted through an Other Transaction Agreement (OTA) with the National Security Technology Accelerator (NSTXL).

“This strategic win positions ManTech as the leading contender to provide hands-on cyber training for the U.S. Army’s next generation warfighters,” said Kevin Phillips, President and CEO of ManTech.

“Together with our partners, ManTech is Bringing Digital to the Mission™ in vital ways that will sharpen skills at the tactical edge of cyber combat.”

Under the OTA, ManTech has partnered with a trio of recognized cyber innovators: APTIMA, Inc. for training assessment expertise, SCYTHE, Inc. for cyberattack ingenuity, and Ultimate Knowledge Institute for dashboard creativity.

This partnership will collaborate with the government integration team and the other two selectees to support the definition, development, testing and integration of best-in-class capabilities into the prototype PCTE platform.

DISPATCHES

The future of combined space ops discussed by multi-national space leaders at AFSPC HQ



"We are actively coordinating to further our national interests through the Combined Space Operations (CSpO) initiative. In part, CSpO collaboration includes enhanced Space Situational Awareness and data sharing among all partner nations to support space activities.

"To enhance our space collaboration, we are also discussing operational concepts, personnel needs and infrastructure requirements to enhance multinational command and control of space forces in and through the Combined Space Operations Center and the other national Space Operations Centers.

"We recognize tangible advances in space cooperation and capabilities have been achieved through the CSpO initiative; and we are dedicated to identifying future capabilities to support our countries' common interests in and through space."

Major General **Stephen Whiting**, Deputy Joint Force Space Component Commander, briefed the status of the CSpO initiatives to the Air Chiefs and senior space officials from the seven nations during the meeting.

www.afspc.af.mil

On April 10, Air Chiefs and senior space officials from Australia, Canada, France, Germany, New Zealand, the United Kingdom, and the United States held a meeting at Headquarters Air Force Space Command to discuss the future of the Combined Space Operations (CSpO) initiative.

Following the meeting, the seven nations released this Multi-national Statement for Combined Space Operations:

"As defense leaders in our respective nations we unequivocally recognize the strategic importance the space domain has on our economy, technology, national security and defense.

"To that end, we collectively share the view that military cooperation concerning the space domain is vital to our countries' interests.

"Our respective Nations are actively working together to address threats and shared interests in space; and to preserve access to the space domain for the future of humankind.

DISPATCHES

USAF's Kaena Point satellite tracking station celebrates 60 years of successful ops



The 21st Space Operation Squadron, Detachment 3, gathered at Kaena Point Satellite Tracking Station, Hawaii, earlier this year to celebrate 60 years of space operations.

One of eight satellite remote tracking stations in the U.S. Air Force Satellite Control Network, Detachment 3 is located on the island of Oahu approximately 40 miles from Honolulu and Hickam Air Force Base, Hawaii.

Major **Edmond Chan**, 21st SOPS, Detachment 3 commander, presided over the ceremony that featured Brigadier General **Ryan Okahara**, Hawaii Air National Guard commander and Guard Advisor to the 14th Air Force commander, as guest speaker.

Jason Hughes, 21st SOPS, Detachment 3 site manager, said in the past 60 years the site has seen advancements in hardware

and software, increasing the level of effort provided.

He noted, *"Rising demands for information by our decision makers across the globe required increased tempo. What was once done by paper and mailed to the remote tracking stations, is now transmitted in mere seconds providing on the spot updates. Where two antennas once stood, we now see one. One antenna now can provide both the tracking and commanding data for our constellation of satellites. As with any kind of progress, over 60 years there have been challenges.*

"Operational tempo and sustainment requirements are steadily increasing. The way we handle the increase is to prioritize activities that are inherently tied to force readiness are automatically a top priority, he said.

In addition to the mission, Kaena Point Tracking Station also works

hand in hand with the local communities in times of need and disaster.

"From fires, hurricanes and search and rescue missions on or near the site, we stand ready to work with our community providing a clear pathway to the skies," Hughes said.

Kaena Point Tracking Station is one in a crucial network of sites that support more than 185 satellites, and perform mission operations around the world.

Major Chan said the support the site provides is important to the success the tracking station has experienced thus far, stating, *"Our team performs 24/7 on-orbit satellite tracking, telemetry, commanding and mission data retrieval operations while simultaneously providing innovative engineering, maintenance and logistical support for the Air Force Satellite Control Network."*

Going forward, Detachment 3 will continue to innovate and execute today's operations as tempos increase and satellites continue to launch.

"Kaena Point Tracking Station has an enduring space mission, sitting on a strategically ideal location in the Pacific and is postured for growth," Chan said.

Reaching the 60th anniversary milestone is a reminder to those working the site of the importance of meeting the mission partners needs.

As of January 22 of this year, the site reached 60,000 error-free satellite supports for 1,000 consecutive days.

This is the excellence Hawaii tracking station looks to continue — mastering space, now and into the future.

Story by
Staff Sergeant Matthew Coleman-Foster,
60th Space Wing Public Affairs

DISPATCHES

SBIRS GEO Flight 3 satellite delivers first imagery



The U.S. Air Force's (USAF) third space-based infrared system (SBIRS) geosynchronous Earth orbit (GEO) satellite has delivered first images from its orbit.

The imagery was transmitted to the SBIRS ground station at Buckley Air Force Base in Colorado.

Lockheed Martin Overhead Persistent Infrared systems mission area Vice President *David Sheridan* said, *"With the satellite successfully on orbit, we are now working to ensure GEO Flight 3 continues the outstanding performance trends demonstrated by its predecessors, including better-than-specified sensor pointing accuracy and the ability to detect dimmer targets than expected."* The Lockheed Martin-built SBIRS GEO Flight 3 satellite is equipped with scanning and staring sensors and was launched on 20 January to support the USAF with accurate missile warning data.

The SBIRS GEO Flight 3 satellite was launched from a United Launch Alliance Atlas V rocket at Cape Canaveral Air Force Station in Florida.

Upon reaching its final geosynchronous orbit, which is approximately 22,000 miles above the equator, the satellite completed deployments of its sun-tracking solar arrays, antenna wing assemblies and light shade.

The satellite is capable of collecting and transmitting infrared surveillance information to ground stations.

The satellite information will be used by the U.S. military to detect missile launches, support ballistic missile defence, expand technical intelligence gathering and bolster situational awareness on the battlefield.

Lockheed said that the next satellite in the series, GEO Flight 4, will undergo final assembly, integration and test at the company's satellite production facility in Sunnyvale, California, ahead of the satellite's planned launch later this year.

The company will also update the fifth and sixth SBIRS satellites under a no-cost contract modification for the USAF.

www.lockheedmartin.com

DISPATCHES

Concurrent, multiple reception capabilities infused by Viasat into their Link 16 product family



The KOR-24A Small Tactical Terminal (STT).
Image is courtesy of Viasat.

The U.S. military recently identified the need for Concurrent Multiple Reception (CMR) capabilities in Link 16 products as a way to enhance communications and reduce network congestion on Link 16 networks.

