SATCOM for ISR

Ability to shift SATCOM capabilities within minutes enables planners to quickly react to new missions.

(Editor's Note: Military Information Technology *recently posed the following question—based on a discussion topic of a workshop scheduled for the Satellite 2011 conference in Washington, D.C., March 14-17—to some of the leading companies in the field of commercial satellite communications: "What role do you see for the commercial SATCOM sector in providing connectivity for government/military UAVs and ISR capabilities?" Following are their responses.)*

Embrace the Investments

Commercial SATCOM players stand ready to introduce new delivery approaches that will provide the government with enhanced service and performance.

By Andy Beegan, Senior Vice President and Chief Technology Officer
Segovia Inc.

The commercial SATCOM industry is well-positioned to provide U.S. government UAV and ISR users with significant increases in connectivity performance and cost efficiency, particularly through global managed services providers. Antiquated processes, however, currently create a formidable barrier to entry and keep government from fully benefiting from the commercial sector.

Ten years ago, as U.S. military activities ramped up overseas, commercial SATCOM was quickly integrated as a significant component of Department of Defense mission planning. Today, commercial SATCOM could play an even more central role because of advances in technology and the development of more mature and repeatable service delivery methods. Deploying these delivery methods is quick and secure, and reduces the per-unit cost of satellite bandwidth.

These advances are particularly important to UAVs and ISR, which rely on airborne applications that require four to eight times the space segment to deliver equivalent data rates compared to land-based VSAT links.

As was the case with land-based networks 10 years ago, UAV and ISR communication platforms are currently limited by legacy terminal hardware, rigid airborne certification requirements and outdated spectrum usage. All of these issues form a major obstacle to the introduction of new solutions that would be more cost efficient and use bandwidth more effectively.

Given that the satellite space segment is the primary commodity cost factor in an end-to-end network solution, government should look to the commercial SATCOM industry's managed services providers. They have demonstrated significant value by maximizing the efficiency of space segment utilization as a core driver of their business operations, and can transfer the cost savings to government customers. Furthermore, managed service providers lean forward to make the necessary investments that produce a

total solution, not just the components, offering both savings and capabilities to the government.

Providers such as Segovia offer far more than raw bandwidth bundles. They engineer, build and manage communications infrastructures designed for customers' specific needs and situations. Services such as monitoring can bring down costs, through careful management of the transponder loading, for example, while simultaneously improving bandwidth efficiencies and increasing the quality of mission-critical communications.

The commercial SATCOM sector is highly adaptable and agile, and as a result, can also achieve increased efficiency through the implementation of new and emerging technologies. In particular, the emergence of Ka-band platforms will deliver greater capability at a lower cost per bit than the traditional Ku- and C-band operators.

As the UAV and ISR market continues to expand, the government needs to embrace the investments that commercial companies are making in this space that will enable the next generation of UAV and ISR applications. The benefit from the commercial SATCOM players who stand ready to introduce new delivery approaches will provide the government with enhanced service and performance with greater value.

Critical Link in UAV Operations

The satellite industry is accelerating its capacity to support high-bandwidth requirements like those imposed by advanced ISR systems.

By Britt Lewis, Vice President, Marketing and Business Strategy
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Time magazine ran a cover story recently on singularity, which is the concept that robotics and artificial intelligence are progressing so rapidly—indeed at an exponentially accelerating rate—that by 2045 we can expect a "cyborganic" environment in which civilization is completely and irreversibly transformed.

Nowhere is this envisioned robotic transformation and impact seen more readily today than in the military's use of UAVs. Indeed, over the last decade or so, the military has seen such an evolution in technology that today, the warfighter has the capability to project power through the use of remotely piloted/unmanned systems that reduce risk to human life while also improving the timeliness of battlefield situational awareness.

Largely behind the scenes in the transformation from manned to unmanned flight lines, however, is the critical role of satellite communications as an enabler of semi-autonomous and, in the future, fully autonomous UAV flight. Reliable satellite communications are a critical enabler for medium- and high-altitude UAVs. Increasing demand for UAVs overall and the increasingly sophisticated sensor suites employed on the vehicles have dramatically increased demand for satellite services.

UAVs have been the most dynamic growth sector of the aerospace industry in the past decade. The Teal Co. expects that trend to continue, projecting that U.S. government spending on UAVs will grow from $3 billion in 2011 to approximately $49 billion by 2020 for medium- and high-altitude combat-equipped UAVs. Based on a static operations tempo scenario, Intelsat projects the U.S. government alone will operate some 800 high-capacity, long-range, high-endurance missions annually by 2018.

