

# New Vistas for UK Military Space

by *Clifford Beal*

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**W**arfare today is all about control of information – how to obtain it, how to exploit it and how to deny it to the enemy. The promise of secure and wide access to space-based communications and intelligence assets has been a long time coming to European NATO nations, including the UK.

With its Skynet 4 constellation in operation since 1988, the British Armed Forces have obtained the edge that satellite communications can provide operationally, but as missions and skill levels increase, so does demand. When the UK MoD embarked on development of Skynet 4's successor, it was realised that a totally new type of solution would be required to deal with the needs of UK forces in the 21st century and become a benchmark for Network Enabled Capabilities. Advances in technology have permitted huge gains in bandwidth (the rate at which voice, data and imagery are transmitted) in just the last ten years.

During Operation Desert Storm in 1991, US military communications satellites (milsatcoms) managed reliably some 92 megabits per second (Mbps). This translated to about 250 kilobits per second, per soldier. By 2003, US forces at CENTCOM in Qatar enjoyed a total bandwidth availability of 3200 Mbps. Over the same period the capacity available to UK personnel has increased ten times.

## Skynet 5

In awarding the Skynet 5 programme to European Aeronautics Defence and Space (EADS) and its subsidiary, Paradigm Secure Communications, the Defence Procurement Agency has embarked on a landmark project that will make the maximum possible use of industrial innovation and commercial best practice. Under a PFI contract issued in October 2003, Paradigm Secure Communications will conceive, develop, launch, operate and own the Skynet 5 constellation. It will provide managed communications services, as well as transponder time, to the UK MoD and also to approved government customers and NGOs outside the UK, potentially including NATO. The programme is the largest of its type to date and will provide the MoD customer with the guaranteed level of capabilities it wants, when it wants them, and without the problem of having to manage the constellation and its terrestrial nodes.

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Skynet 5 services will be provided initially using the existing Skynet 4 infrastructure with enhancements to the ground-based segment. At least two new Skynet satellites, which will leverage the latest EADS Astrium Eurostar E3000 bus technology (as pioneered on W3A for Eutelsat), will be operational from 2007. Both Skynet 5A and 5B will carry super-high-frequency (SHF) and ultra-high-

frequency (UHF) communications payloads, and feature enhanced survivability and anti-jam capabilities compared to Skynet 4 spacecraft. The Skynet 5 contract, valued at around £2.5bn, extends to 2018.

In addition to the provision of the upgraded satellites, the programme covers:

- The management system, to be designed, developed, implemented and supported by LogicaCMG.
- The baseband system, to be designed by Cogent Defence & Security Networks which will provide all associated baseband elements.
- All strategic ground elements, which will be located at three UK sites (Oakhanger, Colerne, and DCSA HQ Corsham) and five overseas sites.
- The provision of 59 land-transportable tactical terminals (Reacher and Talon).
- Upgrades to SCOT terminals on 28 Royal Navy vessels.
- Upgrades to maritime baseband equipment on 36 Royal Navy vessels.
- Provision of 3rd and 4th level maintenance support.

EADS Space will draw on a range of expertise across its subsidiaries to meet the challenge of Skynet 5. Paradigm Secure Communications is responsible for meeting the MoD requirement and serves as the contracting entity. In turn, it will obtain satellite systems from

EADS Astrium and benefit from the 30 years' miltatcom experience in Skynet and SCOT. Paradigm Services will handle actual service delivery, network maintenance, customer support and technology upgrades.

Because Skynet 5 is concerned with the provision of service and not the design and delivery of MoD-owned assets, the contractor will be able to draw on a range of other satcom constellations and services to provide seamless capability and communications redundancy. Paradigm Services already offers the military customer Iridium satellite-phone services through General Dynamics Decision Systems and Inmarsat provision of voice and IP services through Stratos. A glimpse of this 'toolkit' of user options has just been witnessed during operations in Iraq where UK forces found themselves using not only Skynet 4 links, but also Thuraya mobile phones, Internet over Inmarsat, and Iridium for point-to-point communications between HQ and units in theatre. Indeed, it was the first time a British operational HQ utilised civilian bands, specifically Ku-band, providing system reliability and redundancy that was 'the best we've ever had', according to Air Commodore Andrew Warnes, operations director at the UK Defence Communications Services Agency (DCSA). Paradigm Services is continuing to fulfil contracts related to UK military operations overseas by providing secure communications and in building resilience in the network.

This leveraging of commercial satcom services also extended to welfare services provided to British forces in the field, something pioneered using Inmarsat during the NATO Joint Endeavour operation in Bosnia during

1995 and 1996. In Iraq, service personnel had access to telephones and the Internet for up to 20 minutes per week, provided through Paradigm Services, under the MoD's Operational Welfare Package. Coincidentally, EADS Astrium is contracted to produce the Inmarsat 4 series, due for launch later this year.

Warnes says that, currently in Iraq, both satcoms and terrestrial infrastructure are achieving resiliency. He adds:

*'A self-healing network is in sight. Skynet 4 is aging, but was generally quite dependable [in Iraq] except for a few outages. We didn't suffer one loss [of signal] on the civilian bands.'*

Warnes also remarks that, during operations in Iraq, it was the first time that both TALON lightweight deployable ground stations (built by BAE Systems) and the VSC501 mobile units were both utilised in combat and operated by both Royal Signals and the RAF. While true 'satcoms-on-the-move' is not currently achievable, UK forces have successfully implemented 'satcoms-at-the-halt' with the available transportable satellite terminal equipment.

