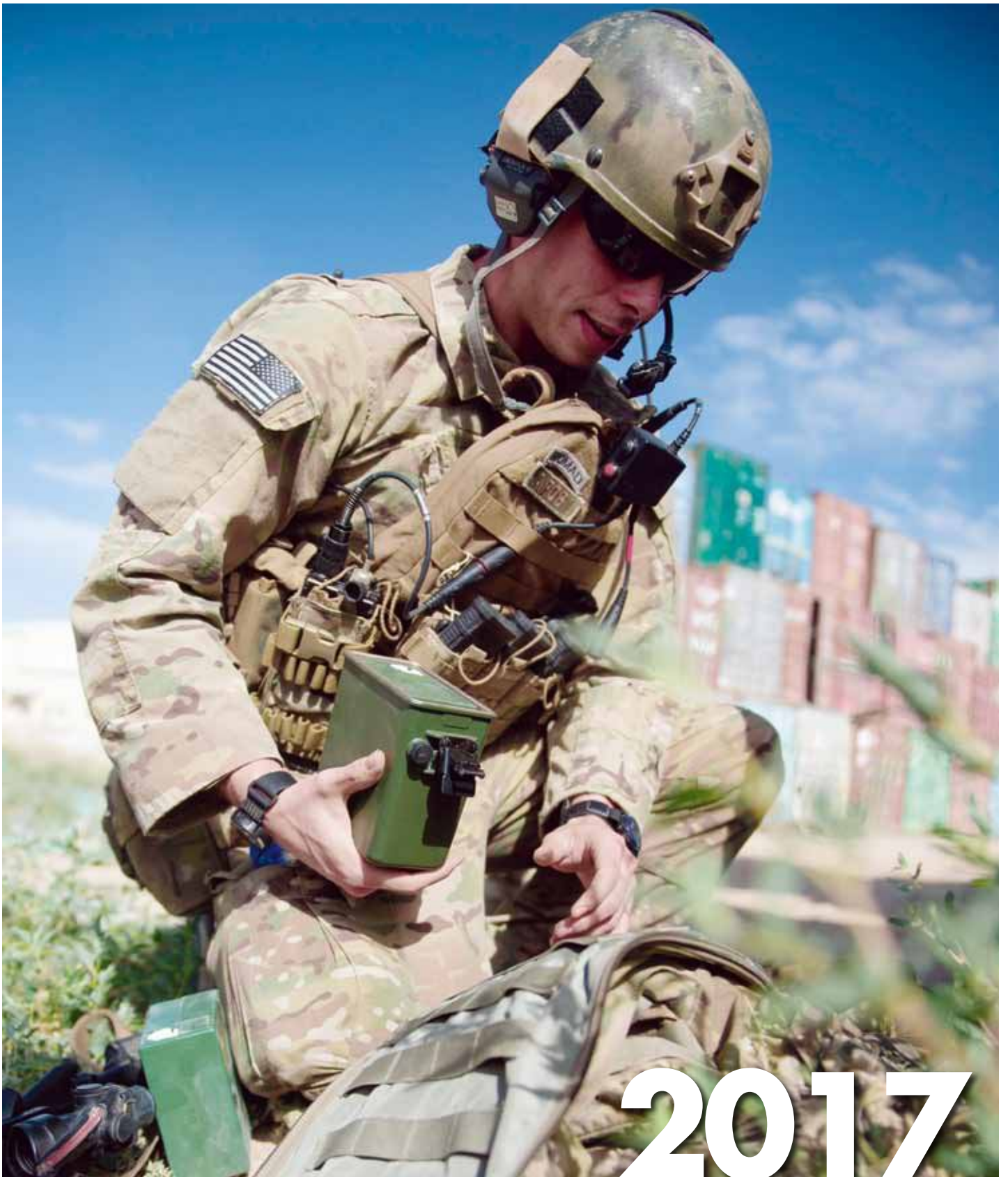


TACTICAL RADIOS

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French soldiers supporting the country's Operation SENTINEL domestic security initiative have benefited from new communications in the form of the Auxylium system.



TALKING TO EACH OTHER

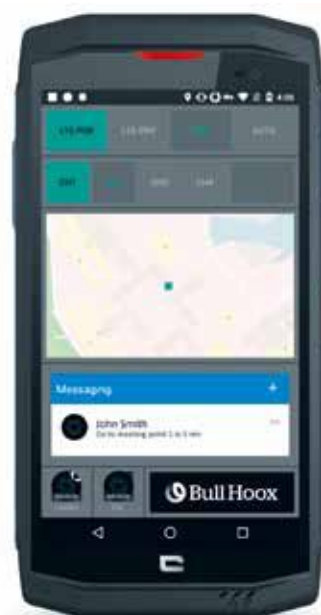
Large-scale tactical radio acquisitions are ongoing in France, Germany and the United Kingdom making Europe a particularly vibrant area for tactical radio acquisition. Advances in the waveform domain are also moving apace to enhance interoperability.

Thomas Withington

Stroll around any large station, airport or place of worship in France and you will almost certainly notice squads of young French soldiers patrolling in a calm, professional manner. Deployed since the January 2015 Al Qaeda attacks in the Ile de France region of northern France, that includes Paris, which claimed the lives of 17 people, *Opération SENTINELLE* (Operation SENTINEL) has seen the French armed forces conducting foot patrols around potential targets for political violence. The operation has chalked up some notable successes, such as on 3rd February when soldiers guarding the Louvre museum in central Paris shot and injured a man who rushed at them while carrying a machete. Yet the deployment of troops around mainland France raised some difficult questions regarding how these soldiers were to communicate with one another, and with civilian first responders such as the country's *Police Nationale* and *Gendarmerie Armée de Terre* (French Army) sources

told the author that it had not been possible to deploy the army's usual tactical radio, in the form of the Thales PR4G Very High Frequency/Ultra High Frequency transceivers in support of the Operation SENTINEL mission due to domestic restrictions *vis-à-vis* the radio frequencies they employ. Instead, as explained by some of the soldiers whom routinely patrol near *Armada's* editorial office in southwest France, troops assisting the operation were initially outfitted with Motorola conventional handheld radios (known to Francophones as a 'talkie-walkie', but to Anglophones as a 'walkie-talkie' for some inexplicable reason) to enable communications with one another. However, the French Army was said to have concerns regarding the communications security of such radios.

A solution to this predicament was realised by Atos which has developed, and now deployed, the Auxylium communication system which uses a secure smartphone, plus a trailer-mounted node, to provide soldiers supporting Operation SENTINEL



Atos

Atos' Hoox product has been enhanced by several innovations including a smaller network node, and a new ruggedised smartphone as seen here.



Thales' vehicular CONTACT transceiver is displayed here. The firm's CONTACT radio family will be interoperable with the PR4G radios in French military services which the new radios will replace.

not only with communications, but also battle management functions. Deployment of Axylium commenced in June 2016, the company told *Armada*, with the system's architecture providing position reporting which is visible on the smartphone's screen so a soldier can see the position of their comrades, and other individuals on the Axylium network. They can also use the architecture to send and receive written messages, and still and video imagery. The soldier carries the smartphone on their person, which is connected to a handset for speaking. A software upgrade is currently ongoing for the Axylium architecture which will allow it to host up to 1000 users on a single network by the end of the year. Moreover, the company told *Armada* during an Atos event in Brussels this June that it expects to imminently receive an order from the French Army for additional Axylium systems to be delivered in 2018. This will allow the complete roll out of the product across all French territory, not just metropolitan France. Although not confirmed by the company, this could enable French Army units tasked with protecting the Guiana Space Centre in Latin America to be equipped with Axylium. Plans are also afoot to enable the architecture to link to the PR4G and forthcoming Thales CONTACT tactical radio systems (*see below*) to enable communications between these networks. The company stated that this will take the form of a software upgrade, presumably adding a waveform that will facilitate communications to this end. This could be particularly useful for French troops supporting so-called 'Hybrid Warfare'; the definitions of which are open to debate, but which broadly encompasses convention warfare; counter-insurgency and/or peacekeeping operations; Humanitarian

Assistance and Disaster Relief (HADR) and cyber warfare.

