A US marine sets up a SATCOM antenna to establish communications on the pause outside the Iraqi town of Haditha. *(Photo: USMC)*

Going Commercial

Finding flexible, affordable and secure means of exploiting commercial SATCOM bandwidth seems essential to the sustainment of airborne ISR. **Peter Donaldson** examines how industry and government are helping secure its future.

Airborne ISR (AISR) is heavily reliant on SATCOM, but its available bandwidth is in danger of being overwhelmed. The growing demand from service users is placing limits on the number of airborne platforms that can be simultaneously supported by military capacity.

Reaper and Predator UAV missions require data rates of between 3.2 and 6.4Mbps, a need that is expected to grow to around 45Mbps – larger vehicles such as the Global Hawk are expected to demand hundreds of Mbps. Service provider Intelsat predicts that the US government will operate around 800 high-capacity, long-range, high-endurance missions annually by 2018. Other estimates put US DoD bandwidth usage at around 30Gbps by 2014.

However, there is a great deal of leverage to be gained from investments in capacity and technology made by the commercial sector, responding to the demand for television and broadband internet services in remote places. For the military, the trick lies in getting affordable, flexible and secure access to it.

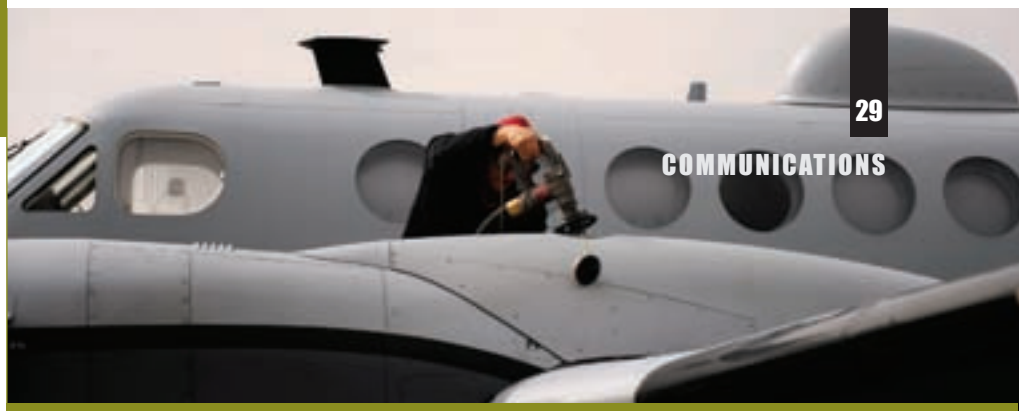
Acknowledging this, the US National Space Policy, published in 2010, calls for public-private partnerships with the commercial satellite industry to fill the gaps, encouraging non-traditional arrangements such as the hosting of dedicated military payloads on commercial satellites, and making use of managed services.

HOST ORGANISATION

Don Brown, VP of business development and hosted payload programmes at Intelsat General, summarised the differences between these approaches. 'Traditionally, military-hosted payloads onboard commercial spacecraft are for military missions that utilise specific military frequencies,' he told *Digital Battlespace*. 'Managed services use spectrum that is allocated to commercial entities and benefit from the low cost of access via multiple terminal suppliers, not a unique set of users using a dedicated terminal in a dedicated frequency band for military applications only.'

Hosted payloads have proven attractive to a number of governments, including those of the US and Australia for example, which agreed to share UHF (0.3-3GHz range, encompassing the military L-band) communications resources in April of last year.

About 12 months before that, the Australian government had signed a contract with Intelsat for hosted payload services for the Australian Defence Force (ADF). This agreement was expanded in April 2010 when the ADF exercised its option to purchase the remainder of the specialised UHF



The MC-12W's SATCOM antenna (top right) is essential for its ISR role. *(Photo: USAF)*

communications payload that Intelsat is integrating into the Intelsat 22 spacecraft – scheduled for launch in the first quarter of 2012.

At the end of March, seven companies announced the formation of the Hosted Payloads Alliance (HPA), which is intended to foster communication between potential users and providers of hosted payload capabilities. Founding members Boeing Space and Intelligence Systems, Intelsat General, Iridium Communications, Lockheed Martin Space Systems, Orbital Sciences, SES World Skies US Government Solutions and Space Systems/Loral serve on the HPA's steering committee, which expects the organisation's membership to grow and broaden its base.

