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Cover story: A US Army specialist sets up a Hawkeye III multiband VSAT terminal to provide communications for tents at Yokota air base, Japan. *(Photo: US DoD)*

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Work in progress

At the beginning of March, it emerged that Thales has been selected by the European Defence Agency (EDA) to carry out a survey of current and future communication capabilities across the continent.

The project brings with it a new acronym – FUCOM (future communications) – and will result in a study of Europe's main terrestrial and SATCOM network programmes.

The conclusions will ostensibly help military planners align available communications resources with the requirements of EU forces, creating an inventory of the existing and future assets of the major member states.

The EDA has also been working on a project known as the Future Interoperability of Camp Protection Systems (FICAPS), which aims to show how 'multinational allies are able to share information in real time… in different locations and across different systems supplied by different manufacturers'.

According to software developer Real-Time Innovations (RTI), which provided its RTI Connext data distribution service for the project, FICAPS has successfully demonstrated interoperable control of effectors and sensors, including streaming video, between equipment based in France and Germany.

Despite the snail's pace of progress, projects such as FUCOM and FICAPS could generously be regarded as an indicator that, at least on a European level, some headway towards widespread interoperability is finally being made.

However, like many other touted interoperability initiatives, they also bring the same knee-jerk reaction – why haven't these things happened before now?

Creating the interoperability needed to cooperate on multinational operations has largely been addressed on a piecemeal basis to date, using various standards and approaches that may not necessarily work on future deployments.

Of course, the default routine is to rely on the US to either provide interoperable assets and resources or take the lead in developing a theatre-specific solution.

Many within industry have long argued that the adoption of standards developed for the commercial world, the widespread embrace of open-architecture (OA) principles and the work of industry bodies, such as the Network Centric Operations Industry Consortium, would lead to products being interoperable by default, while at the same time remaining competitive from a procurement standpoint.

It is clear that this has failed to materialise and, as argued by RTI in a white paper provided to *Digital Battlespace* recently, 'patience has run out'.

'For over ten years, defence procurement agencies have been asking for open-architecture solutions from their supply chains, and all they have got is a tick box exercise for the adoption of open standards, open systems (modularity and "integratability") and COTS technologies,' states the white paper.

The company argues that there has now been a radical shift in defence procurement thinking, and the UK and US are starting to take 'architectural ownership' of the reusable system-of-systems architecture of electronic and software systems they wish to procure.

Evidence of this shift includes the US DoD's UAS Control Segment and the UK MoD's Generic Vehicle Architecture, which both aim to define a common architecture that any future product must adhere to. Are we seeing evidence of progress at last?

Tony Skinner, Editor-in-Chief

RESPONSE

Digital Battlespace's editorial team is always happy to receive comments on its articles and to hear readers' views on the issues raised in the magazine. Contact details can be found on p1.

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- Naval EW
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Boeing nears P-8I delivery

The P-8I offers long-range maritime reconnaissance and ASW capabilities. *(Photo Boeing)*

Boeing has confirmed that it is set to hand over the first three P-8I maritime surveillance aircraft to the Indian Navy this year, following the first on-site delivery in Seattle in December.

The long-range ISR aircraft is based on the 737-800 airliner, and Boeing is on contract for eight aircraft, with options for four more. After the first example was delivered on site, training began in January.

'This provides a great capability for the Indian Navy,' P-8I programme manager Leland Wight explained to a media briefing at the Aero India show in Bangalore. 'This is a big year for Boeing and the Indian Navy, with deliveries in-country starting this year.'

The first spares consignment was sent to Goa during the show, and in the second quarter of 2013, the first aircraft will be delivered to India, with the second in the third quarter and the third in the fourth quarter.

'There are quite a few Indian systems on board,' continued Wight. 'We are in discussions with them [the Indian Navy] with regards to the possibility of carrying out performance-based logistics on the aircraft. Those conversations are going very well and there's momentum in that area.'

Boeing is also on contract to build 24 P-8A Poseidons for the USN, although the programme requires a potential 117 in total.

Wight said that the latest Poseidon flew on 1 February, following delivery of the first five aircraft to the navy in 2012, and the sixth in January, completing the first group of deliveries ordered under a January 2011 LRIP contract. Boeing has said it remains on schedule to build the 24 aircraft.

Rick Heerdt, Boeing VP and P-8 programme manager, said in a statement: 'The P-8 team continues to incorporate efficiencies into our production as we ramp up deliveries in 2013. We've reduced flow times and costs, which ultimately benefits our USN customer.'

The next three Poseidon aircraft are currently undergoing mission systems installation and checkout in Seattle, and two more are in final assembly. Boeing will deliver its seventh production P-8A to the navy later this quarter. The company is also providing maintenance training for the navy, in addition to logistics support, spares, support equipment and tools as part of the LRIP contract.

By Beth Stevenson, Bangalore

L-3 TRL launches new jammers

L-3 TRL has added two new jammers to its Broadshield family, a downsized man-portable lightweight unit and a larger high-power variant for use in vehicles.

Speaking to *Digital Battlespace* at the IDEX exhibition, Alex Hickey, L-3 TRL's head of Middle East and North Africa, said that the Lightweight Countermeasures Suite (LCS) offers dismounted soldiers protection against the threat of remote-controlled IEDs (RCIEDs).

There are two variants of the LCS: one operating in the low band (20-520MHz), and the other in high-band (420MHz-6GHz) frequencies. Hickey said the LCS has been redesigned from the original man packs to improve the electrical system and remove the heavier metal packaging enclosures, reducing the weight to less than 2kg (without battery), while maintaining robustness for military operations.

The Broadshield High-Power Compact System (HCS) for deployment in vehicles offers increased frequencies for jamming and an improved range. Hickey said the waveforms used in jamming can be pre-programmed prior to operations to fit the threat profile of RCIEDs in a specific area, for example to block signals sent by common garage door remotes adapted to trigger such devices.

Operators can control the HCS using a device on the dashboard of the vehicle. The company said the device can be configured into a stack of up to three interoperable units, providing up to 160W of jamming capability across a continuous frequency range of 20MHz-6GHz.

The LCS jammers are designed to neutralise the threat of RCIEDs. *(Photo: author)*

Hickey said the next stage is to complete a testing and demonstration programme this year. The company will offer the system to potential customers for trial, with regional interest expressed by Kuwaiti, Saudi and UAE forces.

By Tim Fish, Abu Dhabi

US Army soldiers survey a valley for insurgent activity in Afghanistan. *(Photo US Army)*

ISAF withdrawal prompts Afghan air power changes

Despite ISR assets being critical to the ISAF mission in Afghanistan, as coalition forces withdraw from theatre this capability will not immediately be carried over to Afghan security elements, a leading official has revealed.

Air Cdre Mike Wigston, director of air operations for ISAF Joint Command between November 2011 and November 2012, told an International Institute for Strategic Studies meeting in London that ISR capability will be available right up until the planned withdrawal in 2014, although it is not deemed a primary concern for the Afghan military to continue with it.

'In terms of the ground commanders and the contribution to the tactical fight, it's probably the [ISR] role that [currently] brings the most valued contribution,' he explained. 'The key development in 2012 was the production of releasable intelligence and surveillance information to the Afghans.

'Until now, we have been hindered by ISAF security classification, but from 2012 we have been releasing information to the Afghans so that they can go off and plan their autonomous operations and missions without the full support of ISAF. There will be a continuing need for protection of ISAF forces, and an increasing need for ISR to understand what is going on in the transitional Afghan-led battlespace.'

Wigston explained that ISR will evolve from the typical assets used at the moment, and instead Afghan forces will rely on 'human ISR'. This will come in the form of local knowledge and visual judgement of observed activity.

It is understood that any physical ISR capability will be operated purely by Afghan special operations forces – the technical inexperience of the rest of the military would make it a challenge to train on sophisticated systems.

'For now, Afghan Air Force roles are limited to battlefield mobility, airlift and casevac, and its [ISR] capability and air-delivered fires – its air-to-ground role – that will be delivered at a later date,' he added.

Wigston noted that the air force will simply act as a support service to the army and police post-2014, underlining that illiteracy and lack of technical experience are high within the service, creating another personnel training challenge.

'The Afghan Air Force is going to have to be used very carefully and selectively in how it supports its army and police in the years to come,' he noted.

The ISAF mission in Afghanistan saw 30,000 ISR sorties in the year up until September 2012, and at present 150 are flown per day. 'And of that, the vast majority was full-motion video [FMV] – persistent overwatch of enemy positions for the protection of friendly positions,' continued Wigston. 'Those 21,000 FMV sorties generate a huge amount of data, so the scale of the flying operations is actually dwarfed by the scale of the processing and dissemination that goes on behind that, both in-country and at coalition bases worldwide.'

He concluded that the changes being made over the next two years will inevitably lead to a reduction in offensive air power requirements, something that is already evident.

By Beth Stevenson, London

News bytes

Raytheon to supply MS3 for ACTUV programme
12 March 2013

Raytheon tests dual-band data link with Thales radar
12 March 2013

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19 February 2013

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Command, control and intelligence-collection capabilities are in high demand across a number of emerging nations in the Latin America and Asia-Pacific regions. **Tom Withington** explores some of the current acquisition trends.

Developing capabilities

Two of the developing world's biggest investors in C4I technology are Brazil and India. Both countries have similar priorities, namely enhancing their border security with the acquisition of new sensor systems.

At the same time, investment is following into communications systems and UAVs, notably in Brazil and Colombia where both nations' armed forces are seeking to improve their connectivity and reconnaissance assets. Countries in the Asia-Pacific region, particularly the Philippines, are upgrading their surveillance capabilities against a backdrop of simmering maritime disputes with China, while similar efforts are being made to enhance the air C2 architecture of Malaysia and Taiwan.

While the investment that Brazil has been pouring into the acquisition of new platforms, such as helicopters and submarines, is well documented, the country is also leading Latin America regarding spending on C2 technology.

ARMY ACQUISITIONS

Some of the most significant C2 development efforts are occurring within the Brazilian Army, which is procuring a border security system known as SISFRON (translated from Portuguese as 'Integrated Border Monitoring System'), designed to monitor the frontiers of the country.

Initially, SISFRON will federate surveillance radars, optronics sensors, UAVs, C2 and communications systems to provide surveillance over Brazil's 6,800km-long western border with Colombia, Peru and Venezuela, although it is expected to eventually provide coverage of all 16,900km of Brazil's land frontier.

In August 2012, a consortium led by local defence contractor Embraer was selected by the Brazilian Army to fulfil phase 1 of the SISFRON initiative, which will install the system in border areas under the control of the country's Western Military Command. The full implementation of SISFRON could be completed by the end of 2019 and be worth up to $6 billion to local suppliers and foreign contractors.

Away from the world of border security, efforts are ongoing in Brazil to improve the connectivity of its army. In June 2012, defence electronics contractor Selex Elsag won a contract to upgrade the service's SISTAC communications system, which supports non-secure and encrypted voice and data communications, and provides a gateway to other defence and civilian communications networks.

Brazilian Army soldiers learn to use an AN/PRC-119 tactical radio. The force is currently modernising its communications via the upgrade of its SISTAC system. *(Photo: US DoD)*

Selex Elsag's upgrade is aimed at further enhancing SISTAC's abilities by ensuring it can operate with future communications systems. The improvements were made to SISTAC units operated by the army's Southern Military Command.

COLOMBIAN CONFLICT

Neighbouring Colombia is no stranger to conflict, with the country having been beset by fighting since 1964, pitting successive governments against Marxist-inspired guerrilla groups and drug cartels.

The security threat that the country continues to face has prompted its armed forces to consider methods by which they can enhance surveillance capabilities. In March, flight trials were performed of an AR4 Light Ray UAV, built by Portuguese company Tekevar, to evaluate the aircraft's performance in Colombia's demanding elevated terrain.

It can remain on station for up to three hours, has a 20km range and carries a variety of optronic sensors. The company is hopeful that it will secure an order from the Colombian government for the UAV, which will provide its armed forces and law enforcement authorities with overwatch of the dense jungle areas where narcotics producers and guerrillas operate.