CMR enables a Link 16 radio to receive multiple messages simultaneously versus legacy radios that can only receive one message at a time.

Taking a proactive approach, Viasat Inc. (NASDAQ: VSAT) has successfully integrated CMR advancements into the company's extensive line of next-generation Link 16 products — ahead of emerging government requirements — to help ensure warfighters have assured access to mission-critical information when using Link 16 communications — regardless of location (air, land or sea) or platform (aircraft, ground vehicle, ship or dismount).

The CMR features have now been implemented in the latest version of the KOR-24A Small Tactical Terminal (STT), of which more than 1,400 units have been fielded by the U.S. and International customers, as well as the AN/PRC-161 Battlefield Awareness and Targeting System – Dismounted (BATS-D) handheld Link 16 radio.

As a result, the new capabilities are also now resident in the Viasat Move out / Jump off (MOJO) expeditionary tactical gateway system and Viasat's other embedded product lines.

These features, coupled with the Link 16 Enhanced Throughput modes that were already resident in Viasat's next-generation products, will enable network planners to fully optimize network performance enabling maximum participants sharing maximum capacity of information to support mission requirements.

Viasat's NDI-driven development processes will bring CMR Link 16 capabilities to products that provide users with access to simultaneous, resilient communications streams of mission-critical data.

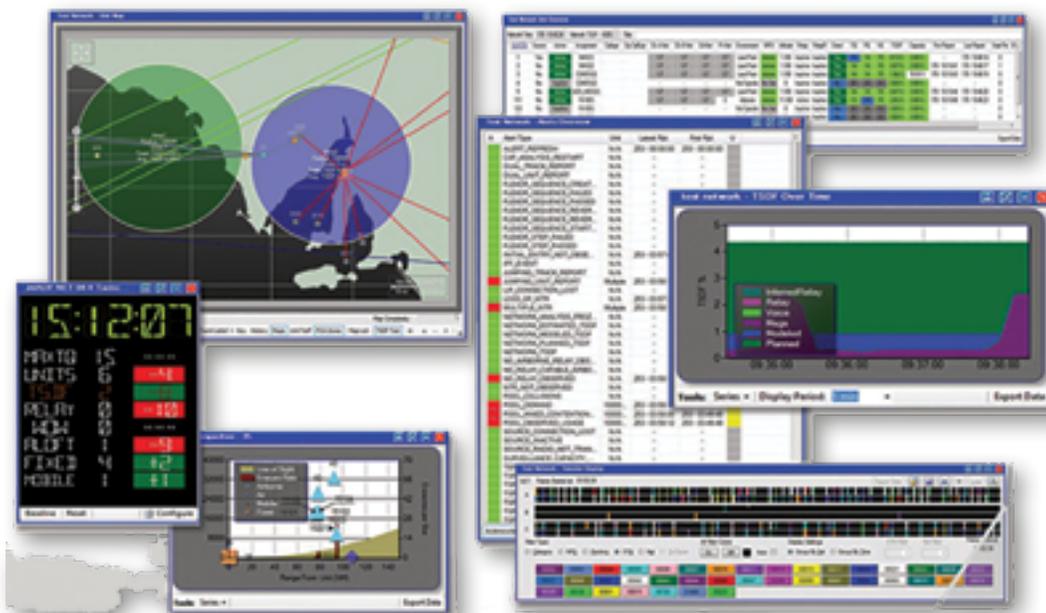
Viasat's CMR Link 16 capabilities will also allow U.S. military customers to both expand the number of units with direct digital access to key tactical data while also addressing network congestion in order to adapt to emerging mission requirements and maintain a tactical edge across today's battlespace.

Ken Peterman, President, Government Systems, Viasat, said the company listens to their customers, understand their pain points and develop products and capabilities that will better serve the needs of today's warfighter. Viasat's proven non-developmental item (NDI) business model is designed to deliver new capabilities significantly faster, at lower lifecycle costs and with lower risk to the customer when compared to traditional acquisition programs and timelines.

Peterman added that bringing CMR capabilities into the firm's Link 16 portfolio will allow military personnel to have battlefield depth — creating a networked force that will have significantly shorter decision cycles, increased effectiveness and improved safety.

Andy Kessler, Vice President and Business Area Director, Next Generation Tactical Datalinks, added that through the company's agile development processes and proven non-developmental item business model, a broad portfolio of next-generation Link 16 products can be delivered that continue to address the urgent needs of today's warfighter, while also providing the technology and capabilities required to support the missions of tomorrow.

Kessler added that, rather than waiting for a Government mandate, Viasat took action to deliver advanced CMR capabilities that will provide U.S. military customers with the tactical edge needed to succeed across today's battlespace.



Link 16 software tools screenshot is courtesy of Viasat.

www.viasat.com

THE FUTURE OF DOD SATCOM

Delivering Fighting SATCOM

By the U.S. Air Force Space and Missile Systems Center (SMC)

The U.S. Air Force (USAF) delivers global satellite communications (SATCOM) capabilities that are foundational to joint warfighter operations across the range of military operations, and will only become more critical in preparation for the battlespace of the future.

With potential adversaries continually seeking to deny, degrade and destroy U.S. asymmetric advantages in space, the USAF is evolving SATCOM capabilities for the nation's warfighters and strategic allied partners.

With the continued successes of fielding the current generation systems — most recently the fourth **Advanced Extremely High Frequency (AEHF-4)** satellite in October of 2018 and the tenth **Wideband Global SATCOM (WGS-10)** satellite in March of 2019 — the entire SATCOM enterprise (military, commercial, and international partners) is transitioning an integrated architecture that is more robust, resilient, flexible, and capable of fighting through a contested, degraded, and operationally-limited (CDO) environment.

Disaggregating for Resilience and Flexibility

A major step toward this new architecture is to implement a disaggregation strategy in the military satellite communications (MILSATCOM) space tier to improve resiliency while maintaining backward compatibility.

The AEHF satellite constellation, in concert with its predecessor, the *Milstar* system, currently provides both protected tactical communications and strategic, nuclear-hardened communications for the President and other decision makers.



An ULA Delta IV rocket carrying the WGS-10 mission for the U.S. Air Force lifts off from Space Launch Complex-37 at 8:26 p.m. ET, March 15. Photo is courtesy of United Launch Alliance.

This architecture delivers enterprise SATCOM capabilities to the Commander, United States Space Command in order to support joint warfighters across the full spectrum of conflict, at the speed of relevance, and in CDO environments. AFSPC refers to this operational vision of the future as "Fighting SATCOM."

The key building blocks for achieving Fighting SATCOM are a management and control framework to coordinate assets/tasking, flexible terminals that can operate in military platforms/environments, flexible networks to rapidly restore network connections as well as a diverse pool of space assets to provide path redundancy and operational flexibility such that as the operational environment evolves, the flexible terminals can "roam" across multiple waveforms, bands and other elements of the architecture including commercial and international partner systems.