The Axylium architecture was evolved from Atos' Hoox product, the latest incarnation of which was launched at the firm's June event in Brussels. Several innovations have been rolled onto the Hoox as a result of lessons learned from the Axylium programme. These include a smaller network node which can fit into a backpack, rather than being positioned in a vehicle or on a trailer. The new ruggedized smartphone provides up to twelve hours of battery life, and gives position reporting every five seconds. Moreover, as well as using its own dedicated network Hoox can perform secure communications over an existing fourth-generation (4G) cellular network. The company continued that each Hoox can carry multiple channels, and can handle a range of up to one kilometre (0.6 miles) between two devices.

I CONTACT

As noted above, the Axylium architecture will be able to link with the CONTACT tactical radios which the French armed forces are procuring to replace the existing PR4G family. During the Paris Air Show held this June, Thales representatives relayed to *Armada* the latest news regarding the CONTACT programme. The development of the radio is being performed in a contiguous fashion with Thales' SYNAPS tactical radio family, launched during the June 2016 Eurosatory exhibition held in Paris. Put simply, SYNAPS uses much of the hardware and software of the CONTACT radio family *sans* French communications security, encryption protocols and national waveforms. The company disclosed that transceivers

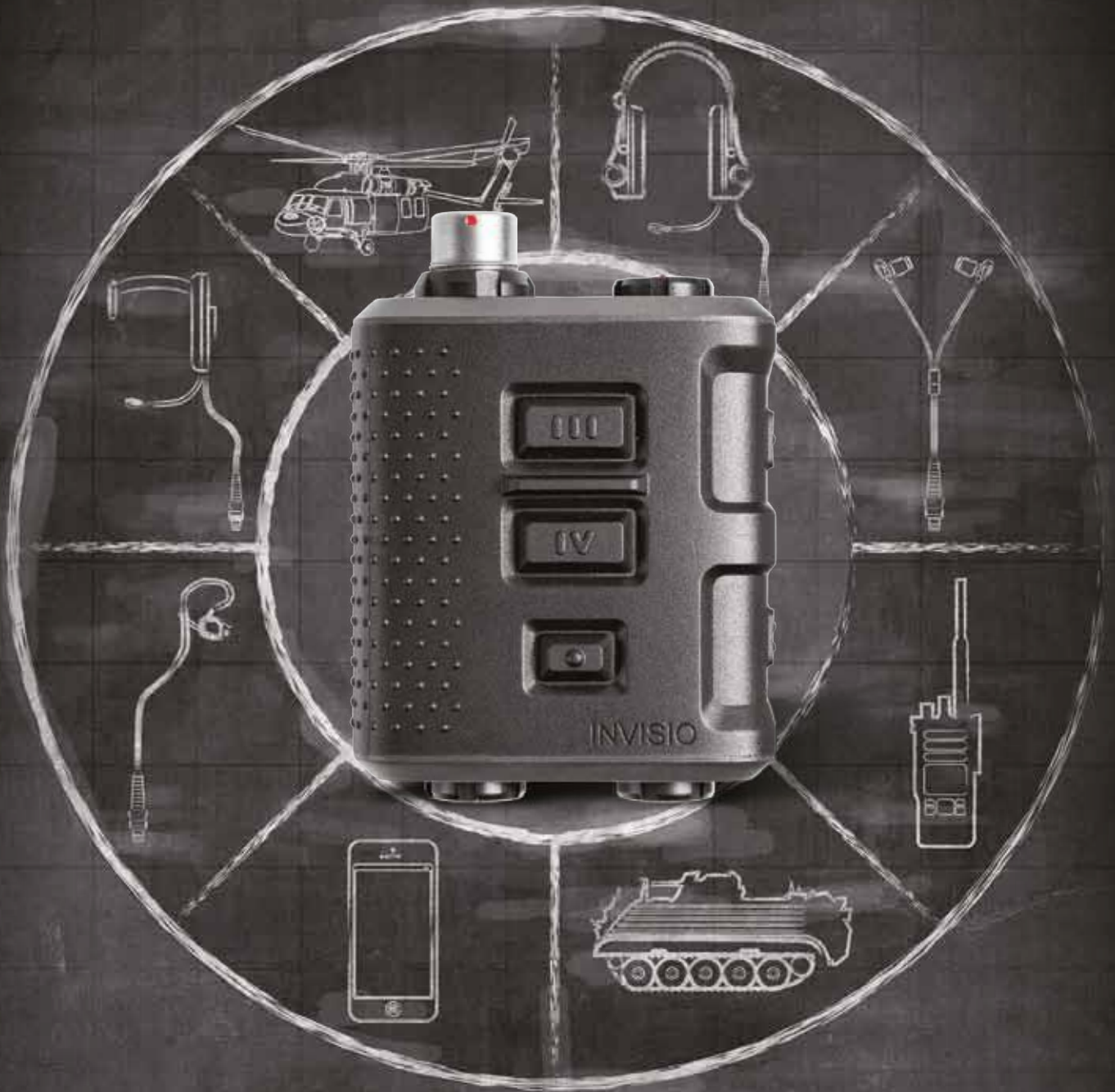
which support the overall CONTACT programme (principally handheld, vehicular and airborne transceivers) are undergoing qualification, adding that the new radios have performed bench demonstrations, and in November the firm performed its first field demonstration of the handheld and vehicular transceivers equipping the SYNAPS and CONTACT product lines. Following these demonstrations, Thales is confident that it will perform the first field testing of the handheld and vehicular transceivers. Other important tests performed over the last six months include the demonstration of existing PR4G VHF (Very High Frequency) radios with the networking capabilities offered by the CONTACT architecture. This represents an important milestone in the programme. There will be an overlap between the PR4G family leaving service, possibly from circa 2025, and the CONTACT radios entering service in the 2020 timeframe. Therefore, it will be imperative for both the PR4G and CONTACT networks to be capable of communicating with one another. For example, both the CONTACT and PR4G radios will use Thales' GEOMUX VHF waveform launched in 2012 which provides simultaneous and secure voice, data and Blue Force Tracking (BFT) services, operating across two channels, the first of which carries voice and data traffic with the second carrying Global Positioning System-based BFT services, which can equip all handheld, manpack and vehicular PR4G family transceivers, official company literature notes. The CONTACT radios will also be outfitted with the ESSOR waveform (*see below*).

I MORPHEUS

The CONTACT programme is one of several major European tactical radio programmes, and is joined by the United Kingdom's Project MORPHEUS initiative. Taking its name from the Greek god of dreams, this initiative is fast becoming a reality following the award to General Dynamics' UK subsidiary of a contract worth \$429.9 million to design and develop the Project MORPHEUS architecture which, according to a General Dynamics press release announcing the news on 6th April, will cover the first phase of this initiative to develop a new communications and information system to replace the British Army's existing General Dynamics Bowman tactical communications system. In fact, the press release continues that the initiative will take the existing Bowman architecture, known as the BCIP-5.6 capability, and develop this into "an open, modular system." The BCIP-5.6 configuration was conferred on

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Bitium

Alongside Bitium's new Tough SDR Handheld radio, the firm unveiled in August its Tough SDR Vehicular radio which, like its counterpart, is expected to equip the Finnish armed forces.

the Bowman system following a UK Ministry of Defence contract award to the firm worth \$164.1 million in 2016 which enhanced the overall Bowman architecture with the delivery of new data terminals, according to open source reports, plus the overall upgrade of the Bowman Battle Management System (BMS). In terms of hardware, this included the procurement by General Dynamics of DRS Technologies' rugged computers and tactical display technology drawn from the firm's MFOCS (Mounted Family of Computer Systems) product line, which is also in service with the US armed forces, to provide 12000 terminals upon which the BMS can be hosted.