As part of the Skynet 5 upgrade, Paradigm Secure Communications will provide the new REACHER family of mobile ground stations beginning in 2005. Procured from EADS Astrium, these will deliver even greater capability and mobility to the user and will consist of six REACHER 'large' units mounted in Bucher Duro 6X6 vehicles, carrying a 4.5m antenna; 36 REACHER 'medium' units also utilising the Duro 6X6 and carrying a 2.4m antenna; and two REACHER 'RM' units mounted on the BV206 tracked, all-terrain vehicle and carrying a 2.4m antenna. In addition, 15

existing TALON units will receive upgrades to network better with the rest of the communications architecture, both space-based and terrestrial.

Paradigm Services has already begun the change-over process to Skynet 5 architecture by putting its teams in place at what have hitherto been government-owned facilities and assets, and is now fully responsible for operation and maintenance of the Skynet 4 communications services. The company is now overseeing the upgrades of the ground segment and is on target to achieve an in-service date for the initial phase of operations in early 2005, with transition to an 'intermediate' phase early in 2007 to dovetail with the operation of the new spacecraft. Full operational services under Skynet 5 are expected to begin in early 2008. Air Commodore Warnes is pleased with the level of progress so far at the UK-based operations centre at Corsham in Wiltshire: 'I've been amazed at the lack of disruption during the change over,' he says.

#### Space-Based ISTAR

Space-based assets are as fundamental to intelligence, surveillance, target acquisition and reconnaissance (ISTAR) functions as they are to strategic communications. Commercial satellite imagery is being increasingly used to satisfy requirements as its resolution reaches levels required to support decision-making. The use of commercial imaging assets also makes coalition use easier to support. High-resolution commercial suppliers have multiplied while European NATO nations are launching their own military imaging payloads, which are primarily optical. Although easier to interpret, optical systems are compromised by cloud

cover, haze, dust/sand, etc. and the need for sufficient solar illumination.

EADS Astrium has proposed the first small imaging Synthetic Aperture Radar (SAR) spacecraft aimed at government customers, offering new, cost-effective capabilities to military forces in Europe. Called MicroSAR, the satellite would use a folding 'snapdragon' configuration which, combined with its small size, would permit it to be launched using a converted ICBM rather than a larger ELV. This would assist in bringing total life-cycle costs down to 10-20 per cent of a full-sized payload such as ENVISAT. Although MicroSAR, development of which has been partially funded by the British National Space Centre, is a dual-use proposition, it could afford a rapid-reaction, weather-independent intelligence capability for military forces 24 hours a day. It would be capable of fine resolution and also be highly agile for quick repositioning in times of crisis. Discussions are currently being held with potential customers and allied governments, including the UK.

Infoterra Limited, an EADS Astrium subsidiary company based in the UK, has enabled EADS Space to create a service portfolio that extends payload provision to ground segment archiving and exploitation through to data fusion, data hosting and dissemination, including wireless technologies. Infoterra is currently the sole supplier of commercial space imagery to the UK MoD, and also functions as an outsource production supplier for the MoD. Infoterra specialises in the management of geospatial data, and has established flowlines for the production of military specification (Mil Spec) mapping products such as Digital Terrain and Elevation Data (DTED), Vector Mapping

(VMAP), and Controlled Image Base (CIB) outputs.

Even commercially-derived space imagery can be exploited to create high resolution, 3D urban models for situational awareness in close-combat situations in addition to mission planning and mission rehearsal uses. The company employs 65 image analysts for exploiting image data and generating geo-spatial data information products. It is now expanding its ground segment capability by moving into data-hosting services and already possesses the largest commercial image-hosting facility in private hands in the UK.

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#### **Challenges Ahead**

By the close of the decade, the UK's space-based and terrestrial communications assets will be more robust and capable than today. Already, both the MoD customer and Paradigm Secure Communications are thinking about how new capabilities inherent in the technology can be turned into new services. Logistics and supply is one area that would benefit greatly from being networked into the Skynet infrastructure. Such a move is already afoot in the US with their milsatcoms tracking critical materiel in theatre. Following Operation Iraqi Freedom, the US Army intends to 'plug in' their

logisticians to the satcom network right from the start in any future military operation. According to the DCSA, similar plans are under way at UK Permanent Joint Headquarters.

Other possibilities for the future might include so-called 'blue-force tracking' to provide more dependable means of defence against fratricide in combat, and to improve situational awareness. American forces experimented with such a system in a limited capacity during Iraqi Freedom using digital systems with satellite links mounted in vehicles. A few hundred units were installed prior to Iraqi Freedom, including a number in British combat vehicles. With Skynet 5, combined with an improved tactical communications network via Bowman, such satellite-based tracking of units in combat could be a permanent reality for British forces too.

But the biggest challenge that lies ahead for the UK in exploiting satcoms isn't necessarily the hardware. Being able to tie all the pieces together, horizontally and vertically, into a coherent architecture will take a huge amount of complex planning. The user community in the UK must be required to adopt protocols and adhere to them. To accomplish this, governance is crucial. Air Commodore Warnes suggests that sooner rather than later, a Chief Information Officer may be required to function as an infrastructure champion. For military space assets to deliver their full promise, it will take active leadership by the government and the full support of the DPA and DLO. The assets provided under Skynet 5 stand ready, however, to enable this, and UK forces are now well on the road to making the leap to Network Enabled Capability. ■