On December 12, 2018, AFSPC assumed sole responsibility for the procurement of commercial satellite communications (COMSATCOM) services for the Department of Defense (DoD) by transitioning the COMSATCOM bandwidth leasing functions into AFSPC and establishing the **Air Force Commercial Satellite Communications Office (AFSCSO)**.

These functions were formerly executed by the Defense Information Systems Agency (DISA). This consolidation of MILSATCOM and COMSATCOM procurement authority enables AFSPC to deliver better-integrated solutions consistent with General Raymond's vision.

The USAF's **Space and Missile Systems Center (SMC)** is furthering the advancement of Fighting SATCOM by awarding development contracts for enterprise management and control prototypes to members of the Space Enterprise Consortium, a team of industry leaders, academic research

institutions, and innovative early-stage and start-up companies working together to develop next generation space technologies.

Prototype solutions will demonstrate key attributes required of the enterprise to include rapid, resilient, sustainable and global access to SATCOM capabilities; terminal, modem and network agility; cyber, link and operational security; and data interoperability with joint command and control systems.

This year's prototyping efforts are focused on delivering situational awareness capabilities and providing a common operating picture that assists users in conducting enterprise SATCOM planning, brokering, and orchestration functions.

These prototypes will be important steps toward defining the architecture, conducting risk reduction, and identifying early technologies and capabilities that can quickly be transitioned into operations.

Defining the enterprise architecture will allow future programs and capabilities to quickly and seamlessly integrate with legacy systems while bringing together the full spectrum of SATCOM

service capabilities.

AFSCSO will pursue enhanced models for acquiring, delivering, and integrating dynamic COMSATCOM requirements into the SATCOM enterprise.

Transforming COMSATCOM in this manner will ensure global readiness and on-demand access to a variety of COMSATCOM capabilities at any time, support roaming between systems, and leverage the DoD's collective buying power. AFSCSO will acquire tools to enable near-real-time access to business and requirements data to improve planning and dissemination of mission data.

AFSCSO will also provide a foundational trial of COMSATCOM managed services to evaluate details of technical and operational risks and opportunities.

Terminals pose a particularly vexing challenge given the broad diversity of SATCOM terminals currently in operation (17,000+ terminals procured by approximately 135 terminal programs).

SMC's SATCOM Pilot Phase 2 effort successfully prototyped and demonstrated terminal flexibility. These demonstrations modified legacy terminals by inserting preloaded configuration files that enabled roaming between different SATCOM services.

This effort also developed interface controls and standards for the Government's enterprise management and control functions, SATCOM service providers, and flexible terminals.

In addition to these efforts, the USAF has conducted extensive workshops that continue to garner enthusiastic participation from this broad community of users, industry, and other DoD stakeholders to move toward standards for future interfaces.



(160712-F-NG695-001.jpg)

U.S. Air Force Captain and a Canadian liaison officer set up an Air Force Ground Multi-band Terminal (GMT) antenna. Photo is courtesy of U.S. Air Force/2nd Lt Darren Domingo.



Disruptive Technologies

Disruptive technologies also look to play a significant role in the future of SATCOM.

Several commercial providers are aggressively pursuing SATCOM solutions comprised of many small satellites in Low Earth Orbit (LEO). This presents an attractive opportunity to access orders of magnitude increases in bandwidth capacity, but is potentially hampered by the lack of available phased array terminal antennas. Unlike traditional dish antennas, phased array antennas are capable of tracking and receiving signals from fast-moving LEO satellites without the need to mechanically point them at the satellites.

Accordingly, maturation of phased array antennas for mobile use looks to be a significant source of influence in its own right. Laser crosslinks present interesting possibilities in their ability to facilitate rapid transfer of massive amounts of data among space assets, improving resiliency.

Additional advancements poised for significant impact on SATCOM include mesh networks and exploiting new spectrum regimes.

A mesh network is a network topology where each node is capable of relaying data and effectively acting as an independent router, a concept that could be leveraged broadly in an integrated SATCOM architecture.

Ongoing experiments exploring applications for using various frequencies are introducing opportunities to drastically increase bandwidth capacity for SATCOM applications.

Speeding Delivery

In addition to the consolidation of MILSATCOM and COMSATCOM procurement authorities, AFSPC is taking steps to reduce delivery timelines by aggressively seeking efficiencies and leveraging new statutory authorities.

SMC is almost six months into implementation of "SMC 2.0" — an overhaul of its structure and processes aimed at acceleration by creating an action-oriented decision framework, fostering innovation, cultivating partnerships, embracing an enterprise mindset, and creating a culture of continuous improvement.

Section 804 of the FY16 National Defense Authorization Act created authorities for a middle tier of acquisition for rapid prototyping and rapid fielding. These authorities provide expedited decision gateways for prototyping (use of innovative technologies to rapidly develop fieldable prototypes to demonstrate new capabilities and meet emerging military needs) and fielding (use of proven technologies to field production quantities of new or upgraded systems). The ESS, PTS, and PTES have adopted new Rapid Section 804 authorities.

In executing direction from Congress, the USAF is also leveraging commercial technologies and practices in procuring the eleventh satellite for the WGS constellation (WGS-11). This satellite improves upon the capabilities of the recent WGS satellites by providing a two-fold increase in capacity and bandwidth, improved resilience with more beams, enhanced coverage, better anti-jam performance, and enhanced flexibility and performance to better serve warfighters.

Furthermore, SMC's Chief Partnership Office continues to forge groundbreaking agreements on the WGS and AEHF programs with a group of ten international partner nations. These partnerships, and the nascent relationship with Norway on the EPS-R program, represent a promising path toward greater international cooperation.

By developing a wide network of Allied, interagency and commercial partnerships, the Air Force can share costs, move faster, and deliver Fighting SATCOM that is more interoperable, resilient and cost-effective.