Reports continued that the decision to enhance the existing Bowman architecture, as opposed to procuring a completely new system, in a similar fashion to the CONTACT initiative, was the result of cost pressures reflecting real term decreases in UK defence spending as a proportion of Gross Domestic Product (GDP), which has reduced from circa 2.5 percent of GDP in 2012 to circa 2.3 percent of GDP in 2016, according to official UK public spending figures. General Dynamics' 6th April contract is expected to run for 45 months, reports continued, with the modernised Bowman architecture entering service with the UK armed forces early next decade. Specifics regarding the architecture, software and hardware that will underpin Project MORPHEUS are fiendishly difficult to come by. For the past year, the author has sent repeated requests to the UK Ministry of Defence (MOD) for more detail regarding the scope of the programme, but while these requests have been

acknowledged, they remain unanswered. What is known according to the MOD's Project MORPHEUS website is that the initiative will "deliver the next generation of Tactical Communication and Information Systems (TACCIS) capability. It will address critical system obsolescence and introduce a more agile TACCIS solution (both technical and business). This will enable emergent technology to be rapidly exploited for user benefit, will be more responsive to changes in user need, and will realise efficiencies in the way in which TACCIS capability is acquired and supported." Translated from Whitehall-speak it seems that what Project MORPHEUS will do is to deliver a better communications and BMS capability than that offered by the current incarnation of Bowman (BCIP-5.6) using existing and future Bowman architecture with the ability to easily accept new software and hardware as and when it becomes available for use by the UK's armed forces. More information regarding Project MORPHEUS came to light during the Paris Air Show this June when sources close to Atos (*see above*) told *Armada* that the firm had received interest from the United Kingdom regarding a variant of its Scorpion Information Combat System BMS, which is equipping the French Army from 2018 at the battalion and company levels, to equip the Project MORPHEUS architecture. As with Bowman, the MORPHEUS undertaking is illustrating that the British Army will receive a new BMS concurrently with its new communications system.

SCANDINAVIA

Further north, Sweden is enhancing its long-

range communications through the provision of Comtech's Modular Transportable Transmission System (MTTS). This uses tropospheric transmissions to reach Beyond Line-Of-Sight (BLOS) ranges of up to 150 kilometres (93.2 miles). The MTTS achieves this by transmitting a narrow beam of Radio Frequency (RF) energy just above the horizon in the direction of the intended receiver. This RF transmission is scattered as it passes through the troposphere, causing some of the transmission to be reflected back to Earth and to the intended recipient. This approach allows BLOS Ultra High Frequency communications. The MTTSs being provided to Sweden, Comtech told the author earlier this year, include the firm's CS67200i digital troposcatter modem, CS4400 frequency converter system, TRP500-4450 solid state power amplifier and Quick Troposcatter Path Analysis Programme. Comtech's official literature states that the MTTS provides data rates of up to 22 megabits-per-second, with the company confirming that the initial MTTSs were delivered to the Swedish armed forces by April 2017. The current contract that the firm has with the Swedish MOD includes options for up to ten additional systems which can be exercised over the next decade. It is unknown which service in the Swedish armed forces (army, air force, navy, home guard or amphibious corps) will use the MTTS.

Meanwhile, *Armada* has been confidentially informed that Sweden will begin to receive new Elbit Systems tactical radios for use by its army during this year. Sources have disclosed that up to 2500 of Elbit's MCTR-7200 vehicular transceivers will be delivered to the country. These radios transmit across wavebands of 30MHz to 512MHz and 225MHz to 512MHz. They carry Elbit's Narrow-Band Waveform (NBWF) and Wide-Band Waveform (WBWF). These have channel spacings of 25 kilohertz (KHz), 12.5KHz and 6.25KHz for the NBWF, and one megahertz for the WBWF. The waveforms carry data rates of circa 115.2 kilobits-per-second (kbps) for the NBWF when using a 25KHz channel, and up to 500kbps with the WBWF on a single channel. Communications security in the form of AES-256 standard encryption is accommodated in the radios, which can also accommodate proprietary encryption. The MCTR-7200 can accommodate up to 16 nodes on a network via the NBWF, although this increases to 60 nodes when employing the WBWF. MCTR-7200 deliveries to the Swedish Army are expected to conclude in 2021.

Sources continue that the MCTR-7200 could eventually replace the Rockwell Collins RA-460 transceivers used by the

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Bittium

Bittium's TAC WIN product has demonstrated its ability to handle tactical radio traffic using the pan-European ESSOR waveform.

force. The RA-460 is reportedly based on the company's multiband (two megahertz to two gigahertz) FlexNet Four tactical radio. This radio is equipped with the FlexNet Waveform, which Rockwell Collins describes as a high data rate *ad hoc* networking waveform. The RA-460 can also support the Thales PR4G and FastNet waveforms, and provides data rates of between 64kbps and five megabits-per-second. The Swedish Defence Materiel Administration's (FMW) 2013 *Tactical Ground Radio System Request for Information* provides some indications of the modernisation path and concept of operations for the MCTR-7200, envisaging

the radio to be deployed within a battalion with a narrowband waveform being used for communications between squads, and a wideband waveform being utilised for communications between armoured vehicles, and between those vehicles and the squads. Although primarily envisaged for ground-to-ground communications, the document continues that the radio could support communications with helicopters, and satellite communications. Furthermore, the document stated an expectation that the new radio will accommodate the ESSOR/COALWNW (Coalition Wideband Networking Waveform). The COALWNW initiative, which involves Australia, Finland, France, Germany, Italy, Spain, Sweden, the United Kingdom and the United States aims to develop wideband communications waveforms which can be used by these nations to facilitate air and ground communications, and to enhance interoperability amongst these countries.

Staying in Scandinavia, Bittium has updated the author regarding its work on the pan-European ESSOR (European Secure Software Defined Radio) waveform initiative. Commencing in 2010 the ESSOR programme is managed by OCCAR (*Organisation Conjointe de Coopération en Matière d'Armement*/Joint Armament Control Organisation); a European intergovernmental organisation which manages collaborative arms programmes involving Belgium, France, Germany, Italy, Spain and the United Kingdom. The initiative aims to develop a high data rate wideband networking waveform for software defined radios which can be made available to the ESSOR participating nations of Finland, France, Italy, Poland, Spain and Sweden. This intends to improve interoperability by providing a waveform which can be used

across the participating nations, and other third party countries in the future, and thus ported into the tactical radios used by these nations. Bittium is one of several companies involved in the development of ESSOR, alongside Thales, Leonardo, Radmor, Saab and Indra. Company sources told the author that the Finnish defence forces plan to employ the ESSOR waveform in their tactical radios from company, to platoon and squad levels. Currently, the firm has completed porting the ESSOR waveform into its TAC WIN high data rate IP (Internet Protocol) wireless network, which provides an IP communications backbone on the battlefield from brigade to company levels. Further recent developments involving ESSOR are discussed in more detail below. The TAC WIN *ensemble* includes the compact and robust TAC WIN Tactical Router and three optional TAC WIN Radio Heads which cover the 225MHz to five gigahertz frequency range. The Tactical Router provides wired and wireless IP networks while the three Radio Heads allow troops to connect to the TAC WIN network, thus giving them IP access. It is these Radio Heads that are receiving the ESSOR waveform. This means that the Tactical Router can act as a junction carrying TAC WIN and ESSOR traffic. Both the Finnish and Estonian armed forces are using TAC WIN, with deliveries to the latter commencing in late 2016.