For the Predator and Reaper, both of which are medium-altitude, long-endurance UAVs, product roadmaps call for data rates climbing steadily to more than 45 MBps, from today's range of 3.2 to 6.4 MBps. Similarly, the very high altitude long endurance UAVs like Global Hawk and the Broad-Area Maritime Surveillance vehicles will progress to 100s of MBps in the future, from 8, 20 and 47 MBps throughput today. This higher throughput is being driven by high-definition cameras, multiple video feeds, wide-area airborne surveillance radar, and modular, multi-intelligence payloads.

Manned ISR platforms are also transitioning from narrowband communications using L-band satellites to wideband commercial and military SATCOM, creating even greater demand for high-capacity bandwidth. Based on the progression of data rates described above, Intelsat projects that ISR bandwidth demand will reach 16GHz by 2018. This is more than double the commercial SATCOM in use today to support operations in the Middle East.

Moreover, Intelsat foresees that there will be a global expansion of UAV operations, UAV capabilities will be apportioned to combatant commands beyond CENTCOM, and coalition partners will make greater use of this technology. In short, assuming a continuing high operations tempo into the future, Intelsat's expectation is that this proliferation is likely to challenge the availability of bandwidth for years into the future, whether on wideband MILSATCOM or commercial SATCOM.

The satellite industry has been successful in supporting this recent growth due to the scale and flexibility inherent in commercial satellite fleets and the frequent technological upgrades offered by robust fleet replenishment schedules. Intelsat and Eutelsat, for example, have redeployed satellites and steerable spot beam capacity over Southwest Asia to meet the current bandwidth demands for UAVs in the CENTCOM area of responsibility. Intelsat today provides some 1 GHz of total wideband capacity, representing more than 50 simultaneous flights of manned/unmanned ISR missions in a number of theaters.

Intelsat believes that changes in the UAV concept of operations can improve the efficiency and effectiveness of the UAV's use of satellite capacity. Such changes might include the use of inclined-orbit satellites as a low-cost alternative to station-kept satellite capacity; increasing the flexibility of the ground control stations to provide greater spectrum/frequency band access and flexibility; more aggressive coding efficiencies to reduce bandwidth usage; and enhanced video compression techniques.

Intelsat is working with satellite manufacturers on specialized payloads, some with the economic advantages of hosted payloads, for next-generation capabilities that would provide dramatic increases in overall bandwidth. These new payloads will also have coverage flexibility, connectivity, gain and wideband channelization that will allow operators to support many additional airframes at much higher data-throughput rates. With a satellite launch cadence of three to five spacecraft per year at minimum, the continuing advances in these future customized UAV-friendly payloads should offer superior long-term performance for UAV operations over the satellite assets flying today. The industry is also evaluating additional security features that can be built into the next generation satellites to enhance overall service resilience.

The critical link in UAV operations is now, and will continue to be, satellite bandwidth. The satellite industry is accelerating its capacity to support high-bandwidth, sophisticated requirements like those imposed by UAV operations. Careful and far-sighted cooperation between government requirements and commercial capabilities will be essential to the success of this enterprise.

Flexibility and Security

Ability to shift SATCOM capabilities within minutes enables planners to quickly react to new missions.

By Jim Ramsey, President
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Whether an ISR/UAV is deployed to swoop over the mountains of Afghanistan or quietly track potential threats in Iraq, the commercial SATCOM sector delivers solutions that are flexible enough to adapt to rapidly shifting missions and environments, within a highly secured network environment.

Most of us within the commercial SATCOM community have the ability to quickly re-groom, re-shape and even re-allocate committed information rates or maximum information rate within minutes. This gives the mission planners and our intelligence community the ability to quickly react to new targets or new missions.

This is especially true for a company such as MTN Government Services, which owns its own teleports, satellite hubs and 24/7 network operations centers (NOC). We have the ability to optimize bandwidth within the area of operations to perform best in specific missions and/or requirements. We can do this within minutes, with a simple call to our NOC. Our community can also see across various satellites, to spot beams and regions throughout the globe and identify the best solution for the government in relationship to the mission(s). This means the customers won't be stovepiped into a single solution. It allows us to plan a seamless transition from coverage to coverage. It's essential for any commercial SATCOM service provider to understand the underlying military mission and the requirements. Because we do, we provide the best possible solutions for the government.