Delivering SATCOM Dominance to the Warfighter

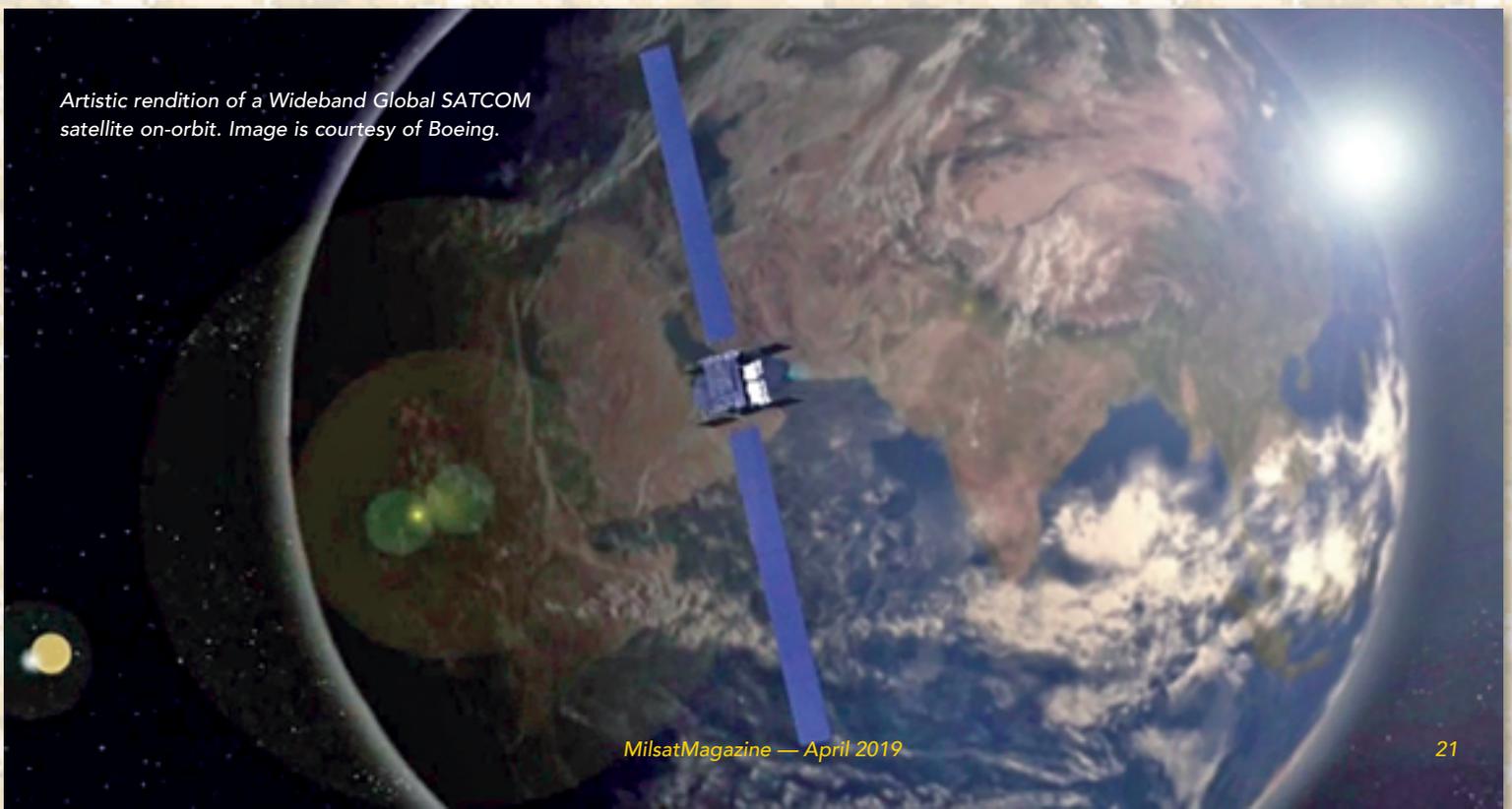
An integrated SATCOM enterprise delivers unparalleled options to joint warfighters for mission success.

Compared to today's collection of stove-piped SATCOM systems, the enterprise will deliver the performance and resilience necessary to address a 21st century contested space domain.

The USAF is accelerating delivery of this enterprise to ensure warfighters receive the operational benefits of SATCOM effects in CDO environments and is embracing faster acquisition processes and faster command and control constructs to maintain the advantage in any conflict.

Delivering Fighting SATCOM for warfighters will be a major step toward maintaining U.S. SATCOM dominance on the battlefield.

Artistic rendition of a Wideband Global SATCOM satellite on-orbit. Image is courtesy of Boeing.



HOW INDUSTRY CAN SOLVE...

... the DoD's perceived SATCOM terminal challenges

By Rebecca Cowen-Hirsch, Senior Vice President of Government, Strategy and Policy, Inmarsat Government



As part of a recent U.S. Air Force technology pilot project, we witnessed how the military can leverage commercial innovation and flexibility to address the Department of Defense's (DoD)-perceived SATCOM terminal challenge.

The pilot was established as part of the fiscal year 2016 National Defense Authorization Act (NDAA — www.congress.gov/114/plaws/publ92/PLAW-114publ92.pdf) to explore ways to use satellite industry capabilities to enhance resilience and lower the cost of military employed satellite communications (SATCOM).

The experiment demonstrated that a military SATCOM terminal can seamlessly roam across disparate commercial networks to employ both the military **Wideband Global SATCOM (WGS)** system and commercial satellites.

Why is this significant? It illustrates that the U.S. Air Force (USAF) is addressing what has been described as a potentially problematic — and “expensive” — issue that “terminals are hard.”

However, in reality, it represents what commercial industry perceives as fairly low-hanging fruit in terms of accelerating the implementation of the enterprise architecture for interoperable SATCOM.

The Pentagon provided a preliminary glimpse into the DoD's summary of findings from the USAF's **Analysis of Alternatives (AoA** — www.acqnotes.com/wp-content/uploads/2014/09/Analysis-of-Alternative-AoA-Handbook-July-2016.pdf) for a future Wideband Communication System.



Artistic rendition of Wideband Global Satcom

We learned that there are “opportunities to expand the use of commercial” communication satellites. However, they went on to add that a major obstacle is that most satellite terminals used by the military are not compatible with modern SATCOM technology, and there are numerous terminals in the inventory.

Replacement of these terminals would require decades to accomplish and potentially cost billions of dollars. The implication is the terminal challenge will be handled separately from the space segment — that, unfortunately, perpetuates the asynchronization of satellite communication networks and will ultimately delay integration of the architecture and may increase even further the cost for operational resiliency over many years.

As demonstrated in the pilot and echoed across industry, addressing near-term improvements and enhanced operational flexibility of legacy terminals is not an insurmountable issue. Commercial technology innovation and flexible business models can resolve this perceived challenge.

The legacy terminals will undergo a recapitalization process, which should take into consideration the deployment of adaptive modems and multi-band features to enable roaming across heterogeneous networks while taking advantage of enhanced modern SATCOM technologies to great effect.

While size, weight and power (SWaP) considerations should be taken into consideration, flexibility in terminal air interface and spectrum offers the optimum operational flexibility without specific commitment to any particular transmission path.

For many communication requirements, the terminals can embed within a SATCOM as a Service model, which provides a critical end-to-end communication infrastructure that is owned and managed by trusted commercial operators and includes the space and ground segment elements that deliver seamless global connectivity. That brings the desired flexibility, security and cost-

efficiency that allow government users to augment their MILSATCOM systems when needed, without any upfront commitment. With this, there would be a clear path toward “Terminal as a Service,” which ensures continual technology refresh and modernization at an affordable rate.

The terminal debate brings up familiar, unsound arguments regarding “sunk costs.” If we allow sunk cost fallacies to keep us from progressing, then we will continue to have inflexible terminals for years, even decades to come.

If we cling to yesterday’s technologies to avoid a short-term and necessary budgetary expense, then we are pressing an “easy button” which stalls forward momentum for building an integrated architecture. It is imperative that multi-band and multi-mode terminals and baseband interoperability are aggressively pursued. An integrated enterprise SATCOM architecture is obtainable best through strong government and commercial partnerships.