In August, the company announced a new series of tactical radios, including its Tough SDR Handheld and Tough SDR Vehicular transceivers which operate in the 30MHz to 2.5GHz waveband. The latter radio, the company's official information notes, also includes an LTE (Long Term Evolution) module enabling the radio to connect to commercial fourth-generation voice and data cellular networks. Both the Tough SDR Handheld and Tough SDR Vehicular radios can be used with the firm's TAC WIN product (*see above*), via the radio's use of the TAC WIN waveform, the latter of which, the firm stated, is continuing to improve: "The main objective for this development is to continue enhancing the performance, data transfer capacity and survivability of the software." Regarding the new radios, the company continued that they will make it possible "to bring broadband data transfer and voice to all troops starting from brigade level all the way across the battlefield." The company's official literature states that both radios can carry the Bittium Narrowband Waveform which can handle voice and data traffic in congested electromagnetic environments and the forthcoming ESSOR waveform (*see above*)



Bittium

In August, Bittium unveiled a new tactical radio in the form of its Tough SDR Handheld transceiver which is expected to equip the Finnish armed forces in the near future.

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EID

EID's PRC-525 radio will equip the Portuguese Army and is expected to be deployed at the brigade, battalion and company levels. Deliveries of the latest batch of these radios are expected to conclude in 2023.

and below). In addition, the firm stresses that the radios can support "the porting of legacy and national proprietary waveforms."

On the same day that the firm announced its two new tactical radios, Bittium revealed that these two transceivers are the subject of a Letter Of Intent (LOI) signed with the Finnish Defence Forces for the purchase of new transceivers, which will complement the TAC WIN systems which the defence forces already possess, and which will replace their existing tactical radios. As of 2012, Elbit Systems was supplying the Finnish Army with its PNR-1000 (225MHz to 512Hz) personal role radio, which may remain in service given the relatively young age of this radio. The firm told *Armada* that the value of any future acquisition resulting from the LOI could reach up to \$155 million over ten years, with deliveries commencing from 2019.

Kongsberg, another of Scandinavia's tactical communications providers, furnished *Armada* with details of its activities over the past twelve months. The company has had a busy year with the launch of its RL-542 point-to-point radio link which has a data rate of up to 200 megabits-per-second across a 4.4GHz to five gigahertz waveband over ranges of up to 40 kilometres (25 miles). Robust electronic counter-countermeasures capabilities promise to make the RL-542, "an extremely potent radio for establishing any high capacity semi-mobile tactical backbone network," the company added. In addition, Kongsberg is upgrading its RL-532A radio with hardware and software modifications, with similar improvements being performed for the firm's MRR 30MHz to 88MHz

transceiver. Software improvements have enhanced the radio's narrowband voice and data capabilities, along with its mobile *ad-hoc* networking.

GERMANY

Alongside Project MORPHEUS and the French CONTACT initiative, two German armed forces communications programmes known as MOTAKO (Mobile Tactical Communications) and MOTIV (Mobile Tactical Information Network) are leading European tactical radio procurement efforts. In March, Rheinmetall and Rohde and Schwarz announced that they had partnered for these two programmes. In a written statement provided to the author, Rohde and Schwarz stated that both these programmes were intended to modernise the communications and networking of the *Heer* (German Army). The MOTAKO initiative will extend IP capable communications to the lowest tactical level, chiefly to infantry troops using their handheld radios. The MOTIV initiative is intended to provide the software and networking which will constitute the MOTAKO network, and ensure the necessary integration *vis-à-vis* German Army vehicles to allow them to access MOTAKO. Ultimately, the MOTAKO network will be rolled out across individual troops, vehicles and deployed command posts, the firm added.

Rohde and Schwarz continued that the challenge incumbent in realising the MOTAKO initiative is, on the one hand, providing IP communications, while ensuring that those communications are both robust

and secure. Rohde and Schwarz is fulfilling the *Heer's* SVFUA (*Streitkräftegemeinsame Verbundfähige Funkgeräte-Ausstattung*/Joint Radio System) initiative which is delivering the next generation of tactical radios to the German Army as part of a comprehensive overhaul of the force's communications. Staying with the MOTAKO programme, on 11th July the company announced it had been awarded a contract to outfit 50 German Army ARTEC Boxer-CP eight-wheel drive and Krauss-Maffei Wegmann/Rheinmetall Puma tracked command vehicles with the SVFUA radio system as part of the MOTAKO initiative, with deliveries of the first examples being concluded by 2020, as articulated in a press release announcing the news. According to Michael Fraebel, director of operational marketing in Rohde and Schwarz's secure communications division, "The contract's framework agreement allows the German armed forces to order additional SVFUA systems within a seven-year timeframe." He added that the SVFUA radios will "be equipped with the innovative Rohde and Schwarz High Data Rate waveform family for secure high data transmissions." Open sources note that the SVFUA radio will cover the 1.5MHz to three gigahertz waveband and will be equipped with both new and legacy waveforms, such as the HAVEQUICK-I/II air-to-ground/ground-to-air digital waveform used throughout NATO and the High Frequency (HF: three megahertz to 30MHz) Multiple Adaptive HF Radio System waveform and new waveforms such as COALWNW (*see above*).

ITALY

Leonardo, meanwhile, remains heavily committed to the Italian Army's ongoing roll-out of new communications systems and the continual improvement of its products, most notably its Swave family of tactical radios. The firm told *Armada* via a written statement that: "today the company is delivering its second generation of SDR systems and at the same time is conceiving the design for a new, modular and universal SDR architecture." Leonardo continued that it "is addressing a number of modernisation programmes where the SDR systems are expected to improve battlefield interoperability among both joint and coalition forces."

PORTUGAL

Smaller-scale acquisitions are ongoing elsewhere on the continent. For example, on 10th July EID issued a press release announcing that it had signed a contract worth \$8.6 million with the Portuguese

Ministry of Defence to provide PRC-525 tactical radios to the *Exército Português* (Portuguese Army). This multiband system is already used by the army and the *Marinha Portuguesa* (Portuguese Navy). The press release added that deliveries will commence this year and are expected to complete in 2023. Earmarked to equip the army's SIC-T (*Sistema de Informação e Comunicações Tático/Tactical Communications and Information System*) BMS to carry voice, data and imagery communications, these radios will also be equipped with the HAVEQUICK-I/II waveform (*see below*), along with High Frequency, fast frequency hopping and fast data (72kbps) waveforms. In addition, the radios will carry national encryption standards. EID told the author that it expects the PRC-525 to be deployed at brigade, battalion and company levels. Other developments witnessed over the last year, EID told *Armada*, include the upgrade of the company's TWH-101 personal role radio family with a new waveform to improve the radio's Global Positioning System tracking and field performance.

ESSOR

As noted above, European tactical radio interoperability is set to be greatly enhanced via the advent of the ESSOR waveform. OCCAR provided *Armada* with an update regarding current and future work pertaining to its development. Reflecting the need to improve interoperability across Europe's armies, particularly in light of an increasingly muscular Russian strategic posture on Europe's eastern flank, OCCAR states that the ESSOR programme overall has a "strong focus on interoperability ... with a clear European identity," adding that the waveform is intended to be used at the brigade level and below. The realisation of the waveform is divided into several phases: Phase one saw the development of the baseline ESSOR waveform and the implementation of all the waveform's high data rate characteristics, but while retaining a true platform and technology agnostic configuration to permit the desired interoperability, OCCAR's statement articulated. OCCAR claims that the waveform "is today the most advanced interoperable SDR waveform for tactical communications." The organisation's statement continued that the ESSOR phase one work is currently transitioning towards the ESSOR Operational Capability One (ESSOR OC1) initiative. This will "address the definition and dissemination of a global Software Defined Radio standard based on ESSOR," which will allow the public release

of the ESSOR architecture and its eventual adoption in operational theatres and "potentially ... the public security domain." In this respect, ESSOR is mirroring a trend which is seeing the increased requirement for tactical radios to be able to work with civilian first responder radios; particularly vital in situations where military and civilian authorities are required to work alongside in public order or HADR situations.