Within this industry sector, we clearly understand the mission and the critical deployment of UAVs and ISR mission. We know our support can't fail—not when lives and global security is at stake. We strive every day to improve our services and sharpen our skills and technology, to support "those who do so much for all of us."

COMSATCOM Flexibility

Commercial solutions can accommodate smaller remote antennas and unique waveforms to create more cost-effective solutions.

By Steve Johnson, Director, Government Services
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It is vital to the security of any nation to defend its borders and analyze both manmade and natural threats while also monitoring conditions that enhance quality of life. Autonomous aerial vehicles (AAVs) and ISR programs play an integral role in facilitating homeland security.

As a satellite communications integrator, Globecomm has been keenly engaged in the development of AAV communications services, specifically for ISR applications. Over the past few years, the company has investigated and modeled various technologies and modulation techniques to maximize the bit-per-dollar ratio.

When a government, NGO or private organization is interested in data collected by an AAV, that data still has to be transported from the vehicle to the ground in an effective, efficient manner that retains the integrity of the data. Today the cost of the payload transport is relatively high because of the current usage of relatively inefficient links over the COMSATCOM constellation.

MILSATCOM is not a realistic option because of the large amount of bandwidth required for this transport and the fact that MILSATCOM is being used for other critical tactical missions. The challenge to industry is to make the link more efficient and cost effective while supporting the ever-growing mission of any single AAV or fleet.

COMSATCOM is more flexible in accommodating smaller remote antennas and unique waveforms to create more cost-effective solutions. This flexibility is the key to addressing two of the most important questions posed to COMSATCOM managed service providers: How can

industry develop new compression techniques (along with on-board processing) to lower the amount of data that needs to be passed; and can higher modulation schemes such as 64 QAM be utilized using ever smaller antennas? Various frequency bands can enable smaller remote antennas to pass larger amounts of data. Having the ability to transmit from a vehicle in Ku-, X- or Ka-band to leverage current availabilities and missions is just part of the answer.

The other part of the solution is more advanced compression algorithms and better on-board processing techniques. Globecomm has engaged multiple companies about their technologies and is looking at how manufacturers of high-end audio/video codecs are able to handle large data packages through SATCOM connections between 2 and 18 Mbps in size. Engaging with non-SATCOM industries is the only way to solve the data processing challenge.

A combination of swappable optics on the vehicles antenna before it takes off; allowing commercial teleports/integrators to be able to transmit/receive Ka- and X-band commercial and military frequencies, and new processing and compression algorithms is ideal. Codec, antenna and modem manufacturers need to work with others in the industry to develop a system that will both adapt to high throughput needs and be easily altered to change to the frequency band required at the time of the mission.

With these improvements installed in these systems, AAVs and ISR data delivery can be transported with a much better bit-to-dollar ratio and allow more vehicles to operate within an era of tightening government budgets. The new AAVs are great tools that allow us to increase our quality of life and security simultaneously and transport the data in or near real-time, enabling the analyst to utilize the data to the fullest extent possible.

A "Must" Relationship

Through true partnership between industry and government, providers can develop turnkey solutions that support the mission across the entire network.

By Jim Tran, Vice President, Defense and Federal Solutions
and William Hartanovich, Account Manager, Airborne ISR Programs
Harris CapRock Communications

ISR delivers indispensible strategic and tactical advantage across all sectors of our nation's defense and homeland security forces. Former Secretary of Defense Donald Rumsfeld and his successor, Robert Gates, each have insisted the U.S. military accelerate procurement and deployment of ISR platforms in theater and across the globe. An ISR task force was developed and approval was given to "reprogram" funds from other areas, in order to support these additional ISR projects.

The number of missions the United States is flying in support of ISR has grown significantly in the last few years. The Department of Defense flew an estimated 400,000 flight hours with unmanned aircraft in 2008. At the time, it sought funding to increase overall UAV missions by 2010. Today, the Army has about 250 Shadows in its inventory, while the Air Force has 147 Predators, 48 Reapers, and 17 Global Hawks. The preceding does not include the vast number of smaller UAVs used by Marines and special operations forces.

The majority of tactical UAVs, such as the Raven, used for close proximity missions make use of line of sight communications for command and control and sensor data. Flying distances between the aircraft and ground control device are relatively short—between 10 and 50 miles.