As well as investigating the procurement of UAVs from third parties, nations in Latin America are developing their own platforms. For example, the Chilean Army's Centre for Army Modelling and Simulation showcased its Lascar UAV at the FIDAE air show in Santiago last year. The aircraft is electrically powered and designed to perform both tactical missions and assist in disaster recovery and humanitarian tasks.

With a 7,500km-long coastline and having suffered a deadly attack on Mumbai that was launched from the sea in 2008, claiming the lives of 164 people, it is little surprise that India is investing in coastal security.

In August 2012, the country commissioned the National Automatic Identification System (NAIS) into service, which has been developed by Saab and local contractor Elcome Marine Services. NAIS is built around optronic sensors and radars mounted on lighthouses positioned around India's coastline, identifying and tracking vessels at a distance of up to 50km from the coast. These systems will be rolled out at 86 sites around the country.

Aerostats have become increasingly popular for the provision of air and ground surveillance – India is one country that is looking to purchase an aerostat-based solution to enhance its AEW coverage. *(Photo: US DoD)*

IN THE AIR

The introduction of NAIS, which will commence operations this year, is just one of several steps India is taking to enhance its security.

Another important initiative is the procurement of up to six aerostat-based air and ground surveillance radars at an estimated cost of $400 million. As well as accommodating an early warning radar, they are expected to carry ELINT and COMINT payloads, plus IFF interrogators.

Once deployed, the aerostat-mounted radars could have a potential range of up to 350km and a ceiling of 30,000ft. The deployment of an aerostat-based system is intended to avoid the expense and logistical challenges of deploying a chain of ground-based gap-filler radars to provide low-altitude coverage.

This aerostat-based radar chain could be supplemented further in the future with satellite-based sensors to provide additional coverage of the country's borders with Bangladesh, Burma, China, Nepal and Pakistan. New Delhi could spend up to $2 billion on this effort by the end of the decade.

The purchase of a space-based border monitoring system will occur concurrently with the acquisition of unattended ground sensors, radar and optronics to enhance the surveillance of India's border regions – many of which are in isolated and inhospitable locations.

Much of India's border security presently relies on fencing, which may only cover around 40% of the total frontier. The upgrading of India's monitoring technology is also intended to relieve the army of a significant quantity of its border control commitments, allowing it to focus more closely on domestic counter-insurgency operations.

India is not the only Asian nation investing in its air C2 posture. Franco-American defence contractor ThalesRaytheonSystems (TRS) declared in February that it had completed full systems acceptance tests in conjunction with the Royal Malaysian Air Force (RMAF) of the Malaysian Air Defence Ground Environment (MADGE) third sector operations centre (SOC). The MADGE programme outfits the RMAF with several SOCs, radars, accompanying communications links and C2 software.

Regarding the latter, the programme has utilised a variant of the TRS Sentry air defence C2 software, which is used by the Royal Canadian Air Force and the USAF for their respective components of the bilateral North American Aerospace Defense Command to federate military and civilian air surveillance radars, and associated communications links, to provide a detailed recognised air picture.

The company has also delivered the GM-400 family of ground-based, medium-range air surveillance radars as part of the initiative.

COASTAL RADARS

Alongside air sovereignty, coastal security is a perennial concern for many nations around the Asia-Pacific region. A cluster of maritime disputes in the South China Sea, coupled with worries regarding narcotics and people trafficking, environmental degradation and illegal fishing, are encouraging the procurement of coastal radars to keep a watch on the prevailing maritime situation. ➤

Indonesia, a country of 17,000 islands, has taken important steps forward in this regard with the purchase of two Kelvin Hughes SharpEye S-band solid-state radars, which have a particularly good performance regarding the discrimination of sea clutter from objects of interest.

The two radars will provide surveillance of the waters around Maluku and Papua provinces, both in the east of the archipelago. The procurement of the SharpEye radar is part of a longer-term Indonesian initiative to enhance the maritime security of the country.

The Philippines is following Indonesia's example and will obtain a surveillance radar and maritime command centre from the US to provide overwatch of its coastal waters. The Philippines is involved in a sovereignty dispute with China regarding Scarborough Shoal, which the latter claims as its own, with the Philippines arguing it lies within its 370km exclusive economic zone.

There is currently no word on the type of radar that the Philippines will obtain, where it will be located, how much it will cost and the date when it will become operational. Tensions between the PRC and the Philippines increased in April last year when the latter's naval vessels attempted to apprehend Chinese ships that Manila claimed were illegally fishing near the Shoal.

THAI DEFENCE

The past year has seen new developments regarding the Royal Thai Air Force's (RTAF's) Air Defence System (ADS) C2 architecture. Australian communications specialist C4I announced in January 2012 that it would deliver a second tranche of its SwitchplusIP IP-based communications system to enhance the ADS.

This builds upon work that the company has already concluded regarding its delivery of the ADS to the RTAF in 2008. SwitchplusIP was procured to provide 'seamless IP-based communications' to a host of RTAF sites spread across the country.

One example of the functionality that this provides to RTAF operations was illustrated by C4I in the company's official press release discussing the delivery, which noted that, via SwitchplusIP, a deployed mobile air force air traffic management system could communicate directly with other C2 assets over the network. SwitchplusIP can be used to accommodate a number of communications systems

Thailand recently declared a new Lockheed Martin AN/TPS-77 air surveillance radar operational. The country is one of several nations around Asia modernising its air C2 capabilities. *(Photo: Lockheed Martin)*

including voice-over-IP, tactical radio and data services.

Allied to the enhancement of national air C2 assets in Thailand are the country's improvements to its air surveillance capabilities. For example, it recently activated a Lockheed Martin AN/TPS-77 long-range transportable radar that will perform the important task providing air surveillance over the Gulf of Thailand.

ROUGH AND READY

While the upward trend regarding the acquisition of C4ISR capabilities across several emerging powers in Latin America and Asia is discernible, the market is assuming its own trends.

While large nations such as Brazil or India may be in a position to buy sophisticated platforms and subsystems off the shelf or develop locally with foreign partnership, those with more modest defence budgets are showing a desire to purchase affordable capabilities that may lack some of the complexity of products offered by Western suppliers, but which can, nonetheless, 'get the job done'.

Colombia's interest in the AR4 Light Ray UAV is an example of this trend. Similarly, local investment is flowing into C4I product development for domestic consumption – Chile's development of the Lascar UAV, for instance. Nevertheless, one trend seems certain – while defence budgets in the West may be under threat, spending on C4I capabilities in several developing countries seems set to continue into the foreseeable future. DB

Encrypting the contents of a communications transmission is easy, but hiding the fact that a message has been sent at all presents a whole new set of problems, finds **Angus Batey**.

Knowledge is power

The need for service personnel to be able to communicate with one another securely is as fundamental and long-established as any other basic aspect of armed conflict.

In 21st-century militaries, many of the concerns relating to communications security are addressed by encrypting data in transit – modern algorithms are hard enough to crack that message content can safely be assumed to be available only to those with the relevant decryption key. However, even an unbreakable cypher cannot solve all tactical communications security problems.

An adversary can gain vital information simply from knowing that communication is taking place – if they can also see not just that data is transiting a network, but whether the transmissions are voice, imagery or digital, that insight can be even more useful. Additionally, they may be able to establish how many nodes in the network are transmitting or receiving that information.

Significant actionable intelligence can be therefore be gained, even if the content of the communication remains unknown. A sudden flurry of network activity could signal an imminent attack, or the passage of large amounts of full-motion video might confirm the presence of an aerial surveillance asset, against which countermeasures can be deployed.

So the art and science of transmission security (TRANSEC) – ensuring that even the fact that communication is taking place is hidden from an adversary – has become an important part of battlefield data assurance.

CRUCIAL COMMUNICATIONS

TRANSEC can be applied to all types of communications, but is perhaps most crucial in systems such as satellite radio, where broadcast and internet protocol (IP) transmission methods intertwine.

'The first thing that's important to realise is, unlike terrestrial communications which are effectively point to point, a satellite beam is broadcasting your transmission over an enormously wide area,' said Karl Fuchs, VP for technology at iDirect Government Technologies – a key supplier of SATCOM solutions to customers including the US DoD. 'So it is inherently more vulnerable to eavesdropping by an adversary.'

This is why transmission security is so important when utilising SATCOM. 'Of course, all of the communications that the military are going to be using will be encrypted with very, very strong crypto algorithms, so that an adversary has no chance of breaking into the channel and understanding what conversations are going on,' he continued.

'But because of the nature of satellite communications, normally the Layer 2 [data link layer] protocols are sent out in the clear. With what's known in the US as a HAIPE – a high assurance IP encrypter – everything is encrypted at Layer 3 [network layer], so all the IP-layer stuff is encrypted and then the crypto builds its own header, and that header is sent out in the clear.

'It has to be sent in the clear so that intermediate routers are able to route the packets appropriately. And on top of that, a Layer 2 protocol is appended over the air. So what the adversary can get to is information in Layer 2, as well as tunnelling information of Layer 3.

'The net effect is that an adversary can not only tell the types of traffic,' Fuchs explained, 'but in many cases they can tell prioritisation of the packets as well. So an adversary could tell if there is high-priority flash override traffic being transmitted over the network. If an adversary is sophisticated enough, they can understand and determine how many remotes are in a network at any given time; they can determine acquisition activity levels; and they can even get a feel for the antenna types and sizes.

'So if, all of a sudden, an adversary sees a dramatic increase in the number of terminals

The TURMA family of combat net radios provides secure transmission capability for manpack and vehicular use. *(Photo: Selex ES)*

US VSAT systems can use traffic obfuscation to make it difficult for adversaries listening in to pick out real transmissions from a continuous background of false data clutter. *(Photo: US Army)*

being brought into the network, they know there are significant troop movements occurring at that point, and they know that very high-priority voice traffic is now traversing the network. So that becomes a particularly disconcerting problem.'

COMBINATION PACK

The solution, as practiced by iDirect in its VSAT (Very Small Aperture Terminal) system, involves a combination of metadata encryption and traffic obfuscation – the end result of which is to make any transmissions harder to understand, and to make real transmissions difficult for an adversary to pick out from a constant background of false data clutter.

'What we do on our system is to encrypt the entire Layer 2 packet,' Fuchs said. 'So our entire Layer 2 protocol, which would then include the Layer 3 tunnelling protocol of the encrypter, is encrypted with our FIPS-certified [Federal Information Processing Standard], AES [Advanced Encryption Standard] 256-bit encryption.

'The traffic engineering information that's going over the air would only really be of use to an adversary for a very short period of time, perhaps in the order of weeks or maybe a month at best – and that's not nearly enough time, with current processing power, to break an AES 256-bit encryption algorithm. So, effectively, by the time the adversary had broken the TRANSEC code, they've already done a History Channel special on the battle so it doesn't matter any more.

'That's the simplest portion of it,' he added. 'There are also some more sophisticated algorithms that provide what's known as a "wall of noise", so that, regardless of how much data is being transmitted, it always looks like a constant stream of traffic. And there are other algorithms that obfuscate the acquisition activity as well.'

ASSESSING THE PARTS

Inevitably, successful TRANSEC means adding information to the network, increasing the demand for processing power and bandwidth. Consequently, operators need to carefully assess which parts of the communication system require this heightened level of security, and ensure commanders are aware of any limitations its introduction may impose.

'The modem system that we would use on a military system would have a number of modes of operation,' explained Patrick Wood, currently UK engineering director for Astrium UK, and formerly programme director for prime system integration on the British military's Skynet 5 SATCOM infrastructure.

'One of those modes might be "low protection but high data rate", and it might be easier to identify the volume of traffic going over that. But as you switch into the "lower data rate but higher levels of protection" [mode], it becomes incredibly difficult to understand if the link is actively communicating data, or whether that link is just keeping itself ready for use by communicating from point A to point B.'

There is an inevitable trade-off between data transfer rates and security, but, as Wood pointed out, even apparent disadvantages ➤

can be turned into elements of a layered information assurance solution.

'If you imagine the amount of processing that you need, or the amount of agility that you might want to put on the RF signal, the more complex that you make it, you're adding a kind of overhead on the top of the message, and that overhead has a finite amount of processing,' he said.