OCCAR added that a contract for the ESSOR OC1 work is expected to be placed with industry by the end of 2017. This effort will also see the realisation of a through life management approach to the sustainment of the waveform for the next two decades. Field tests of the waveform have already been performed, notably in Finland in November 2016: "This event was a world premiere: For the first time, radios of different vendors, independently deployed by different industries according to different national requirements communicated in the field using the same waveform." Additional tests of the waveform have been performed by the initiative's national partners and this information will be collected and analysed, the statement continued, to develop the latest, updated version of the waveform as a result of the ESSOR OC1 initiative. This version of the waveform, the statement noted "will be fully developed and tested during the next four years." Although the baseline version of ESSOR is already in service, OCCAR disclosed, the adoption of the new version of the waveform will be dependent on the participating states' military communications policies resulting from several factors including "operational needs and coalition scenarios, the possible admission of new partners to the cooperation and the feedback on the timing of its standardisation from the international tactical communications community."

Initiatives such as ESSOR indicate the increasing awareness of the importance of tactical communications interoperability across Europe. Russia's annexation of the Crimea region of Ukraine in March 2014 underscored the increasingly assertive posture of the Russian government, and its willingness to challenge Europe's eastern flank. Such threats can be met on the one hand by enhancing and deepening interoperability, especially in the communications domain, while also ensuring state-of-the-art communications systems are used by Europe's leading militaries. ESSOR, CONTACT, Project MORPHEUS and the MOTIV/MOTAKO initiatives are all important steps in this direction.

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VOICE OF AMERICA

Strong demand continues to be witnessed in the North American tactical radios market led by the United States armed forces which are pursuing significant procurements to overhaul the communications used across its land forces.



Members of the Afghan National Army get to grips with tactical radio maintenance. Datron has been instrumental in helping to overhaul the country's tactical communications.



Harris' RF-7800W radio has received improvements to its data rates thanks to an upgrade of its software. Other enhancements have also reduced the radio's susceptibility to jamming.

In late August 2016, Datron was awarded a contract through the US Army to provide up to \$495 million worth of communications equipment to the Afghan National Army (ANA) by 2021. Open sources note that, previously, the ANA had employed AN/PRC-77 radios, which can trace their lineage back to the late 1960s, plus a clutch of Russian systems including the R-130 and R-123 transceivers. The company also benefited from an earlier contract exercised through the US Army in May 2016 when it was tasked to provide \$13.4 million worth of radios and spare parts to the ANA, with the contract to be completed this year. Chalking up additional successes in Afghanistan, Datron had earlier been awarded a contract worth \$25.4 million in August 2009 to provide PRC-1077 VHF (Very High Frequency) manpack, HH-7700 VHF handheld and PRC-1099 HF (High Frequency) manpack radios. No information appears to have been published regarding the transceivers to be supplied to the ANA as a result of the two 2016 contracts.

HARRIS

In late February, Harris unveiled its new RF-300H-MP wideband manpack radio. This new product is part of the company's Falcon-III product line and is billed as: "the world's smallest, lightest and fastest wideband manpack radio," according to Harris' official literature. This new product replaces Harris' legacy AN/PRC-150C. Covering a waveband of 1.6 megahertz (MHz) to 59.9MHz, the AN/PRC-150C can handle data at rates of 9.6 kilobits-per-second (kbps) during HF transmissions. Harris' new radio will transmit over a 1.6MHz to 60MHz waveband achieving data rates of up to 120kbps across wavebands of three kilohertz (KHz) to 24KHz in width. The RF-300H-MP is a descendent, the company told *Armada*, of Harris' RF-7800H-MP wideband HF radio, with the important caveat that

the RF-300H-MP comes equipped with the US National Security Agency's Type-1 encryption standard which uses approved NSA algorithms.

Earlier in the year, the firm disclosed to the author that the development of the RF-300H-MP, and its ability to handle comparatively large quantities of data for an HF radio reflected the contemporary trends experienced on the battlefield regarding the demand for wideband coverage. Historically, the channels available to HF users have been limited to a three kilohertz bandwidth, due to restrictions on sharing available HF bandwidth between military and civilian users. Nevertheless, September 2011 saw the US Department of Defence update its MIL-STD-188-110 military standard for HF communications so as to reflect the need for wideband HF communications, which enabled bandwidths of between three kilohertz and 24KHz. Harris added that the RF-400H-MP has been ordered by the US Department of Defence and will equip the US Army, navy, air force and Marine Corps, following the commencement of deliveries in March 2017.

Furthermore, in early October 2016, the US Army awarded Harris a \$10 million contract for the Limited Rate Initial Production (LRIP) of the firm's AN/VRC-118(V) Mid-Tier Networking Vehicle Radio (MNVR). The AN/VRC-118(V) is a vehicular radio capable of carrying voice, data and imagery traffic from brigade and battalion echelons to companies and platoons. Certified to the US National Security Agency's Type-1 encryption standard, the AN/VRC-118(V) carries legacy waveforms such as SINCGARS (Single Channel Ground and Airborne Radio System) and HAVEQUICK-I/II, while also carrying the WNW (Wideband Networking Waveform) used at the battalion, platoon and company levels, and the SRW (Soldier Radio Waveform) used by dismounted

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Harris' AN/PRC-117G radio has been enhanced with the wherewithal to accommodate the MUOS waveform to enable the transceiver to perform SATCOM.

troops. The radio thus forms the junction where dismounted communications using the SRW connect to the next tactical echelon using the WNW. Harris has told the author that all of the radios ordered as part of the October 2016 LRIP contract have now been delivered.

Towards the end of 2016, Harris unveiled an enhancement to its RF-7800W Multimission High Capacity Line-of-Sight radio which operates in the 4.4GHz to 5.8GHz frequency band. Reflecting the ever-present desire for data bandwidth on the battlefield, Harris has improved the radio to ensure that it can provide high data rates while on the move as well as when at-the-halt. The firm's official literature states that the RF-7800W currently has a standard data rate of 428 megabits-per-second (mbps). The company's enhancement is performed via a software upgrade which is available for download into existing RF-7800W radios, and will be factory-installed on all new RF-7800W radios. The firm told the author that the software upgrade was available as of late-November 2016 and would allow the radio to handle up to 100mbps of data during non-line of sight transmissions, with the capability to maintain data rates of between 50mbps to 100mbps, even across five hops. The company continued that rates of 428mbps have been achieved at line-of-sight ranges of up to 160 kilometres (100 miles).

The software improvements developed by Harris also enable the RF-7800W to be accessed from smartphones and tablets using the radio's Internet Protocol (IP) address, providing that these devices are permitted on the network; the company added. In addition, the improvements allow the radio to seamlessly move between two base stations when roaming; onboard a vehicle, ship or aircraft, for example. Meanwhile, the RF-7800W's new Electronic Interference Mitigation enhancement means that the radio will automatically search for and use a new channel if a specific channel suffers interference or jamming.