EXPLOITING X-BAND

Managed services represent an alternative approach that seeks to guarantee agreed levels of service and security, while providing access to the latest technologies far more quickly than would be possible through more conventional military procurement procedures.

Intelsat General, for example, now offers end-to-end communication services through Paradigm Secure Communications' X-band Skynet 5 military satellite fleet, managing them through its own hubs within Paradigm's secure UK teleports at Oakhanger in Hampshire and Colerne in Wiltshire. The Skynet 5 spacecraft feature 160W high-power transponders that can provide high data rates to small terminals. The satellites can also accept high data rates from small terminals thanks to their active high-gain antennas that enable them to steer their reception patterns over areas of military activity.

The split between SATCOM bands for ISR is evolving, but commercial capacity will be increasingly vital. *(Photo: USAF)*

Intelsat has two types of managed network, the 'global beam' and 'zone beam'. There are two global beam networks that provide a satellite footprint starting in the eastern US and covering all of South America, Europe, Africa, the Middle East, Asia and western Australia. According to the company, a user can deploy a lightweight Very Small Aperture Terminal (VSAT) anywhere within this footprint and be 'linked securely to his or her network or the Defense Information Systems Network'.

Users with man-pack antennas or who need communications on the move on land, at sea or in the air, access the zone beam networks, which, says the company, offer unrivalled high-speed uplinks from very small terminals and provide coverage in some of the current regions of interest.

Intelsat also contracts with other satellite operators to provide X-band capacity. One of these is XTAR, which describes itself as the first US commercial provider in this frequency band and operates a pair of satellites: XTAR-LANT positioned at 30°W over the Atlantic Ocean; and XTAR-EUR at 29°E.

Together, these two spacecraft provide 4GB of X-band capacity from Denver east to Singapore, says XTAR. In November of last year, the companies agreed that XTAR would provide Intelsat with 16MHz of high-power X-band services from XTAR-LANT in support of military mobile and man-pack terminals prior to field deployment.

XTAR-LANT, which entered service in April 2006, carries eight 100W wideband X-band transponders that feature both left- and right-hand circular polarisation. Combined with the spacecraft's sophisticated antenna system, these generate two global beams and three spot beams that can be relocated within the satellite's coverage area.

This is ideal for X-band services in North America for homeland security applications and one-hop connectivity to Europe and the Middle East, and 'this flexibility, added to XTAR-EUR's coverage of Asia, adds tremendous capabilities for government and military users across most of the globe', according to the company.

PROMISING FUTURE

Andrew Ruszkowski, XTAR's VP of global sales and marketing, sees a strong future for X-band services, despite the growth of Ku- and Ka-band services that offer higher data rates. 'Recent government RFIs have indicated that Ku [-band] may be the long-term choice for the DoD on a certain class of UAVs,' he told *DB*. 'On the other hand, Ka-band is not expected to play a large role in AISR.

'At the same time, there are encouraging signs that X-band will be the frequency band of choice for a large share of AISR applications. A number of system manufacturers are bringing to market solutions which leverage X-band's strengths – resistance to rain attenuation and high throughput into small antennas.'

Further extending cross-industry cooperation in providing SATCOM services to the military, DRS Defense Solutions' Global Enterprise Solutions picked Intelsat, Paradigm Secure Communications and XTAR as suppliers to help it deliver a package of managed services to US forces in southwest Asia under a $48 million contract with the US Defense Information Systems Agency (DISA).

Announced in late May, the contract covers a package that includes remote terminals, high-speed modems with advanced coding, ground stations, fibre connectivity and terrestrial equipment for high data rate X-band satellite links with a total throughput of 620Mbps.

In partnership with the US General Services Administration, DISA runs the Future ➤

Commercial Satellite Communications Services Acquisition programme that enables the Pentagon to order bandwidth and other commercial SATCOM services directly from industry.

KU AND IP FOR ISR

Industry is also investing in secure, high-rate airborne video via SATCOM technologies to support ISR operations. Hughes Defense and Intelligence Systems recently demonstrated a two-way Ku-band system capable of air-to-ground data rates of more than 2Mbps, with transmissions that can be viewed over any secure IP network.