Imperative is that capable, commercial SATCOM capabilities are fully considered foundational to the necessary recapitalization and modernization process, while respecting the U.S. Code’s Title 10 authorities for each service to train and equip. Architecturally aligning and synchronizing terminal enhancements and investments is an essential step towards modernizing the DoD’s SATCOM networks, long before any additional military purpose-built satellites should even be considered.

The ground segment should afford flexible adaptation to leverage the full legacy capabilities of the military-operated SATCOM as well as the phenomenal breadth and scope of secure, mobile commercial SATCOM for resiliency and operational effectiveness.

Leadership should present a new strategy that will focus and accelerate investment in innovative commercial SATCOM, network and terminal technologies that support operationally agile, resilient, flexible capabilities.

As valued industry partners, we make significant investments in modular terminals to replace vertically-integrated systems to support the government’s drive towards establishing a completely integrated architecture. In some cases, we modify existing terminals. In others, we build new ones.

Although small scale in nature, the recent Air Force SATCOM pilot results highlighting terminal flexibility and commercial compatibility remain the source of much encouragement.

The pilot is indicative of an area of focus that — despite certain perceived challenges — is not “too hard” to fix. As partners, we can resolve these challenges together in an accelerated manner, with an integrated architecture firmly within our sights.

Rebecca Cowen-Hirsch is Senior Vice President for Government Strategy and Policy at Inmarsat Government Inc., a wholly-owned subsidiary of Inmarsat plc, the world’s leading provider of global mobile satellite communications to the United States government. Ms. Cowen-Hirsch is responsible for establishing Inmarsat’s strategic direction, policy and advocacy with respect to U.S. government.

Ms. Cowen-Hirsch has more than 25 years of defense, aerospace and executive leadership experience. She served in the U.S. Department of Defense (DoD) as the Program Executive Officer for SATCOM, Teleport, and Services at DISA and the first Vice Component Acquisition Executive for DISA. She established the Defense Spectrum Office, serving as its first Director.

She is a rated experimental flight test engineer and became the first female civilian Mission Commander for the Advanced Range Instrumentation Aircraft (ARIA) mission. She was awarded the Exemplary Service Medal for her service to the DoD.

Ms. Cowen-Hirsch received her Bachelor of Science degree in Electrical Engineering from the University of Kentucky.

Ms. Cowen-Hirsch is a Senior Columnist for MilsatMagazine.



FLASHBACK AND FLASHFORWARD

The crucial communication connections for warfighters continue to improve

By Drew Klein, Director of International Business Development



Flash back to World War 2, 1944...

A soldier is guarding his position.

Only a steel helmet shields his head from enemy fire.

He has an SCR-536, commonly known as a Walkie Talkie, attached to his body by a sling.

The Signal Corps radioman carries a 35 lb. SCR-300 Backpack mounted radio set to monitor airwaves for incoming transmissions (image below).

allowing the soldier to survey any possible threat that may be lurking.

Protecting the men and women on the ground in harm's way, via stronger physical shields, more precise weaponry, and highly advanced ammunition, has always been an essential objective in modern warfare.

In like manner, huge advancements are taking place in terms of how military personnel stay in touch with the world both inside, and outside, their zones of carnage.

Historically speaking (according to Wiki), a position that is 'under siege' is one that is under attack, and has lost the ability to transport supplies or personnel — and thus unable to communicate with the outside world.

Though the connection between physical transport and message delivery, in terms of military communications, declined over the course of many centuries, what remains crucial is the vital importance of reliable broadcasting to any mission.

The future soldier may be alone, or in a small group; and yet, he or she will never be more connected to his or her homeland, and to the platoon members, as a result of massive strides in the development of military communications technology.

C-COM Satellite Systems continues to make important improvements

to its product line for the benefit of soldiers engaged in modern warfare, surveillance, and national defence.

The company is a pioneer in the design and manufacture of fully auto-deployed antenna systems (iNetVu®). Users need only arrive at the scene where terrestrial infrastructure is compromised, limited, or non-existent, push one button on the iNetVu® 7000 series controller, and the antenna will automatically connect to satellite in less than one minute, allowing for the transmission and reception of broadband internet.

End users of C-COM product includes militaries from Canada, USA, France, UK, Denmark, Russia, China, Kenya, and many others.

The company has sold more than 8,000 units into 100+ countries around the world and has worked through its vast reseller network to sell its solution to numerous global governments.

Militaries need options as to how they will deploy their crucial communications solutions. Tanks, trucks and other specialized vehicles require a properly mounted and integrated antenna system that meets their required specification.



Flash forward to the year 2030...

A soldier pushes his way through a lush jungle or a barren desert.

Next generation body armor protects his vital organs.

Helmets and backpacks are covered with wafer thin electronically steerable antennas which provide the war-fighter with 'always on' Broadband communications.

He deploys a golf ball-sized drone, from the palm of his hand, which leads the way and sends him back full audio and video, up to a mile ahead,





- **Backpack antennas (iNetVu® Manpacks) are lightweight, single case, highly portable systems that are available in manual point, or auto-acquire.**

All of these products can be used on the battlefield in a Comms-on-the-Pause (COTP) environment.

As a result of their single case form factor, the iNetVu Manpacks are likely to be of key value to soldiers in the field.

Available in three sizes (MP-60 cm., MP-80 cm. (upper left image: top, antenna stowed, bottom, antenna deployed, MP-100 cm.) and in three different bands (Ku-, Ka-, X-), the latest generation of antenna system is more compact, more powerful, and easier to use, than any product C-COM has previously designed.

With the latest on-board antenna controller

technology (iNetVu® 8000 series),

the MP-Series can be carried by one individual who can unpack, deploy and acquire a satellite in under 10 minutes.

The durable carbon-fiber reflector comes in identical and easily replaceable multi-segments.

Emergency responders, disaster managers and other critical personnel can easily bring broadband connectivity via satellite to an area that is completely devoid of terrestrial communications.

Looking toward the future, C-COM is engaged in high level research and development of a unique Comms-on-the-Move (COTM) antenna solution — one that will maintain connection to satellite, even while the vehicle, or soldier, is in motion.

The not-too-distant-future soldier will have access to a highly modular, conformal, electronically steerable, flat panel, multi-beam, self pointing, phased array antenna system with no moving parts.

Such antennas would operate seamlessly over traditional GEO satellites, HTS GEO Satellites as well as Non-GEO (LEO/MEO) satellites.

The potential for this 'holy grail' of antenna design is significant. From easy installation on any moving vessel, be it land-mobile, marine or aeronautical, to wearables like helmets and backpacks, these low-cost terminals have the potential to forever change satellite communications for both military and commercial applications.

Battlefield communications used to be extremely limited and unreliable. In today's connected warrior environment, the operator is more accessible to his peers and surrounding environment than ever before, thanks to smart radios, video links, drones, SATCOM, and much more.

Having the most reliable and advanced equipment available, at a reasonable price, is going to keep soldiers safer and ensure critical mission success.