Meanwhile, on 13th June, Harris announced that it had received a potential contract worth up to \$255 million to supply new tactical radios to replace the USSOCOM's legacy AN/PRC-117G and AN/PRC-158 systems. Under the Special Operations Forces Tactical Communications Next Generation Manpack Radio initiative, troops will receive a new two channel radio from December 2018, the company disclosed to the author, with the radios then to commence USSOCOM testing directly after. The command has not yet announced how many of the new transceivers it will receive, although Harris' statement continued that production deliveries could commence when USSOCOM has completed testing. Moreover, no decision has yet been taken regarding

plans to phase out the AN/PRC-117G and AN/PRC-158 radios, with USSOCOM also to decide on the echelons that will receive the new radio, and its concept of operations. Harris continued that information regarding



Rockwell Collins' new PRC-162(V)1 tactical radio will be furnishing the US armed forces. Deliveries of this radio are expected to occur from the latter half of 2018.

the radio's operating frequencies and its data rates are proprietary and export-controlled, although it did state that these new radios will carry the TSM-X waveform discussed below, along with the standard complement of waveforms currently equipping the AN/PRC-117 and AN/PRC-158. These include the SINCGARS, HAVEQUICK-I/II and SATURN (optional) air-to-ground/ground-to-air and ground-to-ground narrowband waveforms, plus the APCO-25 waveform. This latter waveform allows the radio to be used for communications with civilian first responder radios in the United States. Wideband waveforms carried by the radios include the SRW, the company's proprietary Adaptive Networking Waveform-2 and Ultra High Frequency (30MHz to 300MHz) satellite communications waveforms.

I ROCKWELL COLLINS

New tactical radios have been launched by Rockwell Collins in the form of its PRC-162(V)1 multi-channel transceiver, itself part of the firm's TruNet product family. Offering Type-1 encryption, Rockwell Collins told *Armada* in a written statement that this new radio "brings Rockwell Collins back into the ground tactical communications" domain. The PRC-162(V)1 can perform MUOS communications (see above), as well as carry the Soldier Radio Waveform. The firm adds that "the US armed forces will be receiving (this product) once authorisation is granted by US authorities," adding that the new radio is expected to be available for acquisition from the second half of 2018.

I TRELISWARE

Other new products include TrellisWare's TW-950 TSM Shadow handheld radio launched during the Special Operations Forces Industry Conference held in Tampa, Florida this May. The radio uses the company's TSM-X waveform, itself an enhanced version of the firm's TSM waveform, yet provides sufficient bandwidth for data communications of 16mbps across a single hop, and 7.5mbps for

multi-hop communications, with the waveform possessing a flexible bandwidth of 12MHz to 40MHz, the company articulated in a press release. This allows the waveform to support voice communications and position locating reporting, and data services for networks of up to 200 users. Also carried by the radio is the firm's TSM-X waveform which it states is the "latest version of the TSM waveform which includes higher throughputs, wider frequency range and expanded operational capabilities."

Regarding frequencies, the press release continued, the TW-950 TSM Shadow radio covers UHF wavebands encompassing L-band (one to two gigahertz) and part of the S-band (two to four gigahertz). The company told the author in a written statement that it will begin fielding the transceiver by the end of 2017. Although not confirmed by TrellisWare, it is strongly expected that the radio will equip USSOCOM, and "will be fully interoperable with special forces communications," the statement continued. In November 2015, the firm's TSM-X waveform was selected by Harris to fulfil a USSOCOM requirement. That company had received orders in October 2015 for its AN/PRC-117G and AN/PRC-158 multiband manpack radios. It is entirely possible that these radios are loaded with the TSM-X waveform to allow communications between echelons equipped with the TW-950 and those equipped with the AN/PRC-117G and AN/PRC-158 radios.

I THE US MARKET

Josh Pavluk, principle of the Avascent consultancy, based in Washington-DC believes that demand in the US will continue to dominate the tactical radios market. He attributes this to the US Army's ongoing acquisitions of handheld, manpack, and vehicular radios, plus radios for the service's special forces command, all of which he predicts are going to be "driving an increased demand in the United States." Likewise Tom Schamberger, business development manager for airborne communications at Rockwell Collins, told *Armada* that "the US at the onset is driving the world's need for advanced tactical radios both in the air and on the ground. The driver is the modernisation of communication and networking systems to handle the 'speed of the battle' along with the non-traditional warfighting methodologies that today's adversaries bring."

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WORLD SERVICE

Beyond North America and Europe, tactical radio centres of excellence continue to launch new products, while the market faces technological challenges in terms of software and hardware developments triggered by operational change.



Barrett Communications

Barrett Communications has carved an important niche with the design of highly intuitive communications systems making use of the latest table and smartphone technologies to ease operator use.

Australia continues to occupy a position as a major supplier of tactical radio products. In October 2016, Codan announced that it had received certification from the US Department of Defence's (DOD) Joint Interoperability Test Command (JITC) for its 2210 Envoy High Frequency (HF) radio for Automatic Link Establishment (ALE) requirements. These requirements are enshrined in the US DOD's Military Standard MIL-STD-188-141B stipulations which cover performance and interoperability requirements for HF radios.

According to an official announcement from the JITC, this certification also ensures that Codan's radio can work with other HF

radios already certified by the organisation. This is a particularly important consideration for US forces when operating with other nations which may be using this HF radio. For example, in recent years, Codan has supplied its radios to the Afghan National Army (ANA) and the Iraqi Army. In 2009, the firm was selected by the US Army to provide HF radios to the ANA in a deal worth \$5 million, which included supplies of the firm's 2110M HF manpack transceiver. Furthermore, one month earlier, in September 2016, Codan unveiled a new High HF radio in the guise of its Sentry-H transceiver. The radio is designed to be easy to use and robust. With an output power of 150 watts, it offers channel bandwidths of 500 hertz, 2.4 kilohertz (KHz)

and 2.75KHz. Regarding communications security, the company continued in its statement that the Sentry-H uses frequency-hopping techniques, US National Institute of Standards and Technology's AES-256 (Advanced Encryption Standard-256) and the company's CES-128 voice encryption standard. Meanwhile, Codan's official literature states that the radio can handle data rates of between six to 19 kilobits-per-second (kbps) depending on the waveforms used. The waveforms employed by the radio include the US Federal Standard FED-STD-1045 HF waveform, US Military Standard MIL-STD-188-141B ALE, SelCall (Selective Calling), and Codan's proprietary HF waveforms.

Elsewhere in Australia, in August,

Barrett Communications announced the release of its new Barrett 4075 High Power High Frequency transmitter. Teaming the firm's liquid cooled amplifier with its 4050 transceiver, the company states that the radio has been designed for use as a static base station and believes the liquid-cooled solid state design of the amplifier to be the first of its kind. This translates into the 4075 transmitter being able to run continuously at high power levels. Furthermore, Barrett launched its PRC-2080+ tactical Very High Frequency (VHF) radio which it shared with *Armada* in a written statement, encompasses "improved transceiver specification, new antenna options for improved range and performance and new Lithium Ion batteries with increased capacity for extended field operations." The firm is confident regarding its market sector, which it says is experiencing "growth with peacekeeping and border protection operations and cooperation between national forces becoming ever more prevalent." Regarding technological innovation, the company shared that "there is increased desire from users for more intuitive easy to use platforms requiring less training and more flexibility in deployments,"

with the firm adding that it is developing "easy to use intuitive solutions which offer the user not only a more familiar interface, but require minimal training before operational deployment."

