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**Interview with
Hamid Karzai,
former President
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Why the Europeans Are Afraid of Trump



Donald Trump has been in office for a year, and the world is still not yet on the edge of the abyss. Nevertheless, his intransigent and probably irreconcilable critics, who all over the world use the key media to spread their message, need not be disappointed: he has made it up to them in large measure with his half-baked tweets, misguided public appearances, and all too spontaneous initiatives, from which they can sup their nectar of sarcasm, invective, fake news, and less than serious commentaries. Never before has there been such intense reportage about an American President outside the USA. European citizens wake up to his latest anecdotes on breakfast radio, during the day they read alarmist headlines about what he has gone and done now, and go to bed with the images of head-wagging political gurus trying to stoke the fires on the late TV news. Unfortunately, the intensity of the reporting has not improved anyone's understanding of what is going on in the USA. On the contrary: In the same way as with Eastern Europeans in the days of the Iron Curtain, what are needed now are "West contacts", people you know on the West Bank of the Atlantic, from whom you can gain a picture of what is really and truly going on. Indeed, the Cold War seems to have provided mainstream European media with the inspiration to get to grips with the object of their hatred: their intellectually uninspired agitation against Trump resembles the campaigns which the Eastern Block once waged against Ronald Reagan.

Set against the thunder of the media drums it is hard to gain an impression of what Trump has in fact done, and caused to be done, with regard to security and defence policy in his first year. There is some excuse, then, for many commentators and even minor league politicians to complain, in particular, about his "unpredictability" when called upon to draw up a first annual review. They can hardly base their assessments on facts. Trump has so far demonstrated continuity on almost all major fronts. The Americans are sticking to their guns in the war against terrorism, and in that context have strengthened their commitment in Afghanistan. With regard to Moscow, Trump has not strayed onto a course of appeasement. The USA has emphasised that it is standing by its NATO obligations, and by its presence in Europe is making a major contribution to proving that Readiness and Reassurance are not just words bandied about at

summit conferences, but are indeed guaranteed in reality. Israel's trust in the USA as security partner is greater than ever before. "Rogue States" such as North Korea and Iran have no reason to hope that American vigilance is slipping. Since December 2017, this striking lack of unpredictability can also be perceived in the new National Security Strategy (NSS) adopted by the USA. When it comes to the challenges of security policy and the course to be adopted to meet them, this strategy essentially continues along the lines already pursued by Trump's predecessors in office. One new tone that can be detected here, though, is that there is no euphemistic circumlocution about the rivalry between the Great Powers, but rather that this is accepted as a normal feature of world politics; this does not preclude the possibility, however, that rivals can nevertheless cooperate when it is in their common interests. What is in fact new is the attempt to view the issues of trade and the economy in terms of their relationship with security and defence policy. If a European security strategy had gone so far in pursuing such a comprehensive approach, it would probably have been hailed as particularly innovative. Conversely, the Trump administration is being accused of seeking to place international security policy at the service of (naturally questionable) national economic interests.

What do so many Europeans find so unsettling about Trump? Are they really afraid that he is pulling the rug from under the feet of the transatlantic community of values? The reasons are probably much more prosaic. With his tax reforms Trump is attracting investors, and could unleash a dynamic which would cause an already enfeebled Europe to lag still further behind. Trade imbalances will no longer be accepted without so much as a shrug. And, not least, the USA will continue to insist that the Europeans must themselves, in principle, foot the bill for their own security. It is well known that within NATO the "two percent of gross national product" has actually become a typical characteristic value for defence budgets, on which they have all agreed in unison. In the past, the Europeans have grown accustomed to the USA turning a blind eye when they failed to meet obligations like these; but the present US Administration has a more realistic concept of what is meant by solidarity in an alliance.

Peter Bossdorf

Ambitious Modernisation



(Photo: Miroslav Gyürösi)

The Slovak government approved a new military strategy and a Long-Term Defence Development Plan. **Page 36**

Coping with New Threats



(Photo: US DoD)

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■ Laser Scanners for Norwegian Mine Countermeasures

(ck) 2G Robotics, a producer of underwater laser scanners and imaging systems for subsea mapping, surveying, and inspection, will deliver four ULS-500 PRO laser scanning systems to Kongsberg for integration into the Norwegian Defence Materiel Agency's (NDMA) newly purchased HUGIN AUVs. The first laser scanner has already been delivered to Kongsberg. The Royal Norwegian Navy plans transition to autonomous systems for mine countermeasures. During de-mining operations, HUGIN AUVs will be used to complete surveys of sub-sea environments focussed specifically on locating and identifying mines. The HUGIN systems enable users to conduct fast and efficient operations with zero surface visibility while improving safety conditions by allowing personnel to remain outside the minefield. In peacetime, the AUVs contribute to hydrographic operations. 2G's system acquires data in real-time and provides users with 3D models of targets and environments accurate to the sub-centimetre. The laser scanning system also includes the 2G OBSERVER, an ultra-sensitive stills camera able to capture images at 12fps, and the 2G NOVA, an LED panel designed for AUV integration providing almost 1 million lumens.

■ Wankel Engine to Make a Comeback

(ck) Named after its inventor Felix Wankel the Wankel engine belongs right next to the Otto and Diesel engine but it never quite caught on. The company 3W International

is about to change that. At Xponential 2017, 3W exhibited the new 3W-180 SRE hybrid Wankel engine. With a size of 180cc and weighing 6.8 kg, the 3W-180 SRE

engine achieves 38.5 hp at 7500 rpm. The result is a 5.66 hp/kg power-to-mass ratio consuming 340 g/kW at full load which is why CEO Karsten Schudt believes in the Wankel engine as a future drive technology for UAS. "This hybrid system, as well as the very good power-to-mass ratio, opens up entirely new possibilities for us", says Schudt. The Wankel engine's benefits are obvious: It has only a few moving parts

and its mechanical effectiveness is favourable since there are few friction losses. The compact construction enables greater power with little weight and modest space requirement. Displacement is smaller compared with other internal combustion engines. "It's precisely the high power with low mass and consumption that render the engine especially interesting for helicopter applications," according to Schudt. The Wankel engine combines high power and torque with very little vibration. Compared with the Otto engine, the Wankel engine consumes less fuel at high rotational velocity and can be driven with both gasoline and Heavy Fuel (HF). This additional power can be drawn upon when starting a helicopter or during the acceleration of a fixed-wing aircraft.

■ Semi-Autonomous Landing System Successfully Tested

(ck) With in-flight validation of the on-board image processing system Airbus Helicopters has taken another step in its Project EAGLE. Codenamed EAGLE (Eye



Photo: Airbus

for Autonomous Guidance and Landing Extension), this research project aims to collate all of a helicopter's image processing functions and feed them into the avionics system, thus improving the crew's situation awareness and reducing the pilot's workload by automating take-off and landing in demanding environments. Performed on an H225 flying testbed, the system selected a small ground "target" from ranges of up to 2 miles and automatically tracked it during the approach performed by the pilot. Flight tests have also validated EAGLE's architecture and main components, such as the gyro stabilised optronics package and the processing unit. The next tests will focus on coupling EAGLE with the automatic flight control system to fully automate the approach to a selected landing area. The system is designed to be integrated on various existing and future Airbus vertical take-off and landing (VTOL) vehicles.

■ Airbus to Service RAF PUMA Mk2

(ck) Airbus Helicopters and the UK Ministry of Defence (MoD) have signed a



Photo: Crown / Airbus Helicopters

Follow-on Support Arrangement contract to provide support to the Royal Air Force PUMA 2 fleet over the planned service life of the aircraft. The contract is worth an initial GB£100M. Airbus Helicopters will provide full technical support and logistics until March 2022. The contract can be extended until the currently planned date of decommissioning March 2025. Airbus Helicopters will provide repair and overhaul services in addition to a parts-by-the-hour programme. The contract also includes training PUMA avionics and mechanical technicians and engineering managers. The contract follows on from the previous support arrangement under which Airbus Helicopters maintained the aircraft since the first upgraded PUMA 2 entered service in 2012, recently reaching 20,000 flight hours. Ian Morris, Head of UK Defence Programmes at Airbus Helicopters, said, "This follow-on contract reaffirms the confidence that the MoD has in the aircraft and in Airbus to continue to provide a cost-effective and highly capable solution that will allow the PUMA to continue to support our forces on operations, in very demanding conditions." The PUMA 2 has seen service in Afghanistan and, more recently, during the UK's disaster relief Operation RUMAN in the wake of Hurricane Irma.

■ Finnish Army to Buy BITTIUM TOUGH COMNODE Terminal

(ck) Bittium has received a purchase order from the Finnish Defence Forces for the BITTIUM TOUGH COMNODE terminal. The value of the order is €1.1M. BITTIUM TOUGH COMNODE will fulfill the data transfer



Photo: Bittium

needs of the Finnish Defence Forces' mobile troops by functioning for example as a VoIP phone (Voice over IP), an IP router (Internet Protocol), and an SHDSL repeater (Symmetrical High-speed Digital Subscriber Line). BITTIUM TOUGH COMNODE is rugged, easy to install in different environments and is also portable by soldiers on the battlefield. The terminal is compatible with the software-defined radio based Bittium TACTICAL WIRELESS IP NETWORK (TAC WIN) system, which is meant for broadband tactical data transfer and is used by the Finnish Defence Forces. The terminal offers diverse connectivity options to third-party equipment and systems. BITTIUM TOUGH COMNODE enables the use of legacy Combat Net Radios (CNR) as part of the IP-based tactical communication system (Radio over IP, RoIP).

■ Czech Army to Buy New Hand Grenades

(ck) The Czech Army will be equipped with modern hand grenades. The tender to supply the grenades was won by Česká zbrojovka a.s., a local company that offered the best price. Currently, the Czech army uses the universal VZ. 86 (URG 86) hand grenades and legacy F1 defence hand grenades, both of which are now obsolete. Some batches of



Photo: CZ

the URG 86 grenades produced by the Slovak company VOP Nováky have shown quality problems; their use in the Slovak army has been suspended. Recently, the Czech Army turned down the concept of a combined grenade with an option to modify the initiation after impact or with a delay element as seen in the URG 86. The new grenades will be equipped with a time delay that initiates the grenade within 4-5 seconds. They are smaller and lighter, thereby increasing the comfort for the soldier when wearing body armour, or allowing the soldier to carry more grenades. The weight decrease is significant as the URG 86 weighs approx. 430 grams and the F1 grenade 600 grams. Regarding the new grenades, the fragmentation variant weighs about 340 grams and the concussion variant only about 180 grams. In addition, the pressure wave achieved is large and effective, and in the fragmentation grenade, the number of fragments has increased from about 1,200 to about 3,500. The supply of grenades will also include training variants.

■ Volkswagen to Buy GUARDION

(ck) ESG Elektroniksystem- und Logistik-GmbH was commissioned by Volkswagen



Photo: ESG

AG to develop a mobile drone detection system based on a VW Crafter for use in the Group. The contract includes the supply of a vehicle-based drone recognition system GUARDION against the unauthorised use of drones. "This order once again demonstrates the trust of our customers in the holistic approach of our solutions and in ESG's interdisciplinary, customer-oriented service and consulting competence, beyond our technical expertise," says Christoph Weber, Head of ESG De-fence. The GUARDION counter-UAS system has already been used to secure political events such as the G7 summit in Elmau in 2015, President Obama's state visit in June 2016 and the G20 summit in Hamburg in 2017. The ESG portfolio comprises the selection and integration of high performance sensors, the optimised operational picture and position recognition via the ESG Command & Control System TARANIS as well as the connection to existing IT networks and infrastructures. GUARDION offers scalable solutions to protect against threats from unauthorised drone flights for the industrial and military sectors, for law enforcement agencies and major events as well as for airports, infrastructure and state-owned real estate.

■ Demonstration of Strength by Nexter's Artillery

(ck) Nexter has demonstrated its surface-to-surface artillery systems in 105 and 155mm calibres to a group of more than eighty people from 18 countries. A



Photo: Nexter

focus was on the CAESAR 155mm self-propelled artillery system, presented on 6x6 and 8x8 chassis which has been acquired by the French, Danish, Indonesian and Thai armies and is currently present in several theatres of operations, notably in Iraq within the Wagram Task Force. CAESAR has the reputation of being a good compromise between the simplicity of a towed artillery piece and the mobility of a self-propelled system, partly because of its firepower, reliability and low cost of maintenance. Nexter presented the latest version of the CAESAR 8x8 chassis automatic shell loading system, a device which ensures constant firing rates regardless of environmental conditions. A CAESAR battery pack on a "full automatic" 8x8 chassis demonstrated the simplicity of this weapon system and its survival capabilities against counter-battery fire. The presentation of the 105 LG1, a 105mm towed artillery system, completed the demonstration. Deployable by light vehicle, helicopter, or even parachute, the 105 LG1 is a very light 105mm assault artillery piece, providing fire support to rapid reaction forces. The 105 LG1 is in service with the Singaporean, Thai, Indonesian, Belgian, Canadian and Colombian forces.

■ Romania to Test SPIKE LR Missiles

(ck) Following a 2015 order for SPIKE Missiles by the Romanian government from



Photo: Rafael

EuroSpike GmbH (a joint venture between Rafael, Diehl and Rheinmetall), the Romanian Army has recently completed testing of ten SPIKE LR (Long Range) missiles. The missiles were test-fired as part of the Romanian army evaluation process at the Cincu National Training Centre in Braşov, Romania. Nine of the ten SPIKE missiles were fired by Romanian gunners at the end of the qualification process. The SPIKE LR System was tested in different firing scenarios, including day mode and IR mode, and was fired against tanks and APCs at different ranges. All ten missiles hit their targets. The Romanian army has been using SPIKE

missiles for some time and has deployed the SPIKE LR in its vehicle-mounted version on a 30 mm RCWS on the BMP Platform, and the SPIKE ER Missile (8km range) on PUMA helicopters. The tests involved the infantry launcher configuration of the Integrated Control Launch Unit (ICLU) which is the new digital launcher for SPIKE missiles. The ICLU enables very long range target detection capabilities and integration with a tactical network. The Portable Anti-tank SPIKE-LR Procurement Programme will run through 2017-2019 and will equip the infantry, reconnaissance and mountain troop brigades as well as the artillery regiments of the Romanian Land Forces.

■ Schiebel Delivers Mine Detectors to Ecuador

(ck) Under a contract with the Ecuadorian Ministry of National Defense, the Austrian manufacturer Schiebel has delivered 35 units of the ATMIDTM All Terrain Mine



Photo: Schiebel

Detector. The order for the ATMIDTM was awarded in late September and delivery to the Ecuadorian Land Forces was made in December 2017. The ATMIDTM features dynamic continuous wave detection while retaining the design of the AN-19/2, the world's most widely used mine detector for both humanitarian and military purposes. Suitable for fast, accurate demining in all climates and terrains, the ATMIDTM is highly effective in detecting minimum metal-content land mines – even in areas with severe laterite conditions or with a high content of iron or aluminium oxides.

■ First Indian-Made Submarine Commissioned

(ck) On 14 December 2017, in presence of Prime Minister Shri Narendra Modi, the Indian Navy commissioned INS KALVARI - the first submarine of the P75 SCORPENE class entirely built by Mazagon Dock Shipbuilders Limited (MDL) through years of technology transfer and partnership with Naval Group. INS KALVARI is the first of six Indian submarines under indigenous construction and the first large and demanding "Make in India" programme. The KALVARI class submarine is based on SCORPENE class



Photo: Indian Navy

diesel-electric attack submarines designed by Naval Group and built by MDL. The SCORPENE is a 2000 tonne conventional-propulsion submarine designed and developed by Naval Group for missions such as anti-ship warfare, anti-submarine warfare, long-range strike, special operations and intelligence gathering. Stealthy and fast, it has a level of operating automation that allows a reduced crew, which significantly reduces its operating cost. It has 6 weapon launching tubes and 18 weapons (torpedoes, missiles, mines). In line with the "Make in India" initiative, Naval Group set up a defence industrial park for the indigenous content of the P75 submarines; a significant proportion of the high-tech equipment supplied by Naval Group has been produced in India. INS KALVARI started its sea trials in 2016. She successfully test-fired an MBDA SM39 anti-ship missile and torpedo and thus is combat-ready. All the remaining submarines are in different stages of construction and will be delivered at a rate of one every 12 months.

■ Ireland to Buy Pilatus Aircraft

(ck) The Irish Defence Minister, Paul Kehoe, has signed a contract with Pilatus Aircraft on behalf of the Irish Air Corps, for the purchase of three Pilatus PC-12 NG aircraft. The Pilatus PC-12 is a single-engine turboprop passenger and cargo aircraft manufactured



Photo: Pilatus

by Pilatus Aircraft of Switzerland. The three Pilatus aircraft will replace Ireland's Cessna 172 fleet which has been in service since 1972. The three new Pilatus aircraft will be operated by the Irish Air Corps in Intelligence, Surveillance, Target Acquisition and Reconnaissance (ISTAR) roles. In a Medevac configuration the PC-12s will be equipped to carry nine passengers or two stretchers and support staff. The value of the contract

is €32M, with delivery in 2019 and 2020. The contract includes the purchase and installation of specialist equipment, training and spares. The PC-12 list price is €4.17M per aircraft. The cost to acquire, operate, and maintain a Pilatus PC-12 NG is around half that of its twin-engine competition, and at an hourly operating cost of \$727 (around €662), it is a fraction of the cost of using rotary wing assets for the same missions. With over 1,500 aircraft around the globe, the PC-12 fleet has racked up over 5 million flight hours operating worldwide.

■ Rheinmetall to Modernise Jordanian MARDERS

(ck) The German government has contracted Rheinmetall to upgrade another



Photo: Rheinmetall

25 MARDER infantry fighting vehicles from surplus Bundeswehr stocks, to be destined for the Jordanian armed forces. Delivery will begin in early 2018. The contract was awarded under a German military aid programme aimed at bolstering the capabilities of the Jordanian armed forces in the fight against international terrorism as well as for border security and stabilisation missions. Total value of the contract is €17M. In detail, Rheinmetall will supply Jordan with 25 fully modernised, former German Army MARDER 1A3 infantry fighting vehicles, painted in a desert camouflage pattern, and the package also encompasses spare parts, ammunition, tools, customer support and training for operators and maintenance personnel. In addition to Germany, Chile and Indonesia, Jordan is the fourth nation to deploy the enhanced-performance MARDER: Rheinmetall already supplied Jordan with 25 vehicles of this type in 2016. The MARDER 1A3 infantry fighting vehicle weighs about 35 tonnes, its 600 HP engine enables a top speed of around 65 km/h, and the fighting compartment is roomy enough to seat nine soldiers. An RH-202 20mm automatic cannon serves as the vehicle's main armament.

■ RAM Missile No. 5,000

(ck) The Rolling Airframe Missile (RAM) Programme celebrated the roll-out of missile number 5,000 in December 2017 at Raytheon Missile Systems in Tucson, AZ. This

event is a milestone in the forty-year old German-US industrial partnership as well as in Government cooperation, and under-



Photo: RAM Systems

lines the partnership between Raytheon, RAM System GmbH, MBDA Germany and Diehl Defence. Apart from the transatlantic cooperation partners, the navies of Egypt, Greece, Japan, South Korea, Turkey, the United Arab Emirates and, since 2017, Mexico and Qatar, rely on the capabilities of the RAM ship self-defence weapon system. Since 2014 the US, German and several other Navies have been equipped with the 4th generation of the RAM missile.

■ New BUSHMASTER

(ck) At the 2018 International Armoured Vehicles Conference (IAV) in London Thales launched its new protected vehicle, the BUSHMASTER Multi Role 6 (MR6). The new vehicle is an evolved version of the original combat-proven BUSHMASTER. Designed



Photo: Thales

and manufactured by Thales Australia, the BUSHMASTER MR6 builds on the original's battle-proven features. BUSHMASTER's V-shaped hull deflects blast energy away from the crew providing protection against land mines and IEDs - protection that has proven itself in operations in Iraq, Afghanistan and Mali. Now in service in 8 countries, the BUSHMASTER is used in more than a dozen different configurations in multiple roles. "We are extremely proud to be launching this new BUSHMASTER MR6. It demonstrates our absolute commitment to saving soldiers' lives through continual improvement, taking into account the experiences on the ground and the concrete needs of our customers," said Pierre Bénard, Vice-President in charge of Vehicles and Tactical Systems at Thales.

■ Robots for the French Army

(ck) The French defence procurement agency, the DGA (Direction Générale de l'Armement), has contracted Safran Electronics & Defense to develop the research project "Furious." Covering a period of five years, this project aims to integrate land robots into the French armed forces, as part of the "Scorpion" modernisation programme. The "Furious" project will develop three robot demonstrators of different sizes for a variety of tasks (for example, exploring buildings, carrying loads for infantry soldiers, etc.). The demonstrators



Photo: Safran

will be deployed by an infantry platoon and tested in different configurations. The largest of the three robots will be the eRider autonomous vehicle developed by Safran Electronics & Defense in partnership with Valeo and PSA.

■ US Marine Corps to Buy New Parachutes

(ck) The United States Marine Corps (USMC) has contracted Airborne Systems to deliver the Enhanced Multi-Mission Parachute System (E-MMPS). The E-MMPS is equipped with an Airborne Systems proprietary Hi-5 canopy and edge harness container and features the STORM drogue release system. Airborne Systems will provide training services, manuals, and all necessary support to ensure the successful fielding of this new parachute which will replace existing legacy MMPS. The Hi-5 canopy is best known for its glide modulation system: it features a remarkable 5.5:1 glide ratio and can transition to a 1:1 glide ratio with a simple control input. J.C. Berland, Chief Technology Officer of Airborne Systems, said, "The Hi-5 offers superior glide performance with its unique patent pending Glide Modulation System. It offers stability and resistance to stall and allows for the most accurate landings."

■ Romanian Army to Buy Iveco Trucks

(ck) Iveco Defence Vehicles has signed a contract with the Romanian Ministry of Defence for 173 military logistic vehicles

Photo: Iveco



to be delivered in 2018. Iveco will deliver purpose-designed 6x6 military logistic vehicles, designed as troop and transport carriers with a self-recovery winch. The vehicles are highly mobile (Central Tyre Inflation System included) and C-130 air transportable. In 2015 Romania bought 57 trucks in different configurations: 6x6, tractor 6x6, 8x8, 8x8 with hook lift, and 8x8 with transport container configurations. All of the trucks ordered in 2015 have already been fielded in Romania.

■ NATO to Buy DIRCM Systems from ELBIT

(ck) NATO has awarded Elbit Systems a follow-on contract to supply additional J-MUSIC DIRCM (Direct Infrared Countermeasures) self-protection systems to NATO for its Airbus A330 Multinational Multi-Role Tanker Transport Fleet (MMF) Programme. The contract is valued at US\$46M and will run for a four-year period. Elbit Systems will equip NATO's Airbus A330 tankers with the J-MUSIC DIRCM systems along with the Company's Infra-Red-based Passive Airborne Warning Systems (PAWS IR). Colonel Jan der Kinderen, Chairman of the



Photo: Elbit

MMF Steering Group, highlighted: "The MMF users are very pleased that the Multi Role Tanker Transport aircraft (MRTTs) are going to be equipped with Elbit Systems' J-MUSIC DIRCM system. This will greatly add to the safety and operational flexibility of the total fleet. It is also great to see how Airbus and Elbit Systems work closely together to integrate the systems." Elad Aharonson, General Manager of Elbit Systems ISTAR Division, commented: "This follow-on contract that extends the supply of J-MUSIC DIRCM and PAWS IR missile warning systems to NATO's MMF programme, attests to Elbit Systems' technological and operational competitive

advantage in addressing the intensifying threat of shoulder-launched surface-to-air missiles." Elbit Systems is active in the fields of defence, domestic security and commercial programmes.