The critical importance of stable, robust and 'always-on' communications for soldiers, border security forces, and any remote vertical, continues to grow.

Military comms via satellite (MILSATCOM) can be extremely complex, expensive, and unreliable. Add to this the challenge of portability, robustness and pointing accuracy, and it appears that keeping soldiers connected is no easy feat.

www.c-comsat.com

Drew leads the sales and marketing departments at C-COM and directs the promotion of the iNetVu® mobile antenna, the world's premier auto-deploy and fully motorized VSAT solution. His team works to promote global sales via C-COM's worldwide dealer network as the company seeks to partner with new resellers to sell & support the iNetVu® product. Drew holds a Bachelor of Honours Science degree from the University of Waterloo and brings to C-COM extensive sales and marketing skills acquired through the management and ownership of a commodity brokerage firm in Los Angeles.

C-COM Satellite Systems is a world leader in commercial grade mobile, motorized, auto-pointing satellite antennas, with a C-COM's product line that is a focused Commercial-off-the Shelf (COTS) antenna system.

If portability is necessary, a lightweight, highly robust system is required. When budgets are tight, and certain military specifications are not of critical importance, more and more governments are able to use a Commercial-Off-The-Shelf (COTS) form of antenna that performs an identical function as a mil-spec product... but with a lower price tag.

C-COM offers a multitude of solutions to global governments and militaries for their SATCOM requirements.

- **Vehicle mounted antennas (iNetVu® Driveaways) are installed on to the roof of most any kind of car, truck or trailer.**

- **Transportable antennas (iNetVu® Flyaways) are multi-case products that can be assembled by one person in less than 10 minutes without any tools.**

THE GOVERNMENT SATELLITE REPORT

COTM... Science Fiction or reality?

By Robert Rigsby, Senior Director, Business Development, SES Government Services



New technologies are considered “disruptive” when their introduction changes the fundamental way in which we live, work or accomplish day-to-day tasks.

The past few decades have seen a lot of new, and arguably “disruptive,” technologies enter the marketplace — from the internet, to the mobile device, to the cloud.

When these new technologies are released and begin to gain mainstream adoption, the military starts to analyze and test them to see if there are potential use cases for them in combat.

Can they make soldiers better informed or more connected? Could it improve soldiers’ survivability or increase lethality?

In many cases, the answers to those questions are, “yes,” and then the hard work begins.

The military needs to figure out how they want to bring these new technologies to bear and enable fiber-like communications and how they want to harden those technologies for harsh battlefield environments.

Finally, they will also need to understand how they can use the same equipment and technologies where the conditions are not as austere and leverage the same infrastructure they use at home or work.

For the military to deliver many of these new tools and capabilities into the fight, a high bandwidth, low latency network connection is a prerequisite for operational sufficiency. Today’s network-centric military operators demand high bandwidth connectivity to deliver the new tools, applications and capabilities they need to fight.

Historically, high bandwidth and low latency has unfortunately been the eternal stumbling block in the domain of land-based combat operations.

The Dream of Comms-on-the Move (COTM)

Today’s soldiers first encounter combat operations in barren, austere environments where the infrastructure we are accustomed to back home does not exist or is otherwise inaccessible or unreliable.

This creates a problem for the military. How can those network-enabled tools and capabilities be sent to military personnel at the tip of the spear if they can’t connect?

The answer has traditionally been through satellite. However, satellite has always come with its own challenges for the military.

Traditional military satellite (MILSATCOM) services were delivered via satellites at the geostationary orbit (GEO); examples of this include narrowband communications provided by UHF Tactical satellites or other 56 Kbps satellite data networks.



These systems were — and still are — in high demand. They are only capable of delivering so much capacity and bandwidth because of the distant orbit location.

Moreover, there is then the challenge of providing the correct ground infrastructure — the terminals and antennas necessary to utilize military and commercial satellite networks are often bulky and not exactly what anyone would consider, “mobile.”

While deployed soldiers were in camp or on base, there wasn't a problem. There was the time and space to establish ground infrastructure and deliver communications to the soldiers while they were there.

They were able to have comms at pause, but they couldn't take that connectivity with them, and that's what the military has been looking for — Comms-on-the-Move.

COTM at Sea and in the Air

Luckily, there have been major advancements in the satellite and ground infrastructure industries that could start to make this dream a reality.

Newer satellites, like those closer to the Earth in Medium Earth Orbit (MEO), have been flying since 2014.

These satellites have high-throughput and low latency, the two key features enabling warfighters to do the most demanding tasks via network-enabled services, tools and interactive applications — from high definition ISR video to the highly detailed collaboration on GEOINT necessary for making informed troop movement decisions.

New antenna and terminal technologies have also been introduced that can enable access to this new generation of satellites and deliver comms on the move.

Unfortunately, they still are not small and mobile enough to be carried by soldiers on foot but they are perfectly fine for trucks, ships and large transport airplanes.

Is COTM coming for the Dismounted Warfighter?

Yes. Unequivocally, yes.

The first computers took up the better part of an entire room. Today, that same computing power is dwarfed by something that fits in our pockets. In fact, there is more computing power in a Fitbit than that used to land a man on the moon.

New technologies come out all the time, and they're constantly getting better and smaller. Terminal and antenna technologies are not an exception.

Newer, commercially viable electronically steered, phased-array antennas are smaller and more capable of handling the technical requirements of MEO satellite constellations.

These antennas and supporting electronics are in development and testing right now, and should be available in just two or three years.

When these new antenna and terminal technologies enter the marketplace, they're going to open the door for the military to embrace MEO satellite constellations — and the high throughput, low latency connectivity that they enable — for COTM across all requisite domains: air, sea and land.

That's when the dream becomes reality — when soldiers will get communications at low latency and high throughput.

These critical qualities enable warfighters to enjoy the same fiber-like response times they enjoy at home, and use the same mission critical interactive applications, like they do at home. This will revolutionize warfare.

SES (Government Solutions) has a MEO satellite constellation today called O3b. Moreover, the company has funded and will deliver by 2022 its follow-on capability with 10-25 more capability — it's called **mPOWER**.

Through just seven satellites, mPOWER will deliver up to 35,000 beams globally below 50 degrees latitude. That is an impressive 100 Gbps per spacecraft of capability into the tactical edge tools base.

For additional information about mPOWER and how it can be used in government implementations, download the information sheet, “O3b mPOWER for U.S. Government Missions” at this link: ses-gs.com/govsat/resources/o3b-mpower-for-u-s-government-missions/

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THE ORBITAL TEST BED

Using hosted payload platforms to deliver missions to space — rapidly and affordably

By Craig Gravelle, Director, Space Systems Strategic Development, General Atomics Electromagnetic Systems (GA-EMS)



High value civil and military and payloads and experiments often must wait several years before flying in space... if they fly at all.

Advances in low cost launch and rideshare approaches have helped, but finding real estate on satellite buses — large and small — continues to provide challenges to schedule and cost.