There are, however, special breeds of UAVs that utilize beyond line of sight (BLoS) communications. The BLoS class of UAVs such as Broad Area Maritime Surveillance (BAMS), Global Hawk, Predator/Reaper, Grey Shadow and Warrior A, utilize geostationary spacecraft to cover vast operational areas—hundreds of square miles—and up to thousands of miles from ground control systems. Of the aforementioned aircraft, all except BAMS utilize commercial satellites.

Currently, BLoS UAVs rely on satellites having unique technical capabilities. These aircraft use satellites to send immense quantities of imagery and sensor data from their remote locations to geographically dispersed sites in the United States. Equipping the aircraft with high-definition video, synthetic aperture radar and other sensor packages creates demand for larger quantities of a finite satellite resource: bandwidth.

Due to technical constraints, data throughput requirements, and satellite availability, in some regions of the globe it is unrealistic to operate more than one or two BLoS UAVs at the same time. In other regions, dozens of simultaneous sorties are possible. These problems can be resolved through a combination of efforts, the largest of which involves partnership and planning between commercial satellite services providers and government UAV users.

A recent Northern Sky Research study predicts that "future SATCOM requirements are likely to further increase such that managing the bandwidth, hardware and software available to militaries around the globe will be a tremendous challenge. In enabling the warfighter, the mix and the management of proprietary and commercial satellite capacity will have to be fairly easy and seamless in order for the warfighter to continue to be effective."

An estimated 30 GBps of capacity is expected to be in use by DoD by 2014. This capacity may still be inadequate to support all U.S. government requirements, and there are not enough government spacecraft in orbit to handle the load. Commercial satellite capacity remains the number-one viable solution.

With extremely tight capacity and skyrocketing satellite fleet operator prices, key service providers have focused on developing a more comprehensive approach to providing SATCOM solutions for UAV missions. By tracking customer bandwidth utilization, trends and inventory, and developing network optimization tools, service providers dedicated to the customer mission are able to make informed decisions about the build-out of their

network infrastructure to pre-position services on behalf of government clients, so they will be available when needed.

Service providers know satellite communications are important to the ISR mission. We must be more than a vendor to the government and offer reliable and competitively priced solutions that deliver an end-to-end capability. Industry needs to understand the challenges facing the warfighter, such as the slow transition to the H.264 (MPEG-4) feed standard, mostly due to cost, and be flexible in developing solutions that mitigate these issues.

The government also needs to stop buying independent systems and the disjointed management of the myriad of separate components operated to achieve the same basic results. Service providers should seriously consider partnering with ground suite providers and vendors to offer complete, compatible exploitation capabilities and cost-effective solutions for government customers.

Through true partnership between industry and government, providers can develop and offer turnkey solutions that support the mission across the entire network as an integrated military-grade package, to include air and ground links, connectivity to the ground stations, and the return path back to CONUS. Together we can better address issues of interoperability among the services as well as assure the quality management of video distribution capabilities and more effectively prepare for dynamic changes in missions and growth. Only this type of solutions packaging will bring true value to our national interests.

Great Fit for ISR

Commercial technology is a low-cost way to implement service because the network products are COTS and a global network is already in place.

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We see commercial SATCOM playing a very prominent role in providing connectivity for government/military ISR. Commercial technology and services are a great fit for the application and for today's budget environment for several reasons, including:

- Very low-cost way to implement service because the network products are COTS and a global service network is already in place
- Current network system matches up well with airborne ISR requirements
- Very advanced commercial technology, so government/military customers benefit from current and future research and development dollars, as opposed to having to bankroll development programs.

ViaSat is already operating a global mobile satellite network that is providing connections for aircraft as well as ground mobile and maritime platforms. The network has been operational for over five years, and customers include a wide mix of U.S. and international commercial clients, as well as many U.S. government and military users. It is simple and inexpensive to run service trials or connect to the network just by buying and installing terminals.

In addition to this worldwide service, we also operate several turnkey service regions dedicated to specific military missions. For added security, these regional coverage areas generally terminate in hubs located at U.S. government facilities in the specific areas of responsibility (AORs). But because of our worldwide coverage, aircraft operating in these private hub AORs also have the option to "roam" onto the worldwide network as needed.

This is particularly valuable for en-route communications applications, including USSOCOM C-17 and C-130 missions. So where there are concentrated enclaves of U.S. government aircraft, there can be dedicated, private service. But in areas where aircraft only occasionally pass through, then those aircraft rely on an existing, but enhanced commercial service.