■ Latvia and Turkmenistan to Buy Polaris Vehicles

(ck) The Latvian Armed Forces will buy an undisclosed quantity of Polaris MRZR 2, SPORTSMAN 6x6 and MV850 all-terrain vehicles. The 2-year FMS contract is valued at US\$500,000 and includes spare parts



Photo: Polaris

as well as operator and maintenance training, which will be conducted in Latvia by Polaris. "Latvia's contract for MRZR 2 and ATVs will greatly enhance the mobility of their fleet in the Baltics," stated Doug Malikowski, Polaris Director of International Business Development. The lightweight, all-terrain vehicles will be used primarily for border security. In recent years, Latvia has strengthened security on its borders due to increased regional tension.

In Turkmenistan Polaris has received a multi-million US\$ contract from the SOF to update their tactical vehicle fleet. "The vehicles we provide are highly transportable, off-road capable and are relied on for helping Special Forces navigate restrictive and complex environments" said Malikowski. Polaris military vehicles provide off-road mobility for expeditionary forces in the US and more than 25 countries, and have a high degree of interoperability and commonality among US and allied forces.

■ A400M refuels six F-18 fighters in one flight

(ck) An Airbus A400M has successfully refuelled six Spanish Air Force F-18 fighters in a single mission as part of an air-to-air



Photo: Airbus

refuelling (AAR) human factors certification flight. The mission conducted on 13 December 2017 featured a series of AAR scenarios such as changes of area, receivers with unknown priorities, and unexpected increases in numbers of receivers. Through multiple contacts the six aircraft simulated a fleet of eight. The F-18s included the first Spanish operational fighters to be refuelled by the A400M, and belonged to the Spanish Air Force Test Centre (CLAEEX) and the 12th Operational Wing based at Torrejón. A total of 11.4 tonnes of fuel was dispensed using both the underwing pods and the centre hose refuelling unit. Certification authorities on board confirmed good results. Airbus believes this flight confirms the A400M's two-crew cockpit concept for tanker missions.

■ Iveco Trucks for the German Army

(ck) Iveco Defence Vehicles has received a significant order from the German Bw-Fuhrpark Service GmbH for a new fleet of military multipurpose trucks for the German armed forces. Iveco will deliver 280 EUROCARGO trucks by 2018. After being approved for its mobile and versatile functions, the new military EUROCARGO is now part of the official range of mid-



Photo: Iveco

size tactical trucks. The Iveco MLL 150 E 28 WS vehicles will be equipped with an unprotected truck cab with comfortable new seats, flexible storage for radio systems and military equipment, single off-road tyres, roof hatch, NATO blackout light, trailer version, spare wheel carrier and multi-purpose interchangeable frame for multi-mission missions abroad. All vehicles will be Euro 6 compliant, including full single fuel capability, and offer a first-class payload. Over the past ten years, Iveco Defence Vehicles has delivered almost 1,000 vehicles from its product range (4x2, 4x4, 6x2, 6x4, 6x6 and 8x8) to the German Armed Forces, which have already been used in theatres such as Afghanistan and Mali. The Bundeswehr's most recent orders include 133 armoured TRAKKER 8x8 trucks.

■ Cobham to Provide Electronic Warfare Services for NATO

(ck) Cobham's Special Mission business has received a follow-on contract to provide Operational Readiness Training for NATO for a period of up to five years. Under the terms of the contract, Cobham will deliver electronic warfare



Photo: Cezary Adamczewski

and threat simulation training. Training will be delivered using Cobham-owned and -operated aircraft, carrying a suite of either NATO-furnished equipment or Cobham's in-house-developed electronic warfare training podded technology. Cobham has delivered operational readiness training to military forces across the globe including NATO, the United Kingdom and Middle East. Darren Moncrieff, Vice President of Cobham Special Mission said: "Securing this follow on contract, with a customer as prominent as NATO, demonstrates that we have a world leading, technically advanced operational training capability that is innovative yet affordable."

■ Curtiss-Wright Offers Low-Power Processors

(ck) Curtiss-Wright's Defense Solutions announced the availability of its 3U OpenVPX VPX3-1220 single board computer (SBC) and the XMC-121 XMC processor mezzanine card, both of which make use of Intel's latest 7th Gen Intel XEON processor. These rugged commercial-off-the-shelf (COTS) processor modules feature Intel's low-power E3-1505L v6 XEON processor which provides more quad-core x86 performance than previous processor generations operating at higher power levels. The VPX3-1220 and XMC-121 have been provided to customers since April 2017. Designed for use in size, weight, power and cost (SWaP-C) constrained aerospace and defence systems, these rugged, open-architecture processor modules are suited for general purpose mission computing applications that require the highest possible processing performance while consuming low power. The VPX3-1220 and XMC-121

speed and simplify the integration of Intel XEON processing into demanding aerospace and defence deployed applications, such as mission computing, image and display processing, virtualisation and small multi-SBC ISR systems. The XMC-121 XMC processor mezzanine module features the same Intel XEON processor as the VPX3-1220, but delivers its high performance on a smaller form factor. The XMC-121 enables system designers to add Intel XEON processing to extremely space-constrained systems. A means of reducing system slot count, this XMC processor mezzanine can be mounted on a graphics or FPGA module, or on the power supply of Curtiss-Wright MPMC series system chassis for a zero-slot processing solution. The XMC-121 can also be mounted on the VPX3-1220 to double the processing density in a single slot. "The ideal combination of low power and high performance provided by 7th Gen Intel XEON processor technology is ideal for 3U VPX and XMC small form factor single board computers, bringing new levels of processing to size, weight and power-constrained platforms without increasing power consumption," said Lynn Bamford, Senior Vice President and General Manager, Defence Solutions Division.

■ Torches by Peli

(ck) Peli has introduced new torches for law enforcement and military professionals. Peli's 7110, 7610 and 7620 torches are self-programmable models and run with AA, CR123 and, at the same time, with Peli rechargeable batteries to give users the option to reload with more battery choices. The high-performance of the 7110 torch (up to 445 lumens), the 7610 (up to 1,018 lu-



Photo: Peli

mens) and the 7620 (up to 1,124 lumens) coupled with a full-time battery level indicator offer five selectable programmes and four modes: high, strobe, medium and low. Three sizes are available: 7620 large (17.3 cm), 7610 medium (13.8 cm)

and 7110 small (11.8 cm). The torches have a robust body with hard anodized finish and can withstand harsh weather conditions.

■ XM914 and XM25 – Gunning Down Drones

(ck) Orbital's BUSHMASTER Chain Gun can successfully shoot down hostile drones with its new Programmable Air Burst Munition (PABM), as demonstrated in recent tests. Orbital ATK recently participated in the Manoeuvre Fires Integrated Experiment (MFIEX) at Ft. Sill, Oklahoma. The event allowed soldiers to use Counter-Unmanned Aerial System (C-UAS) technologies to investigate how these systems might fill capability gaps in short range air defence. For the demonstration Orbital ATK com-



Photo: Orbital ATK

bined both electronic and kinetic attack through its Anti-Unmanned Aerial Vehicle Defence System (AUDS) which detects, tracks, and defeats drones, and which also has a kinetic element through the integration of the company's XM914 30mm BUSHMASTER Chain Gun mounted to the STRYKER combat vehicle platform. "The ability to insert proven technologies is the key to shortening acquisition time and providing soldiers with the equipment they need today," said Dan Olson, Vice President and General Manager of Orbital ATK's Armament Systems Division. The AUDS system is modular, meaning that parts of it can be tailored for use on different platforms depending on mission requirements, or it can be installed at a fixed site to provide C-UAS defence for a facility or operating base. Earlier this year, Orbital ATK was awarded a US\$8.5M contract from the Program Directorate Counter-Rocket, Artillery, Mortar (PD C-RAM) to integrate AUDS onto a mobile-anti-UAV defence system. Orbital ATK also demonstrated how a soldier, armed with Orbital's shoulder-fired XM25 airburst

weapon system can down a malicious drone. The XM25's fire control system and 25mm airburst ammunition have shown that C-UAS is a capability the system provides.

■ First TIGER HAD Retrofit Delivered to the French Army

(ck) After completing its formal acceptance process with the French Defence Procurement Agency (DGA), Airbus Helicopters has delivered the first TIGER retrofitted into the HAD version to the French Army Aviation. This upgrade from the HAP to the HAD version involves making modifications to the airframe and installing over 1500 new parts. Compared with the previous HAP version, the HAD TIGER benefits from an increased maximum take-off weight (MTOW) and is equipped with two new MTR 390 E engines and with a new STRIX roof-mounted sight system with a laser designator that allows the HELLFIRE II air-to-ground missile to be fired. For the retrofit programme, Airbus Helicopters has set up a new industrial organisation, combining teams from its Military Support Centre and from its TIGER production assembly line. "This TIGER retrofit programme will give French Army Aviation the additional capabilities they require in order to perform their most demanding operational missions", says Alexandra Cros, head of governmental affairs France at Airbus Helicopters. The TIGER HAD is Airbus Helicopters' multi-role attack helicopter. It is designed to perform armed reconnaissance, air or ground escort, air-to-air combat, ground firing support, destruction and anti-tank warfare, day or night and in adverse conditions. The TIGER attack helicopter has proven its capabilities during operational deployments in



Photo: Anthony Pecchi

Afghanistan, the Central African Republic, Libya and Mali. In service with the armed forces of France, Germany, Spain and Australia, the global TIGER fleet has logged over 92,000 flight hours to date.

Geopolitical Impact of the Oil Price Decline – Winners and Losers

Frank Umbach

The dramatic decline of oil prices from more than US\$100 per barrel in the summer of 2014 to US\$27 in January 2016 has highlighted once again its geopolitical impact on world politics and global stability.

In the mid-1980s, when Saudi Arabia quadrupled its oil production within a few years, a similar dramatic drop in oil prices - coupled with the lack of economic competitiveness, insufficient economic

and the Gulf region. The old oil era was marked by ever-increasing global oil demand due to energy-hungry emerging economies (such as China) and an increase in conventional oil production with

million barrels per day (mb/d) in 2010 to 9.4 mb/d in 2015 – comparable to Saudi Arabia's total production – at a cost of between US\$40 and US\$80 per barrel.

Currently, shale (tight) oil accounts for two-thirds of total US crude oil production. While in the old conventional oil age Saudi Arabia was the global oil price setter, US shale oil production has developed into the new global price setter. While much lower oil prices benefit consumers and importing nations, they are damaging to expensive producers and countries whose national budgets are heavily dependent on oil export revenues and who have a less diversified economy.

In the medium term, global climate policy to decarbonise the world's fossil energy system, the electrification of the transport and heating sector, as well as digitisation, automation, large data volumes, artificial intelligence and other technological innovations such as "digital oil fields" could destabilise many oil and gas producing countries if reduced global oil demand causes oil prices to fall again. While the Arab countries can produce oil for only US\$10-12 US per barrel, they themselves need more than 60 US dollars per barrel to balance their national budgets.

While current oil prices have risen to US\$60-70 US per barrel in recent months, the volatile oil price trend will continue in the coming years and decades. In the short term, the global oil price could fall back to between US\$30-40 per barrel in the next few years, as US oil production, which is not affected by OPEC oil production cuts negotiated, will continue to rise. Due to OPEC's competing national interests within the cartel, it could become even more difficult for OPEC to implement new production cuts. If geopolitical conditions improve, other oil-producing countries such as Iran, Iraq, Nigeria and others will also increase their oil production. But hardly any other oil-producing



Photo: Kremlin

Talks with the Saudi King Salman bin Abdulaziz Al Saud in October 2017 were also about the decline in oil prices.

diversification and high defence spending – led to the collapse of the Soviet Union. In recent decades, Europe and the West have been able to reduce their dependence on oil in general and on oil imports from the politically unstable Middle East

new investments in extremely deep, high-priced offshore fields (such as Brazil's sub-salt fields), remote areas (such as the Arctic or Siberia) and Canadian oil sands. In contrast to the previously forecasted "peak oil" scenario, the current decline in global oil and gas prices shows that oil and gas are no longer scarce resources. Future global demand growth will be largely offset by low-cost production from Arab OPEC countries and US shale games. Within a few years, the combined conventional and unconventional oil production in the USA doubled from over 5

Author

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country has as many financial reserves as Saudi Arabia, despite the fact that even Riyadh has lost almost US\$250Bn of its currency reserves between 2014 and 2017.

The US as a Winner: on the Way to "Global Energy Dominance"?

Since 2012, the US has overtaken Russia and Saudi Arabia combined as the largest oil and gas producer. Two years later it became both the world's largest oil producer (before Saudi Arabia and Russia) and the world's largest gas producer (before Russia and Iran). Oil export restrictions have been lifted since December 2015 and US oil exports have risen steadily. The first 16 countries to benefit from the US's first oil exports were their foreign policy allies Canada, The Netherlands, Italy and Japan. With regard to Saudi Arabia's price war, which is aimed at US shale production, the overall slowdown in production has been significantly lower than expected, due to increased efficiency, operational costs and technological innovation resulting in higher well productivity and resiliency. Average production costs for US shale wells were reduced by 30-40% compared to only 10-12% in other countries. More than 60% of shale oil production is considered to be economically viable between US\$55-60 per barrel and only 20% of conventional deep-sea projects. The shale oil industry has proven to be much more price-elastic and the first to bounce back due to the short-cycle nature of drilling, as it doesn't need large up-front investment to recover quickly when prices rise again. In 2017, production volumes rose by more than 600,000 b/d, as investors were interested in new opportunities due to rising oil prices and declining production costs. The recent rise in oil prices has enabled US shale oil production to grow to 9.9 mb/day by the end of last year. It thus surpassed the previous record of 9.6 mb/d in 1970 and could rise by a further 20% to 11 mb/d in 2019 and rival Russia's level of 2017. In combination with conventional oil production of up to 14.24 mb/d, the USA remained the world's largest oil producer in 2017. As a result of the US shale oil and gas revolution, the dependence of the US on oil and LNG imports from the Gulf region has decreased significantly. It has reinforced the redefinition of priorities in its foreign and security policy, which was already under way during the era of former US President Obama. The reorientation of the focus on East Asia was supported by

the fact that military interventions since 2001 have not produced lasting and sustainable regional stability.

The US could remain a net oil importing country, as more than 50 percent of the world's oil refining capacity is located in the US. It not only exports more and more crude oil, but also still imports crude oil and re-exports it as refined petroleum

For economic and foreign policy reasons, "global energy dominance" is hardly realistic, since the exports of private US oil and gas companies are guided by profitability considerations. The Trump administration cannot dictate – as in the case of Russian state oil and gas companies – where US exports are to be exported. Meanwhile, technological innovation is

Oil Producers	Fiscal Breakeven-Oil Prices (\$)
Nigeria	139
Bahrain	84
Angola	82
Oman	75
Saudi Arabia	74
Russia	72
Kazakhstan	71
Gabon	66
Azerbaijan	66
Iraq	61
Abu Dhabi, United Arab Emirates (UAE)	60
Republic of Congo	52
Qatar	51
Kuwait	45

Fiscal Breakeven-Prices in US-Dollar of Oil Producing Countries (Spring-Summer 2017)

products. Two-thirds of current US oil imports are imported from Canada, while less than one-third is still supplied by OPEC members. A complete independence of the US from oil imports by 2030 seems realistic only within a broader North American framework, involving Canada. The "global energy dominance" of the world's energy markets proclaimed by US politicians has four elements:

- The USA is to use the advantages of its huge oil, gas and coal reserves for domestic and foreign policy objectives.
- Increasing exports of all three fossil fuels – also to reduce trade imbalances with trading partners (such as China).
- A greater dependence on energy imports from the allies Canada, Mexico and the Western hemisphere instead of imports from the politically unstable Middle East, the Persian Gulf and North Africa.
- The use of all three elements to strengthen the US's negotiating positions for foreign policy initiatives.

making further progress with the introduction of waterless fracking, laser drilling, supercomputing, big data and real-time data analysis, neural networks and sensors. They will make the US even safer, cleaner, cheaper, more efficient and internationally competitive.

Saudi Arabia

In the old oil era, Saudi Arabia was not just the worldwide biggest producer and exporter, it also held the largest spare capacity as "the nuclear weapon in the global oil market". It gave Riyadh unrivalled geopolitical influence. But in 2016, the global spare capacity melted down to 1.5-3.5mb/d, which is being considered as insufficient in regard to the global oil demand rising to 97.8 mb/d in 2017 (as it demands a spare capacity of at least 5 mb/d).

In addition, Riyadh's role as an oil producer, which is acting unilaterally as a "swing producer" within OPEC, has challenged

and undermined the role of OPEC as a price cartel. Since 2014, due to economic and geopolitical factors, Riyadh has been less prepared to play this role, as in addition to the reduced regional commitment of the USA, Saudi Arabia is also facing Iran as its geopolitical rival in the Middle East. Given the differences of opinion also between the Gulf Cooperation Council's monarchies on the conflicts in Yemen,

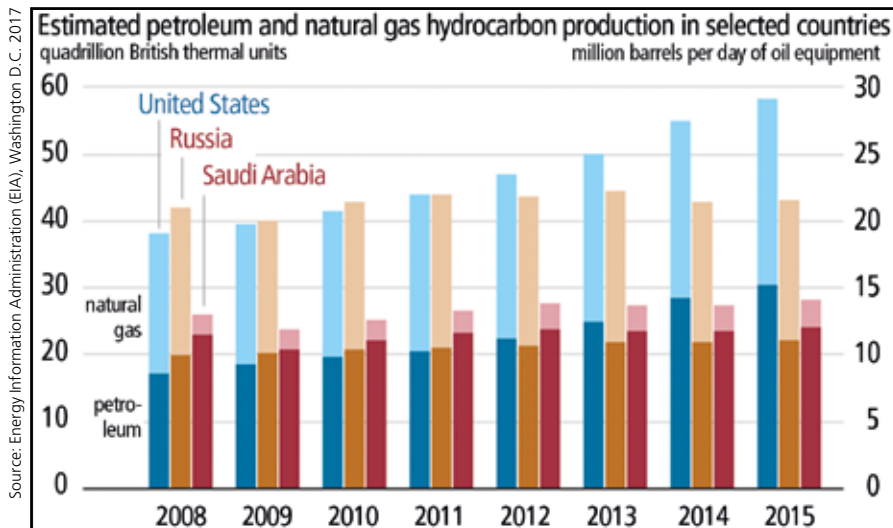
with higher oil prices. But Saudi Arabia has been hurt by its own oil price war as it was already running a budget deficit of US\$98Bn (16% of its GDP) in 2015 and US\$87Bn in 2016, when it was forced to cut public salaries by 20% and to reduce public funding. The deficit could even reach US\$380Bn by 2020. In 2016, Crown Prince Mohammed bin Salman outlined his "Vision 2030" to fun-

Russia

Until 2014, 80% of Russia's energy revenues came from oil and not from its gas exports. They covered around 40% of Russia's national budget. In 2014, Russia's national budget was still based on prices of around US\$117 per barrel. In 2015, the Russian Ministry of Finance expected that the low oil price would cost the country at least two percent of its GDP and that its oil sector would lose around US\$4Bn for each further oil price reduction of US\$10 per barrel. In order to cover production costs and to generate sufficient export earnings for the state budget, an oil price of about US\$65-75 per barrel was still needed. For 2018, the state budget is more realistically assuming an oil price of US\$55 per barrel.

As the world's second-largest energy producer, Russia did not diversify its economy during the past decade of high oil and gas prices. It has just begun to address the manifold challenges with longer-lasting low oil and gas prices, but not with declining oil and gas exports as the result of a decreasing world oil demand due to global decarbonisation efforts as well as the electrification of the worldwide transport and heating sectors. Russia's officially proclaimed future energy policies are still based on best-case scenarios ignoring the world energy megatrends. Russia still vies with Saudi Arabia and the US for the title of the world's biggest oil producer. But it cannot ignore that its aging oil fields will be depleting after 2025, though it is sitting on some 23 new fields, which could add new production in the mid-term perspective. It also explains the Kremlin's support for a collective oil production cut of OPEC as it had to decrease its own production only marginally and is unable to raise its production significantly above its record of 11.1 mb/d in 2014 and 10.98 mb/d in 2017 in the next years.

While Russia might have the world's largest unconventional oil resources, only exploration could prove whether they can be drilled competitively for the world's oil markets. But for those explorations and an increase in its shale oil production, it needs Western technology cooperation with US oil companies, which are sanctioned in regard to any joint oil cooperation with Russia after its annexation of Crimea. Russian oil and gas production and exports are the foundation of economic policy and a prerequisite for restoring Russia's status as a major power. Its commanding heights of Putin's power elite



Syria and Qatar, the diverging geopolitical interests of the individual OPEC member countries have undermined trust within the cartel. It makes it difficult to enforce collective decisions which are beneficial in shared short- and long-term interests. Saudi Arabia has no interest in Iran increasing its economic power through rising oil revenues to dominate the region. A further escalation of the bilateral conflict cannot be ruled out, as the traditional conflict between Sunnis and Shiites has been supplemented by new economic and security dimensions. The conflict between Saudi Arabia and its allies with Qatar has shown that neighbouring countries are increasingly drawn into this widening bilateral conflict between Riyadh and Tehran.

While OPEC acts as a price cartel to coordinate the oil policy of the member states to ensure stable income and stabilisation of the oil market, it has always been Saudi Arabia as the dominant producer with the largest geo-economic impact on world oil markets. But the Saudi Arabian oil price strategy to collapse US shale oil production has largely failed.

Although Saudi Arabia is no longer the world's largest oil-producing country, it is still the world's lowest oil price producer and resilient enough to survive oil prices below US\$30-40 per barrel for a longer period of time, unlike many producers

damentally reform his country and make it more economically independent of oil exports by diversifying its economy to prepare it for the end of the oil era. While many observers and experts are sceptical about whether the timeframe is realistic, unlike most other oil and gas producers around the world, the country has a long-term political vision and the strategies and financial resources for such a comprehensive and ambitious reform of the Saudi state, its economy and society.

But domestic political pressure has increased, along with less enthusiasm and increasing criticism. According to conservative circles, the reforms of Saudi society go too far as they threaten the state-religious foundation of the country. However, the younger generation believes that the reforms are inadequate. The privatisation outlined above and the objective of reducing widening income disparities, combating corruption and reducing monopolies depend on completely new transparency and unknown accountability as well as clear responsibilities. Some of the reforms initiated by Riyadh's National Transformation Plan have already been revised and postponed until the period 2025-2030. Consequently, the reform vision calls for a new Saudi Arabian model of the relationship between state and society.

are closely linked to Russia's oil and gas elite, all of which come from the Siloviki (its secret services and other ministries of power). Russia's economic growth has remained marginal, although it has proved to be better than anticipated in the West. But any real reform policy is elusive with costly geopolitical ambitions (Ukraine, Syria and so on). Russia's government policy continues to focus on balancing the state budget deficit and other short-term concerns at the expense of much-needed long-term structural reforms. During the last decade, Gazprom, Rosneft and Novatek already invested more than US\$100Bn in new oil and gas fields on the Yamal Peninsula and the offshore Arctic waters in its permafrost region. Another US\$150Bn will be spent until 2025, though they are estimated to be the world's most costly projects. Russia's political-economic elite perceive climate change not so much as an envi-

with the 2009 energy strategy. While there is huge potential for RES (such as wind power) beyond hydropower to account for at least 11.3 percent by 2030 (more than double Russia's official forecast of 5%), headwinds appear still greater.

Venezuela

Venezuela is currently considered the most vulnerable OPEC member, as it needs an oil price of around US\$110 per barrel to cover its state budget targets. The country is unable to repay its debts of US\$18.5Bn until the end of 2017. Oil exports have generated 95% of its total export revenues. The lack of those revenues limits the government's ability to subsidise its expensive social programmes and import food and consumer goods. But the origins of Venezuela's political-economic and social crisis are the failing socialist economic policies of former Pres-

that it has the world's largest oil reserves. But these oil reserves are largely heavy fuel oil, which cannot be produced economically at lower oil prices.