'So as you switch to the higher levels of protection, typically you're reducing the data rate. But you're also doing that for other reasons, because if you want to protect yourself against jamming, one of the ways of getting round that is to use much more sophisticated waveform algorithms, and deliberately [use] a lower data rate but [achieve] a higher guarantee that the data will burn through the jamming signal. So sometimes it's advantageous in a high-threat environment to assume that you're going to be under a jamming attack, [so] using the right level of protection means the data throughput would naturally have to go down.'

KEY REQUIREMENT

The requirement for TRANSEC might appear to only apply in high-threat situations and affect militaries operating against technologically sophisticated adversaries, but the advantages of maintaining the ability to communicate covertly have been understood for millennia. The US National Security Agency's 'Cryptologic Almanac' mentions as an example of early TRANSEC the story of a Greek slave in 500BC whose shaved head was tattooed with a message. He was then sent to the required destination only after his hair had grown back.

In modern militaries, advanced TRANSEC is now a part of many SATCOM requirement documents – in the US, the Defense Information Systems Agency mandated TRANSEC for all DoD VSAT traffic around 2010, with a limited and decreasing number of interim authorities to operate issued to entities that have not yet acquired the capability.

The take-up has been spurred by the increasing reliance on IP-based elements of communications systems, but TRANSEC has been an important consideration since before the internet boom. NATO published STANAG 4246, a standard requirement for a secure and jam-resistant comms system known as Have Quick, in January 1987. The requirement is still classified but *Digital Battlespace* understands that elements of TRANSEC were included.

Skynet 5 satellites provide UK forces with secure voice and data communications for combined operations. *(Photo: Astrium)*

'At the beginning of the 80s, we started providing radio for ground-to-air, air-to-ground communications in VHF and UHF,' said a spokesperson for Italian contractor Selex ES.

'Have Quick was the standard applied in the UHF band. Since then, our transceiver has been designed and implemented with Saturn [NATO STANAG 4372], which is a new standard for UHF communications. So we provide both Have Quick and Saturn in our transceivers, and for non-NATO applications we provide our implementation of fast frequency-hopping which we call Easy II, which is able to work on UHF and VHF.'

FUTURE FOCUS

Despite the recent experience of advanced militaries being in conflict with technologically limited adversaries, TRANSEC has remained a high priority. As operations in Afghanistan and Iraq continue to wind down, and future force requirements are reconfigured to address unknown threats from more advanced entities, the challenge of hiding communications seems set to increase.

Future developments will have to react and adapt not just to the capabilities potential enemies may possess, but also take account of the continuing convergence of RF and IP communications.

'Maybe the part that will be more prevalent is frequency-agile signals,' said Wood. 'And spread-spectrum signals, which just appear above the noise floor. There are techniques for spotting that, but it takes time, energy and analysis to do it.'

Selex ES is developing a system described as cognitive radio, which, according to the spokesperson is 'able to understand what the environment is, and change and adapt the communication function implemented in the radios [in terms of] modality of communication, bandwidth and throughput'. The company expects this capability be fielded in three to four years, and it will have an adaptive TRANSEC element.

However, it believes that the key driver for future TRANSEC development will be in integrating communications security and cyber defence elements, as IP- and radio-based communications continue to intertwine, and the frontline demands for smartphone-style handheld multifunction devices continue to grow.

'We try to avoid anyone disrupting our communications,' the spokesperson said, 'So we want to be sure that the radio link is protected. But we have IP on top [of the radio signal], of course, and IP in the tactical environment can be attacked. So we have to protect the IP communication as well. For that we use cyber capabilities.'

'You can draw a fantastic block diagram where the troop on the front line has got his smartphone and he's got an additional little module that allows him to get his SATCOM data,' added Wood.

'Architecturally it's fantastic, and architecturally we could do it today, to be honest. But I think what you find more and more these days is that, from a cyber perspective, people are unwilling to use absolutely brand new technology until that technology is proven to be secure. There's plenty of R&D looking at tactical networks that have a mix of SATCOM, ground and tactical [nodes] and enable communication to small, handheld devices. That will continue to push and expand. But I think they'll use a fairly standard backbone of the SATCOM.' DB

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Calling forward

As militaries continue their focus on dismounted operations, frontline troops are being equipped with greater SATCOM capabilities. **Adam Baddeley** explores industry's response in light of growing data requirements.

Everything shrinks with age, and SATCOM terminals are no exception. Their reduction in terms of SWaP has, however, coincided with the advent of operations characterised by smaller, widely dispersed forces demanding improved beyond-line-of-sight communications.

SATCOM has also had to keep up with the need for higher levels of data transfer to support information-led capabilities, alongside the growing number of bandwidth-hungry applications and their proliferation to lower tactical levels. Such information includes the expansion of the common operational picture, shared situational awareness, ISR, demand for video teleconferencing at lower levels, medical data transfer and biometric data.

HARDWARE ACCELERATION

'Satellite hardware now exists that is extremely portable, versatile and easy to use,' explained Lance Hiley, chief marketing officer at Vislink. 'Modern satellite data terminals can operate effectively in high temperatures or inhospitable conditions, to satisfy the increasingly varied environments found on today's battlefields.'

He noted that this technology can also be deployed within minutes to provide high-bandwidth voice, video and broadband data communications, allowing HD visual assessments to be delivered quickly, without the need for existing infrastructure.

'Due to these significant technological developments, satellite equipment is increasingly becoming a viable alternative to radio communications for military personnel, complementing a range of manned and unmanned equipment for land-, sea- and air-based communications and surveillance,' continued Hiley.

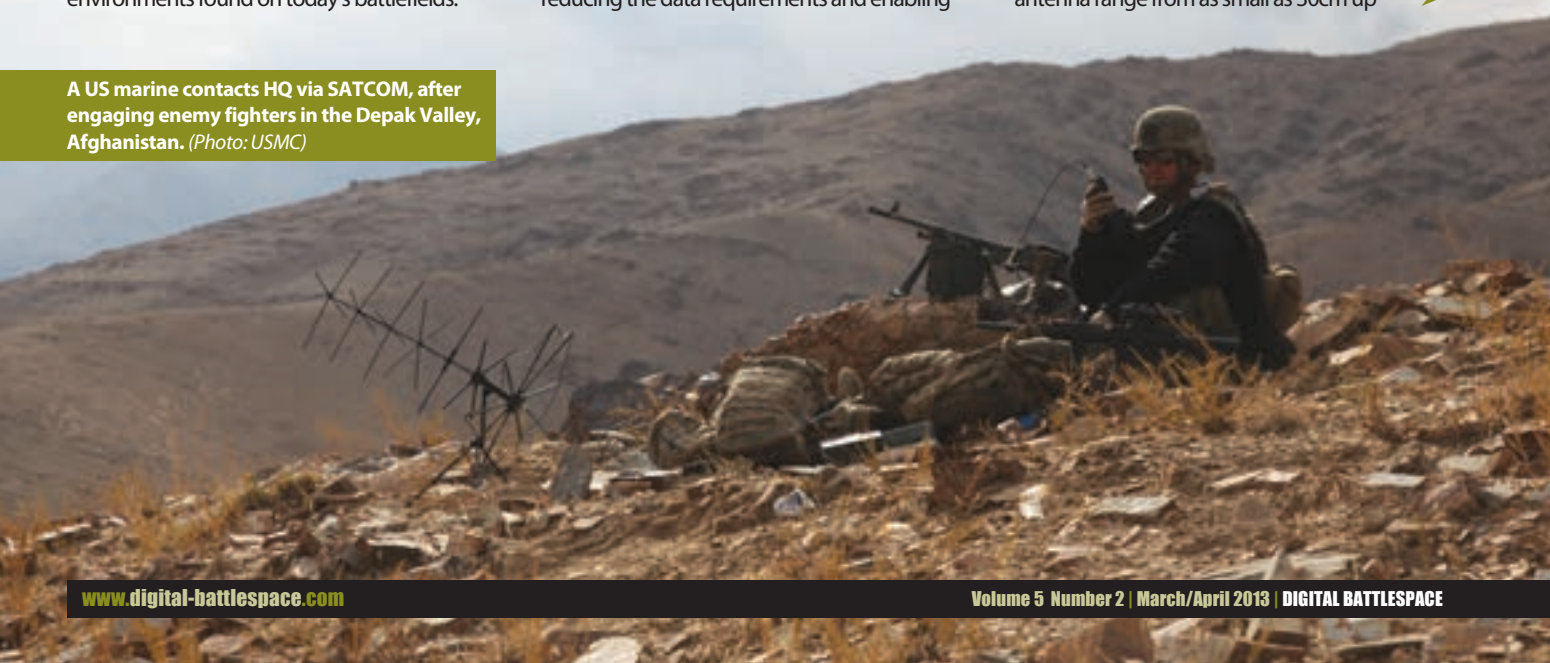
'Vislink's approach has been to adopt design principles that make it easier to integrate this technology with the protection systems, procedures and encryption modules used by military and defence forces, to ensure absolute operational flexibility and security.

'High-efficiency encoders developed for the broadcast industry minimise the data transfer requirement and developments in modulation schemes also maximise available data bandwidth, significantly reducing the data requirements and enabling the defence sector to keep pace with the growing volumes of information generated by using data-intensive tools, such as HD video streaming.'

INTERCHANGEABLE BANDS

In addition to small individual sets, the market is also seeing greater demand for terminals at tactical HQ levels, FOBs and patrol bases.

Requirements can be diverse, but a common thread is their support of interchangeable bands in ruggedised self-contained lightweight man-portable terminal chassis. Scalable antenna range from as small as 30cm up ➤



A US marine contacts HQ via SATCOM, after engaging enemy fighters in the Depak Valley, Afghanistan. *(Photo: USMC)*

to 1.2-1.5m, with integrated RF manual pointing for austere systems and mechanical pointing for others. Some systems weigh as little as 25kg.

Beyond such applications, commercial satellite operators have been responding to growing military demand for higher levels of data transfer, especially for ISR missions.

Mark Daniels, general VP of engineering and operations at Intelsat, said commercial satellite services were part of a 'layer approach' to SATCOM. 'Military planners and warfighters around the world need advanced, robust technology that can supply more bandwidth and provide highly secure mission communications.

'Because the US military wants more HD to support their missions, Intelsat General is advancing its capabilities to support high data rates to UAVs – from approximately 3Mbps to 12Mbps on Predators and 45Mbps to 200Mbps on Global Hawks – through use of smaller, more powerful spot beam technology using the current Intelsat fleet and on the upcoming Intelsat EpicNG [Next Generation] satellites.'

The focus on SWaP has, to a large degree, been due to increased demand for SATCOM by the military, as well as the move towards more dismounted operations – the British experience in Afghanistan being illustrative of this.

In 2001, prior to the beginning of operations in Afghanistan, at the brigade or task force HQ, X-band was provided by the VSC-501 X-band terminal, secure data and voice over Inmarsat at 128Kbps and insecure Iridium. Below this level, the battle group or battalion HQ could expect Inmarsat 128Kbps and insecure Iridium, with the J2 section also relying on a 128Kbps SATCOM link. All other levels of communications were reliant on the terrestrial Clansman combat net radio (CNR).

MEETING DEMAND

The demand for SATCOM was such that by 2008 all staff in brigade HQs, main bases and other key nodes had: secure phones; 'mission secret' NATO terminals and UK secret and restricted systems; UHF Tacsat and C-band Talon and Reacher terminals with throughput of 2-4Mbps; and a 2Mbps link over VSAT.

Below this level, the growth in SATCOM from near zero capability in 2001 is, if anything, even more profound. An infantry company had 'mission secret' Ku- or X-band links with a 256Kbps VSAT link, while at the platoon-level, UHF Tacsat was issued. Medical units at Camp Bastion only had access to Ku-band and VSAT links at rates of 256Kbps.

Since then, demand for SATCOM access has become greater, with the Skynet 5 programme and a range of UORs supplying higher numbers of compact SATCOM terminals. Examples of these include the Skylark terminal and an early entry HQ capability for extreme high-readiness forces described as 'baseband in a box'.