The coverage area for this network also continues to expand, and communication speeds continue to increase as we increase the network capacity to serve a growing commercial customer base, which in turn is available to government/military customers.

The current network is based on our ArcLight modem and networking technology, which was expressly designed to operate with very small antennas, including conforming to the off-axis emissions requirements necessary to avoid adjacent satellite interference within ITU and FCC regulations. Almost any size aircraft can use the service, because it routinely operates with airborne antennas as small as 11.5 inches.

To match up with ISR needs for more video at higher definition, the current shared forward link operates up to 24 MBps, while the individual return links operate at up to 1 MBps. A software upgrade in 2011 will increase the forward link data rate to over 30 MBps. Additional near-term upgrades using commercial technologies such as adaptive coding, spreading, and modulation will provide even more robust performance and additional capabilities for mobile users.

With the advent of Ka-band satellites that bring a lower cost per bit and higher performance, plans are also well under way to augment our global mobile network with Ka-band coverage. We can see a future need for Ka- and Ka/Ku-dual band plus multi-band, multi-beam electronically steered array antennas to ensure seamless transition between frequency bands, satellite beams and coverage areas. Government/military customers will benefit from those developments without paying full development costs.

We are building a series of Ka-band high-capacity satellites, with the first one being launched in the second quarter of 2011 (ViaSat-1). Other satellites will follow, with each providing well over 100 Gbps of usable throughput.

ViaSat has also entered into agreements with other Ka-band operators including Eutelsat (KA-SAT, successfully launched December 26, 2010) and Yahsat (first satellite launching later this year) to share technology and bandwidth access that will ensure maximum Ka coverage throughout North America, Europe, the Middle East and portions of Africa—the areas of greatest need for government and military customers.

Demonstrating the validity of all that we have said here, we are already serving hundreds of military and government customers. We have logged approximately 150,000 flight hours on commercial aircraft and more than 400,000 on military aircraft.

New SATCOM Synergies

It is important to value SATCOM across a number of future mission areas.

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Commercial SATCOM capabilities, as always, are essential to future UAV and ISR missions and requirements. Developments in select markets bring new synergies that stretch beyond the atypical boundaries of connectivity and telemetry for UAVs and special sensors.

Let me frame five major focus areas for the future of SATCOM from ORBCOMM's perspective:

Dynamic Capacity. SATCOM core functions tied to capacity for UAV payload backhaul, telemetry, tracking and control, data processing, and high capacity broadcast of products will continue to stay core to these missions, and such capabilities will continue to be the major consumers of bandwidth for the war-fighter and first responder. Of importance will be expansion of services to support cloud computing, edge network capabilities, and inter-switch IP network trunking for 3G/4G and other wireless services. Continued work on high capacity communications "on the move" and "on the pause" is needed for future operations both on air and ground C2 platforms.

Mobility. UAV and ISR functions are not broadband only. The need for intelligence collection and dissemination that remains network agnostic, agile and securable is essential. Additionally, SATCOM cannot be treated as an independent enterprise, and tomorrow's requirements must focus on the integration of spectrum, waveforms, terrestrial carriers and versatile open standards. Continued use of MSS services, integrated 3G/4G wireless and other civil and commercial wireless standards is key to future operations. Moving from stovepipes to "netpipes" is not the answer. This perhaps can be best defined by the need to integrate such concepts as an Android operating system within military device structures for core security, applications development, man/machine utility and visualization, or the need to integrate national, theater and local data tailored to an operation with access with a mobile warfighter or responder.

Machine-to-Machine, Distributed Sensors and Telematics/Telerobotics. These SATCOM functions sit in ORBCOMM's "sweet spot." The C4ISR community is significantly lagging behind commercial best practices in M2M programs. The state of affordability in advanced micro-processing and micro-networks hosted off a parent modem device and sensor concepts across all senses and domains offer our forces a technical advantage elegantly based upon the transfer of bytes as opposed to manipulation of terabytes. The complexity of machines can be overmatched by the simplicity of telematic reporting and sensing, and simple remote control and manipulation of robotic assets will carry the day as force structure or operational risks impede mission success.

The introduction of advanced satellite RFIDs and TTL devices act both as asset management and tracking devices, and also "surrogate" SATCOM links for sensor devices. Distributed unattended C4ISR information "mines" allow for cueing of events, their 3-D location and even their characterization. This limits the need for painting the sky with energy, or placing troops in harm's way in many missions. Such capabilities also can apply to integrated cooperative tracking of small and large vessels tied to the Automatic Identification System and its

current and future missions, which ORBCOMM performs as a worldwide service.