Last year, Venezuela produced less than 1.9 mb/d compared to 3.5 mb/d at the beginning of the Chavez presidency in 1999, when 2.5 mb/d were exported. President Maduro amended the Constitution in order to override the separation of powers, constitutional rights, democratic participation and parliamentary scrutiny. The US Trump administration has tightened its sanctions against Venezuela's dictatorial regime. But President Maduro's policy has driven Venezuela even more into the arms of China and Russia in particular. The Russian state-owned oil company Rosneft granted a major loan to Venezuela's state-owned energy company PdVSA as early as 2016 and in return received 49.9 shares in Citgo Petroleum Corp., the US refinery and business unit

Photo: Kremlin



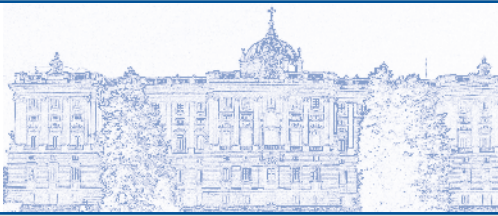
Russian President Vladimir Putin speaking to oil and gas workers in Vladivostok

ronmental disaster and economic threat, but rather as an opportunity for its future economic development. The melting of the Arctic ice opens new offshore oil and gas production (up to 25% of the world's remaining conventional oil and gas reserves) as well as new sea-routes for commercial shipping. President Putin himself has contradicted any assertion that the hydrocarbon era is ending and the need to phase out hydrocarbons in Russia's and the world's energy mix. The draft Russian energy strategy up to 2035 replaced the previous "optimistic" 4.5% 2020 target for renewables with a "more realistic" target of 2.5% compared

ident Hugo Chavez during his presidency (1999 to 2013). As a typical rentier state, its oil exports served to finance all-pervasive corruption, populist policies and the mismanagement of its renationalised economy. In view of the dramatic drop in oil prices, Venezuela's economic policy proved unsustainable. Rapidly rising inflation rates of up to 700%, skyrocketing crime and violence, as well as a further decline in GDP in 2017 to only one-third of the level of 2013 have made the country one of the poorest in Latin America. At the time of Chavez' death in 2013, the country had a budget deficit of 14% of its GDP (currently >17%), despite the fact

of Venezuela's state-owned oil company. Rosneft recently received two new gas fields as the first foreign company to receive 100% of the licence.

The situation in Venezuela has deteriorated further, as China is not prepared to provide financial support. Venezuela could indeed become the first oil-producing country in history to fall into bankruptcy due to the double effect of Western sanctions and declining export earnings. But, for geopolitical reasons, Russia still supports Maduro's regime financially, economically and with military weapons to compete with the United States in its own backyard and sphere of influence. ■



Viewpoint from Madrid

Elections in Catalonia: Independence versus Tabarnia



Esteban Villarejo Ceballos

After pro-independence political parties declared the illegal independence of Catalonia at the regional Parliament on 27 October 2017, the president of the Spanish government, Mariano Rajoy, announced the dissolution of the Parliament according to article 155 of the Spanish Constitution and called for elections on 21 December.

Seven Political Parties

There were seven main political parties involved: three pro-independence parties, another three parties against independence and one which supported a legal and negotiated referendum to decide the political status of Catalonia. Namely: Junts Per Catalunya ("Together for Catalonia") with Carles Puigdemont as main candidate in the "pro-independence" corner; ERC ("Republican Left of Catalonia") with Oriol Junqueras; and the extreme-left party CUP (Popular Unity Candidacy). The three parties in the "anti-independence" corner are: Ciudadanos ("Citizens") with Inés Arrimadas as main candidate; PSC ("Socialist Party of Catalonia"), the historical brand of

PSOE in Catalonia; and PP (People's Party), President Rajoy's political organisation.

Finally, in the "no man's land" there is Podem ("We Can"), the political party of Pablo Iglesias that joined other parties and social groups in Catalonia, some of them ambiguous about the independence debate.

Which Party Won the Election?

For the first time in the history of the Catalan regional elections, a non-nationalistic party won. It was the "anti-independence" party Ciudadanos which got 1,109,732 votes (25–35% of the share) and 36 seats.

However, the three pro-independence parties maintained a majority of seats despite losing votes due to the electoral system. Seats are allocated to constituencies, corresponding to the provinces of Barcelona (85 seats), Tarragona (18), Girona (17) and Lleida (15). Let's say it is "easier" to get seats in these last two provinces with fewer votes. Girona and Lleida are very strongly pro-independence provinces.

Which Political Block Won the Election?

Winner of the election are the “pro-independence” parties that got 70 seats, whose campaign was surprising led by Junts Per Catalunya with Carles Puigdemont from Brussels. He gained 34 seats for the “pro-independence” corner. Secondly, ERC with its leader in prison got 32 seats. Thirdly, CUP got 4 seats.

On the non-independence side, Ciudadanos got the majority support of the centre right, leaving Rajoy's PP with its worst result in the history of the Catalan elections. Both parties that comprise the PSC socialists got 56 seats. And the ambiguous Podem got 3 seats.

The pro-independence side having gained 2,079,340 votes against the 2,228,421 votes of the pro-Spain side clearly reflects how divided the society of Catalonia is.

Therefore, the three pro-independence parties should negotiate a new government. The elections represent the stage Catalonia is currently at, but the negotiations won't be an easy task taking into consideration that the “winner” of the independence side, Carles Puigdemont, fled to Brussels, and the “second-placed”, Oriol Junqueras (ERC) is in prison.

Is There Any Solution?

There are three options:

1. The new Parliament insists on the “telematic” voting of Puigdemont as regional president of Catalonia (that option would further complicate things);
2. The replacement of Puigdemont with a new candidate of consensus between the pro-independence forces to lead the new government; or
3. New elections in Spring

Russia and the “Fake News” Factory

The Spanish government claimed that Russia had interfered in Catalonia's “illegal” referendum on 1 October 2017 by promoting independence messages on social media and using fake accounts to spread photos and news. In many cases, those were false or related to other demonstrations or international events. The Spanish ministers of defence and foreign affairs said that Spain had evidence of Russian groups being involved in the use

of social media to massively publicise the separatist cause and swing public opinion in the run-up to the referendum. Some of those messages came from Venezuela.

For example, Russia Today and Sputnik news agency have been actively promoting the separatist ideas in social media and on their own websites.

These claims of Spanish authorities are shared by European Commission and the US Senate. Also NATO believes that Moscow is involved in a deliberately ambiguous strategy of information warfare and disinformation with the intention to divide the West and break its unity over economic sanctions imposed on Russia following its 2014 annexation of Crimea.

The European Union Faces a Problem

The Catalan crisis has raised nationalistic aspirations in other countries of the European Union, such as the Corsican nationalism in France, the Flemish in Belgium, the Bavarian in Germany or the Lombardy and Veneto in Italy.

These regions could lead new movements to get greater autonomy or a different political status within their countries. Russian media are willing to support their causes.

Free Tabarnia, Save Europe!

The so-called historical right for the independence of Catalonia is an illusion; however, it is becoming real in the social marketing sphere. But... what is Tabarnia?

After the elections and the split of Catalonia into two main blocks again, a group of citizens claimed the right of the pro-Spanish urban and more populated districts of Tarragona and Barcelona (known as “Barna”) to get its own referendum for their independence in case Catalonia becomes a new state. That is the way “Tabarnia” was set up.

For now, it is only an idea, but Tabarnia already has its own flag and maps, which are being delivered to promote the idea of “the independence inside the independence”... And it has a slogan: “Free Tabarnia, save Europe!”

At the end of the day, the Catalan case is similar to the case of the famous Swedish-founded multinational group: “Welcome to the Independent Republic of your Home.” This is a risky game in a time when other big powers would like to see the European Union weaker than ever.

Russia's Naval Probes

Stephen Blank

Recent newspaper articles have highlighted Russia's threat to transatlantic cables and sea lines of communication (SLOC)...

Russian submarines, entering into the North Atlantic either through the Baltic Sea or the Arctic, have been observed in the vicinity of the vital transatlantic cable network and could also interdict troop or other transports in a time of crisis. However, NATO and its members have grasped that threat for some months if not years and it is one of the factors that have led to the reorganisation of NATO's command structure. The new Atlantic Command's primary task is to ensure the security of the undersea cables and the SLOC. But vital as the security of the transatlantic SLOC are, it is by no means the alpha and omega of the threats posed by Russia's naval probes to European security.

Even though the navy has traditionally been, and most likely will be the stepchild of the new Russian military procurement plan through 2025, programmes now in force demonstrate Moscow's intention of striking at allied navies or restricting their access to critical waterways possessing significance for European security. This programme is particularly visible in the Eastern Mediterranean, Middle East and all the way to Central Asia and, if fully consummated, could put much of European energy supplies under permanent Russian threat. Indeed, if and when the grand design is realised, Russia will have achieved something the Soviet Navy sought but could not sustain or realise with incomparably greater conventional firepower than the Soviet Navy possessed. The first step was the conversion of the Black Sea into a Mare Clausus (closed sea) after 2014. As this writer and others have

observed, since 2014 a sustained build-up of Russian forces in Crimea and the Black Sea have gone far towards creating a layered A2AD (anti-access and area denial) zone in that sea although NATO has begun to react to the threat and exercise forces there. That layered defence consists of a combined arms (air, land, and sea) integrated air defence system (IADS) and powerful anti-ship missiles deliverable from each of those forces. Moscow has also moved nuclear-capable forces to the Crimea and

ern Mediterranean, Moscow is seeking to make good on the request stated by Defence Minister Shoigu on 26 February 2014 (as the Ukraine invasion was beginning) for a global chain of air and naval bases. Shoigu stated then that Russia had made progress in talks with eight governments to establish a global network of airbases to extend the reach of Russia's long-range maritime and strategic aviation assets and thus increase Russia's global military presence. Shoigu stated, "We are working actively with the

Photo: Boevaya Mashina



A transport loader for the ISKANDER-M weapon system on parade in Moscow

Black Sea to further display its determination to keep NATO out but also to use the umbrella it has created as the basis for an even more expansive strategy (resembling that used by the Egyptian Army in the Yom Kippur War of 1973) from which it can project power further out and deny those areas to NATO or at least threaten NATO with heavy costs. For example, in response to talk of NATO exercises, Andrei Kelin, a spokesman for the Ministry of Foreign Affairs labelled such exercises as destabilising and further added that, "This is not NATO's maritime space, and it has no relation to the alliance."

Having poured in these weapons systems to the Black Sea and having strengthened the Mediterranean Squadron that it has created as a permanent force in the East-

Seychelles, Singapore, Algeria, Cyprus, Nicaragua, Venezuela, and even in some other countries. We are in talks and close to a result." Shoigu cited Russia's need for refuelling bases near the equator and that, "It is imperative that our navy has the opportunities for replenishment."

And in August 2014, responding to NATO's heightened naval presence in the Black Sea due to the Ukrainian crisis, Shoigu demanded a new naval modernisation plan to "improve the operational readiness of Russian naval forces in locations providing the greatest strategic threat." In June 2014, Russian ships even deployed for the first time west of the Straits of Messina. These moves show why dominating the Black Sea is critical for Russia's power projection into the Mediterranean and Middle East.

Author

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However, the Mediterranean Squadron may be as much a response to previously declining NATO deployments that created a strategic vacuum there, as it is a conscious strategy. Since 2014 Moscow has moved to reinforce the Black Sea Fleet to use it as a platform for denying NATO access to it, Ukraine, Russia, and the Caucasus and to serve as a platform for power projection into the Mediterranean and Middle East. And since the intervention in Syria, Moscow has started to fortify the missile, air defence, and submarine component of its Mediterranean Eskadra (Squadron) to impart to it a capability for denying the area and access NATO fleets in the Mediterranean. Indeed, we see a clear sea denial strategy against NATO and other fleets in the area just as in the Black Sea and other maritime theatres. By May 2016, US intelligence confirmed that Moscow was building an army base at Palmyra.

Nevertheless, matters do not end there. Western military analysts have described Russia's efforts to build its IADS, anti-ship, and overall A2AD networks in terms of "bubbles" at certain "nodal points", namely in the Baltic Sea, around the Black Sea, and around Syria. They also include the Caucasus. Just as Moscow has delivered ISKANDER missiles to Kaliningrad – a move that garnered much attention – it has also deployed them in Armenia, ostensibly though not actually, under Armenian control. Indeed, it is virtually inconceivable that Moscow would grant Yerevan operational as well as physical control over those missiles, which are dual capable and could take out any target in Azerbaijan or a radius of 500 kilometres (if not more), which includes parts of Turkey. Air and air defence deployments at Moscow's Gyumri base in Armenia thus provide coverage of the entire Caucasus and eastern Turkey. Those deployments in Armenia have received virtually no publicity in the West, but they have vital strategic significance far beyond Azerbaijan and Georgia.

Coupled with the IADS and A2AD networks that Russia is building in and around Syria and the Black Sea, as well as the base in Hamdan, Iran, that Moscow used in 2016, Russia is constructing an elaborate network of air and naval defences. This not only interdicts foreign intervention in Syria's civil war; it also places the entire Caucasus beyond the easy reach of NATO and Western air or military power, while surrounding Turkey from the North, East and South with Russian forces and capabilities that can inhibit any Western effort to come to Turkey's aid. These capabilities also include the naval and A2AD capacity in the Caspian and the deployment of Russian ships

with KALIBR or other cruise missiles there, and the possibility of introducing nuclear-capable systems like the ISKANDER into the Baltic Sea – an already highly volatile theatre – if not the Black Sea as well.

power into the Middle East as well. Indeed, we have seen the previous use of Caspian Flotilla ships to launch the deadly KALIBR sea-launched cruise missile into Syria. Russian expert Sergei Mikheyev openly stated

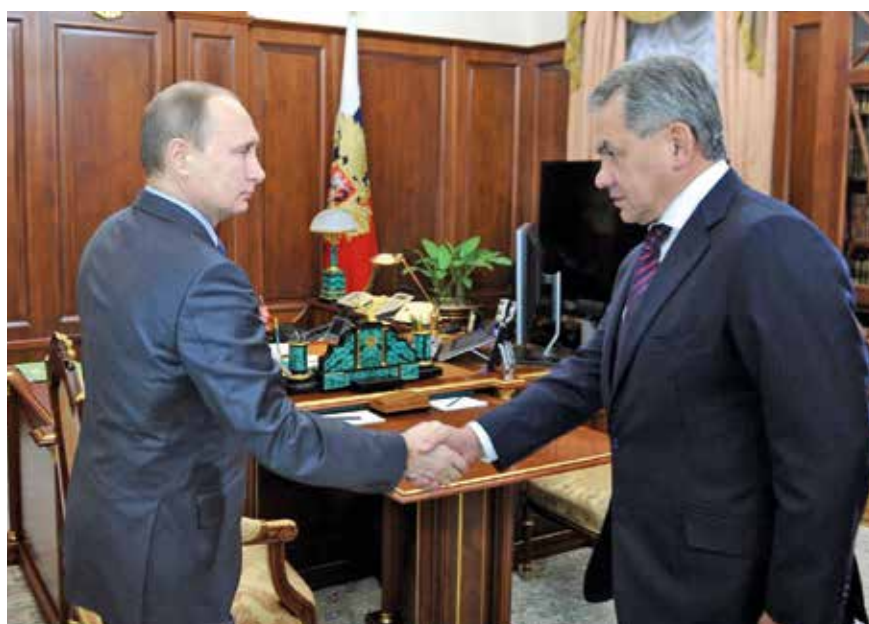


The 3M-14E submarine-launched land-attack cruise missile from Russia's KALIBR weapon system

Indeed, in 2017 this net further tightened. First, Moscow began the construction of a new naval base at Kaspiysk in Dagestan to control the Caspian Sea. It will accommodate all of the Caspian Flotilla's guided missile vessels and ensure rapid deployment for use of high-precision strike assets. This base is supposed to become the most advanced of all bases compared to those in the Arctic, Black, and Baltic Seas. Clearly, this is the latest example of Russia's consistent strategy to dominate not only the former USSR but also to project long-range military

the reasons for this base. He observed that, "The region is of growing interest for third countries. It is rich in oil and gas. Besides, an alternative corridor from Centra Asia to the West via post-Soviet Transcaucasia can go through it. The idea is promoted by the Americans and the Europeans, but Russia and Iran are against it."

We can and probably should also expect that Moscow will soon announce an accompanying air defence network to add to this base and to the other air and ship defence "bubbles" that encase the so-called



Sergei Shoigu, Russian Minister of Defence, meeting with Russia's President Vladimir Putin

southern tier of the Black Sea, Caucasus, and Central Asia. These bubbles comprise the land, air, and ship-based anti-air defences at Gyumri in Armenia, the Black Sea and around Ukraine and in Syria. Indeed, it already is the case that Russian forces to its north, east and south in the Black Sea, Caucasus, and Syria encircle Turkey, for all practical purposes. The new base will only increase that encirclement.

is stabilised, and in Yemen where Russia is aiding the Iranian-backed Houthis. Indeed, already in 2008, Admiral Ivan Kapitanets (Ret) former First Deputy CINC of the Soviet and Russian Fleets stated that Russia needs ports anchorages, and access to bases in the Mediterranean, specifically in Libya. And there are many reports of Russia's interest in acquiring just such a base in Libya. Mattia Toaldo, a Libya expert and Senior

power projection capabilities over the Gulf of Suez, and the Canal, the Red Sea, the Arabian Sea, and the Western reaches of the Indian Ocean, possibly including the Persian Gulf. The implications for Middle Eastern and European energy transports are obvious.

Finally, towards the end of 2017, Moscow pulled off what might be its greatest coup. The Egyptian government agreed to host



The Caspian Flotilla on parade in Astrakhan, Dagestan, in 2012

Similarly, this new base expresses Moscow's ongoing determination to project long-term and long-range military power into the Middle East and even close to the Persian Gulf. The Russian Ministry of Defence has long since proclaimed its desire for this regional network of naval bases, and experts are no less candid in explaining the strategic justification for this policy. Thus Mikheyev also said the Caspian Sea is a valuable asset for the Russian military as it is located close to the Middle East and directly borders on Central Asia. "The Syrian operation showed that the Caspian Sea is a safe launching pad for cruise missiles. It can accommodate our warships armed with high-precision weapons. The sea is out of reach for potential adversaries and third country navies," he said. Also in this vein, the Russian newspaper Gazeta.Ru cited an anonymous high-ranking official in the Ministry of Defence on 21 November 2017 as stating, "The Russian military presence in the Eastern Mediterranean is necessary for keeping the balance of power and the interests that we lost after the USSR's [Union of Soviet Socialist Republics'] disintegration 25 years ago." Beyond this development Russia has for some time shown this intention with prior statements and actions to ensure a network of bases from Cyprus and Syria to Egypt where Moscow has expressed an interest in a base, Libya, where we can expect a request for a base once that country

Fellow at the European council on Foreign Relations in London, has commented that, "Russia could get a foothold in Libya that could be helpful in strengthening its overall position in the Mediterranean." He also noted that, "There is increasing talk of a Russian base or even just docking rights in Benghazi. Coupled with Syria and in view of the rising ties with Egypt, this would allow Russia to have a much stronger position in this part of the world."

Meanwhile, in Yemen's case, Moscow has dramatically upgraded its political profile in Yemen's civil war. Russia's deepened commitment to ensuring a ceasefire in Yemen can be explained by a mixture of strategic considerations and broader geopolitical aspirations. From a strategic standpoint, a cessation of hostilities could allow Russia to construct a naval base on Yemeni soil. Even though the Russian February statement on Yemen did not include a reference to the construction of a potential base, a Russian military official told ITAR-TASS in 2009 that establishing a naval base presence in Yemen was a medium-term strategic objective. A Yemeni base would have significant strategic value for Russia, as it would increase Moscow's access to the Red Sea's shipping lanes and the Bab el-Mandeb Strait, which links the Red Sea to the Gulf of Aden.

This base, presumably at or near Socotra where the Soviet Union had a base, would give Moscow significant monitoring and

a Russian air base and allow Russia freedom to use its air space (undoubtedly to fight anti-Russian forces in Libya). Furthermore, President of Sudan Omar Al-Bashir announced he was seeking Russian protection and arms against the United States and discussed with President Putin the idea of a Russian naval base on the Sudanese coast. And at the end of the year, Russia announced that its Syrian naval base at Tartus will be upgraded to the full status of a naval base and will be under Russian control for 49 years, along with the Khmeimim air base. The strategic implications of these Russian moves are enormous. Moscow will undoubtedly utilise its Egyptian air base to strike at anti-Russian and pro-Western factions in Libya. It also now has acquired for the first time direct reconnaissance over Israeli air space and increasing leverage through its Egyptian and Syrian air bases upon Israel, something Israel has sought to reject since its inception as a state. In addition to the projected base in Sudan it now has the capability to strike at Saudi targets as well.

However, the dimensions of Moscow's achievement go much further. These bases showcase Russian military and political influence throughout the region. Moscow will now have strike and/or ISR capabilities across the entire Middle East. In practical terms this means that the bases in Syria, Egypt, and probably in Iran give it the capa-

bility, along with its other bases inside Russia, including the Crimea, and in Armenia, to project power across the entire breadth and length of the Middle East, much if not all of the Eastern Mediterranean, the Suez Canal, and the Red Sea. Bases in Libya, Cyprus (which it has also sought), Yemen, and Sudan would also extend that range to the Central Mediterranean, including Italy and parts of the Balkans, the Arabian Sea, Indian Ocean, and the Persian Gulf. Closer to home, Moscow would have secluded the Caucasus and Central Asia from Western power projection capability, drawn a cordon around Turkey, and be able to threaten Israel in ways Soviet leaders could have only dreamt about. Meanwhile, Russia will probably deploy its fire-strike weapons and integrated air defences across these bases. Should Moscow outfit these naval and air bases with UAV, UCAV, UUV, EW, and ISTAR capabilities and long-range cruise missiles, as is likely, Russia could then contest Western aerospace superiority throughout the atmosphere over these areas. In other words, given the bases already acquired and those that Moscow still seeks, a naval base in Alexandria, bases in Libya and Cyprus, Moscow would be able to contest the entire Eastern Mediterranean. And given its strong ties with Algeria we should not rule out the possibility that it seeks a deal along these lines with that government as well. With the ability to contest the entire Mediterranean, it will place NATO land, air, and/or naval forces at risk. Should Moscow also acquire those new bases, it will then be able to deploy its long-range strike capabilities and integrated air defence network at all those sites and integrate them into a single overarching network, as it has done at its existing bases. Then it will have coverage of the Mediterranean, Black Sea, Caucasus, and Central Asia, and the Gulf that would make any Western operation in any of those theatres extremely hazardous and costly. Given the existing bases in the Black Sea, Caucasus, and the Levant, Turkey is already almost totally surrounded and Balkan states and Italy could be vulnerable as well. Arguably, Russia is attempting to create what Marshal Ogarkov once called a reconnaissance-strike complex across the Mediterranean, Red Sea, Suez Canal, Caucasus, Central Asia, and Persian Gulf by integrating its ISR and fire-strike capabilities from these naval and air bases. This is not only an issue of challenging the West's reliance on an aerospace precision-fire strike in the first days of any war and thus Western and American air superiority. These capabilities also threaten international energy supplies, because Moscow can then use the threat

of its naval and/or air power in the Persian Gulf, Red Sea, Suez Canal, and Mediterranean to interdict or curtail energy supplies that traverse these waterways.

Thus completion of this network of naval and air bases not only challenge Western aerospace superiority, naval assets and lines of communications, and key NATO or Western allies, these bases also consolidate Russia as a key regional arbiter and also as an arbiter within each country's politics where it has bases, for example Syria, Libya, Yemen, and Sudan. Moscow also stands to gain enormous leverage on Middle Eastern energy supplies to Europe because it will have gained coverage of both defence threats and international energy trade routes. Undoubtedly, it will then take advantage of all these situations and assets to attempt to free itself from sanctions by pressuring Middle Eastern countries as it is doing already or by pressuring European states to repudiate the sanctions.