One solution is Rockwell Collins' Swe-Dish CommuniCase Technology 120 (CCT120) terminal, which is a three-box package weighing 150kg. It has seen operational service in support of missions in Libya.

Cobham has developed another solution, which entered service in 2012 and provides assured 2Mbps links. It is based on the company's Microsat µSat-7X, which can be fitted into a single airline-checkable case, can operate in wind speeds of 95km/h and is ruggedised to IP-65. According to Cobham, the system has a set-up time of less than two minutes and uses a dual-folded flat panel array antenna described as being equivalent to a 1.2m reflector dish.

A SWAN mini-SATCOM system is assembled during field training. *(Photo: USMC)*

UHF REQUIREMENT

In the UHF Tacsat domain is the Skylight UOR, which uses the Harris RF Communications AN/PRC-117(F), and more than 1,800 of these manpacks are currently in operation.

The UK is one of a number of countries wanting to move away from UHF Tacsat for tactical levels of command – other than for some voice and backup capabilities – a decision driven by a lack of UHF channels that can be allocated to data. The UK is still trying to get more out of its UHF, with the adoption of an integrated waveform, which increases the number of demand-assigned multiple-access channels from six to 20.

Industry has naturally sought to support the demand for new capabilities across a range of individual sets, terminals for bases and compact SATCOM-on-the-move (SOTM) capabilities.

A key driver for smaller terminals will be the increasing use of the Ka-band. The frequencies used allow for inherently ➤

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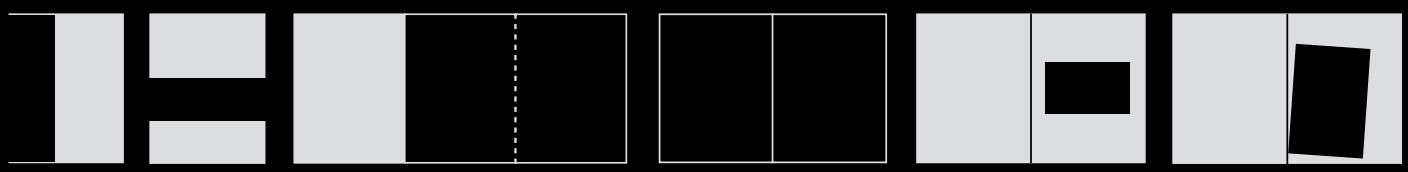

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smaller and lighter terminals by the military, helped not least by the advent of the Boeing combined X-band/Ka-band Wideband Global SATCOM programme, providing a significant increase in available throughput.

Four satellites are currently on station, with ten required in total, and the US has allocated 1GHz of that space to military users for wideband services. However, the availability of the Ka-band is limited in comparison to the Ku- and C-bands.

ITT Exelis' Global Network on the Move Active Distribution (GNOMAD) SOTM system has been involved in the US Army's Network Integration Evaluation (NIE) process, and its latest iteration is currently being tested at the service's Network Battle Laboratory at Fort Gordon, Georgia, ready for inclusion in NIE13.2 later this year.

Exelis has integrated components from a number of suppliers in GNOMAD. For its latest iteration, it has opted to move from the larger StealthRay 2000 to the StealthRay 200 small dish antenna, which is around 53cm in diameter and 20cm in height.

The overall system is modem-agnostic, but primarily uses the ViaSat LinkwayS2 modem, reflecting current US preferences. The Warfighter Information Network-Tactical programme uses the L-3 Communications MPM-1000 modem, which has also been successfully tested, although to date this has not been used with GNOMAD in the NIE.

LIMITED SPACE

The switch to the StealthRay 200 produced a smaller SOTM solution for armoured vehicles. While many platforms like MRAPs have large top surfaces suitable for flat plane arrays, turreted vehicles such as the Bradley and Abrams have limited space when hatches and force-protection-related features are considered. This year, the new smaller version of GNOMAD will be tested at Aberdeen, with the main weapons of the vehicles being fired to see how the antenna fares.

The Rockwell Collins CCT family has been designed to have common elements across the range. The user is able to swap between transponders and modems quickly when required, shifting between Ku-, X- and Ka-bands according to mission requirements.

A field radio operator sets up a SATCOM terminal in Iraq in 2008. *(Photo: USMC)*

With size there is a trade-off, as with all multi-band designs – a system which supports the specifics of three bands carries more baggage than single-band dedicated solutions.

The dishes used by the CCT family are made of carbon fibre to balance strength and weight, with other features allowing antenna gain efficiency, maximising throughput in the antenna. The CCT120 was also used in NIE12.1 in support of the Company Command Post programme. Brazil acquired the terminal in 2009.

A larger 2m CCT200 solution has also been developed in the X-, Ku- and Ka-bands, with total weight across the four cases of 125kg. The system uses a dual offset antenna to support data rates of up to 50Mbps.

After a number of years supplying US Special Operations Command with a number of terminals under the banner of the Special Operations Forces Deployable Node-Family of Terminals, Rockwell Collins was awarded a further $500 million contract to deliver tri-band Hawkeye III Lite 1.2M terminals and quad-band 2.0M terminals to US special forces, which began in late 2012.

Also on offer is the L-3 Global Communications Systems Panther parabolic VSAT. This terminal uses the embedded iDirect Evolution iConnex e850mp modem with DVB-S2 receive capabilities and a TDMA return channel, and it can be carried in a rucksack or standard airline case. In the field, it uses passive radio rather than fan-based cooling, and has a modest-sized antenna, supporting up to 3Mbps uplink and 6Mbps downlink.

PERSONAL SATCOM

The Netted Iridium-based Distributed Tactical Communications System (DTCS) has enabled personal SATCOM to become a reality for US forces via the ITT Exelis RO Tactical Radio.

Originally conceived to meet a joint urgent operational need statement, the system has the look and feel of a standard CNR and automatically sends global and regional position location information to US Strategic Command's mission management centre, and from there into high-level situational awareness packages.

While DTCS is a US system, other sources of Iridium-based SATCOM are available. Gilat SATCOM's Dynamic Relay System, for example, connects to a CNR and establishes an IP-based ad-hoc mesh network over Iridium.

Hughes offers a range of terminals in its HX family, which are field-proven and can be readily configured and networked in any combination of star or mesh topologies, thereby optimising the use of expensive satellite bandwidth for whatever mix of data, voice or video traffic is needed on the ground.

Rick Lober, general manager for defence and intelligence systems at the company, said

whether it is fixed, transportable on a moving vehicle or in a manpack, a SATCOM solution is only as good as the system design behind it.

'Unlike fragmented solutions employing pieces of equipment that are somehow cobbled to work together, Hughes SATCOM solutions employ fully integrated and highly reliable terminals – including routers, antennas, radios and interconnect hardware – all working seamlessly together with our industry-leading ExpertNMS [Network Management System],' he said.

Selex Elsag's Micro Very Small Aperture Terminal (Micro VSAT) weighs 23kg and is carried in a single Peli case, with cue to the operators via embedded GPS positioning and inclinometers for manual alignment of the 1 or 1.2m dish. It is offered in X- and Ku-bands and has a built-in iDirect modem or optional user modem – a Ka variant is also in development.

Under Skynet 5, the X-Band Micro VSAT can support single-channel-per-carrier links of up to 20Mbps. This is complemented by the larger Talon Lite, which in turn followed on from the Dagger and Talon. The Lite variant is a 1m dish that weighs 20-30kg, and can operate in X- and Ku-bands as well as support a CDM570L-IP satellite modem.

Routine maintenance is performed on a satellite dish at FOB Shindand in Afghanistan. *(Photo: USAF)*

OPERATIONALLY RELEVANT

Integrating Broadband Global Area Network (BGAN) closer to the front line is not simply a case of lugging the terminal – it also has to remain operationally relevant to ensure users take it into battle.

Harris has two offerings in this field – the RF-7800B Land Portable BGAN Terminal and the RF-7800B Land Mobile SOTM BGAN Terminal.

The quick-halt Peli case-based Land Portable variant has data rates of up to 432Kbps and consists of a square antenna. It can be operated by a Touch Book or similar laptop, with the user establishing a connection via an intuitive steering tone.

The SOTM solution can operate at speeds of 70Mps, with up to 100° of motion per second while travelling through difficult terrain, and still maintain a link that is slightly higher than its Land Portable sibling.

Another Inmarsat BGAN solution is the RapidSat700 developed by Beam Communications, which is based around a single suitcase. It has a 492Kbps wi-fi connection of up to 45m outdoors, with sufficient battery power for 24 hours.

The future for UHF Tacsat is the Mobile User Objective System (MUOS) – the first satellite in a five-bird constellation – which was launched in February 2012. MUOS offers 16 times the capability of the legacy system. The next systems will launch later this year, with full operational capability of four satellites plus a spare due to be in place by 2015.

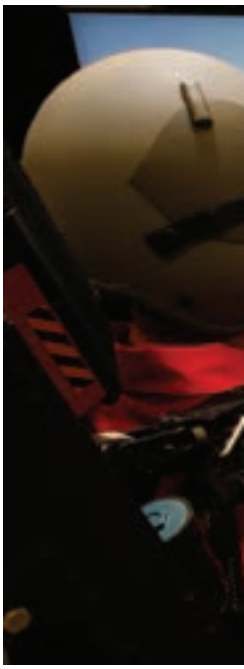
The US Army has chosen the General Dynamics C4 Systems two-channel AN/PRC-155 as its main initial bearer for MUOS under Army Capability Set 13.

Harris's path to MUOS compliance is the AN/PRC-117G, which uses two internal transceivers – one narrowband for waveband in order to support the key feature of the MUOS waveform, which differentiates it from other waveforms, as it is full-duplex rather than half-duplex. The same approach will ultimately be taken with the handheld AN/PRC-152A. DB

ITEC 2013
Digital Battlespace show preview


Photo: CAE


Photo: CAE



ITEC is the international exhibition and conference for military training, education and simulation technology and services, providing world-leading military experts with an annual opportunity to discuss, develop and compare different approaches to complex and demanding issues associated with modern warfare.

Organised by Clarion Events, which is acknowledged for its high-calibre portfolio of defence and security events, top government officials and senior military personnel from the operational and procurement communities use ITEC to meet with leading global providers of services and equipment, to develop partnerships, conduct business and network for future growth.

ITEC 2012, which was staged at ExCeL London, hosted over 500 military attendees from 45 countries, as well as eminent representatives of multinational organisations such as NATO, SISO and MIMOS. ITEC's organisers anticipate an even more impressive attendance from international VIP attendees to this year's event, due to be held in the historic city of Rome.

A unique hub for international training and simulation, Rome is the location for NATO's Modelling and Simulation Centre of Excellence (M&S COE) which acts as a catalyst for transformation through the involvement of NATO, government, academia, industry and operational and training entities. The city is also home to NATO's celebrated Defence College, a unique international institution established to educate officers and officials and conduct academic studies and research in support of the Alliance's wider goals.

A meeting of minds

Recognised as the foremost forum for the debate, display and discussion of military simulation and training requirements, this year's ITEC agenda is tailored to offer an expert overview across a wide range of topical issues. Following an opening address, delivered by **Vice Admiral Filippo Maria Foffi, Commander in Chief of the Italian Fleet**, a panel of senior officers will examine the vexing issue of training for operations in the face of continued defence cuts. Led by **Lt. Gen. Carlo Magrassi, Deputy Commander, Italian Air Force Operational Forces Command**, the eminent panellists will call on their own experiences and responsibilities to illustrate current thinking on training strategy.

The conference will then divide into six strategically themed streams, each focused on key aspects of current and future training and simulation technology. These themes are: *Innovative Learning Technologies; Medical Training Challenges; Current and Future Military Operational Needs; Technological Innovations in Modelling and Simulation; Civil Support, Protection and Disaster Management; and Cyber Security Education*.

Cyber central

Now accepted by experts within the defence establishment as the 'fifth dimension' of modern conflict, the complex threat of cyber warfare has swiftly scaled the international agenda. The cyber threat is perceived to be a priority by those responsible for safeguarding critical national infrastructure and numerous governments have responded rapidly, developing both defensive and offensive capabilities.