Cyber-Support and Timing. Commercial space offers plausible future means to mitigate risk in network mission success. Commercial space offers the potential to rectify shortfalls in network timing and Internet-based cyber-attack. Selected space links should be provisioned to inoculate networks and resurrect or ensure PNT for network continuity of operations. Network-centricity is the main enabler of future UAV and sensor programs. The denial of such services in network attack cannot be tolerated. Some attainable provisions for cyber and timing protection remain essential in supporting network centric operations in the future.

Social networks, stability operations and nation building. In recent months we have seen the impact of civil and partisan C2 over Twitter and other Internet-based social media. This arguably has emerged as an ISR tool, if not a "weapon" of the future. Commercial SATCOM can play and should play a major role in offering infiltration and exfiltration communications to those societies that seek our help, be it social or political reform. SATCOM becomes a great enabler in support of news gathering, local intelligence and assessment, situational awareness to the world and, in many cases, stability in crisis. Multiple systems and hosts offer the flexibility to function through Internet denial or filtering. Additionally, entertainment and educational broadcasts still matter with regard to supporting a population generating and expecting change.

In closing, it is important to value SATCOM across a number of future mission areas. In many cases it will be more important to work the elegance of a byte than the processing of a terabyte, and perhaps just as critical to see a YouTube or Twitter feed as that of a UAV.

Adopt Open Standards

A standards-based strategy will allow military systems to operate much more efficiently and facilitate closer cooperation with commercial industry.

By Rick Lober, Vice President and General Manager, Defense and Intelligence Systems Division
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The military's demand for SATCOM has increased exponentially in the past 10 years. Much of this demand has come from the increased use of commercial SATCOM in ISR efforts via UAVs and other tactical communications needs. The military is currently utilizing commercial satellites to meet its mission requirements, and we will continue to see greater engagement with the commercial satellite sector as the military's need for SATCOM continues to rise, enabling complete situational awareness on all fronts.

Acquisition vehicles such as the General Services Administration (GSA)-Defense Information Systems Agency (DISA) Future COMSATCOM Services Acquisition (FCSA) will also help the military and intelligence communities work with industry to not only meet their requirements, but also increase the bandwidth efficiency of systems. For example, current SATCOM technology in use within DoD for ISR systems is often based on full-time, dedicated channels, such as Single Channel per Carrier links or dated standards such as the Common Data Link, which is generations behind commercial technology with regard to bandwidth efficiency. Increasing bandwidth efficiency will help the military decrease the cost of both SATCOM hardware and operations.

To help meet the needs of current and future military and intelligence requirements, open standards should be adopted, such as IP over Satellite (IPoS), which is the world's leading satellite air interface standard, developed by Hughes and approved by ETSI, TIA and ITU organizations, and supports Multi-frequency Time Division Multiple Access (MF-TDMA) links.

Following a modern standards-based strategy will allow military systems to operate much more efficiently and facilitate closer cooperation with commercial industry in developing integrated fixed and on-the-move implementations. In particular, as airborne missions become more critical across military and homeland defense operations, IPoS/MF-TDMA links have proven ideal for supporting fixed wing platforms, and tests are progressing rapidly for rotary wing applications.

Hughes is also developing new signal waveforms that will allow military users to greatly reduce antenna size and cost in Ku- and Ka-band applications. These new waveforms will operate at a fraction of the cost of current L-band systems and will significantly lower antenna hardware costs in Ku-, X- and Ka-bands. As the military shifts to Ka-band and more advanced Ka-band commercial satellites become available in the market, partnering with industry will be the only cost-effective way to meet the military's ever-growing demand for bandwidth, while providing the best value for government.

A good example is Hughes' latest satellite under development, Jupiter, a next-generation, high-throughput commercial Ka-band system with more than 100 Gbps of capacity, approximately 100 times greater than conventional Ku-band satellites. Scheduled for launch in the first half of 2012, Jupiter is designed with an advanced multi-spot beam, bent-pipe architecture that is able to support multiple waveforms, and Hughes is exploring the possibility with partners around the globe to bring this technology to military and government users wherever the mission may take them.

Hughes is committed to developing advanced solutions which help our military and government customers meet mission objectives anywhere in the world—on budget, and on time and creating best value for those that serve. ✭

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