At the same time, Moscow will also likely revitalise its ongoing proposals for a vast but nebulous anti-terrorist campaign that

Azerbaijan, into its orbit through combined economic, ethnic, military, and political pressures, it is also ensuring that these countries will be placed behind an air defence umbrella. Completion of that umbrella would then allow the Russian army and/or navy to advance into them if necessary and to do so with impunity since Western forces would be deterred by the likely high rate of casualties they would incur. Indeed, when this system is complete Moscow need not invade but only threaten to undermine the sovereignty or integrity of these countries, or their pro-Western affiliations and economic-political ties.

But beyond the Caucasus and Central Asia, Moscow also wants to project lasting and long-range military power into the Middle East and connect it to those installations it is now building in the Caucasus, Central Asia and the Middle East. So while Russian naval operations and undersea threats to the SLOCs in the Atlantic and Mediterranean are formidable and important threats that merit constant and close scrutiny, they are only part of a grander naval and mari-

Photo: Kremlin



Vladimir Putin giving a speech at Russia's Khmeimim Air Base in Syria in December 2017.

legitimises its seizure of Crimea and the Donbass. Meanwhile, in the Middle East, its main interest is not peace but the controlled or managed chaos of so-called controlled conflict. Since "power projection activities are an input into the world order," Russian force deployments into the greater Middle East and economic-political actions to gain access, influence and power there represent competitive and profound attempts to engender a long-term restructuring of the regional strategic order. Ultimately, clearly, Moscow is not content merely to dominate the Caspian and Black Seas and their littorals. In other words, as Moscow moves to manoeuvre Turkey, as well as Georgia and

time design that go back at least to 2008/9, as we have seen. Moscow's naval probes in the southern tier therefore merit no less careful and constant scrutiny by NATO and its Middle Eastern allies. If we remember that the cardinal point of the post-Cold War settlement was the indivisibility of European security and keep in mind how imbricated European and Middle Eastern security are, then we can see this naval grand design in the light of Moscow's professed desire to overturn that post-Cold War settlement and the total nature of the naval threat to Western security that is generated by Russian policy in Europe and the Middle East as a whole. ■

The Nagorniy-Karabakh Conflict: A Simmering War on the European Periphery

Gayane Novikova

European security is under siege. Several factors make it vulnerable to correlated internal and external threats.

Shaping the European Security System

The reaction of European societies to major internal threats is manifested in Brexit, in the German elections, in the referendum on independence in Catalonia and the response of the Spanish Government, in the approach of the Visegrád Four to certain key issues, in Turkey's foreign and domestic policy and, last but not least, in home-grown terrorism. Although the fight against uncontrolled migration is a priority and controversial issue in many European societies, vulnerability at the EU's external border is a growing concern.

These developments require a re-evaluation of the scale of (in)security and threats for each European state and for the European Union in general, especially in the context on the one hand of growing nationalism and, on the other hand, of both an unpredictable US foreign policy and a prolonged standoff with Russia. The EU has become increasingly nervous about the confrontation between the US and Russia, which reminds us of the first Cold War. In the context of the Cold War 2.0, the wars in the immediate (Ukraine) and distant (South Caucasus, Middle East) neighbourhoods – where Russia's direct involvement is obvious – demand more attention. A new strategy for unresolved conflicts on the periphery of Europe should be based on the recognition that European security depends on security in its neighbourhood. On April 2, 2016, a small war involving the direct participation of two independent South Caucasus states – Armenia and Azerbaijan – resumed on the European periphery. It made only a few headlines in the world's leading mass media. Military clashes in and around Nagorniy Karabakh



Photo: Nikolas Babaian, Wikipedia CC

Destroyed Azeri tanks in Nagorniy Karabakh



Graphics: Achemish, Wikipedia CC

(NK) and along the Line of Contact (LoC) between Azerbaijan and the unrecognised Republic of Artsakh and Azerbaijani artillery attacks on Armenia once again confirmed that a) this conflict was never

"frozen"; and b) the conflict can be transformed into a full-fledged war. Recent developments have indicated that even minor "turbulence" can have a broad negative impact not only upon the three direct par-

ties to the conflict, but also upon their neighbouring states: Georgia, Turkey, Iran, and Russia. This article discusses the question of whether the unresolved Nagorniy Karabakh conflict influences the European security system, and if so, to what extent.

To Be or Not to Be Involved?

The NK conflict is the oldest of the conflicts that erupted on the eve of or immediately after the dissolution of the Soviet Union. Its internal logic is defined by the completely different narratives of the direct parties to the conflict – Armenia, Azerbaijan and the unrecognised Republic of Artsakh (until February 2017, the Nagorno-Karabakh Republic). In the course of more than 25 years, the dynamics and character of this conflict have changed. Beginning as a confrontation between the Nagorno-Karabakh Autonomous Region and the central government of Soviet Azerbaijan in 1988, it quickly escalated into an ethno-political internal conflict that – after proclamations of independence by the Nagorno-Karabakh Republic, Armenia, and Azerbaijan in 1991 and a three-year war (1991-1994) – transformed into the international Nagorniy Karabakh conflict.

The position of the European Union and its Member States has also changed over the years. First, the NK conflict that erupted in the then territory of the Soviet Union naturally was considered as an internal issue. The West in general had no intention to intervene.

Secondly, the beginning of the 1990s was one of the most painful periods in European post-WW2 history. The pacification of the Balkans in the mid-1990s required significant political, diplomatic, economic, and military efforts; and membership of the Balkan states in NATO and the EU has been considered the most important mechanism for the achievement of peace and stability in Europe. With all its "small" wars the South Caucasus was beyond the range and mainly out of the interest of European policy- and decision-makers.

Therefore, the West took very cautious steps toward the integration of Armenia and Azerbaijan into some European institutions and avoided any promises regarding their membership in NATO and the EU. The European states, above and beyond developing bilateral relations with these two South Caucasus states, were acting within the framework of "soft power": They viewed their own mission as one of stimulating democratic structures and institutions, enhancing good governance and rule of law; and promoting and improving human rights in Armenia and Azerbaijan (via their membership in the Council of



Photo: Marshall Bagramian, Wikipedia CC

An Armenian T-72 tank memorial near the outskirts of the city of Stepanakert, Nagorniy Karabakh. The tank was advancing to attack Azeri positions in Askeran, where it hit a mine. All occupants were killed in the explosion.

Europe (CoE), OSCE, and several EU programmes). It was comforting to believe that democratisation of these South Caucasus states would reduce political-military tensions and gradually create peace in this region. The dominant vision among the EU and CoE member states was to approach Armenia and Azerbaijan simultaneously and to offer the same initiatives and programmes. The EU was very clear about its main priority areas in cooperation with these states. A slightly differentiated approach – with moderate recognition of differences between Armenia and Azerbai-

jan and of unique aspects of each of them – was introduced through the EU Eastern Partnership Programme. None of these initiatives was and is still related directly to the resolution of the Nagorniy Karabakh conflict. The unrecognised Republic of Artsakh is not included in any EU programmes.

In the "Comprehensive and Enhanced Partnership Agreement between the European Union and Armenia" (signed at the Eastern Partnership Summit in Brussels in November 2017), the parties to the Agreement have recognised "the need to achieve that [the NK conflict – G.N.] settlement on the



Photo: NATO

The President of the Republic of Armenia, Serzh Sargsyan, visited NATO in February 2017 in Brussels and met with NATO Secretary General Jens Stoltenberg.

basis of the purposes and principles enshrined in the UN Charter and the OSCE Helsinki Final Act, in particular those related to refraining from the threat or use of force, the territorial integrity of States, and the equal rights and self-determination of peoples and reflected in all declarations issued within the framework of the OSCE Minsk Group co-chairmanship."

As a leading political-military organisation in Europe, NATO attempts to provide (in addition to bilateral programmes) a platform for cooperation between Armenia and Azerbaijan through its PfP programme. It does not have any intention to be involved in the NK conflict. Furthermore, this unresolved conflict, with its potential to transform again into full-scale military clashes, on the one hand has been determining NATO's interaction with two states. On the other hand, Azerbaijan does not want to become a member of any military bloc and Armenia is a founder state of the Russia-led CSTO. These two South Caucasus states are rendering their participation, in particular, in the joint NATO military exercises dependent upon participation of the adversary. A recent example is the bizarre (non)participation of Armenia and Azerbaijan in the Noble Partner exercise in Georgia (the first large-scale practical NATO initiative gathering Georgian, Armenian, and Azerbaijani troops to perform a common task) in September 2017.

Photo: President of the Nagorno Karabakh Republic



A meeting aimed at conflict resolution between the President of the self-proclaimed "Nagorno Karabakh Republic" and the OSCE Minsk Group co-chairs in 2008.

The only European organisation directly concerned with the NK conflict is the OSCE and its Minsk Group (MG, co-chaired by France, Russia and the USA). Several objective obstacles reduce the effectiveness of the MG. Among them is a clear intention to balance the OSCE approach to the parties to the conflict: the wording of its resolutions was quite cautious and as neutral as possible; both Armenia and Azerbaijan had

reasons (although different) to blame the MG for not being precise. After the April 2016 war, the MG slightly modified its approach, trying to introduce a more realistic evaluation of the situation in the area of the conflict: "There is no military solution to this conflict and no justification for the death and injury of civilians. We are also aware of allegations of atrocities committed on the field of battle in April, which we condemn in the strongest terms[...] We urge the parties to remove all remaining obstacles to expanding the mission of the Personal Representative of the OSCE Chairperson-in-Office and to make progress on a proposal to establish an OSCE investigative mechanism" (see: "Joint Statement by the Heads of Delegation of the OSCE Minsk Group Co-Chair on December 8, 2016"). In spite of criticism (more broadly from Azerbaijan and more specifically from Armenia), for now the OSCE MG is the main and single platform for the Armenian-Azerbaijani dialogue that is conducted on the level of the Presidents with indirect involvement of the Republic of Artsakh; and the only platform for French-Russian-American cooperation in the conflict resolution field. Against the background of European relative passivity, a trend exists towards visible domination by Russia in respect to developments around Nagorniy Karabakh. Russia is gradually becoming a main external actor, using its political and military (in the case of Armenia, also economic) leverage to prevent a worst-case scenario in close proximity to its southern borders. Owing to its strategic interaction (that includes also a strong military component) with two parties to the NK conflict, Russia is not ready



Photo: OSCE

Ambassador Andrzej Kasprzyk, the Personal Representative of the Chairperson-in-Office during a meeting of the OSCE Permanent Council, Vienna, 3 November 2011. He represents the CiO in issues related to the Nagorniy Karabakh conflict, assists in achieving an agreement on the cessation of the armed conflict and in creating conditions for the deployment of an OSCE peacekeeping operation.

to choose sides; rather it is interested in preserving the status quo – at least in the mid-term perspective. There is a noteworthy nuance: If Armenia proper is attacked by Azerbaijan, a new war can be easily transformed into a large war with Russia's involvement. This transformation can happen in accordance with several bilateral Armenian-Russian military agreements. On October 5, 2017, the Armenian Parliament ratified an agreement on establishing a joint Russian-Armenian military unit that includes troops of the 102nd Russian military base stationed in Gyumri and the 4th Corps of the Armenian Army. In peacetime, this unit will be subordinated to Armenian military structures, while Russia's Southern Military District will take command in war periods.

This step is a logical extension of the Armenian government's efforts to make Russia's military presence in Armenia stronger and to secure the latter's role as its important security guarantor. The apologists of this agreement argue that it will restrict Azerbaijan (and Turkey) from military actions against Armenia. I would argue that this agreement would not prevent Azerbaijani attacks against the unrecognised Republic of Artsakh. Furthermore, in the course of the April war in 2016, when Azerbaijani artillery was bombarding Armenia's territory, Azerbaijan received signals that Russia, as well as other members of the CSTO (Collective Security Treaty Organization), will be reluctant to support Armenia in its overt conflict with Azerbaijan around Nagorno Karabakh.

Russia's growing influence upon the parties to the conflict is a source of concern for the EU. As a Head of the European Commission office in Yerevan mentioned, "[The EU] cannot accept the reality in which some part of this region becomes the territory of someone's absolute influence. We don't want to return to the zero point [in the relationships – G.N.] with our partners. We don't want to play geopolitical games." However, the EU does not have a *modus operandi vis-à-vis* Russia in dealing with conflicts in those areas Russia views as crucial for its own security.

The NK Conflict and the European Security System

There is no likelihood of reducing tension between the parties to the NK conflict or any possibility of progress at the negotiation table in the foreseeable future. Both sides are firm in their approaches, and both have their own reservations, fears, and mistrust. Under these circumstances a small local war (although very damaging for its immediate participants) cannot be

excluded. The question involves to what extent it will affect the European security system in general.

The European institutions dealing with political-military security issues have their motives for avoiding any direct involvement in the unresolved conflicts of the South Caucasus. The annexation of Crimea and the small-scale war in Eastern Ukraine forced the Trans-Atlantic partners to take actions not only because of a rough violation of an international border

parties to the conflict need to reduce possible tension(s) in their respective societies.

- The economic attractiveness of the region for the EU in general is quite low not only because of the small scale of the local economies, but also because of a high level of corruption; a possible flow of migrants – as a consequence of an overt war – from the area of the conflict will not pose threat to the European job market.



Photo: David Stanley, Nagorno Karabakh Defence Army

Troops of the self-proclaimed "Nagorno-Karabakh Defence Army" assemble before the National Assembly building on Renaissance Square in Stepanakert, Nagorno Karabakh.

and the sovereignty of Ukraine, but also because Ukraine, with its immediate proximity to the EU borders, is a "buffer zone" between the EU and Russia.

In comparison to the Ukrainian situation, the simmering war in the South Caucasus is not viewed as a direct threat to the European security system. A cool-headed approach can be explained by several factors, which reduce EU strategic interests in this region:

- As long as a balance of forces is preserved in the South Caucasus, Russia, Turkey or Iran will not participate in military clashes in the area of the NK conflict. Their involvement will be limited by statements encouraging the parties to the conflict to resume negotiations.
- There is a very low-level probability that military actions will spread across the internationally recognised borders of Armenia and Azerbaijan. The NK conflict will remain a local war with its internal logic; it will reach its peaks when the

The Nagorno Karabakh conflict does not pose a direct threat to the European security system. Meanwhile, it is an irritating factor in bilateral relations of the European states and pan-European organisations with Armenia and Azerbaijan. It is also a leverage utilised by Russia to reduce the manoeuvrability of these two states and to limit their cooperation with the EU and NATO. Although the myth that this conflict is "frozen" has been dispelled, European institutions will nevertheless remain mainly external observers owing to several reasons: The parties to the conflict in general do not trust Europeans and do not wish their involvement in the conflict settlement, and the EU states, some of which are dealing with secessionist movements, view involvement in this conflict as very complicated and even dangerous. The European (and Russian) approach to the NK conflict will be unchanged as long as it simmers within Azerbaijan's internationally recognised borders. ■



Viewpoint from Jerusalem



The USA and Israel: A Solid, Trustworthy Alliance

Tamir Eshel

Following eight years of derailed relations between Israel's right-wing Prime Minister Benjamin Netanyahu and the US White House under Democrat President Barack Obama, the election of President Donald J. Trump brought a big sigh of relief in Jerusalem. It took few months to align expectations with realities, on both sides. Although some of the right-wing politicians in Jerusalem expected the new administration to give Israel a free hand to do anything they like, Washington remained reasonably neutral in its view of the conflict between Jews and Palestinians and openly stated that it has no intention to impose a plan.

The main change was in attitude, that eased the draconian limitations demanded from Jerusalem to cease construction in Israeli settlements in the West Bank. On the other hand, Washington left the lines open with both sides, as well as other parties in the region, encouraging "confidence building".

It was hoped that a balanced announcement by Washington, backed by the moderate Arab nations, would pave the way for a dialogue between the Israelis and Palestinians. Israel was open to discuss such a "deal", as were most of the Arab countries that the US administration involved in the process. But the Palestinians held firm against change and instead turned to reconciliation with their domestic foe - the Hamas movement. After few months with no new developments, President Trump announced the US's recognition of Jerusalem as the capital of Israel; a unilateral move that raised protest and anger throughout the Arab world, but surprisingly little opposition among some countries - probably those that understood the motivation for the move.

However important the Israel-Palestinian deal is, this is a sideshow to more pressing issues that trouble the leaders of the region and throughout the world. As the Middle East erupts into rapid and violent change, Iran has quickly seized positions of influence throughout the Middle East; Iraq, Syria, Lebanon, and Yemen have all fallen under Iranian influence or dominance. Even the Joint Comprehensive Plan of Action (JCPOA - also known as the 'nuclear deal') with Iran, loathed by President Trump, Benjamin Netanyahu and the Saudi regime, is not as critical as it used to be, and could be opened for renegotiation under a firm and continuous US pressure. The time is right for such change, as in eight years, when JCPOA expires, Tehran's dominance of the region will be bolstered by the military and political gains it achieves now, and the nuclear weaponry it will be free to produce.

The mutual interests of Washington and Jerusalem are aligned with the perspectives of Saudi Arabia, Jordan, and many of the moderate Arab nations in the Gulf, although each country's perspectives may differ in the detail. Those countries have discretely established bilateral relations with the Jewish state in recent years. This trend is based on the understanding of Israel's unambiguous antipathy towards Iran, and its strong ties and influence with the US administration.

In recent years Israel demonstrated a relaxed attitude toward US Arms sales to Middle Eastern nations considered to be moderate. Israel and the USA have a common interest to help the Gulf States and Saudi Arabia since those countries are the first to confront Iranian expansion and Shiite influence in the Middle East. This new policy contrasts with Jerusalem's and the US Congress' attitude that vocally objected to such sales in the past. Arms acquisitions by the Gulf States and Saudi Arabia amount to hundreds of billions of US\$ and include highly advanced fighter planes, smart weapons, and missile defence systems: the most recent is the proposal of F-35 LIGHTNING II stealth fighters to the UAE and the sale of F-15QAs to Qatar. The sale of such advanced weapons is an unprecedented act that, in the past, was perceived as undermining Israel's qualitative technological superiority in the region. Such superiority has been guaranteed by Washington since the 1980s as part of the US-Israeli strategic understanding and it is unlikely that such a proposal was made without prior consultation with Jerusalem. Israel may also be involved, directly or not, in arms sales to some of these countries. Recent news reports indicated that Saudi Arabia is interested in acquiring defensive means to counter Houthi rocket attacks from Yemen, and their weapon of choice is the Israeli IRON DOME, available from the USA via Raytheon.

Despite its close relations with Israel, Washington is pursuing its own policies and agenda in the Middle East, which sometimes conflicts with Israel's point of view. In July, Israel was surprised when the US administration negotiated a plan for a ceasefire in Syria that ignored Israeli concerns.

Despite the differences, the two countries remain bonded. US presidents and Israeli prime ministers come and go, but the bilateral relationship, valuable to both countries, has faced difficult times and endured. With thriving economic, military, and diplomatic assistance, the USA and Israel remain solid and reliable allies - the current two administrations have shown that the Israeli-American bond is strong and lasting.

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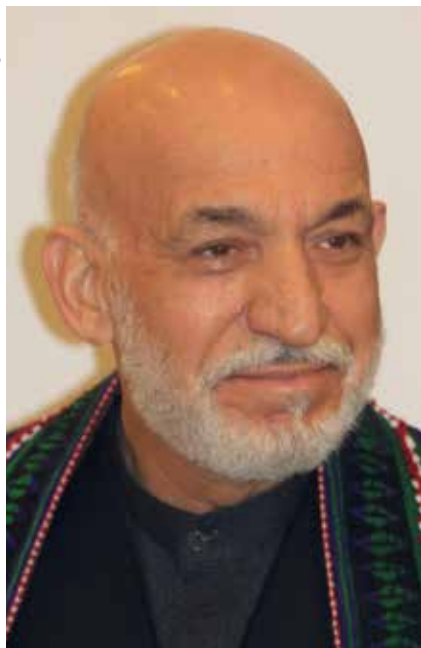
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 **COGES**

"The heart of our problems beats in Pakistan..."

Photo: Georg Mader



Interview with Hamid Karzai, former President of Afghanistan.

In mid-January, former Afghan President Hamid Karzai visited Vienna on invitation of the Austrian Institute for European and Security Policy (AIES). He was received by Federal President Alexander Van der Bellen for an informal background discussion at the Hofburg and an exchange on the current situation in Afghanistan and the region but also on Afghan migrants in Austria and Europe, an issue potentially relevant to election outcomes. AIES-chairman and former Minister of Defence, Werner Fasslabend, also organised a gathering at Vienna's Diplomatic Academy to which he invited ESD as well. The long-standing leader of the Islamic Republic of Afghanistan patiently answered a whole series of questions about the complex and discouraging security situation of his war-torn homeland, for which he wishes and prays above all for prosperity and security.

ESD: Before discussing the situation in your country, what is your message to leaders and journalists here in Europe?

Karzai: It is twofold. First of all, I would like to express my gratitude for what Europe is doing - including for its own security - to help and stabilise Afghanistan. Remember: We are closer to you in geography and history than the Americans. On the other hand, I have a message for the many thousands of Afghans who have come to Austria and Europe. Not everyone is a classical refugee under the Geneva Convention, but some understandably aspire to a better life. To them, many of whom come to events where I am allowed to speak, I shout: "Behave well, integrate unconditionally and adapt! Follow the laws of the host country and respect its norms, standards and traditions. Work hard and don't rely on social welfare, or only for a short time. Instead, study and learn, and if you are well educated, you will return to your country to rebuild it! All these Afghans who have come to Europe can and should return! We need them."

ESD: A nice call! Many more people should actually hear it, not least because of the repeated sexual crimes and rapes committed by young Afghans in Europe, as you may have heard. There are also figures showing an above-average suspicion rate of radicali-

Photo: Georg Mader



Hamid Karzai, former President of Afghanistan, speaking at the Vienna School of International Studies in January 2018.

sation and terrorism in Germany or Austria. Do you have any explanations?

Karzai: To be honest, no. This high proportion of Afghan citizens in your unquestionable crime statistics hurts and upsets me, because that is inexplicable to me! In general, because of the fate of the refugees for decades, we consider our people to be particularly capable of integration and hardworking. This may have something to do with the very different cultures in terms of gender relations, but this is no excuse for assault. Once again, Afghan society has traditionally been extremely respectful of

women. With regard to Islamic radicalisation, I suspect a "guiding hand" that must have guided these individuals. Pakistan in particular is trying to seduce young Afghans into violence - not only in Afghanistan, but apparently also in Europe via the Internet. Lawsuits in Germany have shown that there is not only a militant pipeline bringing recruits to the FATA tribal areas of Pakistan, but also a parallel pipeline in which extremists in Germany send money and equipment to German militant comrades in Waziristan. This is a major problem, because in the end, poorly educated peo-

ple fall victim to a completely false image of Islam. If such abused men survive the fight against combat aircraft and mortars, they don't belong here and there. They are wild but lost souls.

ESD: Let us turn to the current rather gloomy security situation in your country. Western nations and especially the United States, in cooperation with the Afghan army and security forces they equip and train, are still fighting the Taliban. But many people wonder how loyal Afghan leaders like you stand to these efforts and to the billions they have spent.

Karzai: All support and financial aid is a good thing. And I think that, in principle, I and others can underline the loyalty to the United States, which has been linked to its long-standing activities against Islamists in Afghanistan since 11 September 2001. But for 40 years Afghanistan has been a blood-soaked ground for wars involving foreign powers. After 11 September 2001, the United States and NATO began fighting the Taliban, which continues to this day. At the same time, however, we also demand respect for the country's legitimate institutions and - let us call it that - a "re-legitimation" of the US presence. It is true that after so many years since the Soviet invasion of 1979, Afghanistan has built up a "warrior community" and the will to fight, but at the same time has lost its defensive capacity. It takes time to build an independent and loyal security force, but we acknowledge our responsibility. When asked about their common loyalty to the American and Western armed forces, Afghan citizens talk all about too many civilian casualties in the wake of not always so "surgical" US attacks. On the other hand, I also appreciate what the United States and others are doing to equip and support our own forces. These are now more than 300,000 and, thanks to our partners, they are getting better trained and equipped.