Operational payloads, such as the **Aireon** air traffic surveillance system on **Iridium NEXT** satellites, have demonstrated benefits of constellation-wide commercially hosted payloads. Experimenters and principal investigators, however, face daunting challenges to hosting their 'one-time' demonstration and experimental payloads on large

satellites. They are often subject to overly involved and extraneous compatibility requirements with primary payloads, and a negligible ability to effect schedule and launch dates.

Similarly, procuring a dedicated smaller satellite from industry providers to support payload requirements demands increased investment and oversight, and resultant longer timelines to get a payload to orbit.

General Atomics Electromagnetic Systems (GA-EMS) is uniquely positioned to meet these challenges through a strategy of modular, scalable satellite designs and hosted payload platforms that can be optimized to suit the needs of multiple customers.

With a rich heritage in satellite design and operational flight experience, GA-EMS offers a broad portfolio of bus sizes and capabilities, from **Low Earth Orbit (LEO)** CubeSats to 600 kilogram platforms that can be tailored to a payload provider's unique mission needs. GA-EMS' service approach allows the company to work closely with customers to negotiate the best solution, which can also include launch coordination and on-orbit mission control services, to deliver their payloads when and where they are needed.





The Mission Operations Center.
Photo is courtesy of GA-EMS.

GA-EMS' **Orbital Test Bed (OTB)** spacecraft (*artistic rendition of the OTB is presented on the previous page and is courtesy of GA-EMS...*) are providing a much needed capability to rapidly and affordably deliver customer payloads into a broad range of Low Earth Orbits. The flexible, modular, and scalable architecture of the OTB platform is designed to be optimized for high performance missions and a broad range of payloads.

OTB's versatility enables the launch of single or multiple payloads on a space platform, offering a more cost-effective solution to meet a wide variety of government, commercial, and academic technology demonstration requirements.

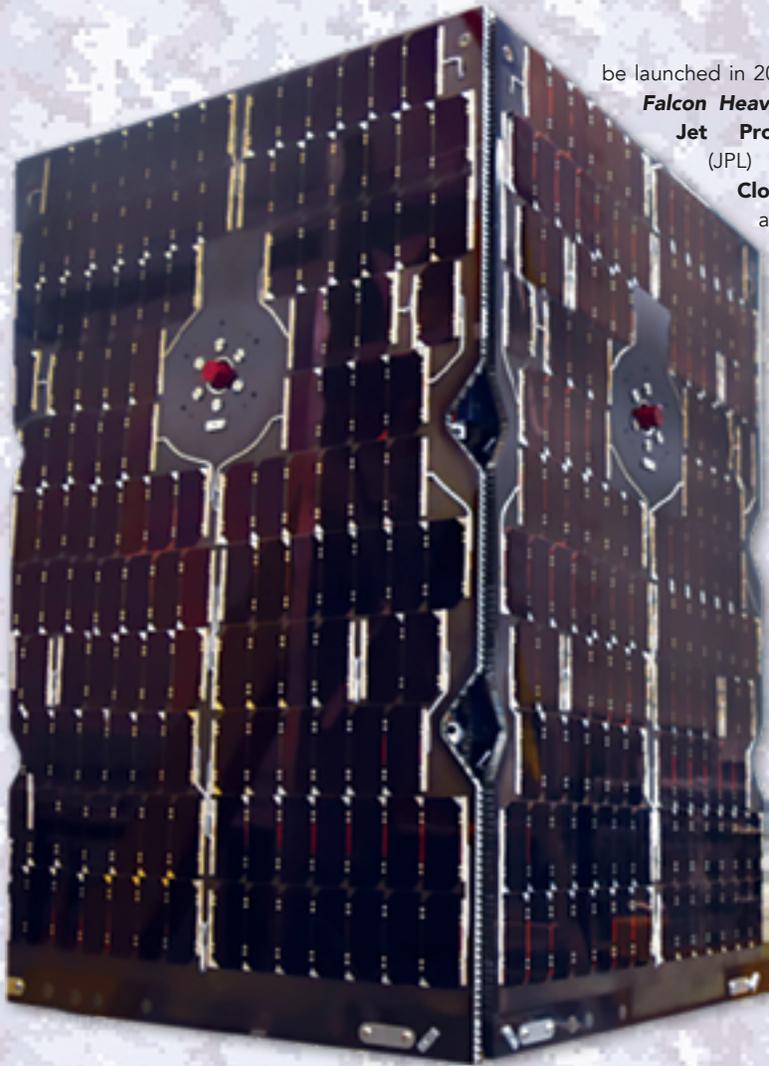
Payload Spacecraft

The United States Government (USG) provides several avenues for rapidly and affordably flying space experiments and payloads. Most notable are **NASA's Rapid Spacecraft Development Organization (RSDO)** program and the **Department of Defense (DoD) Space Test Program (STP)**.

The **United States Air Force (USAF) Space & Missile Systems Center (SMC) Hosted Payload Solutions (HoPS)** program provides a contracting capability to standardize processes and interfaces for placing military capabilities aboard commercial satellites. The OTB program is complementary to these programs and effectively uses them to further optimize the procurement process.

For military payloads, STP has been providing flight opportunities for missions on the **Space Experiments Review Board (SERB)** priority list for more than 50 years. The **Orbital Test Bed** contracting approach is designed to streamline acquisition and reduce costs. The approach breaks from the current paradigm of selling a spacecraft to customers who — unlike for other commodities — can't get the spacecraft back or resell it.

For OTB missions, GA-EMS owns the spacecraft and recovers cost by providing flight services to the hosted payload providers. This enables a *'lean forward'* procurement strategy that allows GA-EMS to start the planning for the next mission while working early to broker with and coordinate between interested payload providers.



A "fully dressed" OTB. Photo is courtesy of GA-EMS.

The first or 'anchor' payload provider is typically the most instrumental in defining the spacecraft and associated capabilities. However, GA-EMS retains the flexibility to enhance the bus design to accommodate additional hosted payloads without compromising the service provided to established payload providers.

GA-EMS has been contracted for OTB platforms that demonstrate the flexibility and scalability of the OTB approach. The first OTB spacecraft will

be launched in 2019 on the next **SpaceX Falcon Heavy** and hosts the **NASA Jet Propulsion Laboratory's (JPL) Deep Space Atomic Clock (DSAC)**. DSAC is a miniaturized, ultra-

precise, mercury-ion atomic clock that, while hosted on OTB, will demonstrate its functionality and utility for one-way-based navigation.

This ESPA-class OTB also hosts additional payloads and experiments including an **Air Force Research Laboratory (AFRL) Modular Solar Array**, the **USAF Academy Integrated Miniature Electrostatic Analyzer (iMESA-R)**. The primary payload suite consists of a **radiation effects monitor (RadMon)**, a programmable receiver (**FlexRx**) and **Celestis** cremains.

Planned for launch in 2022, another OTB spacecraft is being designed to host the **NASA Langley, JPL-**

built, **Multi-Angle Imager for Aerosols (MAIA)** payload. MAIA will characterize the sizes, compositions and quantities of particulate matter in air pollution and the link with health issues. At 280 kilograms, this OTB spacecraft demonstrates the flexibility of the hosted payload service to tailor a solution to suit the large, unique MAIA payload.