Building on the success of ITEC 2012's inaugural Cyber Security Training and Education workshop, the *Cyber Security Education* theme will examine the latest developments in this dynamic domain. Attention will be drawn to the importance of cross-sector expertise and how education and training can be implemented not only by defence and the military, but a variety

developments in military training and simulation


Photo: Alenia Aermacchi

of vertical sectors. Confirmed speakers on 'Approaches to Cyber Security Education', which will take place **Wednesday 22 May**, include Rear Admiral De Felice, Director of the Italian Centre for Defence Innovation, as well as representatives from the European Defence Agency.

Reflecting these high-level discussions, ITEC will host a unique cyber security round table event on the exhibition floor. Focused on 'shaping the cyber warrior for 2020', this pioneering addition to the ITEC 2013 agenda, will bring together leading experts in cyber security and education from across academia, industry and the military to further debate the future of cyber security education. Organised in association with **Lancaster University**, a UK Government certified Academic Centre of Excellence for Cyber Security Research, the event will generate discussion that will form the basis for an official white paper, to be released after ITEC 2013. Taking place Thursday 23 May, the session is open to all ITEC attendees and will seek a wide range of perspectives, encouraging lively debate between the panellists and the audience.

Confirmed panellists include Dr Dan Prince, Security Lancaster, Andrea Rigoni, Director General Global Cyber Security Centre, Rear Admiral Simon Williams OBE, Chairman Clarion Defence and Security, and Eneken Tikk-Ringas, Senior Fellow for Cyber Security, IISS; Visiting Senior Mentor, Baltic Defence College.

Innovation abounds

Exploring the most recent advancements in mobile applications and serious games, as well as the application of civil technologies in military scenarios, the Innovative Learning Technologies conference stream will offer delegates an understanding of innovative solutions to emerging military requirements.

Particular highlights include the Serious Games in Defence Technology conference session, when insight will be given into 'The Command Control and Communications Trainer (C3T)', while on **Thursday 23 May, LTC Malcolm Conway, Headquarters Forces Command** will review 'Project Horizon, the Australian Army's approach to emergent learning technology'.

The evolution of technological skill and expertise will also be examined in a unique panel session on **Thursday 23 May**, entitled '*2020 Technology Vision – the Future of Innovation*'. **Pete Morrison, CEO, Bohemia Interactive Simulations**, will join Flag Officers from the Netherlands, United States and the Czech Republic, to discuss the direction of innovation in military technologies – from command and staff training to self-paced training. Drawing on their operational, instructional and industry experience the panel will put forward their findings on the impact of new technologies in current training and ideas for future technology use.

Exhibition developments

An exclusive showcase of the latest innovations for the military simulation and training market – from more than 140 organisations – ITEC combines the needs of those who define, influence, procure and implement military training from around the world. An impressive number of new participants are also due to exhibit, including the world-leading providers of healthcare education and resuscitation training, **Laerdal Medical**; **Transas Marine International**; Ankara-based **Onur AS** which provides integrated telecommunication and electronic systems supporting airfield communication and Navigation and Surveillance Systems; Germany's **eurosimtec** and **Q4 Services**, a business which specialises in manufacture, service, and support of visual display systems to the global flight simulator industry. ITEC 2013 is also delighted to welcome back exhibitors **Finmeccanica**; **Bohemia Interactive Simulations**; **Saab Training Systems**; **Quizdom**; and Norway's leading supplier of defence and aerospace-related systems, **Kongsberg Defence Systems**.

"As the importance of training and simulation continues to grow in both the civil and military spheres, I am confident that this year's event in Rome will see a significant participation from the Italian government, industry and educational institutions, as well as high-level attendees from across Europe, USA and crucial emerging markets," said **Cristiano Montrucchio, Head of Avionic Systems at Alenia Aermacchi, a Finmeccanica Company** and **ITEC 2013 Conference Chair**.

ITEC will be held at Fiera di Roma exhibition ground, Rome, from 22-24 May 2013.

For more information about the event, register to attend, to view the full conference programme, please visit *www.itec.co.uk*

Degrees of improvement

The US Army is pursuing a dual-track modernisation of its ground-based radar capabilities, involving both new and upgraded systems. **Scott R Gourley** fills in the details.

The AN/MPQ-64 ground-based radar has enhanced counter-UAV detection capabilities. *(Photo: author)*

An early December 2012 briefing titled 'US Army Fires 2020' serves to highlight the dynamically changing roles and vision surrounding ground-based radars in modern operational environments. The presentation also provides a framework for exploring several recent and pending developments involving US and international radar systems.

For example, reflecting current field artillery modernisation strategy, the briefing outlines an existing environment that includes systems like: the AN/TPQ-36/37 Firefinder series radars; the Enhanced AN/TPQ-36 ('EQ-36', now AN/TPQ-53); and the SRC AN/TPQ-48 (a quick reaction capability for US special operations forces designed to be compatible with airborne operations and deployable by parachute) and AN/TPQ-49 (follow-on design for use by expeditionary forces) Lightweight Counter Mortar Radars.

In addition to these systems, FY2008 witnessed the US Army Product Manager Radars acquire two Saab Giraffe Agile Multi-Beam (AMB) long-range radars to provide 360° force protection for US forces then in Iraq.

Near-term strategies for evolving these systems include 'pure-fleeting' with the AN/TPQ-53 to fill identified gaps for combined arms manoeuvre and wide area security, and fielding a mobile AN/TPQ-50 to eliminate any 360° gaps in counter-rocket, artillery and mortar operations.

In parallel with field artillery modernisation plans, 'Fires 2020' also addresses current ground-based radar inventories and near-term evolution of air defence capabilities. A key element of this strategy involves introduction of the ThalesRaytheonSystems (TRS) AN/MPQ-64 Improved Sentinel radar that will provide future forces with improved counter-unmanned aerial system (UAS) detection capabilities.

PROGRAMME ACTIVITY

One of the key programme activities currently under way to satisfy the modernisation vision involves the AN/TPQ-53 counterfire target acquisition (CTA) radar now in low-rate initial production (LRIP) by Lockheed Martin.

The AN/TPQ-53 provides long-range counterfire target acquisition for mortars, rockets and cannon. *(Photo: Lockheed Martin)*

Mounted on its 5.1t Family of Medium Tactical Vehicles prime mover, the solid-state phased array Q-53 detects, classifies, tracks and determines the location of enemy indirect fire in either 360 or 90° modes. This innovative sensor is replacing the ageing AN/TPQ-36 and -37 medium-range radars now in the army's inventory.

Lockheed Martin won the competitive development contract for the EQ-36 radar in 2007. Responding to urgent needs statements from theatre and following early programme successes, the army awarded the company an accelerated contract for 12 initial production systems in July 2008 and a follow-on with options for an additional 20 systems in April 2010. In autumn that year, the army began deploying EQ-36 systems to combat in Iraq and Afghanistan.

According to Lee Flake, programme director for counterfire target acquisition radar programmes in Lockheed Martin's Mission Systems & Sensors business, the Q-53 LRIP contract included two iterations – an award for 12 systems on 29 February 2012, and a second for 21 additional systems on 16 March 2012.

'We were already under quick reaction contract for 21 initial production systems, so that brought our total up to 65,' he explained to *Digital Battlespace*. 'Two weeks ago [late January 2013] we delivered the 32nd of those 65 systems, which was the last of that quick reaction capability contract. I've still got the 33 low-rate initial production systems in front of me, and I just received notification from the army that I can expect another order, for "LRIP 3", in the next 60-90 days. I think that in round numbers that will be for about 20 systems.

'Today I have eight systems in Afghanistan,' he added. 'They are performing exceptionally well over there. I also have my support programme in place supporting systems in Afghanistan, continental United States, Hawaii, Alaska and Germany. I am in the middle of environmental testing and low-rate initial production testing. We completed a limited user test in October of 2012, and we are moving toward IOT&E [initial operational test and evaluation], beginning in October and running through November of this year.'

Successful completion of testing should pave the way for a full-rate production (FRP) decision/award in 2014.

SOLICITATION EFFORT

In preparation for that milestone, on 19 December 2012, the US Army released an RfI with the purpose of conducting pre-solicitation planning and market research to determine production capabilities for procurement of the AN/TPQ-53 system, including training in support of OCONUS (outside continental US) tasks.

'This [announcement] is being issued to satisfy a requirement of the February 2012 acquisition decision memorandum which required Product Manager Radars to conduct market research to ascertain industry's ability and interest in satisfying AN/TPQ-53 production requirements,' it stated. 'The information gained from the [announcement] will be used to support development of a business case analysis which assesses the feasibility of reintroducing competition for FRP in FY2014.'

'They have to issue that sources sought, regardless of how they are going to approach [FRP],' Flake explained. 'And we don't know how they are going to do it. We don't know if they are going to compete it again. We would love for them not to compete it, but they might – that's always their option.'

Further reflective of an ongoing modernisation emphasis in ground-based radar systems, Flake acknowledged the introduction of improvements within the LRIP phase.

'There have been some improvements, primarily to make the system operate better in a rainy environment and also to make it operate a little bit better in a hotter environment,' he said. 'As we learned things from our time in Iraq and Afghanistan, we had no major issues, but we saw some minor things that we could tweak.'

He noted that the mechanical changes included the addition of 'a rain hood and some other things that would just make it more impervious to water in a torrential downpour. And we've seen a lot of that, quite frankly, in Afghanistan. Over the last two weeks it has been raining torrentially and the radars are performing very well. We have not lost anything – no components, nothing. No radars have gone down even in the heavy rains they have seen in Afghanistan lately.

'And of course we continue to upgrade the software throughout the life of the programme,' he added. 'We're continuing to make the software better nearly every quarter.'

LEGACY UPGRADE

But the army's goal of 'pure fleeting' with Q-53s will certainly take time. In the meantime, the service has enhanced its existing counterfire capabilities with upgrades to its legacy Firefinder systems.

In June 2011, for example, TRS announced that its 'advanced Firefinder radars' had been fielded in theatre to support and protect US and allied troops. The new radars feature a number of reliability and maintainability improvements that extend service life and reduce life cycle costs. TRS is delivering the modernised radars in conjunction with Tobyhanna Army Depot. ➤

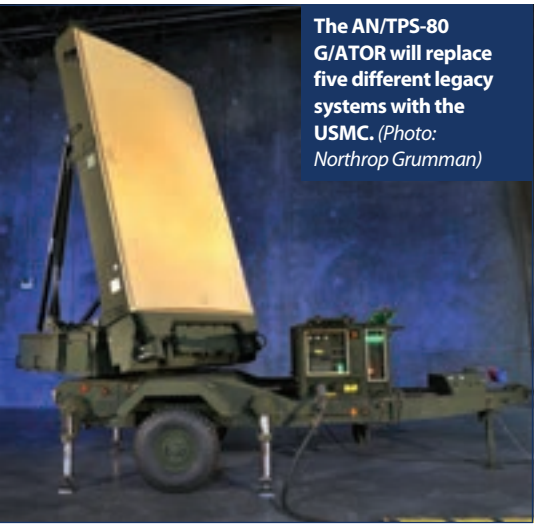
'Firefinder radars have been serving the US Army since the 1970s,' offered Cynthia Baker, communications manager at TRS. 'But this is not your grandfather's radar. Redesigned from the inside out, the latest version of the AN/TPQ-37 is the most accurate, most reliable and most widely proven weapon-locating radar available today.'

The current AN/TPQ-37(V)9 is improved in both reliability and maintainability as a result of extensive hardware modernisations. Specific upgraded features include: a new fully air-cooled modular transmitter; a digital programmable waveform receiver exciter; a new advanced radar processor; and a fully digitised operations central shelter.

Baker added that 2011 and 2012 saw TRS initiate an internal project to further improve Firefinder performance, with the overall result being a fivefold increase in power amplification module mean time between failures. The Improved Firefinder is fully exportable to allied nations worldwide.

'ThalesRaytheonSystems continues to invest in and implement technology advances to improve capabilities and efficiencies in all radar systems,' she added.

Another example involves the AN/MPQ-64 Sentinel battlefield air defence radar. As noted earlier, the 'Fires 2020' briefing highlights a near-term move towards an 'Improved Sentinel' to provide enhanced counter-UAS detection capabilities.