ESD: Nevertheless, 2017 was a successful year for the Taliban. According to Taliban propaganda, which claims to fight the foreign invaders led by the USA until the expulsion from the "holy land", 40% of Afghanistan have already been "cleansed". So is the presence of Western troops the cause of the never-ending war - or the only possible solution?

Karzai: Please let me explain. After 11 September 2001, the Afghans welcomed Western troops as friends who, together with heroes like Shah Massoud, liberated the Afghan people from cruel and medieval Taliban rule within a few months. As a result, there have been many positive chang-

The Current Afghan Security Situation

2017 ended in bloodshed and political power struggles. In Kabul, the year ended with a suicide attack in which 40 civilians were killed. In 2018, the country could probably once again be plunged into violence, with at most a little bit of political order. Even in urban areas, the unpredictable presence of Taliban, IS or Al-Qaeda (although these groups are very different, as Hamid Karzai explained, the "outcome" is the same for the average Afghan) should not be underestimated. According to the UN, more than 11,500 civilians were killed or injured in 2016. In the first three quarters of 2017 there were at least 8,000 civilian casualties - figures that will not decrease significantly in the foreseeable future. The Taliban insurgents continue to play a strong role on the battlefield. Currently at least 40% of the country is controlled or threatened by them. There is a rather small but active "foreign" IS cell. In the worst case scenario, the construction of an Afghan nation-state could collapse in 2018 as a result of these power games. In order to prevent this, the Trump administration announced in August of last year a new plan for Afghanistan, involving 3,000 to 4,000 additional troops to end the stalemate there. At the beginning of January, President Trump announced that he would send more UAVs and about 1,000 new military advisors to Afghanistan. The larger fleet of armed and unarmed drones will provide air support and collect the ISR. In addition, the Pentagon plans to add more helicopters, vehicles, artillery, etc. to the list. At the height of the ISAF mission, 150,000 foreign troops were stationed in Afghanistan; today it is about 17,000. In 2016 Germany has strengthened its forces in the Hindu Kush and currently has about 1,000 in Masar-i-Sharif and Kabul. Since 2016, the Afghan Air Force has been using the US-funded EMBRAER A-29 Super Tucano COIN aircraft and MD530F attack helicopters.



Afghan Security Forces undergo military training.



US Forces of the 32nd Rgt. receive briefing in Northern Afghanistan.



Photo: US DSCA

A US-sponsored MD-530F attack helicopter of the Afghan Air Force

es, such as schools for girls, the number of which has multiplied. The Afghans could finally feel that they were once again the owners of their land. It worked well for a few years. But then the setback began - and it came from Pakistan: terror, suicide bombers, weapons, etc. And the US persistently ignored these developments, even though the Taliban were obviously armed with weapons from over there. The US governments - I have argued from Bush to Obama - regarded Pakistan as an "ally" and instead bombed Afghanistan, regardless of the civilian population. They have wiped out entire families, invaded homes at night and disregarded Afghan identity. The positive and at first really grateful mood in the population changed because the Americans turned friends into opponents - not intentionally but with their deeds.

ESD: So you are saying that the United States would have done better to solve Afghanistan problems in Pakistan?

Karzai: Exactly. And they should have done

that 15 years ago! It is certainly not only the inability of the Afghans to end the war and ward off the then disorganised and militarily defeated Taliban. But our allies did not care in time about Taliban hideaways beyond the Pakistani border. The Americans did not pay attention to what they saw, or they did not see what was going on, even though they had all the technical means at their disposal.

ESD: But now US President Donald Trump is putting pressure on Pakistan when he twittered: "The US will no longer invest as much aid in Pakistan as under former presidents - more than US\$33Bn in the last 15 years - as long as this country does not contribute to but hinders the fight against terrorism in Afghanistan."

Karzai: Years too late, but good! I have long accused Pakistan of not doing enough to shut down the Taliban hideaways in Pakistan. But US regional policy was also a disappointment. I therefore welcome President Trump's clear mes-

sage. I also propose a joint coalition between the United States and the region to put pressure on Pakistan to bring peace not only to Afghanistan but to the region as a whole. Up to India, the heart of all problems beats in Pakistan. Not in the people of Pakistan, don't get me wrong! They are our neighbours, brothers and often relatives. But in Pakistan's military and intelligence apparatus. Today, the Taliban are in reality Afghans and not the medieval foreign Qoran students who they were in the past. But Pakistan is still hosting them. Nevertheless, I do not want Pakistan to be attacked; I am a pacifist. But I want Pakistan to correct its policy.

ESD: Is it now too late for the Afghans to regain confidence in American and Western troops?

Karzai: No. If they bring security through training and equipment, if they do not wage war with as many civilian victims as in the past, it is not too late. The problem is not the presence of troops, but their behaviour, their sometimes indiscriminate methods...

ESD: I was on board the active US carrier CVN-75 a few years ago during the OEF operations and witnessed that the F-18s, more often than not, returned still carrying their ordnance because there was no "go" due to unclear intel about possible collateral damage.

Karzai: You're right, things have improved in recent years. On the whole, however, people have suffered too much since 2011. There are inevitable or inherent errors, not in the drone itself, but in the reconnaissance chain or in time-lapse.

ESD: You have often been criticised for trying to integrate the Taliban into a larger solution. Now you mentioned once again

Photo: US DSCA



American-sponsored helicopters of the Afghan Air Force at an helicopter apron near Kabul.

that the Taliban are in fact Afghans, compatriots. Could we then imagine reaching a final political agreement with them? And under what conditions?

Karzai: Absolutely! An agreement based on Afghan reality. We are a deeply religious country, but for decades we have been a society on which foreign ideologies have been forced. A country that has become a stage for extremism and therefore if I call for an agreement along the reality of Afghan life. Along the achievements and cultures of our country but not compromising on the right of women and their access to school and education. Also no compromise on the right to free elections - no compromise on fundamental human rights.

ESD: Ultimately, such a negotiation solution would have to be approved by a Loya Jirga, the traditional grand tribal assembly. Should such a meeting be convened and would it be possible to organise one under the present circumstances?

Karzai: Of course it is. Although I did not want to be understood as an opponent of the current Afghan leadership, the Loya Jirga is the highest legitimacy in this country. But the United States have always been against another incantation. They fear that the Loya Jirga will ask them to withdraw from Afghanistan. But it wouldn't do that! It would only ask them to behave better, to respect the laws and traditions of this country. The Loya Jirga unites the rationality of the people of this country in all periods of history. And this rationality would not call on the USA to withdraw. Nobody would vote against stability.

ESD: But now, to complicate the stability, there is IS or Daesh. Recently, bloody terrorist attacks have taken place in Afghanistan and all the way to Kabul. The black flag of IS is waved. Is there a new danger?

Karzai: IS and Al Qaeda - long led by Bin Laden from Abbottabad in Pakistan - belong together. But neither of them are Afghans or compatriots, unlike most of the Taliban. These are completely foreign elements that come from abroad and cannot even communicate with the local population. Originally they came from Pakistan, where they invaded from abroad. Now it seems that they also come from Syria and Iraq. They have no power to conquer Afghanistan as they once did in Iraq, but they can evade into Pakistan's FATA territories. No doubt, IS is a clear danger and there is no type of conversation that is possible or makes sense with them. It must be defeated, wiped out....

The interview was conducted by Georg Mader.



Photo: Via author

Taliban "having a break"



Photo: Via author

Afghan Taliban in local conversation



Photo: US Army

A US Army outpost in Afghanistan

"The need for a strong, competitive air force has become evident!"

Photo: Joel Thungen / Forsvarsmakten



Major General Mats Helgesson

**Interview with Major General Mats Helgesson,
Commander of the Swedish Air Force (Flygvapnet)**

In recent years, the strategic and the airspace situation around and above the Baltic Sea has worsened. The Swedish Armed Forces are a watchful observer and sometimes partner with their Scandinavian neighbours and NATO, while still adhering to the general security orientation of this non-aligned nation. Against this backdrop and with the purchase of "big ticket" equipment and some other modifications, Flygvapnet is confident that it will "send a clear signal of enhanced capabilities to potential opponents in our common and vital home region", as Flygvapnet's commander explained to Georg Mader of ESD. Sweden has approved its largest defence budget in more than 20 years, with a €2.6Bn investment in defence until 2020.

ESD: MajGen, let's start with money, the ever-pressing funding issue. In our last conversation in mid-2016, you rightly said that no commander except in the UAE or China has enough money. But does Flygvapnet expect to see a proportion of the increase in Swedish defence expenditure covering reasonable operations AND the planned investments?

Helgesson: Well, that was honest then and it is honest now. What is 'enough'? We have been given more money, which is something we have been requesting for a long time. This is very positive, but just a step in the right direction. Because it is not really as much as we think we will or might need. Nevertheless, you are right – recent tensions and developments in and over the Baltic Sea have prompted Sweden to improve its defence capabilities. The need for a strong, competitive air force has become increasingly evident – that goes for most politicians. The Armed Forces will soon make a decision, regarding how the money will be divided between the services and shared between the different material acquisition projects. From Flygvapnet's side we have made our arguments in conjunction with our future tasks and requirements on our future material projects.

ESD: You have referred to the situation in the Baltic. Since 2014/2015 we have seen many reports of Russian Su-27 entanglements or '(too) close calls', when intercepting Swedish ELINT-"KORPEN" (Swedish name for the ELINT/SIGINT S102B "Gulfstream") aircraft and NATO/Finnish aircraft as well. Is this still going on? No calls, no transponders? And have those Il-20 or Tu-22 aircraft forced you to change QRA-procedures or organisation? Do your current political leaders take the issue seriously? Is there a media uproar or downplay?

Helgesson: There are many nations now patrolling the Baltic airspace. Sweden is one of them and Russia is another, along with several other nations. It is true; there are occasional close encounters and/or aircraft without active transponders and/or communication. But Sweden, together with other nations, are using QRA assets to do a VID (Visual Identification), follow these aircraft and thereby support the civilian ATC with the locations of the 'unknown' contact. Swedish Armed Forces are continuously following and reviewing the security situation over the Baltic Sea. With these assessments, we adapt our QRA procedures accordingly. Our political leadership is giving us full support to proceed with our missions.

ESD: At the roll-out you told me that Flygvapnet is looking forward to the 60 GRIPEN E aircraft. Will it be 2019 or 2020? And will there be a "troop test unit or will they go to the squadrons right away? And which ones? And will there be industry coverage for anything deeper than line-maintenance? What happened to the option they told us about in 2016 of 10 – or even 20 – more?

Helgesson: With the GRIPEN C/D the Swedish Air Force is operating one of the most capable multirole fighters in the world. We have introduced its latest edition MS20 in 2017. This version adds a lot more capability, especially when it comes to Air Defence. We are the first air force operating the METEOR missile, which truly is a 'game changer', with its magnificent agile performance and long endurance. The GRIPEN C/D fleet will be the backbone of our fighter force in the 2020s. In our assessments for the future, however, we forecast an introduction of new Russian weapon systems in our vicinity. It is therefore essential for the Swedish Air Force to bring GRIPEN E into service during this time period to remain a relevant player in our region, capable of defending our nation as well as supporting our partners when called upon. Our plan is to have an Initial




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Operational Capability (IOC) in 2023 and a Full Operational Capability (FOC) in 2026. Our Gripen Operational Test & Evaluation unit will when it is time for In-Service-Date (ISD) - receive the Gripen-E first to perform their tests and to develop a syllabus for the training of the operational pilots in our squadrons. We know from experience that the process of commissioning a new aircraft must be carried out with great caution and conscious decisions. We will not accept an operational risk due to not having a fighter capable and ready if the security situation demands it. Nevertheless, I am very much looking forward to having the Gripen E in service.

ESD: How will the E-model change the Flygvapnet's warfighting capabilities and doctrines? And still no F-models for Sweden?

Helgesson: The introduction of Gripen E will enable the Swedish Air force to remain relevant in the future when it comes to operating fighters in a multispectral challenging environment. Gripen E will overall be a smart fighter equipped and integrated with state-of-the-art sensors and weapons. With the Gripen E we will be able to continue to cover all our current capabilities in a more challenging and contested environment. The decision to acquire only a single-seated Gripen E is still valid. Only the Brazilian air force has ordered Gripen F. It will be produced in Brazil by SAAB and Embraer.

ESD: Allan Widman, the chairman of your Parliament's Defence Committee, who is opposed to the dismantling of C/D Gripens, once said: "It is difficult to justify switching from almost one hundred aircraft to sixty in a deteriorating security situation...". What is the current status of C/D Gripens after 2026? How many could soldier on? I suppose some D-models would do that, and would there really be some "scrapped" ones? Or on the other hand, would some C/D Gripens from the Flygvapnet frontline be available if FMV [the Swedish Defence Materiel Administration] and SAAB agree further sales or leaseings of used airframes?

Helgesson: As I have already indicated, the Swedish Armed Forces have conducted an investigation regarding the future replacement of Gripen C/D. This investigation was thorough and included assessments of the future threat picture in our vicinity. Based on those forecasted threats, simulations and 'joint war gaming' were conducted against different alternatives of a future fighter for the Swedish Air Force. The outcome of the investigation was a recommendation to the politicians in 2012 to acquire 60-80 new fighters with a Gripen E configuration. The

Gripen in (and from) Flygvapnet Service

The Swedish Air Force received its final SAAB JAS-39C on 19 March 2015. On that day, the aircraft with bort number '294' landed at F17 Ronneby Airbase near Karlskrona in southern Sweden to join Flygvapnet's fleet of 73 operational single-seat C and 12 two-seat D versions.

Since 1988 SAAB in Linköping has built 247 Gripen fighter jets since 1988, with the type's first flight occurring in December of that year. Flygvapnet ordered a total of 204 A, B, C and D versions. From 1996 to 2006, SAAB produced 104 A and 14 B versions. Thirty-one A models were converted to NATO-compatible C standard, supplemented with 69 new-built Gripen-Cs. All -Bs have been converted to the NATO-compatible D standard, with 12 still serving in Swedish colours.

Combat strength has gone down over the years to those 85 jets mentioned. This is also because ex-Flygvapnet single-seat Gripen-Cs and two-seat Ds plus several new aircraft via FMV have been sold or leased to the Air Force of the Czech Republic (12 Cs and 2 Ds), Hungary (12 Cs and 2 Ds), South Africa (19 Cs and 9 Ds) and Thailand (8 Cs and 4 Ds).

The Next Generation Gripen - dubbed E for the single-seat and F for the two-seat version - is planned to enter the Flygvapnet in 2020, a year after the FAB (Força Aérea Brasileira) will receive the 28 Gripen single-seat Es and eight two-seat -Fs it ordered so far. To be delivered until 2026, Sweden will then be operating at least 60 of the new versions. The current order might be expanded to 70 or maybe even 80 jets in the coming years. From around the middle of the next decade, Gripen-Cs will be gradually begin to be outphased while ~20 Cs are likely to remain in service well after 2026 to make up for the gap between the 80 E models that the Flygvapnet wants and the 60 that it is getting (or 10 retained if the number of Es rises to 70). The two-seat D models will naturally remain the longest, since currently there are no plans to acquire a domestic F model, which will - at least until further nations would order the "Super-Gripen" - remain a purely Brazilian (and Brazilian-built) issue.

SAAB announced on 18 December that FMV had awarded it a SEK400M (€40M) modification to the original SEK57.9Bn (€5.82Bn) development contracts for Gripen E from 2013. This modification covers the production of new parts that were originally slated to be taken from retired Gripen C airframes. Thus the upcoming Gripen E will no longer use recycled parts for the windscreen and canopy, the outer elevons, the ejection seat, the internal gun and conveyor system and other ancillary equipment. Instead, each aircraft is now to be built completely from scratch. In a statement regarding the contract modification, SAAB explained that "this is intended to secure availability so that the Flygvapnet can keep the Gripen C/D fleet operational during the entire time when Gripen E is being delivered and put into operational service."

reason to recommend a span rather than a fixed figure was that the needed number of aircraft for the future varies due to the chosen capabilities of a future Ground Based Defence System (GBAD), as well as on our future capabilities on our war bases. The Gripen E will be more capable than the Gripen C/D. That was one of the reasons to recommend lesser aircraft than in our current fleet of Gripen C/D's in 2012. On the other hand, the security situation has worsened since then, which prompted the political side to consider acquiring another 10 Gripen E. The acquisition decision will most likely be made after a parliamentary report regarding the future of the Swedish Armed Forces. Concerning your question

of potential sales of Gripen C/Ds in the future I refer to my answer regarding the transition time between Gripen C/D and introducing the Gripen E. Before we make any risk management decisions of selling existing Gripen C/Ds, we must be sure that we have the relevant and necessary fighter capability in place.

ESD: In the 1960s/70s only Sweden and Austria introduced the venerable but outdated SAAB Sk-60 Side-by-Side Jet Trainer (SAAB-105 OE in Austria) and still fly it today. The Austrian Air Chief said these aircraft will "die out" around 2020, with a replacement - if at all still open. Sweden modernised them with new engines, but

what are Sweden's plans for this aircraft? How many of these aircraft are left in Sweden in daily ops and is their fate connected to the US T-X outcome and the related Boeing/SAAB bid?

Helgesson: From the originally acquired 150 Sk-60s, we re-engined 115 aircraft in the mid-nineties. Another upgrade of 37 aircraft was conducted in 2012 when the avionics was upgraded to feet and knots instead of metres and km/h and additionally a replacement was made of an old gyro to laser gyro platforms. Today, there are currently 37 Sk-60s in service. From our perspective, there is no connection between our plans for a possible Sk-60 replacement and the outcome of the USAF T-X competition. We are scanning the entire market for a future trainer to fit into a new training system for the Flygvapnet. Since we will not have a two-seat GRIPEN F in the future, we need to make sure future pilots are adequately trained when they begin their GRIPEN E conversion training.

ESD: A rather mathematical-economic question: I always struggle to understand how flight-hour costs are being counted and what is counted in them. How does Flygvapnet calculate flight-hour cost? Do you calculate only aircraft, pilot, technicians and fuel/lubricants? Or do you include a share of the maintenance or the entire ground organisation?

Helgesson: I agree; it is difficult to compare the cost of flight hours between different aircraft and air forces. There are many ways of doing this mathematics. When we calculate the total cost per flight hour we add the following param-

eters: cost for the aircraft (depreciation), maintenance and overhaul (both on an O- and I-level), fuel and parts of the cost for our ground organisation. This could be described as the daily cost divided by the number of air movements. I would argue it is very important to be clear on how and why you calculate the figures before making a comparison.

ESD: Some colleagues were surprised that there is no real interest in the KC-390, although your industry is now strongly connected to Brazil through GRIPEN E/F. Instead, it looks as if the antique HERCULES - with all due respect - is obviously being modernised or life-extended. Why? Are there purely financial reasons or technical aspects of the KC-390?

Helgesson: The Swedish Armed Forces decided to modify our C-130 aircraft to extend the life of the fleet until 2030. In parallel, we are developing requirements and are scanning the market accordingly to find a suitable replacement matching our future needs. EMBRAER's KC-390 could be one alternative among others. It has shown to be a transport aircraft with an impressive performance.

ESD: Beside the KORPENs, Sweden's only ISR/Special Mission/MMAs are the two SAAB-340-based AEW&Cs. Are there any plans or chances Flygvapnet will get something like the excellent SAAB GlobalEye now in service with the UAE?

Helgesson: The Flygvapnet is operating the current ASC-890 frequently and it is a highly appreciated sensor system. But the ERIEYE radar in the ASC-890 system

needs to be replaced due to obsolescence in a few years. There is no decision yet on any replacement.

ESD: Faced with a changing security environment and threats in the Baltic Sea, Finland and Sweden are approaching each other and NATO. Was this the basis of the 2017 "Aurora" and the Finnish "Ruska" exercises? Could you elaborate on Sweden's participation and the results?

Helgesson: The Action Plan for a long-term commitment to deeper defence cooperation between Finland and Sweden was signed by the defence ministers of Finland and Sweden back on 6 May 2014. The plan aims to improve security in a regional context and strives for resource and cost efficiency in defence-related areas. Furthermore, the cooperation increases interoperability and the capability to act jointly both domestically and internationally. Based on the already-close defence cooperation between Finland and Sweden - like the cross-border training with Finnish F-18s and our GRIPENs - the cooperation will be realised both bilaterally by participating in each other's national exercises, as well as within existing forums such as NORDEFCO, the EU, NATO or the UN, and hence supplement other multinational cooperation. The overall assessment at a military level is that bilateral cooperation as a whole is cost effective, and it also sends a significant signal of strengthened capabilities to potential adversaries in our common and vital 'homeland' region.

The interview was conducted by Georg Mader.

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Viewpoint from Vienna

Austria – Turn Right when Red?

Georg Mader

Shortly after he was sworn in as Austrian Minister of Infrastructure and Transport on 18 December 2017, the former FPÖ candidate for Federal President Norbert Hofer announced that he intended to introduce right-hand turns at the red traffic light. What is customary from East Germany to the USA also seemed to be an option for 60% of Austrian voters. In the face of a new social democratic coalition, right-wing populist FPÖ voters made it possible to join a coalition shortly before Christmas. Under the young and convincing conservative chancellor Sebastian Kurz, they gained control of the ministries of the Interior, Foreign Affairs and Defence. This means access to all armed formations and their three services as well as to the information they collect. When the party last became a member of a coalition government in 2000, Austria was shunned by its European partners and threatened with EU sanctions. This time, the reaction is rather subdued. Obviously, right-wing positions in Europe are increasingly accepted as a (different) form of politics.

How to Classify this Swing?

While today's fragmented and divided EU needs a stringent security policy, it remains unclear whether Austria – assuming the EU Council presidency by mid-2018 – will make the contribution large European players like Germany and France expect. This all has to do with migration and with the fact that the word "Islam" appears 21 times in the programme of the new coalition government. Political Islam is a focal point of domestic security. Under the new government, Islamic schools and cultural institutions foreign to Austrian values will be closed. The new Austrian government also announced that it would propose the registration of illegal migrants rescued at sea in centres outside Europe. It also proposes sanctions against immigrants who do not integrate themselves into Austrian culture and promises stricter border protection, including by the military.

Reorientation towards the East?

This sentiment has also an international aspect to it; it resembles positions held by the Visegrád Group (Czech Republic, Hungary, Poland, and Slovakia). And very much like Visegrád politicians, Chancellor Kurz and FPÖ-leader Heinz Christian Strache pledged to advocate a more substituted European Union. Kurz' moderate pro-Europeanism to a certain extent seems to make him an advocate of the sceptic Visegrád governments. Many observers and columnists fear that he will adopt their alleged 'backward' views on the EU, but the author belongs to those who hope that he will rather make



them adopt his. This might forge a new consensus on a way ahead for European integration. The FPÖ's recent election manifesto read: "We firmly reject any artificial synchronisation of the diverse European languages and cultures by means of forced multiculturalism, globalisation and mass immigration quotas. Europe shall not be reduced to a political project of the EU elites." Nevertheless, for this 5-year pact a referendum on leaving the EU is ruled out. The influence of the now co-ruling ring-wingers would not be strong enough to cause Austria to exit the EU, but they could make Austria withdraw

from the centre of EU politics – or get it pushed out one day. The latter, maybe, because of a 5-year friendship-treaty signed in 2016 by FPÖ leaders Strache (now vice chancellor), Norbert Hofer (minister for infrastructure) and Johann Gudenus (head of FPÖ parliamentary section) with President Putin's "United Russia" party. Hungarian journalist Szabolcs Panyi claimed after the elections that US, British and French secret services would cease cooperating with the BVT (Austria's civil intelligence agency) on Russia-related matters because they distrust Herbert Kickl (also FPÖ), the new interior minister who is in charge of overseeing the BVT. The BVT rejected this allegation; Mario Kunasek's MoD also denied any substance. Sebastian Kurz, as Austria's new Chancellor and leader of the conservative ÖVP and senior partner in the coalition, travelled to Brussels right before his government declaration in parliament, to assure EU leaders of the general pro-EU stance of the new Austrian administration. He said his government would support more integration in foreign policy, defence and immigration but wants more autonomy in areas where member states and regions are better positioned to decide and act. And he also underlined euro governance based on rigorous fiscal rules, as opposed to Mr. Macron's plans for a euro government, Europe-wide social standards or a communitarisation of debts.