I ISRAEL

Israel is a known centre of excellence for tactical radio design and production, and Israel Aerospace Industries' ELTA Systems division unveiled this year the firm's ARC-8400 multiband radio. The firm's official literature states that the product is designed for the carriage of voice and data traffic using conventional line-of-sight satellite communications. The radio carries analogue and frequency modulation waveforms across VHF and UHF wavebands: 30MHz to 88MHz, 108MHz to 174MHz; 225MHz to 400MHz, with an option to increase this to 512MHz plus optional 960MHz to 1220MHz and Ku-band (twelve gigahertz/GHz to 18GHz) frequency extensions, and also has protected waveforms for secure voice and data transmissions.

The literature continues that the radio can handle data rates of between 32 kilobits-per-second (kbps), up to 512kbps, and handle up

to 64 networks. Other new products from the IAI ELTA Systems stable include the firm's Tac4G tactical broadband cellular network. Incorporating a tactical smartphone capability which can handle third- and fourth-generation cellular communications, the Tac4G network is managed using either a manpack or vehicle mounted base station, the company's literature states, with the firm adding that the product can support low-intensity operations, as well as high intensity warfare, plus special operations missions, battle management and humanitarian assistance and disaster relief missions.

Elbit Systems is celebrating the decision of the Israeli Defence Force (IDF) to invest circa \$100 million, according to the company, in new tactical radios procured from the firm. Details are sparse, although an official company press release announcing the news stated that Elbit will supply handheld, vehicular and airborne radios to the IDF. The company has not revealed the type of radios to be acquired by the force, although sources close to the IDF inform *AMR* that the radios will come from the firm's E-Lynx product line. In the VHF and Ultra High Frequency (UHF) domains, the E-Lynx family includes



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Codan

Codan has received certification from the US DOD JITC to improve the interoperability of its high frequency radios, with other HF radios already certified by the organisation.

the MCTR-7200 vehicular radio, and the PNR-1000 and MCTR-7200HH handheld radios. No further details were provided by our source regarding which E-Lynx transceivers the IDF will obtain .

The PNR-1000 is a UHF transceiver carrying a narrowband waveform capable of handling around ten megabits-per-second of voice and data, or voice and video traffic. The PNR-1000 also carries a wideband waveform (Elbit Soldier Radio Waveform/ESRW) which can carry up to ten megabits-per-second of data. So far, Chile and Finland have both ordered the PNR-1000, and the radio is undergoing testing as part of a requirement for a new handheld tactical radio from the BENELUX (Belgium, Netherlands and Luxembourg) countries. Production of the radio for the BENELUX customers is expected to commence in 2017. The firm also has plans to port the ESRW into the MCTR-7200 family (see above). This will provide simultaneous voice and data communications using 200 kilohertz/KHz of channel bandwidth.

Speaking during the June Paris Air Show, representatives from Rafael Advanced Defence Systems explained to the author that the firm's BNET multiband tactical radio family has undergone some recent enhancements. These have included the addition of new wavebands to the BNET-HH soldier radio, notably the ability to handle L-band (one gigahertz to two gigahertz) communications, with similar modifications being added to the BNET-V vehicular radio. The company added that the BNET-V (Vehicular) member of the family has been fielded, with the expected launch of the



Reutech

Reutech's LANDSEC family offers a suite of products enabling the procurement of an entire tactical communications capability off the shelf. The firm's PWH-4001 represents one of the LANDSEC family members.

BNET-MPS+MPV (BNET Manpack for Soldier and Vehicular Mounting Manpack) occurring over the next twelve months.

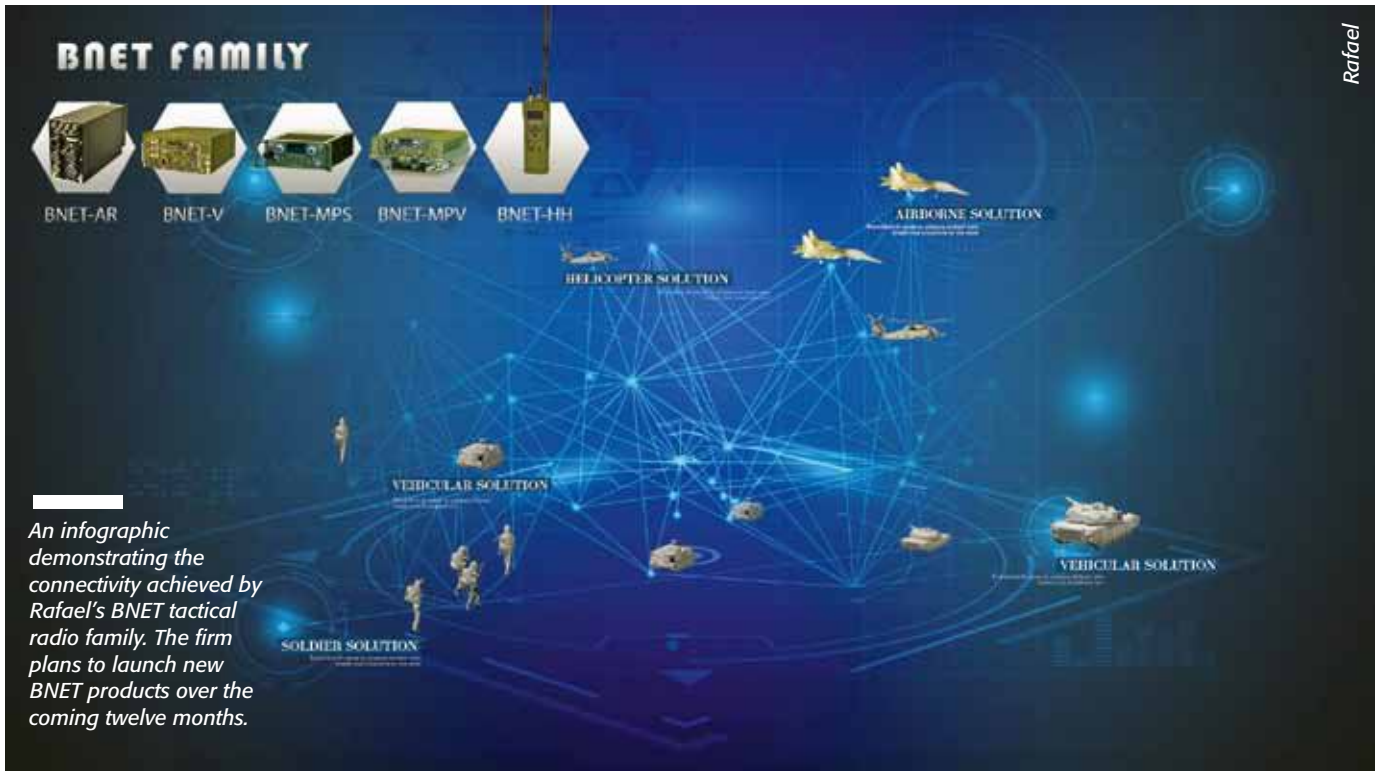
I RUSSIA

Exacting information regarding communications in the Russian Army is fiendishly

difficult to acquire, not assisted by the author's lack of Russian language skills, nevertheless information does sporadically appear regarding ongoing initiatives. The force is thought to have upgraded its tactical communications in recent years and, to this end, NPO Angstrom's Azart R-187-P1E tactical radio is now equipping Russia's armed forces. This V/UHF (27MHz to 520MHz) handheld system provides communications security through frequency hopping rates of 20000 hops-per-second, according to the company's official literature. In VHF, the radio has a channel spacing of one kilohertz, 6.25KHz and 8.33KHz (VHF) and 25KHz (UHF). Offering ranges of up to four kilometres (2.5 miles), the radio can carry 256kbps of data when operating in an encryption-free mode. This reduces to 28.8kbps when operating in a frequency-hopping mode and thence to 7.2kbps when transmitting using the radio's encryption mode. In terms of waveforms, the firm continues that it offers simplex, half duplex and full duplex voice communications, and can receive geolocation information across the Russian GLONASS and US Global Positioning System satellite constellations. The firm has told the author that it is already planning a number of enhancements to the radio which will include extending its frequency band, and the radio's output power so as to extend its range. More waveforms are in the offing alongside increased data transfer speeds and the ability to host a larger number of users on a single network than the radio handles at present.