GA-EMS is also designing and building a third OTB spacecraft for a primary payload called the **Remote Sensing Payload (ReSI)**. ReSI will provide reflectometry data of signals from **Global Navigation Sensing System (GNSS)** satellites.

Through the HoPS contracting mechanism, the **USAF's SMC** contracted for services to host and operate the **Advanced Data Collection System (A-DCS)** payload for **NOAA/CNES**. A-DCS supports the **Argos** worldwide location and

data collection system by providing data used for studying oceans and atmospheric conditions; preserving and monitoring wildlife; managing water resources; and monitoring volcanoes, fishing fleets and shipments of dangerous goods.

This OTB mission is planned for launch in early 2021 and is approximately two years after SMC contracted with GA-EMS for the hosting service, once again demonstrating the quick reaction capability of the OTB approach.

The Orbital Test Bed satellites are designed and built in the company's Englewood, Colorado, facility. The **Mission Operations Center (MOC)** is also located in this facility to provide customers with control, operation and data download services for on-orbit payloads. GA-EMS is supporting launch and mission operations at their MOC for the first OTB and will also be the primary operations center for the OTB missions supporting the MAIA and ReSI missions.

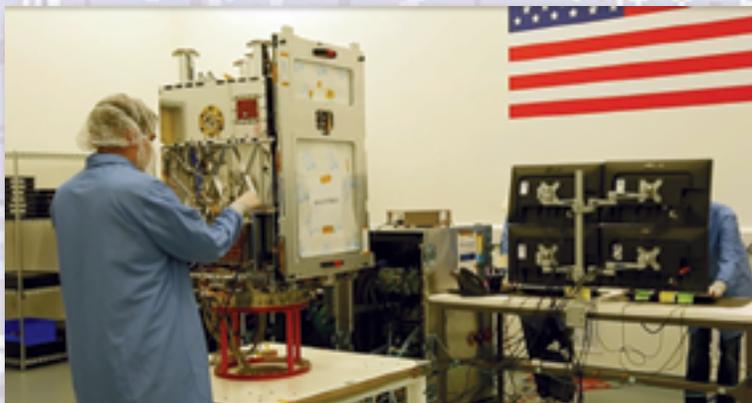
GA-EMS is the spacecraft manufacturer for **Draper Laboratory's NASA Commercial Lunar Payload Services (CLPS)** program. The team will support NASA in the delivery of small rovers and instruments to meet lunar science and exploration needs, advance development of lunar landers for human missions, and conduct research on the moon's surface ahead of a human return. GA-EMS will apply its manufacturing and satellite design expertise to deliver CLPS spacecraft supporting NASA's next mission to the moon.

GA-EMS is planning for future Orbital Test Bed missions and is working with primary, secondary and dedicated payload providers to define their service needs. Drawing from a broad portfolio of satellite platforms, early customer involvement in planning efforts will result in optimized platforms that meet payload and mission needs rapidly and more affordably.

www.ga.com

spacesystems.info@ga.com

Craig Gravelle is the Director, Space Systems Strategic Development at General Atomics Electromagnetic Systems. Mr. Gravelle is responsible for the growth of the GA-EMS space systems business for US Department of Defense and civil government programs. Mr. Gravelle has more than 35 years of experience and has held senior management and executive positions in a variety of companies ranging from start-ups to large aerospace companies. He has a broad range of industry experience developing new business opportunities with the intelligence community, US Air Force, international clients, and commercial space systems customers.



The OTB lab. Photo is courtesy of GA-EMS.

NORSAT ASSISTS THE USAF TO...

... stay "above all" rescue operations

Founded in 1907, the United States Air Force (USAF) is the largest and most technologically advanced as such military arm in the world.

The 31st Rescue Squadron is part of the USAF Pacific Air forces, 18th Wing, at Kadena Air Base, Japan. This squadron trains, equips and employs combat- ready pararescue specialists with a sole focus of 'search and rescue.'

The 31st Rescue Squadron selected Norsat's CFK-100E compact SATCOM fly-away kit for secure communications during rescue missions.

Background

The 31st Rescue Squadron is responsible for disaster relief missions, rescue missions and emergency response, especially the organization and management of resources for dealing with all humanitarian aspects of emergencies (preparedness and recovery).

Whether an emergency at sea or an ambush on the ground at a deployed location calls for the retrieval of military members from a deadly situation, members of the 31st Rescue Squadron must be ready to complete a mission within a specific time frame.

There is a need for seamless communication between personnel for rescues in diverse environments, whether it be from a helicopter or fixed-wing aircraft, on the ground, in a crowded city or remote mountainous terrain.

There are instances where Airmen may even be deployed for sensitive equipment recovery, hostage rescue missions and classified jobs.

Challenges

The environment that this Squadron may need to operate in, is arbitrary, volatile and unpredictable.



Norsat's CFK-100E SATCOM fly-away kit.

To effectively achieve their objectives, the communication between Squadron Commander and combat rescue officers, pararescue (PJ) specialists and survival, evasion, resistance and escape (SERE) specialists needs to be robust and secure with durable equipment.

The team remain in constant contact to work together and facilitate the return of isolated personnel or materials, with support sections like Aircrew flight equipment, Armory, Admin Airmen and more.

In addition to the harsh surroundings, they have stringent response deadlines, which is often not more





The hard, rugged cases with handles and wheels ensure easy storage and transport to remote locations.

In addition to ample storage and integrated power for two Cisco ASA-5505, KG250/ KG175D/STE systems, two Panasonic CF-19 rugged laptops and an E710 BGAN terminal, the kit provides Power-Over-Ethernet.

Defense organizations are faced with increasing demands to provide real-time data to and from the field. The reason being — information saves lives.

Norsat values its customers, such as the USAF, and is committed to providing

than half an hour. This means the team needs to set up integrated fly-away communications centers supporting simultaneous voice, video and data communications over classified (red) and unclassified (black) networks within a short span of time.

Understanding the needs of the U.S. Air Force (USAF), Norsat manufactured and supplied CFK-100E compact fly-away kits in record time to the organization.

Each high performance integrated kit is packaged in two airline easy carry-on cases that provide secure and non-secure communications via a Type 1 NSA Certified Inline Network Encryption Device and an Explorer 710 Inmarsat BGAN satellite terminal.

Even without the presence of an external plug-in power source, the kit functions smoothly due to SMART UPS battery backup using two UBI-2590 batteries.

Custom OEM rigid backpacks with nylon covered foam insets ensure the kits are light weight and easily deployable within a matter of minutes.

them with the best products, service, and support.

For more than 40 years, Norsat has worked closely with its customers to provide standard or customized solutions to meet the exact requirements of the customer's application.

Norsat supports the 31st Squadron motto "*These things we do that others may live,*" and continuously strives to develop sophisticated communications tools for rapid deployment into the harshest of environments.

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