Austria's Neutrality and PESCO

What is the new FPÖ Defence Minister Mario Kunasek about? At least his party claims that it is "happy to work with this peace project of the EU in foreign and security policy – provided that the EU preserves Austrian neutrality and keeps its distance to non-European powers and military alliances dominated by non-European countries and their adventures." This statement seems to reflect often 'blinking' anti-Americanism of the FPÖ. Nevertheless, it should here be underlined that it was neither the 'word' neutrality nor the 'mighty' Austrian army that saved Austria's membership of the West. It was the QRA-readiness of American, German and British pilots.

Because the Soviets suggested it, Austria declared neutrality as a condition of its state treaty in 1955. Since then, it has become part of the national psyche. The FPÖ wants to preserve neutrality, because it "served Austria well and protected us from damage". Today, however, we know from various archives that the Warsaw Pact – and subsequently also NATO – would have ignored Austrian neutrality. According to recent surveys, however, 90% of Austrians feel protected by the status "neutral" and see it as part of the Austrian identity. It was just good luck that Austria's neutrality was never put to the test...

Shortly before the 2017 elections, Vienna surprisingly signed PESCO to join a possible future EU army. Although Austria had offered to take on only four detailed projects and to integrate the capabilities of the Austrian Army into the training for mountain warfare, this signature triggered discussions as to whether Austria could still be genuinely neutral after its accession to the EU if PESCO required Austria to participate in CSDP and NATO-PfP. Gerhard Jandl, Director of Security Policy at the Austrian Foreign Ministry, called for a "rational, realistic review". Soon the Yellow Press accused Jandl of "eroding our foundations and risking Austrian soldiers coming home in body bags from military NATO adventures in global oil and colonial conflicts." The Austrian constitution is clear: its neutrality excludes membership in military alliances and the establishment of foreign military bases. It also prohibits participation in wars excluding self-defence. Participation in international missions is only possible if a UN mandate/resolution exists. But the constitution does not demand political neutrality and Austria's population and political leadership have always regarded themselves as being part of the West. No one in Vienna calls for maintaining an absolute political equidistance between attackers and aggressors, especially against modern Islamic terrorism. At least against this threat, the FPÖ leadership and Chancellor Kurz agree: the rejection of political Islam, which, if fully developed, could lead to unrest and civil wars not only in Austria.

Continuity in International Military Participations

Austria has been an active contributor to UN, EU and NATO/PfP missions for decades. Ever since the end of the war in Yugoslavia, Austria has provided troops for NATO peacekeeping forces. The new government also considers active participation in the EU and NATO to be necessary. The new coalition government wants to be taken seriously as a foreign policy actor and not to be dismissed as a free-rider. Austria will continue to maintain its neutrality, but this will not prevent Vienna from being a reliable EU partner. This became apparent two days after President Van der Bellen took the oath, when several missions with Austrian troops were extended for 2018 in the relevant parliamentary committee. Participation and relevant strength were confirmed:

- ALTHEA (EUFOR) in Bosnia-Herzegovina (400),
- KFOR in Kosovo (600 + 250 if necessary),
- RACVIAC in Zagreb (7),
- OSCE in Moldova (10),
- OSCE's SMM in Ukraine (20 + C-130 Aeromedevac),
- UNFIL in South Lebanon - Litani area (250),
- RSM Afghanistan in Kabul (20),



Photo: Georg Mader

The new minister of defence, Mario Kunasek (FPÖ), at the official Transfer of Office ceremony at the Austrian Ministry of Defence on 18 December 2017.

- EUNAVFOR 'SOPHIA' Mediterranean (30 special forces),
- EUTM Mali (20),
- MINUSMA Mali (15)

Minister Kunasek told the author that a total up to 1,500 soldiers remain earmarked for rotation abroad.

Keep and Upgrade or Abolish the Eurofighters?

In his opening speech, Mario Kunasek emphasised the military character of the Austrian armed forces, which he wants to prioritise by making disaster relief secondary. His most important decision in the near future will be the fate of the 15 Austrian Eurofighter jets. The system was deliberately mutilated and downgraded in 2007 by the predecessor Darabos (SPÖ) and poorly maintained by Kunasek's predecessor Dörmöller (SPÖ). Minister Dörmöller had suggested retiring the TYPHOON from 2020 on – only six years after paying the last instalment for the aircraft which should have in service for 40 years. However, it is possible to upgrade the modular aircraft and to correct Mr Darabos' 'saving mistakes'. There already is a relevant letter from Airbus and EF-GmbH to the MoD. A few additional T1 two-seaters of the German Air Force could also be possible in the context of TORNADO replacement. Mario Kunasek wants to forward all these issues to (yet another) commission of experts, who should report to him until early summer.

The fate of the Bundesheer depends on Minister Kunasek and whether he can assert himself against the similarly unknown finance minister and former insurance giant UNIQA's CEO, Hartwig Löger. The new government claims it targets to increase military spending from the current record-low level of 0.6% to 1% of GDP (~€3.5Bn) by the end of 2022. But nobody has two billion to buy new fighter planes. Quite the contrary, it would be helpful if the officers could defend their 2017 budgets at least in the financial planning for the next two years.

Slovakia Starts Ambitious Modernisation of Armed Forces

Miroslav Gyürösi

In October 2017 the government of the Slovak Republic approved a new military strategy and a Long-Term Defence Development Plan focussing on build-up and advancement of the armed forces with prospects until 2030.

Intensive and extensive discussions followed by pursuance have occurred after the change of the geopolitical situation in Central and Eastern Europe. New steps taken in Slovakia were preceded by the Ministry of Defence's (MO SR) publication of the Defence White Book in 2016. The

year 2017 was very challenging for MO SR. Of course, some projects were already running, but most of the acquisition projects before the actual geopolitical changes are more ad-hoc cases only. The year 2017 marked a real change for Slovakia. In that year, Slovakia welcomed the first two

everything is running smoothly, some orders are delayed because of a slip in critical chapters of production, especially for the Air Force (3D radars, multi-role tactical aircraft).

The Armed Forces of the Slovak Republic or OS SR (Ozbrojene sily Slovenskej republiky) urgently need to modernise forces and acquire new techniques or modernise some of the outdated equipment, practically in all areas of their inventory. The new Long-Term Defence Development Plan is ambitious, and of course its fruitful accomplishment is founded on a successful fulfilment of the planned 2% of GDP set aside to the Defence Budget, of which at least 20% is assigned to direct modernisation of forces. If we look back at the previous 25 years of the new Slovak Republic, the plan is really ambitious. In terms of new inventory, the armed forces are looking to acquire new equipment within the period from 2018 up to 2030. The planned acquisitions include for the Army

- 81 pieces of BOV 8x8 wheeled armoured combat vehicles,
 - 404 pieces of BOV 4x4 armoured combat vehicles and
 - VTV 4x4 multi-role tactical vehicles,
 - new artillery systems,
 - 445 new ATGM systems,
 - 353 medium all-terrain trucks,
 - 323 heavy all-terrain trucks, and
 - 310 light all-terrain vehicles.
- Those for the Air Force include
- one transport aircraft,
 - seven multi-role helicopters,
 - 14 multi-role tactical aircrafts,
 - six medium-range 3D radars,
 - five small-range 3D radars,
 - three airport surveillance radars,
 - training aircraft,
 - light multi-role helicopters, and
 - UAVs.

The plan also includes the modernisation of BVP-2 IFVs, plus the gradual acquisition of a new design, upgrade of 25 pieces of artillery systems, preparation of the acqui-



Photos: Miroslav Gyürösi

Slovakia's new BOV 8x8 wheeled infantry combat vehicle developed jointly with Finland



The new BOV 8x8

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UH-60M BLACKHAWK helicopters, the first C-27J SPARTAN and also started the trials of the new BOV 8x8 wheeled infantry combat vehicle developed jointly with Finland. Furthermore, preparation of some new acquisition projects started. But not

sition/modernisation of a medium-range Air-Defence Missile System (ADMS), acquisition of the Short-Range ADMS, acquisition of new types of engineering vehicles, a new type of MBT and many others. When the plan was approved by the parliament, the budget needed for the main armament projects in the years from 2018 to 2030 turned out to be more than €6.7Bn. If possible, the Slovak Republic wants its own local defence industry to fulfil its acquisition or modernisation requirements. Should that not be possible, local defence industry companies are to be involved.

Ground Forces

The most recent improvement in the Ground Forces of the Armed Forces of the Slovak Republic (PS OS SR = Pozemne sily Ozbromenych sil Slovenskej republiky) are the 18 modernised reconnaissance combat vehicles – BPsVI (Bojove prieskumne vozidlo ISTAR) – that were accepted into the inventory of the ISTAR battalion in Presov in 2017. The basic design of the modernised BPsVI is a Slovak defence industry product. The project runs in co-operation with joint-stock companies KONŠTRUKTA-Defence, DMD GROUP, EVPU and Limited Liability Company MSM GROUP. Designers fitted the new remote control weapon station TURRA 30 to the modernised vehicle, which was developed and produced in Slovakia. The TURRA 30 turret is armed with a 30 mm calibre 2A42 automatic cannon manufactured in Slovakia by joint-stock company ZTS-SPECIAL, 7.62mm calibre PKTM machine gun and two ready-to-launch 9M113 KONKURS ATGMs. The BPsVI vehicles also carry a wide range of ISTAR equipment including a UGS sensors suite, MicroFalcon UAVs, JIM Compact multi-role binoculars, MIM-ID miniature mine detector, Kestrel-5500 weather meter, FLIR Ranger R20SS surveillance radar and many other devices. With the acquisition of 18 BPsVI vehicles by the ISTAR battalion, this specialised unit received a modern and capable tool, which meets NATO needs to the fullest extent. Actually, the biggest acquisition effort of the PS OS SR and Slovak Armed Forces is the development and planned acquisition of the new BOV 8x8 combat vehicles, BOV 4x4 / VTV 4x4 combat vehicles and multi-role tactical vehicles (BOV = Bojove opancierovane vozidlo, VTV = Viacucelove takticke vozidlo). This project will probably cost Slovakia €1.2Bn.

The first part of this project is the development of the BOV 8x8 wheeled infantry combat vehicle jointly run by the Slovak Republic and Finland. The new BOV 8x8



The BPsVI reconnaissance combat vehicle is based on a modernised version of an older AFV.



18 BPsVI vehicles were accepted into the inventory of the ISTAR battalion in Presov in 2017.

design is a combination of the Finnish Patria AMV 8x8 SK four-axle armoured modular vehicle specially adapted according to Slovak specifications and the Slovak-made TURRA 30 remote control weapon station. The main contractor for the BOV 8x8 project is KONŠTRUKTA-Defence, partners are Patria Land Systems Oy, EVPU and the Ministries of Defence of the Slovak Republic and Finland.

The control trials of the prototype of BOV 8x8 took place in Slovakia, having started in mid-December 2017 and ended in mid-January 2018. The control trials will be immediately followed by user trials, which will be completed in late March 2018. The user trials will be run in both the Slovak

Republic and Finland. After successful completion of control and user trials and the approval of the Slovak government, the Ministry of Defence of the Slovak Republic is planning to achieve up to 81 serial wheeled infantry combat vehicles based on the BOV 8x8 design between 2018 and 2024. The BOV 8x8 project plan authorised by the government of the Slovak Republic includes the procurement and delivery of the first 10 BOV 8x8 vehicles in 2018 with the price per unit not being higher than €4M (including VAT). The price for the complete programme of BOV 8x8, including support (logistics, ammunition, infrastructure) is calculated to be €417M (including VAT). The basic intention of the

Slovakian Ministry of Defence is to equip one mechanised battalion of PS OS SR by 2021 with three BOV 8x8 vehicles as training units and one BOV 8x8 vehicle for the brigade commander and, by 2024, equip a second mechanised battalion of PS OS SR. Figures and delivery dates can be changed according to real prices for one BOV 8x8 vehicle and spare parts.

Soon after the start of the BOV 8x8 programme, also in 2017, preparations for the BOV 4x4 / VTV 4x4 two-axle combat vehicles and multi-role vehicles acquisition project started. In this category of vehicles, the priority is to equip the ISTAR battalion and 23rd mechanised battalion, which will follow the fulfilment of the needs of 21st and 22nd mechanised battalion and 5th Special Forces regiment. After the first package, another three mechanised battalions, which are currently using tracked vehicles, will then follow: Combat support and Combat service support units, Central Reserve, Training battalion and Military Police. According to the plan, the first seven 4x4 chassis configuration vehicles can be delivered to the Slovak Armed Forces (OS SR) in 2018.

The needs of OS SR for BOV 4x4 two-axle armoured combat vehicles and VTV 4x4 two-axle multi-role tactical vehicles amounts to 404 pieces which will be delivered from 2018 until at least 2023. Planned price tags for this category of vehicles vary between €1.2–3.5M (including VAT), depending on the version and equipment. The planned budget for this part of the project mounts up to €782.7M (including logistic support, costs of ammunition and infrastructure). Only time and budget accessibility will show the destiny of this project. In case of lacking finances, this project can be moved up to the next years. After 2024, when the BOV 8x8 project will have been completed, the budget to acquire 4x4 vehicles can be increase to €80M annually. The basic goal of the BOV 4x4 and VTV 4x4 vehicles project is to fulfil all the needs until 2027 or 2029 at the very latest.

Air Force

In the case of the Air Force of the Armed Forces of the Slovak Republic (VzS OS SR = Vzdušné sily Ozbrojených síl Slovenskej republiky) the situation is also critical with most of the inventory. According to the modernisation plan, most of the critical areas need immediate upgrades. However, in reality, only two of the bigger contracts amongst the planned acquisitions have so far been realised (in scale of the Slovak Republic). This includes the acquisition of nine

new UH-60M BLACKHAWK multi-role helicopters and two C-27J SPARTAN transport aircraft. The respective contract for the production and delivery of nine UH-60M multi-role helicopters was signed in the first half of 2015. According to the Minister of

political circumstances and turbulences the contract with the Italian company Leonardo to produce and deliver two C-27J SPARTAN aircraft was not signed until 29 October 2014. Originally, the delivery of the first aircraft was planned



The Slovak Air Force acquired two C-27J SPARTAN transport aircraft.



The first two of nine new UH-60M BLACKHAWK multi-role helicopters were handed over to the Slovak Air Force in summer 2017.

Defence of the Slovak Republic Martin Glivac, the price of the whole package does not exceed US\$261M (ca. €236.7M). The first two UH-60M helicopters for VzS OS SR with serials 15-27639 (Helicopter number 7639) and 15-27640 (Helicopter number 7640) landed at Presov airport 26 June 2017. Shortly after, 3 August 2017, the two new choppers were officially handed over to the armed forces. During the year 2018, these two helicopters will be followed by another two pieces. The last batch of five UH-60M helicopters of the total nine ordered will arrive in Slovakia in 2019.

The acquisition of the new transport airplanes has been running in Slovakia for a very long time. In fact, the decision was made back in 2008, but due to

for 2016, but the programme was not successful and on 17 December 2015 the partners signed a contract supplement. Finally, the first C-27J SPARTAN aircraft for Slovakia with aircraft number 1931 landed at Malacky-Kuchyna airport on 24 October 2017 with 49 days' delay (the Slovak MoD sanctioned the production company). The official handing over of the aircraft to the Air Force took place 31 October 2017 at Malacky-Kuchyna airport, home of the Transport Wing of the VzS OS SR. The production process of the second aircraft with aircraft number 1962 is running according to plan and the Armed Forces of the Slovak Republic await the delivery of the new airplane at the end of March 2018. ■

"We want to have a flexible navy."



Photos: Guy Toremans

Admiral Gonzalo Nicolás Ríos Polastri was appointed Commander General of the Peruvian Navy on 30 December 2016.

Back in 2013 the Marina de Guerra del Peru (MGP) began renewing its fleet with new and more advanced platforms to be able to comply with its increasing commitments. As of late December 2017 the Peruvian Navy already inducted fourteen new units into the fleet: the logistic support ship BAP TACNA, the coast guard patrol boat BAP FERRÉ, the oceanographic polar research vessel BOP CARRASCO and the indigenously built sail training ship BAP UNION, the salvage tug BAP MORALES, four RIO PATIVILCA Class patrol boats and five Plataforma Itinerante de Acción Social con Sostenibilidad (PIASS) platforms.

ESD: Admiral Ríos, on 29 July 2016 the new Peruvian Government was inaugurated. Did it bring much changes to your navy's procurement programmes approved by the former Humala Government?

Admiral Ríos: When the new government took office it was a great relief to hear the new leaders remain in favour of the naval projects which had been approved by the previous government. It is very important for Peru to modernise its fleet because our navy has to carry out a wide range of tasks, covering the whole spectrum of maritime operations. So we are confident that our main procurement programmes can go ahead as planned. Our naval aviation's capabilities have been boosted with the acquisition of five SEA SPRITE SH2-G helicopters from the Royal New Zealand

Interview with Admiral Gonzalo Nicolás Ríos Polastri, Comandante General de la Marina de Guerra del Peru

Air Force. And we are to acquire AB-412EB helicopters and TWIN OTTER hydroplanes.

ESD: What are your experiences with these new platforms?

Admiral Ríos: All these assets make truly great additions and provide excellent services. In particular BAP TACNA (ex-HMNLS AMSTERDAM), acquired from The Netherlands in December 2017, bolstered our HA/DR assets and allows us to sustain our ships during long-range missions; BAP FERRÉ and the four RIO PATIVILCA Class units considerably enhanced our Coast Guard's patrol capabilities. Negotiations for the transfer of a second PO HANG Class are underway and we plan to build another six RIO PATIVILCAs; and BAP MORALES proves to be an excellent example of a small polyvalent unit. Another success story is our PIASS programme with five units already in service and seven more planned. The BOP CARRASCO sailed Callao on 14 December on her very first deployment to Antarctica, e.g. ANTAR XXV - the 25th scientific campaign of Peru to Antarctica.

And, obviously, we are very proud of our sail training ship BAP UNION; she is a real ambassador for Peru. She arrived back home from her 6-month VIEX-2017 Training Cruise to Europe on 5 November 2017.

ESD: One of your major programmes is the Landing Platform Dock (LPD) project. What is the status of this programme?

Admiral Ríos: The lead ship BAP PISCO is in the final stage of being fitted out and due to join the fleet end-February/early-March 2018. Upon her commissioning she will carry out mainly national tasks. You may remember that in April 2017 Peru was struck by heavy flooding. Therefore we will keep her in our home waters in order to provide assistance in case "El Nino" throws another calamity at us. Only when the second unit joins the fleet we will deploy BAP PISCO on the international scene. The keel of the second unit, BAP PAITA, was laid on 14 December 2017.

ESD: What will these new LPDs offer your navy in terms of meeting Peru's defence and security requirements?



The Peruvian Navy's sail training ship BAP UNION, sailing off Callao in November 2016 for her maiden training cruise VIEX-2016



The Peruvian submarine BAP ANGAMOS off sailing on the surface off Callao



Some of the Peruvian Navy's major surface combatants alongside in the Callao Naval Base. From left: BAP VILLAVISENCIO (inboard), BAP PALACIOS, BAP MARIATEGUI (inboard), BAP QUINONES, BAP GUARDIAMARINE SAN MARTIN (ex-BAP CARVAJAL), BAP BOLOGNESI (inboard), BAP MONTERO, BAP FERRE (ex South Korean PO HANG Class ROKS KYONG JU) and two VELARDE Class corvettes.

Admiral Ríos: Capable to act as an afloat support base, deliver goods and vehicles in damaged or non-existent ports, produce potable water and embark extensive medical facilities, the LPDs will provide us with the means to support HA/DR missions in a timely and effective way. Once both LPDs are operational one could be positioned offshore to provide logistical and medical support, acting as an afloat command and control (C²) and hospital platform, while the second unit can transport materiel and personnel to and from the disaster-stricken area.

ESD: Will you have to re-think the navy's concept of operations to make the most out of these units?

Admiral Ríos: For every "first-of-class" joining the fleet there is a learning curve.

However, having operated amphibious ships like our PAITA Class LSTs for more than half a century we do have experience with amphibious platforms and operations. New capabilities can retain the same concept of operations, yet the approach on how to implement the new capabilities can differ. Obviously, the ship's well-dock is a new asset and will see our Marine Amphibious Brigade transferring from a "territorial defence force" into a "mobile international deployable force".

ESD: The SIMA shipyards have proved to be the cornerstone of the Marina de Guerra del Perú's new projects. Are there other navies showing interest in the platforms SIMA designed and constructed?

Admiral Ríos: Yes, several foreign navies are showing interest in some of SIMA's concepts and asked to look into possible partnerships or to share expertise. For instance Bolivia, Brazil, Colombia, Ecuador, Indonesia and the Philippines are interested in the PIASS and BAP MORALES designs.

ESD: In addition to the new programmes, the MGP is also modernising some of its current platforms. What is the status of the modernisation programmes?

Admiral Ríos: The mid-life upgrade of the Aquirre class frigates is on track, with BAP BOLOGNESI fully operational again and BAP AGUIRRE to follow in early-2018. The modernisation of our four Angamos-class submarines kicked-off as well. Work on the first boat - BAP CHIPANA - is underway. BAP TACNA is to receive some upgrades as well, e.g. the installation of the VARAYOC combat system, a Mage QHAWAX electronic support measures system (ESM) and SACAF III weapon systems.

ESD: Can you also give us a rundown of the MGP's future procurements? Which projects are planned or in the pipe-line?

Admiral Ríos: The agreement has been signed with our neighbours, Brazil and Colombia, for the joint construction of the helicopter-capable riverine patrol vessels (Patrullera Fluvial Posa-Helicoptero). We will acquire two of these units, with the first anticipated to join the fleet by 2021. And I anticipate that this tripartite project will open new opportunities of collaboration. On the longer term, we will replace our AGUIRRE Class frigates and ANGAMOS Class submarines. And, as we plan to build a flexible navy, off-shore patrol vessels are certainly on our wishlist, as well as the procurement of drones.

ESD: What are the baseline requirements for the new frigates and submarines? Which designs are being studied?

Admiral Ríos: Our baseline requirements for the new frigates call for a platform in the 3500/4500 tons range with state-of-the-art, yet proven sensor and weapons systems compatible with our Varayoc CMS capable to embark mission-specific modules as well as a helicopter. Possible designs include the Italian "Pattugliatori Polivalenti d'Alta" (PPA) multipurpose units, the German MEKO 200A design, the Singapore Navy's Formidable-class, the South Korean KDX II destroyers, the French FREMMs type, Navantia's F 538 design based on the AVANTE 3000/2400 concept), and the DAMEN Shipyard's



The CARVAJAL class frigate BAP MARIATEGUI and the ANGAMOS Class submarine BAP PISAGUA exercising off Callao

concept. As for the new submarines we are looking at designs in approximately the same tonnage as our ANGAMOS class boats. Some of the designs we are looking at are the South Korea's Daewoo Shipbuilding & Marine Engineering (DSME) and Germany's ThyssenKrupp Marine Systems Type 214, DCNS' SCORPENE design, and Navantia's S-80 design. And we are also assessing the procurement of a series of offshore patrol vessels.

ESD: How do you see your navy's roles and responsibilities evolve with regard to the increasing maritime security issues?