I SOUTH AFRICA

Away from Russia, Reutech is continuing to promote its LANDSEC tactical communications family which the firm told *Armada* "has been designed as a system from the top down to provide all the components to build a fully integrated tactical communication system across all the users, covering all aspects of the communications system lifecycle, for seamless interoperability and operation." The LANDSEC family was developed, the company added, from a realisation that "users of tactical communications products are frequently faced with the dilemma that equipment is acquired piecemeal by different user groupings due to policy and budget constraints." Such an approach "tends to restrict users from realising the full advantage of the advanced network and security features available in modern radios." The company adds that, operationally, this can leave "users vulnerable to electronic attack and unable



IAI's Tac4G offering can be used to provide a tactical broadband cellular network. This can be used across a wide spectrum of operations from high tempo warfare to humanitarian assistance and disaster relief.

to benefit from the force multiplying ability of a well integrated and interoperable tactical communications network." Through the realisation of the LANDSEC product line, the company states that it has an ensemble of products which can equip "an entire national defence force" not only with hardware, but also with the necessary waveforms, cryptographic software and additional capabilities.

ACCESSORIES

In June, Invisio was the recipient of a contact worth circa \$2 million for hearing protection and communications systems under the US Army's Tactical Communication and Protective Systems (TCAPS) programme. The TCAPS programme, open sources state, will see the acquisition of 82000 pairs of the firm's X-50 earbuds which will work to protect a soldier's hearing, while ensuring that they can hear their communications, along with ambient sounds through the use

of embedded microphones outfitting the earbuds. The earbuds are designed in such a way as to enable the wearer to hear ambient noise such as gunshots, thus not limiting their situational awareness, while at the same time, reducing battlefield noise to safe levels to prevent damage to the soldier's hearing. Additional hearing protection is provided through the automatic blocking of noise that reaches above a certain decibel threshold. The company has also received orders from the UK Ministry of Defence via a contract awarded to Marlborough Communications as part of the British Tactical Hearing Protection Systems (THPS) programme worth \$3.6 million, as announced in

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Invisio has been awarded a contract worth \$2 million to supply its X-50 earbuds to the US armed forces as part of that force's Tactical Communication and Protective Systems programme.



June. According to an official press release disclosing the news, the company articulated that it would be providing its S10 in-ear protection and communications system to the British armed forces, with deliveries expected to be concluded before the end of the year.

I THE MARKET

According to Josh Pavluk, principle of the

Avascent consultancy, the tactical radio market globally remains in good health: “We continue to see robust demand and we expect that to continue,” he told *Armada*. Mr. Pavluk added that the market is being driven by changes witnessed at the tactical level as armies around the world turn towards smaller, more agile and hence easily deployable units. For example, the US Army is in the midst of a personnel reduction which will see it reduce

to 980,000 active troops by the end of 2018, including soldiers from the Army Reserve and the Army National Guard. The rapid deployment of comparatively smaller (3000-4000 troops), more agile all-arms units such as the US Army’s Brigade Combat Teams (BCTs) as opposed to the division-based order of battle which the army had followed during the Cold War and its immediate aftermath.

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This reduction in personnel and improved agility places a high premium on the use of information thus ensuring that targets can be located in a timely fashion, and such information can be shared effectively: "In the drive towards information warfare, tactical communications are going to be more important than ever," observed Mr. Pavluk.

Moreover, he stated that, despite the focus on software demonstrated in programmes like the North Atlantic Treaty Organisation's ESSOR (European Secure Software Defined Radio) waveform initiative discussed elsewhere in this compendium, the acquisition of tactical radio hardware will continue to be an important market driver in the software defined radio domain: "I don't see the demand for hardware moving away. We will have a demand for continued software upgrades for tactical radios, but hardware will remain in demand for future acquisitions." As far as hardware is concerned, much as in the civilian smartphone domain, the demand will continue for reduced Size, Weight and Power (SWAP) consumption regarding transceivers, Mr. Pavluk added: "Operators are always going to want reduced SWAP and that is one reason why hardware will continue to be of interest." That said, Bittium notes the vital role software will continue to play in tactical communications design: "product and system life cycles are long and software evolves during these long life cycles. New capabilities are enabled with continuous development, software bugs are corrected, security threats change and call for software updates ... Therefore good software maintenance principles and practices are needed from suppliers and users."

Regarding technology, Bittium told *Armada* that "the tactical radio market is in a very interesting stage, as new software defined radios enter the market and there is a clear need for new capabilities." The firm added that it sees "current and legacy products and systems being increasingly replaced by modern IP (Internet Protocol) communications systems, which enable new capabilities with real-time situational awareness and advanced command and control on the move." Allied to

this, is the need to enable customers to have a high degree of control over their tactical communications architecture. According to Hartmut Jäschke, senior vice president of Rohde and Schwarz's secure communications sales and projects market segment: "Allowing customers to develop and port their own waveforms and utilize their specific national security functionalities," will become increasingly important.

As SDR technology develops, survivability and inclusion remain two important factors in ensuring tactical communications networks can function in conditions where heavy electronic warfare maybe present, and where deployed networks may feature a multitude of nodes. Leonardo told *Armada* in a written statement that there is a need to "improve network survivability in extreme operations and the necessity to unify as many forces as possible." Similarly, Rafael Advanced Defence Systems sees a growing demand for "wideband applications, such as data plus video, plus voice. In today's network centric operations, more and more combat applications are sensitive to low latency, and require high data rates on the move in highly dynamic and challenging networks," the firm told *Armada*. Mirroring Leonardo's position, the company added that challenges include the "scalability of networks to contain over hundreds of nodes with no compromising on performance of data rate and latency." Other technological challenges predicted by the firm include achieving the "right form factor, weight, size and simplicity to operate in harsh environments, and full interoperability between different services."

US-driven demand is likely to result in "stable spending with long-term growth," Mr. Pavluk observed. Meanwhile, he continued that in Europe the German Army's tactical radio acquisitions, plus similar acquisitions via the British Army's MORPHEUS and the French Army's CONTACT programme, will be important in sustaining tactical radio demands in Europe over the coming decade. Meanwhile, demand in the Asia-Pacific and Latin America is expected to remain strong. ☐



ON THE COVER: Moving as much capability as possible to the soldier at the forward edge of the battle area remains the touchstone for tactical radio engineering efforts. © US DOD

Tactical Radios

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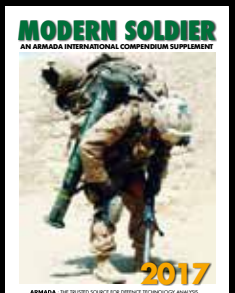
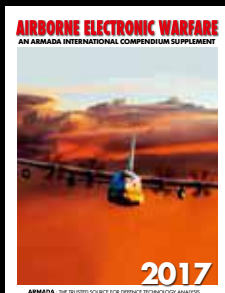
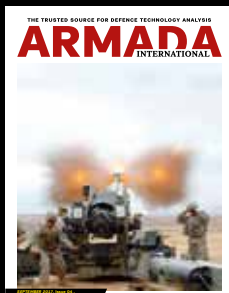
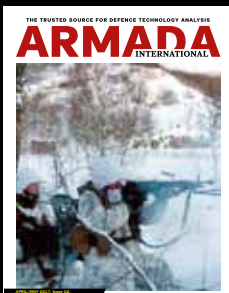
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