The AN/TPS-80 G/ATOR will replace five different legacy systems with the USMC. *(Photo: Northrop Grumman)*

Looking around

Just as US manufacturers are exploring new international markets for their ground-based radar offerings, companies outside the US are positioning some of their products to fill identified DoD capability gaps.

An example of this can be seen in the June 2008 cooperative agreement between Saab and Sensis 'to promote, enhance and support Saab's Giraffe AMB family of radars in the United States'.

A more recent example of interest in potential gaps in the US market could be seen at the October 2012 AUSA annual meeting and exposition in Washington, DC, where Israel's Rada Electronic Industries highlighted its full range of ground radar solutions.

Rada offers advanced pulse-Doppler, multi-mission, active electronically scanned array radars. The software-defined radars can assume numerous operational missions and enable advanced force and border protection. Both the Compact Hemispheric Radar (designed for use on combat vehicles and short-range protection applications) and Multi-mission Hemispheric Radar (designed for force and border protection applications) families were highlighted during the event. DB

In October 2011, TRS announced that the US Army would procure 56 Improved Sentinel radars, later increased to 57.

The announcement described Sentinel as a three-dimensional, phased-array radar operating in the X-band frequency range. The primary mission is to automatically detect, track, identify and report airborne threats, including aircraft, cruise missiles and UAS. Sentinel's capabilities are suited for missions such as air defence/missile systems coordination, homeland defence and infrastructure, asset and special event protection.

The first of the 57 new Sentinels is slated to roll off the production line this year.

SERVICE SYNERGY

The US Army is not alone in its ground-based radar activities. USMC efforts include the AN/TPS-80 Ground/Air Task-Oriented Radar (G/ATOR), developed by Northrop Grumman Electronic Systems.

G/ATOR is a three-dimensional short-to-medium-range tactical radar designed to detect, identify and track low-level cruise missiles, manned aircraft and UAS, as well as rockets, mortar and artillery fire. G/ATOR's digital design allows the system to perform the functions of five different legacy ground-based radars it is slated to replace.

The AN/TPS-80 was delivered for government testing in the middle of 2012, with subsequent trials slated to set the stage for a possible low-rate production effort in 2013.

The G/ATOR programme also serves to highlight technology synergies between different radar projects across the services. Specifically, military representatives have described future goals of transitioning G/ATOR to a next-generation gallium nitride (GaN) semiconductor technology. Not only would this translate to less weight and lower power consumption, but the same sources have acknowledged the possibility that GaN technology will translate to system capabilities similar to the next-generation radar requirements of other armed services.

That possibility is also reflected by industry sources, who note how some aspects of emerging radar designs could also present future planners with multi-mission/expanded role flexibility.

As an example, while choosing his words carefully, Flake observed: '[The Q-53] was designed as a multi-role/multi-functional/multi-mission radar. The prototype of it could do both the CTA mission we do – the counterfire mission – and it could also do air surveillance missions. Today we "see" air targets, but because our primary mission today does not include those air targets, we simply filter them out.

'It's clear to me that there could be a path forward for this radar to have benefit/value to a customer if it could report those air surveillance type targets. So there is plenty of growth potential in this radar. And we are working on Lockheed Martin [internal R&D] dollars to fully develop what we see as potential capabilities.'

As might be expected, many of the new ground-based radar designs are also drawing considerable interest beyond the borders of the US.

For example, about the same time as the October 2011 US order, TRS also received an FMS contract for six AN/MPQ-64 radars 'to be procured by two countries in South America and North Africa'.

Examples of 'immediate opportunities' for the Q-53 noted by Flake included the Canadian Medium Range Radar programme as well as a reported counterfire radar requirement in Singapore. DB

Borderline success

Whether it is to prevent illegal immigrants entering the country or monitor lines of conflict, effective border control is vital, and suitable surveillance technology must be employed, **Beth Stevenson** reports.

In order to maintain sovereign control over what enters and leaves a country, border control, and in turn surveillance, are essential.

Recent political tensions across certain frontiers have led to security being stepped up, with technology taken to the next level and permanent infrastructure being put in place to increase the ISR capabilities these particular countries have.

The border between Israel and the Palestinian Territories saw significant disturbance in November when a firing campaign between the two was conducted over the Gaza Strip.

Adding to the strain already felt in the region, the firings lasted eight days, and some 150 people were killed, mostly Palestinian. Armoured vehicles were reportedly lined up on the border by the IDF, and reserves were called up in the case of a full-scale attack. However, a ceasefire was declared on 21 November, which both sides adhered to for the most part, although the strain between the two is still evident.

ADDRESSING CONCERNS

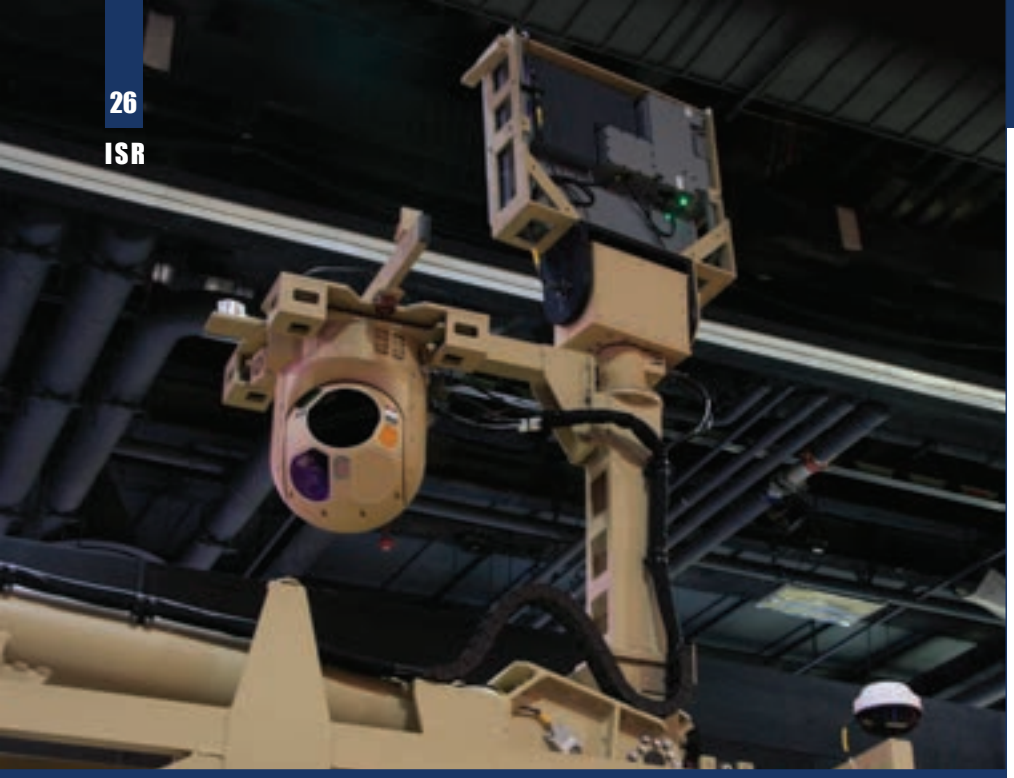
'The devastating round of violence is a stark reminder that the status quo is unsustainable,' Robert Serry, special coordinator for the Middle East peace process, told the UN Security Council on 27 November, according to a UN news statement. 'There will be no progress if Israel's legitimate security concerns are not addressed. At the same time, it will give Palestinians a strong additional stake in a durable calm if it leads to a lifting of the closure on Gaza.'

The eight days of violence left an estimated 158 Palestinians dead – including 103 civilians – and 1,269 injured, Serry reported. Six Israelis – four civilians and two soldiers – were reportedly killed by Palestinian rocket fire and 224 Israelis were injured, the vast majority civilians.

While the broader issue of the future of the region is discussed internationally, Israel continues to enforce strict surveillance of the area in response to these kinds of events. From 'defensive forestation' efforts along the Gaza border to more sophisticated sensor systems, activity is monitored daily. In turn, the country's industry is rapidly developing surveillance solutions for domestic border control, which also lends itself to international markets.

Ness Technologies, for example, started development of the Sixth Sense detection system some five years ago at the request of the Israeli MoD following a stabbing incident that took place in Jerusalem. ➤

Photo: US Customs and Border Protection



FLIR introduced its MSC vehicular long-range detection system at AUSA. *(Photo: Tony Skinner)*

'According to video recorded before the incident, the terrorist acted in a way that was abnormal – he stayed at the scene for a long time, going back and forth,' Michael Zinderman, president of the Technologies & Systems Group at Ness Technologies, told *Digital Battlespace*.

'Later when the system was presented to border protectors, the operational requirements were widened to also cover border protection, especially related to crowded border pass control points.'

SENSITIVE LOCATIONS

The system is designed for use at border control points, in crowded urban environments and for VIP protection, although it can be used in any 'sensitive location'. At present, it is installed at a 'sensitive military site' in Israel for operational evaluation, which is part of the advanced development stage of the programme.

'The main purpose was to develop a system for common use,' continued Zinderman. 'Therefore, it works with a broad range of video cameras, modern cameras as well as the cheapest, even obsolete, analogue video cameras.'

The system's sensor comprises two cameras, and future development will include the incorporation of different options, including pan-tilt-zoom and IR cameras and RFID.

The detection and alert mechanism is automatic, based on initial setup by the user. The system output can be displayed locally and/or disseminated to a distant control centre or another C2 system. Meanwhile, the cameras are also installed in all-weather boxes, and the camera choice fits the lighting and weather conditions expected.

'On 27 January, the IDF announced that it was deploying more sensor capabilities along the Syrian border.'

During the AUSA Annual exhibition in Washington, DC, in October, another Israeli company, Rada Electronic Industries, demonstrated what it described as 'the first software-defined radar' to the US market.

The fact that the pulse-Doppler multi-mission AESA radars are software-defined means they lend themselves to multiple types of operational missions and profiles. The company said that it was seeking a US partner to team with to integrate its systems on a variety of platforms.

SYSTEM DEMONSTRATION

Dov Sella, Rada's VP of business development, told *DB* that the company's Multi-Mission Hemispheric Radar (MHR) had been demonstrated to the US Army at Yuma Proving Grounds, Arizona. He claimed that the system was less than 10% of the cost of competing systems due to the COTS nature of its development.

It was also announced in February that successful testing of the MHR had been completed with the IDF, using the RPS-40 Counter-Artillery, Rockets and Mortars variant.

The RPS-40 detects, tracks, classifies and locates direct and elevated threats fired at stationary or mobile forces. These include rockets, artillery, mortars, ATGMs and RPGs. The system can be integrated with any protection and/or C4I system and installed at stationary bases and posts, or on board fighting vehicles.

Zvi Alon, CEO of Rada, said at the time: 'We are very pleased with the results of the tests, which have proved the advanced capabilities and the technological maturity of our radars.

'Our next goal is to establish the serial production line by mid-2013. In the coming months, we will conduct further tests on additional operational missions, and estimate that by the end of the year our radars will be installed and in use by select customers.'

The company's range includes the Compact Hemispheric Radar (CHR) family for use on vehicles and for short-range protection applications, the RPS-10 sensor for active protection systems and the RPS-15 hostile fire management radar system for combat vehicles.

The MHR family is designed for force and border protection and includes the RPS-42 for tactical air surveillance and the RHS-44 for border intrusion management, alongside the RPS-40 radar system.

SYRIAN FOCUS

It is not just the Palestinian border that concerns Israel. On 27 January, the IDF announced that it was deploying more sensor capabilities along the Syrian border.

'Specifically, the IDF leadership has decided to strengthen the border fence while upgrading intelligence-gathering capabilities in the area,' an IDF statement explained. 'In recent weeks, soldiers of the Ga'ash Formation, which defends the area, have worked extensively on this project so as to enhance the area's general security.'

These moves are designed to prepare for developments in Syria, as well as countering future terrorist activity.

'Reports claim that India has been increasing surveillance measures in Kashmir in response to recent events.'