Admiral Ríos: The security environment in Latin America is characterised by complex, diverse, and non-traditional challenges. Consequently, maritime security and situational awareness are a top priority. International co-operation is no longer a matter of choice but a necessity. We must take every opportunity to strengthen the cooperation with other navies and, at the same time, build trust and confidence in order to ensure effective collaboration and share the gathered intelligence. Hence our participation in several initiatives such as the South American Defence Council,

the Inter-American Naval Conferences, the Western Pacific Naval Symposium and, since 2015, the bi-annual Regional Seapower Symposium in Venice; and we also conduct dynamic exchanges of information on a regular basis with partner services mainly in the Pacific basin but also in Europe. Since 2015 we also have an officer assigned as staff of the Information Fusion Centre (IFC) in Singapore. We plan to establish a similar IFC in Callao.

ESD: What is likely to have the biggest impact on the MGP in the coming years?

Admiral Ríos: Notwithstanding the fact that we already made significant investments in modernising the fleet, the challenges are still considerable. Complexity and uncertainty continue to increase. You can imagine that things are not going to get any easier. Our multifaceted missions can only be achieved with modern platforms and highly qualified and motivated personnel. Therefore we must also ensure that a naval career continues to be an attractive option for young Peruvians.

The interview was conducted by Guy Toremans.

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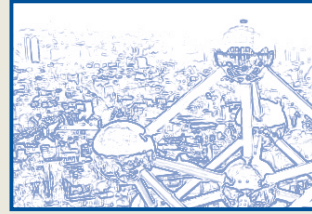
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The Visegrád Group and the European Union

Joris Verbeurgt

At the end 2017, the European Commission (EC) launched an exceptional procedure against Poland because, according to the EC, the government in Warsaw would undermine the independence of the Polish justice system. The procedure had never been used against an EU member before and could lead to the suspension of Poland's right to vote in the next Council of the European Union. However, as soon as the procedure was initiated, Hungary's Prime Minister Orbán declared that Hungary would veto any sanction of this kind. Viktor Orbán has himself clashed with the EC on several occasions before; more specifically, with regard to the EU's handling of the refugee crises. Poland, Hungary, the Czech Republic and Slovakia all reject the EU's notorious relocation programme

ters, these countries are more sympathetic towards President Trump's position than the President of the EC Juncker and his entourage. As the election of Donald Trump was met with disbelief and aversion from Brussels, President Trump received a hearty welcome in Warsaw, where he met with twelve leaders from "the new Europe" last summer. Fear of Russia makes them the fiercest supporters of NATO and of the expansion of US military presence in Eastern and Central Europe.

In recent years, there has been a lot of grumbling in the EU. Not only is the Brexit turning into a painful divorce battle, Central European countries, too, have started to question the way the EU is run and where the integration process is leading. Within the Visegrád Group (or the Visegrád Four,

The V4 and Euro-Atlantic Integration

The name of the Visegrád Group stems from a small town on the Danube river in Hungary, where in 1335 the kings of Poland, Bohemia (the Czech Republic) and Hungary held a congress that led to a peace treaty between these countries and to an alliance that was directed against the imperialistic ambitions of the Habsburg monarchy. On 15 February 1991, the group was established in this historical town by the President of Czechoslovakia, Václav Havel, the President of the Republic of Poland, Lech Wałęsa, and the Prime Minister of the Republic of Hungary, József Antall. Aims of the group were to eliminate the remnants of communism in Central Europe, to overcome the historic animosities that had troubled the region for centuries and to accomplish the transformation that would allow the integration into Europe. Between 1991 and 1993, the group played an important role in the talks with NATO and the EU. When the Czechs and the Slovaks broke up in 1993, both countries remained within the V4. Later on, cooperation slackened, because each country believed that integration into the Euro-Atlantic region would be easier to obtain on an individual basis. Poland, the Czech Republic and Hungary joined NATO in 1999, Slovakia followed suit in 2004. That same year, all four countries became members of the European Union.

Photo: P. Tracz / KPRM



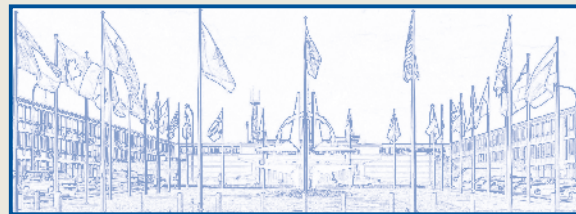
The representatives of the Visegrád group during the V4 Visegrád Summit in Prague in December 2015

for refugees and are willing to stand their ground and potentially face (financial) sanctions from the EU. These four countries – representing 62 million Europeans – were recently joined by Austria in their resistance against the European migration policy, which they consider too liberal, ineffective and even dangerous. In international mat-

ter or simply V4), Poland, the Czech Republic, Slovakia and Hungary coordinate their efforts to preserve and strengthen their "shared cultural and intellectual values and common roots in diverse religious traditions." They do this in a number of fields of common interest but within the framework of European integration.

The Civic Component

In 1998, Visegrád cooperation was resumed in order to strengthen stability in Central Europe. It was made clear from the beginning that the V4 did not wish to compete with the existing European structures and that it offered in no way an alternative for European integration. By the imparting of values in the fields of culture, education and science and by the exchange of



information, the V4 wishes to preserve and promote cultural cohesion. The Group encourages cooperation among all countries (particularly its neighbours) and promotes democratic developments in all parts of Europe. Currently, joint projects are being implemented in the fields of culture, environment, internal security, science,

quisition of material and weapon systems, preference is given to a joint and interoperable approach.

Cooperation has intensified and accelerated since 2010: the financial crisis of 2008 and the implementation of the NATO Smart Defence concept and of the EU Pooling and Sharing concept stimulated the search for

on Establishment of the V4 EU Battlegroup. The first step in establishing multinational units and running cross-border activities is thereby taken. Three months later, to ensure the execution and implementation of the promises made in Budapest, the prime ministers of the V4 officially committed their ministers of defence to start the preparation of an action plan with the "Budapest Declaration of the Visegrád Group Heads of Government on the New Opening in V4 Defence Cooperation" (24 June 2014). The action plan includes elaborating the V4 Training and Exercise Strategy, exploring the possibilities of strengthening the cooperation among the V4 defence industries, the common development and procurement of universal modular tracked platforms and the formation of a permanent modular force to be used as a Visegrád contribution to NATO and to the EU Rapid Reaction Forces. Closer cooperation in subareas like military education, Joint Airspace Protection and communication strategy is also anticipated.

Photo: NATO



During his visit to Hungary, General Petr Pavel, Chairman of the NATO Military Committee, lays a wreath at the Tomb of the Unknown Soldier on 29 September 2016.

education, justice, transportation, tourism, energy, and information technology. The V4 is not institutionalised, but thrives solely on periodical meetings between the heads of state, ministers, diplomats and experts. The meetings are supported by institutions, think tanks, NGO representatives and regional networks. The associated countries invest €8M per year in the International Visegrád Fund that grants scholarships and residencies to students and artists as well as financially supports initiatives of NGOs and individual citizens.

The V4 Defence Cooperation

Besides a civic component, the Visegrád Group also endorses a strong military component: the V4 Defence Cooperation. From the start of the V4, Poland, the Czech Republic, Hungary and Slovakia placed the V4 at the heart of their contribution to the European security architecture. Within the existing transatlantic and European structures, they coordinate their plans and cooperate in the field in an effective, functionally complementary and mutually reinforcing way. In areas such as capabilities development, education, training and exercises and ac-

scale advantages and the coordination of defence efforts. Regional cooperation is considered the way ahead for strengthening the bond between Central Europe and the Euro-Atlantic community.

The Visegrád Group is strongly committed to strengthening Euro-Atlantic security by further implementing the 2010 NATO Strategic Concept. In 2012 and 2013, several joint statements and declarations were issued with regard to an intensified cooperation and a more effective and stronger Common Security and Defence Policy. In recent years, cooperation evolved from coordinating positions to developing a long-term vision on common capabilities development, joint training and exercises on an annual basis and creating a framework for enhanced defence planning and cooperation. These intentions were formalised on 14 October 2013 with the "Budapest Joint Statement of the Visegrád Group Heads of Government on Strengthening the V4 Security and Defence Cooperation". Another milestone for the V4 Defence Group was reached in March 2014, when three documents of strategic importance were signed by the respective ministers of defence – among others the Memorandum of Understanding

The Future of the Visegrád Group

Opinions about the future of the Visegrád Group are divergent: Supporters of an "ever-closer union" believe that regional groups like the V4 (or the Benelux or the Council of Nordic Ministers) are a thing of the past and will evaporate once the EU has become a real federation. Others believe in the future of the V4 and are dreaming of extending the cooperation to the field of entrepreneurship, environmental protection, the development of a common capital market and to common energy and infrastructure initiatives. Although the V4 is not institutionalised and its members disagree on a lot of issues, such as the position to be taken vis-à-vis Russia, it is undeniable that Central European cooperation is growing and that stimuli for that process come from the highest political, diplomatic and military levels. Certain viewpoints of the V4, for example on immigration, national sovereignty, the future of the EU and the relations with the US under president Trump, are not in line with the plans and policies drawn up in Brussels. New clashes between the V4 (possibly supported by Austria) may therefore be expected in the future.

Trends and Developments in Joint Fire Support Operations

Tim Guest

Joint Fire Support (JFS) is a complex bringing together of land, air, sea and other assets to achieve an objective, but it requires careful coordination and cooperation between command and component elements of any joint forces' JFS structure. Today, commanders across NATO rely on detailed STANAGs and tested doctrine so all parties in a JFS plan "sing from the same hymn sheet", where possible.

JFS procedures in place today across NATO nations have largely derived from and been proven and applied over the course of past and current 20th and 21st century conflicts. Over this time, defence industry developments have also evolved in surface-to-surface, air-to-surface, sea-to-land munitions and delivery mechanisms

allied JFS capabilities are cutting edge and provide any Joint Force Commander (JFC) with a wide portfolio of state-of-the-art weaponry and delivery means to meet their objectives. That said, the available assets of NATO nations or joint allied forces/coalitions will vary, and such differences will be part of any overall information shared

JFS-related STANAGs and approaches involved. It will then look briefly at one defence industry JFS-related project.

Setting the Scene – JFS Outlined

Joint Fire Support (JFS) is the employment of joint fires using land, air, sea and other assets available to a Joint Force Commander (JFC) that will generate and maintain combat power throughout a joint service, allied or coalition operation, assisting air, land, sea and special operations forces in their efforts to move, manoeuvre and control territory, populations, airspace and key territorial waters. JFS does so by delivering a JFC's desired lethal or non-lethal effects on a particular target, or targets, selecting and using the most appropriate asset or munitions to achieve the aim. It relies on the JFC and component commanders – that is, those commanding supporting commands, whether allied, coalition, or sister service – providing component fire support assets to the mix. Together, they must synchronise and integrate each JFS asset to both maintain and increase the effectiveness of their joint fires.

JFS includes target acquisition, command and control and attack delivery systems and as well as incorporating the synchronised and integrated use of air, land and sea assets, in today's technologically advanced battlespace. Joint fires may also be delivered through cyberspace, from space, or through the use of special operations forces.

While the principles of such joint operations have been honed over the course of many conflicts, latest technological capabilities designed for and available as joint fire support assets mean that JFCs and the operational procedures followed for delivering effective allied, or NATO JFS, adapt as necessary to take these into account.



Photo: Sgt. Alex Kouns, US Marine Corps

JFS doctrine on the "Use of Helicopters in Land Operations" is detailed in STANAG 2999/ATP-49. Pictured: Two of Hawaii's first three AH-1Z VIPERs fly near Marine Corps Air Station, Kaneohe Bay on 19 December 2017.

and weapons platforms, as well as C2/C4i command, control and communications systems, all of which can be called upon in joint operations. They help ensure that

among the component supporting units/forces in a JFS operation at the earliest stage. Further to this, a JFC must also consider all the requirements and costs needed to sustain any of the units under his command that contribute any called-on joint fire support assets.

This article gives a general JFS overview of some of the current and latest procedural considerations of JFS and offers insights from within NATO on specific Alliance

Author

Tim Guest is a freelance defence journalist and former officer in the Royal Artillery.

JFS – Planning

The success of any major battle plan will depend on being able to plan and coordinate the use of joint and coalition fires in the execution of deep operations. Knowing what assets are at hand and from where is essential to a JFC – typically the Land Component Commander – in order to maximise the effectiveness of any deep operations. Likewise, all component stakeholders involved in a JFS operation, from the Joint Force Air Component Commander down to all other component commanders, need to have a clear understanding as to the intent and targeting objectives of the JFC.

A JFC's guidance in this regard will ensure the correct synchronisation and coordination of the use of tactical, operational and strategic fires so that all desired lethal and non-lethal effects are implemented to achieve the objective. This sets a 'scheme of fires' in place and may include objectives, priorities, effects, munitions, no-strike list and restricted target list, as well as fire support coordination measures. Munitions, for example, are selected in order to create desired on-target effects deemed necessary to achieve an aim, although guidance will also be issued by the JFC on the use, or restricted use, of certain munitions or unique weapon systems, which may include such things as cluster munitions or mines. The use or allocation of joint operations area-wide systems like the TOMAHAWK long-range, all-weather, subsonic cruise missiles (primarily used by the US Navy and Royal Navy in ship and submarine-based land-attack operations), or the Army Tactical Missile Systems (ATACMS) for specific purposes, will also be prioritised at JFC level.

JFS – Targeting

Selecting and prioritising targets, then matching an appropriate response and asset to each is the process of targeting and is a prerequisite to any JFS operations and one that requires the input and participation of all staffs of each component force taking part in JFS. Within US and, by default, NATO operational procedures, there is typically a six-phase approach to the execution of joint targeting:

1. End state and commander's objectives
2. Target development and prioritisation
3. Capabilities analysis
4. Commander's decision and force assignment
5. Mission planning and force execution
6. Assessment.

During the preparation phase of any joint ops, detailed joint intelligence on potential targets will be gathered by the various com-

Photo: KMW



The Dutch DMO has ordered the modification of 30 FENNEK reconnaissance vehicles to Joint Fire Support Team/JFST status for the German Army.

Photo: KMW



The latest FENNEK JFST configurations include both Forward Artillery Observer and Forward Air Controller variants.

Lethal vs. non-lethal JFS: such as psychological effects. Feedback from HQ Allied Air Command (AIRCOM) on this matter indicated that all delivered fires and even the presence of fire support assets have a positive effect on own troops besides the classical effects generated on the adversary power. Even if FS assets just fire non-lethal ammunition, friendly forces show their resolve and the readiness to use lethal ammunition, if necessary. Psychological effects encompass deter, demoralise, discourage, and so on. Psychological Operations and Information Operations require North Atlantic Council authorisation and an authorised target audience; they will only be conducted during operations within a theatre of operations. NB: PSYOPS and INFO OPS are not conducted during peacetime.

On 30 November 2017, the Pentagon issued a memorandum that said: "... the Department will retain cluster munitions currently in active inventories until the capabilities they provide are replaced with enhanced and more reliable munitions." In relevance to this article it added, "Combatant commanders will continue to ensure that the employment of cluster munitions is consistent with the law of war and applicable international agreements in order to minimise their harmful effects on civilian populations and infrastructure." Within NATO, new doctrine and approaches, such as the legal use, or prohibited use, of the likes of mines and cluster munitions during joint operations are dealt with by the Joint Air Power Competence Centre in Kalkar, Germany.

ponent forces about the operational environment, or Joint Operational Area (JOA), and such information, as well as country assessments, will be shared between these commanders and the JFC. This joint targeting process enables the JFC to match lethal and non-lethal effects to targets, and task subordinate and supporting commands.

The next step in JFS is typically target engagement, when the JFC and "supported commanders" authorise supporting component commanders to engage targets. However, this does not remove the need for all forces engaging targets to conduct their own careful analysis, not only of the JFC's objectives and any restrictions there may be from higher authorities, but they must also conduct their own combat identification prior to and during any target engagement and remain fully aware of friendly force locations at all times.

Finally, determining the effectiveness of a JFS operation is achieved through an assessment plan that evaluates current and executed JFS activities in order to adapt the process and adopt any adjustments for future JFS activities, as needed.

From Within NATO

The department responsible for coordinating the alliance's procedural approach to JFS and doctrine is the NATO Standardisation Office (NSO), whose mission it is to initiate, coordinate, support and administer standardisation activities conducted under the authority of the Committee for Standardisation. The NSO is also the Military Committee's lead agent for development, coordination and assessment of operational standardisation.



Photo: KMW

The AS-90 ("Artillery System for the 1990s"), known officially as Gun Equipment 155 mm L131, is an armoured self-propelled artillery weapon used by the British Army.



Photo: NATO

NATO's AArtyP-5 STANAG 2484 on "NATO Fire Support Doctrine", details the application of integrated fire support and effects, particularly those related to field artillery. Pictured: A Lithuanian artilleryman fires the M101 howitzer during exercise Winter Wolf 2017 in Pabradė, Lithuania.



The FENNEK JFS has extremely high-performance observation equipment and the system's tasks include battlefield monitoring, target acquisition and directing fire; the FENNEK is set to play an essential role in many alliance JFS requirements.

When it comes to deciding how individual countries contribute what to an Alliance JFS operational role, NATO establishes a combined joint statement of requirements, a kind of "shopping list" from which allies decide who will fill what requirement best. In practical terms this may lead to apportioning responsibilities, such as "for this op the US provides air support, The Netherlands artillery, the UK naval gunnery and cruise missile support, and so on."

It is individual STANAGs, according to HQ Allied Air Command (AIRCOM), which detail all aspects of fire support integration and synchronisation, and these currently provide the detail, (which for space reasons can only be touched on in this feature), followed for JFS ops in the Alliance.

AIRCOM itself is NATO custodian for STANAG 3736 AJP-3.3.2 – "Allied Joint Doctrine For Close Air Support and Air Interdiction", STANAG 7144 ATP-3.3.2.1 'Tactics, Techniques and Procedures for Close Air Support and Air Interdiction' and also for STANAG 3797 ATP-3.3.2.2 'Joint Terminal Attack Controller Programme'.

Of the other key JFS-related STANAGs, NATO's AArtyP-5 STANAG 2484, for example, on "NATO Fire Support Doctrine", details the application of integrated fire support and effects, particularly those related to field artillery. Its AArtyP-1 STANAG 2934

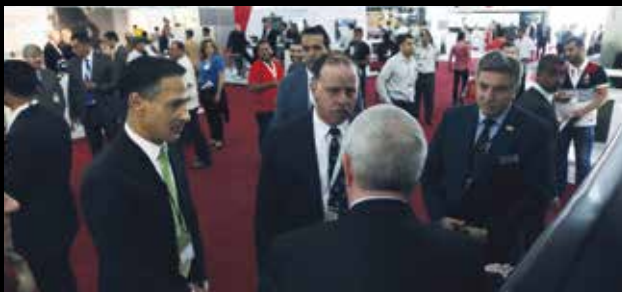
further addresses artillery procedures and is bolstered by its AArtyP-3 STANAG 2432, which addresses artillery procedures using automated data processing systems, all of which have a bearing on the use of artillery in a JFS context.

Other current STANAGs/APs on the specific aspects of fire support integration include STANAG 1034/ATP-04, which addresses 'Allied Naval Fire Support' and STANAG 1149/ATP-08 that relates to 'Doctrine for Amphibious Operations' and how JFS can be brought to bear in such scenarios. STANAG 2490/AJP 3 relates to 'Allied Doctrine for Joint Operations' and STANAG 3700/AJP 3.3 details 'Allied Joint Doctrine for Air and Space Operations'. 'Allied Joint Doctrine for Close Air Support and Air Interdiction' is detailed in STANAG 3736/AJP 3.3.2 and doctrine on the 'Use of Helicopters in Land Operations' is detailed in STANAG 2999/ATP-49. As for overall JOA airspace matters, STANAG 3805/AJP 3.3.5 deals with 'Allied Joint Doctrine for Airspace Control' and STANAG 7189/ATP-3.3.5.1 with 'Joint Airspace Control Tactics, Techniques and Procedures'. This series of detailed doctrinal edicts goes some way to illustrating the complexity of JFS and all the considerations that must be taken into account to prosecute a successful joint fire support operation.

Photo: Seaman Michael A. Colemanberry, US Navy



An expected (2018) new edition of the NATO ATP-3.3.2.1 "Tactics, Techniques and Procedures for Close Air Support and Air Interdiction" will be substantially aligned with US doctrine on CAS. Pictured: An F/A-18F SUPER HORNET, assigned to the Mighty Shrikes of Strike Fighter Squadron 94, prepares to launch from the flight deck of the aircraft carrier USS THEODORE ROOSEVELT on 21 December 2017.



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Allied Air Command indicated that in relation to the assets most important to a JFS role or operation, NATO looks at overall effects – that is to say, what is required or best suited to bring fires to the joint battle, such as air-to-surface, surface-to-surface, submarine-based-to-surface assets. Most important is the coordination of joint fires and interoperability among allies and their weapon systems and capabilities. Besides all this, allied personnel who are expertly trained, prepared and ready are what matters most according to our AIRCOM contact. "Specialist weapons systems operated by trained airmen in the air and soldiers on the ground from all our allies provide the hardware that generates the desired/required effects." About close air support (CAS), AIRCOM added that this is only part of joint fires besides artillery, helicopters, MLRS, and so on. "During FAC/CAS exercises the biggest opportunity is for a forward air controller (FAC) from one ally to work with a ground commander from another ally and call in CAS from an aircraft, or several aircraft, from yet another ally. This forges our allied capabilities into strong, ready and interoperable teams. It is important during these exercises to bring various allies' capabilities together and see how we can hone these further and iron out any incompatibilities."



Photo: KMW

According to FENNEK manufacturer Krauss-Maffei Wegmann (KMW), the FENNEK JFS is intended to provide pinpoint information to operations in the coordinated network of the German Army, Navy and Air Force.

When it comes to JFS contingencies and SOPs in place to effect JFS between any or all the 29 member nations of NATO, Allied Air Command told ESD that regarding air-to-surface fire support, NATO has a "NATO Joint Terminal Attack Controller Accreditation Programme" (ACO directive 075/012). The purpose of this directive is to set the framework for NATO Forward Air Control (FAC) and Terminal Attack Control (TAC) standardisation activities. This directive is the governing document to standardise the accreditation process of national FAC programmes throughout NATO and Partnership for Peace (PfP) nations. This ACO Directive also provides Headquarters Allied Air Command (HQ AIRCOM) direction in assisting nations in the development of their national FAC and TAC programmes. It helps to assess the nations' ability to provide required capabilities in support of NATO operations and exercises in accordance with STANAG 3797 ATP-3.3.2.2 "Joint Terminal Attack Controller Programme" and STANAG 7144 ATP-3.3.2.1 "Tactics, Techniques and Procedures for Close Air Support and Air Interdiction".

Asked how US national JFS doctrine and approach provides the key framework for the Alliance's overall JFS approach, our Allied Air Command contact responded that, "In relation to CAS, the expected (2018) new edition of the NATO ATP-3.3.2.1 'Tactics, Techniques and Procedures for Close Air Support and Air Interdiction' will be substantially aligned with US Joint Publication on 'Close Air Support' 3-09.3."

Currently, joint CAS field exercises that take place in Europe, essentially testing air-to-surface fires, include: SERPENTEX (France), ADRIATIC STRIKE (Slovenia), and AMPLE STRIKE (Czech Republic). Strictly speaking, these exercises are not NATO exercises, because they are nationally led by the countries mentioned in brackets. However, allies are invited by these nations to contribute their assets to allow realistic joint training across the services. AIRCOM Forward Air Controller Capabilities Section provides advice and observation during these exercises.

Photo: Spc. William Gibson, US Army



In any JFS operation, munitions are selected in order to create desired on-target effects deemed necessary to achieve an aim. Pictured: Soldiers fire an M777A2 howitzer while supporting Iraqi security forces near al-Qaim, Iraq on 7 November 2017.

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By the Numbers – An Analysis of European Armoured Vehicle Fleets

David Saw

The treaty on Conventional Armed Forces in Europe (CFE) sets limits on the numbers of tanks, artillery pieces, Armoured Combat Vehicles (ACV), combat aircraft and attack helicopters that can be located between the Atlantic and the Urals. Signatories to CFE have a ceiling on the numbers of systems they are allowed to have in each category and have to make an annual and verifiable declaration of the number of systems that they actually have in each category.