The Advanced Airborne Video Solution (AAVS), which the company describes as a cost-effective and proven COTS platform, was first developed to meet the needs of partner company Row 44 and its commercial airline customers. AAVS uses Hughes HX technology and expert network management system capabilities. For the demonstration, Hughes integrated equipment from partner companies, including Tecom Industries' KuStream 1000 bi-directional Ku-band antenna and Streambox's highly secure video coding and viewing subsystem. The system was flown aboard a Grumman Albatross amphibian operated as a testbed by Row 44, and communicated via Intelsat General's Horizons-1 satellite orbiting at 127°W.

Hughes says that AAVS performed at speeds much greater than available in the commercial market, while 'maintaining or exceeding currently available quality and performance', according to Rick Lober, VP and general manager at Hughes Defense and Intelligence Systems.

Although AAVS is currently a Ku-band system, Hughes is developing Ka-band capabilities to enable customers to use smaller aircraft antennas and benefit from even higher data rates.

Astrium Secure Satcom Systems' new AirPatrol terminal is one of a new generation of products that can operate over the Ka-band in addition to the Ku- and X-bands. Launched in July last year, the module was selected by Canada's Department of National Defence to support its Radar and Imaging for the Land/Littoral Environment (RIFL2E), a technology demonstration project intended to evaluate the feasibility and operational capability of an AISR platform. RIFL2E is designed to improve Canada's coastal surveillance capabilities and support its sovereignty in the Arctic.

SATCOM-on-the-move capability in small mobile command posts will increase bandwidth demands. *(Photo: author)*

The AirPatrol terminal makes extensive use of carbon-fibre-reinforced plastics in its construction to reduce weight without sacrificing the robustness that helps make it suitable for service on all types of aircraft, including UAVs – a typical configuration would weigh 16kg. The use of carbon composites also permits a higher level of RF path integration, resulting in better performance than can be obtained from standard aluminium antennas, says the company, which claims that data rates of 20Mbps have been demonstrated using the standard 60cm dish.

'We are confident that AirPatrol will form an integral part of Canada's RIFL2E project,' said Aidan Joy, managing director of Astrium Services' Secure Satcom Systems. 'AirPatrol ensures that it is possible to stream live images from airborne reconnaissance missions directly to ground-based receivers and remote users.'

The ability to receive high-data-rate video from AISR platforms is also of increasing importance to small naval surface combatants, and Ku-band systems continue to penetrate this market. Israeli company Orbit Communication Systems shipped its 1,000th OrSat maritime VSAT system earlier this year. This milestone comes in the wake of a $19 million order for 'one of the world's principal navies', which encompasses both Ku-band OrSat-G and C-band systems along with a multi-year service contract.

KA-BAND FUTURE?

In the quest for more bandwidth, much commercial investment is flowing into Ka-band satellites, which promise greater capability at a lower bit cost than Ku- and C-band systems. Two Boeing-built Ka-band spacecraft will, for example, be at the heart of Inmarsat's new Global Xpress service, which is due to begin deployment in 2013 and will, the company told *DB*, be fully interoperable with new generation government ISR systems and feature steerable spot beams. The service is designed to address established and growing markets for VSAT services, offering data rates of up to 50Mbps.

To counter the potential rain attenuation problems faced by Ka-band systems, Rebecca Cowen-Hirsch, Inmarsat's senior VP of government policy, strategy and outreach, told *DB* that the company takes a similar approach to that used by the military Wideband Global SATCOM system in ensuring that the spacecraft has sufficient power to close the link with margin. 'In addition to the link budget on the satellite and the waveform employed, Inmarsat will have fully redundant ground infrastructure to assure a very high degree of availability,' she said. 'For UAV and ISR applications, the altitude at which these birds fly mitigates the impact of atmospheric attenuation at Ku and/or Ka.'

Only with intelligent use of new technologies and innovative commercial arrangements will growing bandwidth demand from AISR be satisfied. DB

SATCOM frequency bands

UHF – *0.3-3GHz*
L-band – *1-2GHz (NATO definition is 40-60GHz, but IEEE definition is from about 1-2GHz)*
C-band – *3.7-4.2GHz for downlinks and 5.925-6.425GHz for uplinks*
X-band – *8-12GHz (ITU assigned uplink band is 7.9-8.4GHz, downlink band 7.25-7.75GHz)*
Ku-band – *10.95-14.5GHz*
Ka-band – *26.5-40GHz*