'This project contains within it a significant procedure for strengthening intelligence-gathering, by stationing radars and state-of-the-art cameras throughout the Golan Heights sector,' said Ga'ash Formation engineering officer Lt Col Shai Unger, who is responsible for the project. 'Additionally, a barrier has been placed along the line of the fence, which will provide added security to the surrounding communities.'

The building of the fence is being carried out in a similar fashion to that of the 'Hourglass Project' on the Egyptian border, which has proven its effectiveness recently in preventing illegal border crossings, according to the IDF.

'In the beginning, we chose to invest our efforts in the areas close to civilian communities, but I believe in the future we will equip the entire Golan Heights with the same kind of barrier,' continued Unger.

IRON DOME

Meanwhile, the country's Rafael-built Iron Dome rocket interceptor, operated by the Israeli Air Force, was used during the disruption in November, and of the five batteries in service, one was moved to the north of Israel, near Haifa in January, amid fears of conflict with Syria. Unconfirmed reports also state that Israel already had one Iron Dome stationed in the north near its borders with Syria and Lebanon.

The system is undergoing a sensor and software upgrade, with improved capability allowing detection of 99% of the rockets and missiles launched towards Israel, allowing for specific scans of an attacked area.

One of the main system improvements is the ability to have a more precise evaluation of the area under attack within the country. This will allow earlier alerts that can be activated in specific zones.

Rafael and the Israel Missile Defense Organization within the MoD successfully tested the upgraded variant, the IDF announced on 21 January, having completed a series of pre-planned trials.

The upgraded system, designed to shoot down threats at greater ranges, is a response to reported intelligence that Hezbollah in Lebanon has received longer range rockets from Iran.

Iron Dome mainly consists of a mobile detection and tracking multi-mission radar, a battle management and weapons control unit, an interceptor with special warhead that detonates threats from ranges up to 70km and a missile firing unit.

In the coming months, an upgraded model of the Tamir interceptor, used to interrupt rockets and missiles, is expected to enter into operational use. Currently, 20 Tamirs are allocated to each battery, and Iron Dome will use the new upgraded rocket alongside the current version.

At the end of January, it was also reported that Israel had targeted a research centre in Syria, using fast jets and flying below radar to attack the site, adding to the tension in the region.

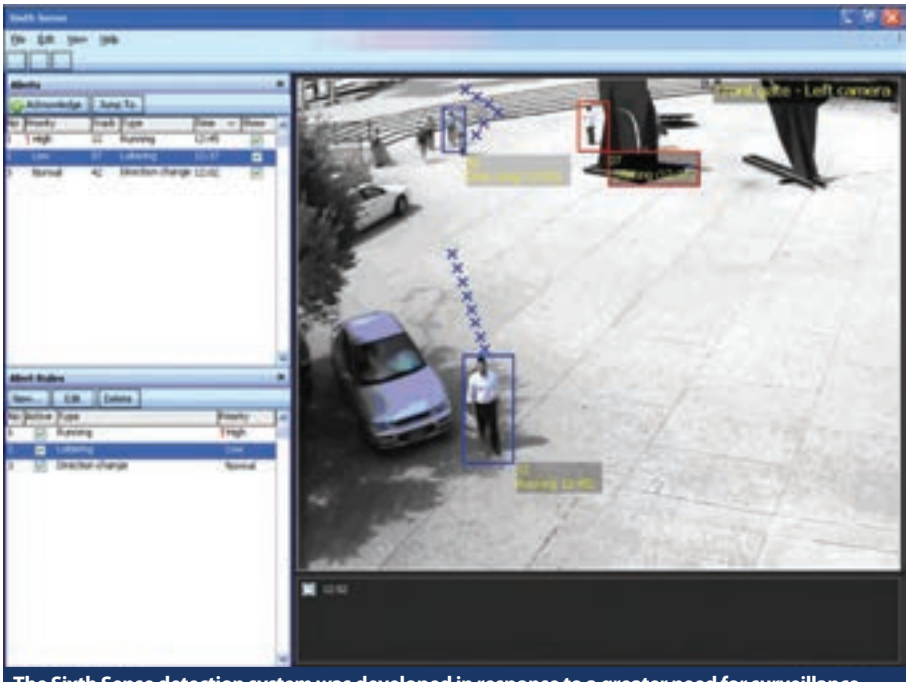
LINE OF CONTROL

Another border that is controlled and monitored is the Line of Control (LoC) in Jammu and Kashmir, which is subject to an ownership dispute by India and Pakistan.

In January, tensions mounted as the two sides accused each other of breaking ceasefire rules. Military activity near the border is regarded as common, but accusations of encroaching on each other's considered territory is not, and subsequently three Pakistani and two Indian soldiers were killed.

Trade and travel across the border have commenced again, but reports claim that India has been increasing its surveillance measures in response to recent events, and thermal imagers and long-range reconnaissance and observation systems are already in operation along the LoC.

In March 2012, the Indian Institute for Defence Studies and Analyses (ISRO) proposed the launch of Radar Imaging Satellite 1 ➤



The Sixth Sense detection system was developed in response to a greater need for surveillance, following a stabbing incident in Jerusalem. *(Image: Ness Technologies)*

(RISAT-1) with C-band synthetic aperture radar (SAR).

'ISRO also proposes to launch a GEO imaging satellite [GISAT] in geostationary orbit to provide near-real-time pictures of large areas of the country, including borders, under cloud-free conditions,' according to the ISRO.

'RISAT-1 will be transmitting the picture data only during the passage of the satellite over India to the receiving station located at Hyderabad. The GISAT will provide the pictures of the areas of interest on a near-real-time basis. That is, selected sector-wise imaging every five minutes and entire Indian landmass every 30 minutes at 50m spatial resolution.'

It is understood that India currently has one satellite with SAR equipment, but because it is not designed to transmit 24/7, new sensors with night capabilities could be considered. Another option, according to news site *Tribune India*, would be a SAR capability on board a UAV.

'We are at looking at improving surveillance capability and ramping up human intelligence,' the site reported the Indian Army Chief as saying. 'We are revisiting doctrine and strategy and making it relevant and compatible.'

STATESIDE SEPARATION

Some 3,200km of border separates the US and Mexico, and although the two countries are not caught up in any kind of conflict, the boundary is still monitored to prevent illegal immigrants crossing from the latter to the former.

'To help improve low-level air detection and monitoring along the southwest border, the DoD and [Department of Homeland Security] continue to coordinate the testing, evaluation and employment of suitable surveillance technology,' states the 2011 White House 'National Southwest Border Counternarcotics Strategy'.

'The DoD-owned Tethered Aerostat Radar System is an effective tool to detect low-flying aircraft, maritime and land traffic at the border and between the ports of entry. An effort to integrate DoD portable radar systems will further optimise the air picture.'

US Customs and Border Protection (CBP) has also acquired and deployed mobile surveillance systems on select areas of the southwest border. These units include a radar system and

Rada has demonstrated its MHR system to the US Army at Yuma in an effort to market the system to new territories. *(Photo: Rada)*

video camera mounted on a rugged truck that can be driven to tactical areas of high risk.

In October 2012 at the AUSA exhibition, FLIR Systems unveiled its Mobile Surveillance Capability (MSC) vehicle-based long-range detection system. Developed in conjunction with CBP, it incorporates the TacFLIR 380-HD sensor, Elta Ground Master radar and FLIR's CommandSpace Adaptive C2 software.

Deliveries of an undisclosed number of MSC units to CBP under a $100 million contract were expected to begin as this issue went to press. FLIR also confirmed to *DB* that three of the international variant, the CommandSpace Cerberus Mobile Vehicle Surveillance System (MVSS), have been ordered by a Middle Eastern customer. MVSS uses FLIR's R20SS radar, while the CBP variant uses the Elta GroundMaster.

A FLIR spokesman at AUSA also said that the company was in discussions with Kenya for possible export of the system.

The surveillance system is designed with a 'one button to detect' capability and can be set up in less than eight minutes, according to the company. The system on display at the exhibition was on a test vehicle, which had been put through 8-9g stress testing without any damage to the sensor suite.

'The [US] Coast Guard has deployed multi-sensor DoD detection technology in both the Pacific and Gulf maritime regions to enhance the operating picture and better identify, track and intercept maritime targets of interest in support of surge operations,' notes the White House paper. 'Agencies should continue to develop and utilise all available means for detection and tracking of suspect air and maritime contacts, and improve information-sharing to enhance southwest border domain awareness, including improved technology and mechanisms to share information with other federal, state and local partners.'

'Agencies should develop and utilise all available means for detection and tracking of suspect air and maritime contacts.'

As part of the DoD's military support to civilian law enforcement agencies (MSCLEA), Joint Task Force (JTF) North aided the effort to monitor the Mexican border.

TECHNOLOGY SHIFT

'During the first decade of JTF North's MSCLEA operations, the support provided to law enforcement was relatively personnel-intensive, using people on the ground to provide border detection,' JTF North explains in its 'Military Homeland Security Support: Joint Task Force North Supports Federal Agencies' statement. 'Today, JTF North support has shifted to a greater focus on the application of technologies, including ground sensors, radar, airborne platforms and thermal imaging.

'The evolution of the support has resulted in more effective border detection. JTF North has shifted its intelligence support efforts from the borders outward and deeper into the approaches to the US.'

Surveillance capabilities offered by the DoD to federal law enforcement agencies include: aviation reconnaissance; air and maritime surveillance radar; UAS; ground surveillance radar; listening post/observation post; and ground sensor operations.

'JTF North executed a multi-sensor land and maritime homeland security mission in support of the USCG along the US-Mexico border south of San Diego,' continues the statement. 'The support mission included both day and night aviation reconnaissance and maritime radar support operations.'

Helicopters with FLIR sensors have been known to patrol the border, and since 2005 Predator UAVs routinely survey it. DB

Sharpening the gaze

Reduced maintenance levels and the ability to detect small, highly mobile targets are key aims of the USAF's ongoing 3DELRR radar programme. **Tom Withington** reviews progress to date.

The USAF is looking forward to the replacement of its veteran Northrop Grumman AN/TPS-75 ground-based air surveillance radars, which entered service in 1968, with the new Three Dimensional Expeditionary Long-Range Radar (3DELRR). The 3DELRR programme is moving forward, and a number of milestones are expected in 2013.

The AN/TPS-75 provides theatre-level air surveillance as part of the USAF's Ground Theater Air Control System (GTACS) C2 architecture, which forms a key part of the service's Theater Air Control System (TACS). The AN/TPS-75 is based on Northrop Grumman's AN/TPS-43E radar. This latter S-band system has an effective range of 450km when detecting a fighter-sized target, and can be used for ground-controlled interception, fire control and general air surveillance.

Several electronic counter-countermeasures are built into the AN/TPS-75, including frequency agility, a new ultra-low sidelobe antenna designed to reduce sidelobe emissions by up to 50% compared to the AN/TPS-43E, a reduced maintenance burden and improvements to the back end of the radar in the form of advanced signal processing techniques. These utilise Barker phase-coded pulses to increase accuracy, range and resolution.

'One of the aims of the 3DELRR programme is to reduce the maintenance burden still further.'

AESA ARCHITECTURE

One of the aims of the 3DELRR programme is to reduce the maintenance burden still further vis-à-vis the radars which will eventually be replaced. This will be partially achieved via use of an active electronically scanned array (AESA) with transmit/receive (T/R) modules mounted directly on the antenna, as opposed to the previous radar's design which has the transmitter, receiver and processors located in the transportable shelter accompanying the antenna.

In terms of mission, the original solicitation released by the DoD regarding 3DELRR required the radar to 'provide long-range surveillance, control of aircraft and theatre ballistic missile detection'. In addition, the document called for the future replacement system to 'correct current radar system shortfalls by providing the capability to detect and report highly manoeuvrable, small radar-cross-section targets, as well as to discriminate the type of non-cooperative aircraft'.

Work on the 3DELRR initiative commenced in May 2009 with the award of two contracts (worth $21.9 million and $24.9 million) to Saab Sensis and Lockheed Martin to provide radar engineering and design support during the technology development (TD) phase 1 of the programme. The formal solicitation for 3DELRR was published on 29 October that year.

An artist's rendering of Lockheed Martin's proposed 3DELRR design. The company is competing with Northrop Grumman and Raytheon to fulfil the requirement. *(Image: Lockheed Martin)*

In December 2009, Saab Sensis completed a systems requirement review (SRR) for the engineering, integration and test processes that the firm had performed regarding its work on the programme. Lockheed Martin completing its SRR in December 2010, demonstrating a functioning 3DELRR prototype at the same time. This was closely followed in January 2011 by Sensis completing demonstration of its radar prototype.

PROGRAMME RESTRUCTURING

However, a radical restructuring of the programme was announced in March that year during a 3DELRR industry day, reflecting DoD financial considerations and a desire to ensure that which ever radar is procured will be exportable. This latter focus could reduce ➤

eventual procurement costs, given that the more export customers receive the radar, the lower the unit procurement price will be for the US military.

This effectively relaunched the competition, resulting in the award in August 2012 of contracts for TD phase 2/pre-engineering and manufacturing development (EMD) activities to Lockheed Martin Mission Systems, Northrop Grumman Electronic Systems and Raytheon Integrated Defense Systems, which received contracts worth $36 million, $34.8 million and $35.2 million respectively.

During this phase, the USAF will review studies already undertaken by industry regarding 3DELRR requirements and its strategies for meeting them. Furthermore, the service will perform preliminary design reviews (PDRs) and evaluate technological maturity levels. Of the two original companies involved in TD phase 1, only Lockheed Martin remains, with Saab Sensis bowing out as a prime contractor. Nevertheless, the firm is still involved with the initiative and is working with Raytheon to this end.

Discussing its selection for the pre-EMD phase, Andy Hajek, 3DELRR programme director at Raytheon Integrated Defense Systems, said that the company is 'required to complete a [PDR] as part of our pre-EMD contract, along with a capability demonstration of a 3DELRR radar prototype. We are diligently working on the tasks associated with completing those milestones.' He noted that the company has 'a very capable team and great partners in Saab Sensis, and we are on track to complete both the PDR and demonstration on schedule'.

PUBLIC SPEAKING

Like Raytheon, Northrop Grumman has spoken publicly about its offering for the 3DELRR programme. Mike Meaney, the company's director of ground-based tactical radar, told *Digital Battlespace* that the contractual requirements are to 'mature all required technologies to Technology Readiness Level 6 or above', and 'conduct an [AESA] system demonstration this coming summer'.

'In order to win, you have to be able to offer a system that isn't just affordable to procure, but affordable to operate.'

As part of its pre-EMD contract, Meaney said Northrop Grumman has 'conducted a very successful customer post-award conference in early September and an equally successful system requirements/functional review [SRFR] in mid-December. The customer indicated they were extremely pleased with the breadth and depth of the data we provided them, including a demonstration of a complete AESA radar system incorporating high-efficiency gallium nitride [GaN] T/R modules.'

Raytheon is also touting its GaN expertise – this material can operate efficiently at higher temperatures and higher voltages than gallium arsenide, which is currently in widespread use in radars. These properties make GaN ideal for microwave power amplifiers. 'Gallium nitride technology is one of the key requirements for 3DELRR,' Hajek said. 'Raytheon was the first defence company to recognise the potential of this revolutionary technology, and as a result, we have invested heavily in it for a number of years.' He added that 'this puts us in an extremely strong position to provide the air force with a system that meets their requirements at an affordable cost'.

He further argued that the company's previous experience in designing and producing ground-based air surveillance

The USAF's AN/TPS-75 medium-range ground-based air surveillance radar has been in service since the late 1960s. It is based on the earlier AN/TPS-43E. *(Photo: US DoD)*

Northrop Grumman hopes its experience developing the AN/TPS-80 G/ATOR for the USMC will give it a decisive advantage in the 3DELRR contest. *(Photo: Northrop Grumman)*

radars also holds it in good stead: 'We certainly have the technical expertise to meet the requirements. We've been building radars for many decades, so this kind of competition is aligned with one of our core competencies.'

ACTIVE LINE

Like Raytheon and Northrop Grumman, Lockheed Martin is involved in the pre-EMD phase of the 3DELRR initiative and will also perform an SRFR, and develop and demonstrate a full-scale prototype, according to company spokesman Keith Little. The firm believes it is well positioned to fulfil the USAF's requirements thanks to the experience that it has gained to date in building radars for the service.

'Lockheed Martin has an active radar production line. We still manufacture and deliver the AN/FPS-117 and the tactically mobile AN/TPS-77 long-range surveillance radars,' Little said. Both of these are phased-array, three-dimensional radars that have been sold widely around the world.

Furthermore, Little claimed that the company has placed a major emphasis on reducing the maintenance burden for any future 3DELRR system: 'The high number of line replaceable units on fielded radars today will be drastically reduced. Lockheed Martin is sharing components from across its current line of radars and applying those to 3DELRR. For example, the levelling legs from our AN/TPQ-53 Counter Fire Radar that automatically and quickly level the radar are being considered. That saves development costs, and those legs are already qualified and in use today in combat. It also helps with procurement costs.'

He also stated that 'Lockheed Martin matured its gallium nitride transmitters for its 3DELRR system and will now use those components on current radars such as the company's AN/TPS-59 USMC air surveillance radar, along with the AN/TPS-77 and AN/FPS-117 in their transmitters.'

However, Raytheon's Hajek warned that simply meeting the requirements is not enough: 'We are in an extremely budget-constrained environment, so in order to win, you have to be able to offer a system that isn't just affordable to procure, but affordable to operate. You need a system that is affordable throughout the entire life cycle of the programme.'

G/ATOR AID

Meaney argued that the experience accrued by Northrop Grumman regarding the GTACS initiative could place the company in an advantageous position to fulfil the 3DELRR requirement: 'In addition to our unique GTACS radar experience, another factor that qualifies us to implement the 3DELRR programme is that we are the only US company that has designed, built and tested a production-quality ground-based AESA air defence radar [in the form of the G/ATOR for the USMC – see below], so we have already encountered and addressed technical issues that our competitors probably wouldn't even discover for another three years or so.'

The AN/TPS-80 Ground/Air Task Oriented Radar (G/ATOR) replaces the marine corps' existing Lockheed Martin AN/TPS-59 L-band air surveillance radar, which has a range of up to 370km and a 100,000ft ceiling, using a planar array where radar pencil beams are mechanically scanned in azimuth. The AN/TPS-80, however, will be capable of tracking all air threats, including air-breathing targets as well as rocket, artillery and mortar fire.

In addition, the radar will be used to provide air traffic management services during USMC deployments. The array of tasks which G/ATOR can perform is made possible by its employment of AESA technology which allows T/R modules mounted on the antenna face to be utilised for different surveillance tasks. The AN/TPS-80 has completed its first two government development testing milestones at Wallops Island, Virginia, and will now move ahead with follow-on activities, along with performing an operational assessment at Yuma Proving Ground, Arizona, by the end of the year.

Meaney argued that several 3DELRR requirements are similar to those of the AN/TPS-80, chiefly high operational availability to perform air defence missions. He argues that this allows Northrop Grumman to expedite radar design and production, and ultimately entry into service should the firm be awarded the contract. 'As a result, we have the ability to significantly accelerate the 3DELRR acquisition, which is vitally important to the air force given the age and limitations of the existing radar systems that 3DELRR will replace.'

FUTURE MILESTONES

Where does the 3DELRR programme go next? Following the completion of TD phase 2/pre-EMD, the USAF expects to move towards the full EMD phase in the first quarter of FY2014. A single winning bidder will be selected following the conclusion of this phase in late 2017/early 2018, with a subsequent go-ahead for low-rate initial production. Following this, USAF 3DELRR initial operational capability is expected to be declared in 2020. DB

Common ground

Rafael's legacy in providing ISR sensor pods is leading the way towards new developments and opportunities for the company, **Zvi Yavin**, its director of airborne ISR systems, tells Beth Stevenson.

Rafael offers a range of sensing pods for both manned and unmanned aircraft, which are interchangeable between the different types. Yavin explained to *Digital Battlespace* how the company is using this commonality to help meet customer demands.

'It takes a huge amount of experience to integrate systems to platforms,' he said. 'We have already installed pods on most of the combat aircraft in the world, and we know how to do it. It is quite simple – the system interface is a separate software segment, which is very easy to adapt.

'One of our goals is to put the Reccelite [tactical reconnaissance pod] on the Predator. This always starts with a customer requirement. The fact that the customer has Reccelite on combat aircraft means that it is natural that they'll put it on their UAVs. This is one of the advantages – you can use the same pod on different platforms. For example, the Italian Air Force, they have Tornado and AMX both flying Reccelite, and the pods can be switched. The pods will recognise the aircraft and behave relative to that aircraft. UAVs are the same, just with a different interface.'

EASE OF OPERATION

Yavin said that customers are involved in conversations to put the pod on board their UAVs, and he believes that the sensor suite will be easily operated on board the Predator.

'Predator is different to other known UAVs,' he explained. 'It has a pilot that operates it like a combat pilot. For that reason, the operation of Reccelite on the Predator would be done by the pilot, not by a guy in the ground station as with other UAVs, which makes it even simpler because this is how the pod is operated in combat aircraft.

'The information from the pod can be transferred via our wideband data link over a long distance, but with limitations of line of sight, or the pod can be connected to the SATCOM [from the Predator] and then work over the horizon.'

CUSTOMER BASE

He said that NATO customers, of which there are four, are the largest ones for the Reccelite, and the ground station is built to support NATO standards.

'We are preparing right now the next generation of the ground system, and we are doing it with our customers, especially NATO,' continued Yavin. 'We are carrying out a requirement definition with them. It will enjoy the latest generation of image processing algorithms, and knowing the needs of the market, the ground station is built in such a way that it will be able to work with other sensors simultaneously or offline.'

'We have been talking about UAVs for almost ten years, but in reality most of the activity is still done by combat aircraft.'

It will also have a 'smart archive' that will categorise the data according to location and time, providing accurate information on the EO data feed.

'This is one thing that we know – if we want to be operational in NATO then we have to support those standards to ensure interoperability. In parallel, the fact is that a significant part of NATO is using Reccelite. I hope that this part will also grow in the future. This will create a standard of its own.

'We have been talking about UAVs for almost ten years, but in reality most of the activity is still done by combat aircraft,' explained Yavin. 'There is a huge delay between the promises and the activity. If you look at NATO countries, they don't have UAVs, yet they have plans… but it will come.

'For one of our customers we have already integrated, together with IAI, the pod for the Heron TP. It is one version of the pod, not necessarily the version that all of our other customers have – it is already operational.'

EUROPEAN SALES

Rafael is working with IAI for some customers that are considering the Heron TP, and Yavin believes that when the aircraft is sold to Europe, it will contain the Reccelite pod.

'This is coming from the customers,' he said. 'IAI is trying to promote their sensors, but it's the customers that decide. We are less concerned with lessons learned. We are more concerned with looking forward to unknown challenges, and this is the reason why we are trying to create the most flexibility for the system, and the result is that we can adapt the system to any challenges that are coming.' DB

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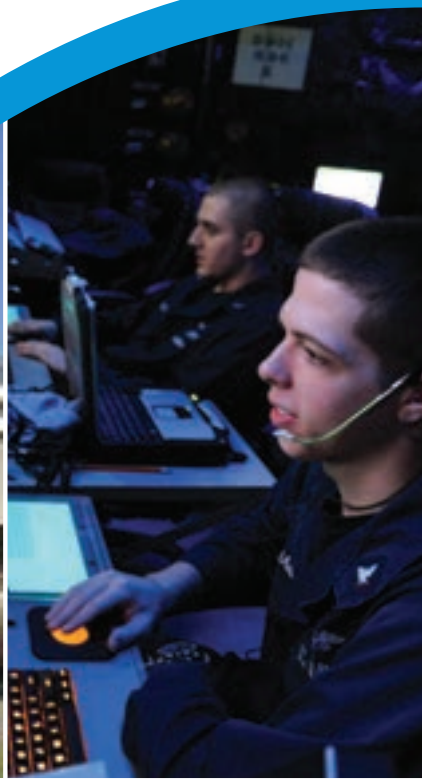

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