The ceiling numbers for the CFE treaties were originally negotiated during the Cold War period, in consequence the ceiling numbers for many of the nations involved are substantially higher than

it does not include all of the nations in the European space. Of the nations who signed the treaty, only four have ratified the treaty (Belarus, Kazakhstan, Russia and the Ukraine). Due to the fact that all of the origi-

In this article our aim is to focus on the category within CFE/CFE-II known as Armoured Combat Vehicles (ACV). The ACV terminology covers, as one might expect, all armoured vehicles with a combat role.



Photo: British Army

In 2020 the first of 589 AJAX vehicles manufactured by General Dynamics Land Systems-UK will enter service with the British Army. This £4.5bn programme will deliver 245 AJAX reconnaissance vehicles, 93 ARES reconnaissance support vehicles, 112 ATHENA command vehicles, 50 APOLLO support repair vehicles, 51 ARGUS engineer reconnaissance vehicles and 38 ATLAS recovery vehicles.

would be considered necessary today. Another factor, that necessitated CFE-II, was the collapse of the Warsaw Pact and the Soviet Union, and the emergence of new countries from the wreckage. These new circumstances had to be reflected in the ceiling numbers.

CFE/CFE-II has, broadly speaking, been a very successful arms reduction treaty, but

nal signatories had not ratified the treaty, Estonia, Latvia, Lithuania and Slovenia were unable to sign CFE-II upon joining NATO. As previously noted, Russia had both signed and ratified CFE, but in 2007 it withdrew its ratification. Despite this Russia continued to make declarations on its actual equipment holdings until 2011, after that point Russia ceased making CFE declarations.

It would appear that this is an all-encompassing definition of armoured vehicles and ought to cover everything in that equipment category. This would seem to be untrue if you consult the British CFE declaration, here the ACV numbers are declared and the numbers of different systems are listed. However, Britain makes an additional declaration for what it describes as "Armoured



Photo: British Army

Exploring Numbers

The fact that the British are quite prepared to declare all of their armoured vehicle holdings on a system-by-system basis is tremendously helpful as it presents an authoritative reflection of their armoured vehicle fleet from January 2000 through to January 2017. It should be noted that under the terms of CFE/CFE-II, the declaration only applies to British equipment located in the CFE area, which covers the UK, Cyprus, Gibraltar and Germany (all British troops are due to leave Germany by 2020). Later in this article we will use these detailed figures to provide a detailed analysis of the decline of the British armoured vehicle fleet from 2000 onwards. Before that though it is necessary to look at the overall equipment status of the other nations in Europe that are signatories CFE/CFE-II, starting with those nations that are not members of NATO. The nation with the largest ACV fleet ceiling under CFE/CFE-II was Russia which was entitled to 11,280 ACV. As previously noted, Russia ceased CFE declarations in 2011, but their declarations from 2007 to 2011 are of interest. In 2007 they declared 9,871 ACV, this went down to 9,149 in 2008 and was reduced to 8,944 in 2009, a significant drop to 7,926 followed in 2010 and numbers declined in 2011 to 7,690.

British Army WARRIOR IFV on exercise. The current declared WARRIOR fleet, including combat and specialist variants, is 456 according to the British CFE declaration of 2017. Under the WARRIOR Capability Sustainment Programme (WCSP) it is planned to upgrade up to 380 vehicles, but the future of this programme is uncertain.

Combat Vehicle Look-alikes" and Armoured Vehicle Launched Bridges (AVLB).

To the British the difference between a declarable ACV and an ACV Look-alike is complicated, the FV432 APC in a declarable ACV, but an FV432 with an 81 mm mortar is not. The majority of SPARTAN vehicles were declared as ACV, but the version of the SPARTAN with the MILAN ATGW was not. The non-declaration of

armoured vehicles in support roles, such as repair and recovery for example, appears logical as they have no offensive combat potential. On the other hand the British did not consider the Stormer HVM as declarable, despite the fact that it carried the Starstreak missile system. This demonstrates that the CFE/CFE-II ACV designation is not as all encompassing as might be expected.

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Belarus has a CFE ceiling of 2,600 ACV and what is interesting here is that Belarus shows very little fluctuation in declared fleet holdings between 2007 and 2017. They declared 2,339 ACV in 2007 and 2008, with 2,337 in 2009 and 2,324 in 2010. This was followed by a gradual, though limited, decline: 2,270 in 2011, 2,160 in 2012, 2,159 in 2013 and 2,155 in 2014. The 2015 figure dips to 2,134, then 2,092 in 2016 and 1,988 in 2017.

It is a different situation in the Ukraine. Here the CFE ceiling was set at 5,050 ACV and in 2007 the declared total was 4,250, reduc-

ing 239 in 2017. Georgia has a ceiling of 220 ACV and its 2017 declaration is for 190 systems, while Moldova has a ceiling of 210 ACV and has declared 159 systems.

NATO Numbers

There are 29 nations in NATO, of these Estonia, Latvia, Lithuania and Slovenia did not sign CFE. Other NATO nations not included in CFE are Albania, Croatia, Iceland, Luxembourg and Montenegro. Thus only 20 NATO nations are within the CFE limits, of these, Canada withdrew its permanently

European military capabilities have diminished in recent years, with Belgium being a prime example of this trend. In the article on tank numbers we noted that Belgium had a CFE ceiling of 334 tanks but declared only five tanks for 2017, or under 1.5% of their CFE ceiling. The situation in terms of ACVs is slightly better, with the CFE ceiling being 1,005 and the declared number being 105, or just under 10.5%. Another European nation with diminished capability is The Netherlands, their CFE ceiling for tanks was 743, but they declared 91. In terms of ACV, The Netherlands had a CFE ceiling of 1,040, but they declared 471.

Both Greece and Turkey have sizeable declared ACV fleets, the Greek CFE ceiling is 2,496 and they declared 2,314 ACV for 2017, while the Turkish ACV ceiling is 3,120 and they declared 2,715. Romania has a CFE ceiling of 2,100 ACV and declared 1,304, around 62% of their ceiling. Italy, with a CFE ceiling of 3,339 ACV, declared 2,324 systems, a little over 69% of their ceiling. The Spanish CFE ceiling is 2,047 vehicles, with their declaration being 1,057 ACV, a little over 51% of the ceiling total. As for Portugal they have a CFE ceiling of 430 vehicles and a declared fleet of 403 ACV, or slightly over 93% of their CFE total.

After analysing the decline in their tank numbers, one would expect the ACV fleets of Britain, France and Germany to be significantly below their CFE ceiling numbers. This is most certainly not the case in France, where the French Army has traditionally been a proponent of light armour for reasons of operational flexibility and deployability. Even so, the numbers are unexpected. France has an ACV ceiling of 3,820 vehicles and its declaration for 2017 was 3,022. By contrast the German ACV ceiling was 3,281 and the declaration for 2017 was 1,486, while the British had a ceiling of 3,176 and declared 1,377.

When a country makes a declaration of fleet size, it does not mean that this number represents active and deployable systems. The British, for example list, training aids, gate guardians and museum pieces on CFE declared sites within their declared systems. They have also been known to list range targets and in the case of their ACV declaration for 2008 admit that problems with a new tracking system meant that they were unable to include UK-based SULTAN vehicles in their declaration. An admission that is somewhat surprising as they did not have to make it, the SULTAN is an armoured command vehicle and is not directly CFE declarable, the British list the vehicle under their unique heading of Armoured Combat Vehicle Look-alikes.



Photo: Bundeswehr/Mario Bahr

A Bundeswehr BOXER armoured vehicle participating in Exercise Lightning Ace II on Salisbury Plain, England on 21 November 2017. The exercise was designed to test interoperability. The BOXER is seen as one of the main contenders for the British Army Mechanised Infantry Vehicle (MIV) requirement, assuming that there is money for the programme.

ing to 4,127 in 2008, and down to 3,937 in 2009, and 3,833 in 2010, rising to 3,855 in 2011. A slight drop in 2012 to 3,815, was followed by a further drop to 3,782 in 2013 and a rise to 3,794 in 2014. The 2015 figure was 3,508, down to 3,086 in 2016 and then 2,985 in 2017. Reductions in ACV numbers post-2014 can most likely be explained by the outbreak of armed conflict/Civil War in the Ukraine in 2014 and subsequent combat losses. Prior to that ACV number fluctuations are likely the result of sales of surplus equipment for export.

As to the other non-NATO states covered by CFE these are Armenia, Azerbaijan, Georgia and Moldova. Both Armenia and Azerbaijan have a ceiling of 220 ACV, they are also unique in the fact that they are the only CFE signatories to admit to being in excess of their force ceilings, with Armenia declaring 241 ACV and Azerbaijan declar-

based forces from Europe on 30 July 1993, although it does regularly deploy troops to Europe. As a signatory to CFE, Canada has an ACV ceiling of 263 systems, but as it does not have permanent equipment in Europe it declares nothing for CFE. The US is a different case entirely, its CFE ceiling is 5,152 ACV, back in 2014 it declared only 353 ACV in the CFE area, matters improved by its 2017 declaration which has 489 ACV.

In our study of tank numbers it was no real surprise that Greece and Turkey had such high tank fleet numbers, what was notable was that Italy had tank numbers equivalent to some 77% of its CFE ceiling and that Portugal reached 73% of its CFE ceiling. The numbers for ACVs offered some real surprises of this nature as well. There were also some more predictable results that demonstrated how western

The British ACV Experience

The detailed nature of the British CFE declaration allows us to look at the evolution, or to be more precise contraction, of their armoured vehicle fleet over an 18-year period from 2000 to 2017. In 2000 Britain declared an ACV fleet of 2,330 vehicles and separately an ACV Look-alike fleet of 1,609 vehicles, by 2017 the declared ACV fleet was down to 1,377 vehicles and the ACV Look-alike fleet was down to 513.

What complicates the British armoured vehicle picture is that you have the core vehicle fleet with systems such as the WARRIOR, and then you have systems that were purchased under an Urgent Operational Requirement (UOR) for Afghanistan, such as the Force Protection MASTIFF for example. After active involvement of significant British forces finished in Iraq and then eventually in Afghanistan, the British Army then had to decide whether it wished to keep these UOR vehicles and include them into the core fleet or dispose of some or all of them.

The primary British ACV is the WARRIOR and in 2000 the British declared 527 of these vehicles, in this case they would be the FV 510 Infantry Section Vehicles (489

Photo: Armée de Terre 2017



A French Army VBCI of the 1re compagnie du 5e régiment de dragons, French Army, acting as the OPFOR on a NATO exercise in Lithuania in 2017. France has long been a believer in the value of light armour, its CFE ceiling for armoured combat vehicles (ACV) is 3,820 vehicles and for 2017 it declared 3,066 ACV.

purchased originally) and the FV 511 Command Vehicle (84 purchased originally). Separately listed under ACV Look-alike were 70 WARRIOR RA (FV 514 Artillery

Observation Post Vehicle, 52 purchased originally, and the FV 515 Battery Command Vehicle, 19 purchased originally). Then came 38 WARRIOR recovery variants

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A CV9030 of the Telemark Battalion, Norwegian Army, on exercise at Stjørdal in Norway in October 2017. Norway has a CFE ceiling limit of 275 Armoured Combat Vehicles (ACV); its 2017 CFE declaration was for 194 ACV.

(FV 513, 39 purchased originally) and 91 WARRIOR repair variants (FV 512, 105 purchased originally).

Current WARRIOR numbers are 336 declared as ACV in 2017, the separate look-alike declaration lists 44 WARRIOR RA, 20 FV513 recovery variants and 56 FV512 repair variants. Originally the out-of-service date for the WARRIOR was originally going to be 2025, but will be extended to the 2040s due to the WARRIOR Capability Sustainment Programme (WCSP). In 2011 Lockheed Martin UK (LMUK) were awarded the WCSP development contract and up to 380 vehicles, in five variants, could be upgraded.

At this point a decision is awaited on whether to proceed with WCSP, with there being concerns over increasing costs and programme delays, neither of which is helpful when the Ministry of Defence (MOD) is under heavy financial pressure. Another critical issue is that originally the aim was to acquire two Brigade sets of upgraded WARRIORS, changes in the future British force structure indicate that at present only one Brigade set of equipment will be required if current plans are adhered to. With the requirement potentially being halved, the long-term survival of WCSP is becoming increasingly doubtful.

In 2000 the British ACV declaration included 748 FV432 and 11 FV432 RARDEN (the FV432 with the Fox armoured car turret, 19 converted for service in Berlin). Separately listed were 162 FV434 repair vehicles, 78 FV432 with 81 mm mortar, 135 FV432 command post/RA vehicles, 17 FV432 with CYMBELINE radar, 12 FV432 EW vehicles,

236 FV436 command vehicles and 47 FV439 signals vehicles. Production of the FV432 family of vehicles had ended in 1971 with 3,000 built and some 29 years later nearly 50% of the vehicles manufactured were still in service.

In 2017, some 46 years after the last FV432 left the factory, 458 FV432 were declared as ACV. Elsewhere there were 63 FV434 repair vehicles, 17 FV432 with 81 mm mortar, 120 FV436 command vehicles and 28 FV439 signals vehicles. All is not what it seems though, under the terms of a November 2005 contract BAE Systems was charged with upgrading 500 FV432 to the FV432 MK.3 BULLDOG standard, an upgrade that included a new engine and transmission, with the first 50 vehicles delivered in 2006. Also upgraded were FV434 repair vehicles. Out-of-service date for the FV432 is now 2030, by which point many of these vehicles will be over 60 years old! One caveat though, the MOD is so short of money these days that there is no guarantee that the FV432 fleet will survive into the long-term.

There is one future armour programme that is safe and that is AJAX being built by General Dynamics Land Systems-UK under the terms of a £4.5Bn contract to build 589 vehicles, with the vehicles coming into service from 2020. The AJAX programme, described as "the UK's biggest single order of armoured vehicles in a generation," consists of 245 AJAX reconnaissance vehicles, 93 ARES reconnaissance support vehicles, 112 ATHENA command vehicles, 50 APOLLO support repair vehicles, 51 ARGUS engineer reconnaissance vehicles and 38 ATLAS recovery vehicles.

As to current core inventory the British

declared 254 SPARTAN as ACV and 104 SULTAN command vehicles in the look-alike section. Part of the CVR(T) vehicle family, these systems have an out-of-service date of 2026. In September 2014 the UK MOD confirmed that 123 CVR(T) vehicles would be overhauled and refurbished as part of a £39.4M contract to sell the vehicles to Latvia for use by the Latvia Land Forces Infantry Brigade, with deliveries taking place in 2015.

The other major system declared in the ACV totals by the British is the MASTIFF, from 2006 onwards the British Army ordered a substantial amount of vehicles from Force Protection as a UOR. These included 506 MASTIFF Protected Patrol Vehicles (PPV), 168 RIDGEBACK 4x4 PPV and 130 WOLFHOUD Heavy Tactical Support Vehicle (HTSV). In 2013 it was decided that these vehicles would become part of the core British vehicle fleet, with fleet numbers being 400 MASTIFF, 160 RIDGEBACK and 125 WOLFHOUD. In terms of CFE declarations only the MASTIFF as an ACV and the WOLFHOUD in the look-alike category are covered. The 2017 declaration listed 222 MASTIFF and 18 WOLFHOUD in British service in the CFE area. The MASTIFF is due to go out-of-service in 2024.

An important future programme is the Mechanised Infantry Vehicle (MIV), for an 8x8 wheeled armoured vehicle. The British Army plans to establish two Strike Brigades, each of which will have two infantry battalions that will be equipped with MIV. Thus the minimum MIV requirement is four battalion sets of equipment, hence the interest of Rheinmetall, BAE Systems, General Dynamics, Nexter and Patria amongst others in the project. The crux of the matter for the British Army is although they have what appears to be a justifiable case for a MIV acquisition, that might not be convincing enough at a time when the MOD is in crisis in terms of funding and the British Treasury (Ministry of Finance) has decided that the British Army could be further reduced in size, thus allowing cuts to major procurement programmes.

This analysis has demonstrated how European armoured vehicle fleet have, with certain exceptions shrunk dramatically since the end of the Cold War. The contraction of the British Army armoured vehicle fleet since 2000 demonstrates that this shrinkage continues. The arrival of the AJAX family of vehicles from 2020 will be an extremely positive development, but currently the WARRIOR upgrade is by no means safe and the future MIV programme remains clouded by uncertainty. At this point future prospects for British armour appear less than encouraging. ■

Mobility versus Protection

Jack Richardson

Since the use of chariots in ancient times, there has always been a compromise with military vehicles. A heavier, more protected vehicle has traditionally been less mobile whereas a lighter, more mobile one has by necessity had less protection.

Technology has always sought to avert this compromise with concepts such as slanted and reactive armour granting lighter vehicles greater protection. However, in the post Cold War era of crises developing rapidly around the world, different vehicle manufacturers are still trying to bring about a reasonable balance. Stryker brigades utilise a derivative of the PIRANHA 8x8 to deploy troops over long distances at speed whilst affording a decent level of protec-

tion. However, these were not entirely the silver bullet envisioned because they were unable to achieve a target set by the US Army to be deployed by C130 HERCULES aircraft. In addition to ensuring vehicles are able to reach the battlefield, the balance of mobility versus protection becomes even more paramount once deployed. New technological developments are adding additional dimensions to this debate, with improving crew comfort systems enabling greater mobility whilst protection is enhanced through greater situational awareness and continuing innovation. Despite these new technologies, including jamming devices fitted to vehicles to sabotage Improvised Explosive Devices (IEDs) and active kill systems, there is still a balance to

be struck and US allies have attempted to ensure that contemporary vehicles are able to be adapted to different situations and combat environments as they arise.

One prominent vehicle is the BOXER 8x8, designed for the post-Cold War era by the initial partners of the UK, France and Germany and from the outset, deployable from the larger A400M. This vehicle was designed with a unique modular philosophy to alter mobility and protection at will. Germany operates the vehicle as an Armoured Personnel Carrier (APC) in addition holding modules enabling the vehicle to be operated in support functions such as Command and Control, Ambulance, Repair and Recovery. The Dutch Army has also ordered the vehicle for support roles such as

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The APC BOXER is a cooperative European design project aimed at producing the next generation of armoured utility vehicle. It is a German-Dutch multirole armoured fighting vehicle designed to accomplish a number of operations through the use of installable mission modules.



The PUMA is a German infantry fighting vehicle (Schützenpanzer or short SPz) designed to replace the ageing MARDER IFVs currently in service with the German Army. The PUMA is one of the world's best-protected IFVs, while still having a high power-to-weight ratio.

this and the versatility of the platform has been underlined by Lithuania purchasing BOXER chassis in addition to new modules that feature a troop compartment and a heavier gun. This configuration would allow BOXER to be operated as an Infantry Fighting Vehicle (IFV) with an offensive capability beyond that of an APC. This same modular concept also provides a degree of future-proofing as videos released by its manufacturer, demonstrate modules that allow the vehicle to deploy Unmanned Ground Vehicles (UGVs) for reconnaissance purposes. However, BOXER has its shortcomings because the price of providing greater protection has made it too heavy to be transported by C130J leading the UK to withdraw from the programme in 2003. The principle of modularity is also applied to the next generation tracked IFV being procured for the German military. PUMA is currently being delivered in order to replace the veteran MARDER IFV, with 400 currently under contract. A clean sheet design, PUMA seeks to build on the concept

of modularity to tailor protection levels to the deployment, with subsequent impact on mobility. With a baseline weight at 31 tonnes to be transportable by A400M, this has the capacity to be scaled up to cope with high intensity combat by adding additional modular armour.

Jointly developed by Rheinmetall and Krauss-Maffei Wegman, PUMA is currently being marketed to export to customers around the world, having been tested in both arctic and desert conditions. Built to enhance crew survivability, the vehicle is equipped with a remotely controlled main turret. To meet the demands of the export market, Rheinmetall has also produced the lower cost LYNX tracked IFV. Unveiled at Eurosatory 2016, this vehicle is also targeted at finding a balance between protection and mobility with a lower unit cost than the PUMA. Also utilising a modular armour concept but with key differences from PUMA including a manned turret, LYNX seeks to provide greater protection with innovative ballistic armour and

internal linings, whilst being marketed as able to scale significant obstacles. Weighing upward of 38 tonnes, LYNX is offered in a reconnaissance version, able to carry six dismounts, alternatively, an IFV variant adds capacity for two more passengers, whilst both options can be configured for wider roles such as command and control, or repair and recovery. PUMA and LYNX are both technologically advanced vehicles, accounting for new developments in modular protection whilst ensuring mobility is not compromised. A common method of accomplishing this is the option to carry SPIKE ER anti-tank missiles, reducing the need for other, more costly and heavy, anti-tank guns. However, these operate in a crowded field of tracked IFVs.

In Europe, a widely deployed solution is the BAE Systems CV90. This vehicle has been updated continuously to carry a three man crew in addition to eight dismounts. Different versions are offered, all purporting to offer a strong balance between mobility and protection. In addition to a highly advanced jammer suite, this is a platform which takes protective technology further, by trialling adaptive camouflage, to prevent detection by enabling the vehicle to blend into nearby surroundings. Whilst these tracked vehicle designs have a strong balance between mobility and protection, it is argued that due to the need for more frequent maintenance and being heavier, tracked vehicles have a greater bias towards protection, and wheeled vehicles a greater amount of mobility. This is particularly the case as future conflicts are likely to become more asymmetrical, with an emphasis being placed on operations that occur off road and on hostile terrain; where the more flexible suspension systems of wheeled vehicles (whose tyre pressure can be adjusted accordingly) lend an advantage. As a result of this approach, the French Army's primary IFV is another 8x8 wheeled vehicle, developed after the country also withdrew from the BOXER programme. With a crew of three and up to eight dismounts, the VCBI has a diesel propulsion system and a 25mm gun. The platform has a proven track record from the way in which VBCCI was used to such effect by France to rapidly deploy forces to Mali under Operation Serval in 2013. Through also using the modular armour concept, VCBI is seen as future proofed, as seen by the fact an upgraded version, dubbed the VCBI-2 has been brought by the Armed Forces of the State of Qatar. This has learnt the lessons of the Mali conflict of a more efficient climate control system and larger tyres, to further enhance off-road mobility. New weapon options are also available,

including missiles for long distance engagement and the heavier CTA 40mm cannon. The success of this vehicle in contemporary conflicts from Mali to Afghanistan is cited a key model for how the British Army is now going forward, with a number of VCBIs loaned to the force in 2014.

The Strategic Defence and Security Review (SDSR) of 2015 announced that under "Army 2020 refine", two "strike" brigades would be created by 2025 to ensure that the British Army is able to operate autonomously at long distances in the future. These will be hybrid formations and will be equipped with two battalions of the AJAX tracked reconnaissance vehicle in both this configuration and as a "medium tank". There will also be two battalions mounted on a Mechanised Infantry Vehicle (MIV) in 8x8 configuration whilst artillery, medical, combat engineer and logistics element will also be attached. Theoretically, this enhanced mobility granted through the procurement of an MIV and the firepower inherent with AJAX will enable the British Army to conduct an operation similar to that carried out by its French counterpart in Mali. Alongside the aforementioned competitors of BOXER, VCBI (in addition to the PIRANHA), a widely used and proven wheeled vehicle in Europe is the Advanced Modular Vehicle from Patria. This 8x8 configured machine can be refined for a variety of roles and is already in service in the Eastern European states of Poland, Croatia and Slovenia replacing their previous Soviet stocks. Despite the inherent mobility and versatility wheeled armoured vehicles offer, other programmes being undertaken suggest heavily protected forces still have a place alongside their more mobile counterparts. Alongside the Life Extension Programme (LEP) for the Challenger 2 Main Battle Tank (MBT), the centre piece for modernising the British Army's tracked vehicle fleet is the Warrior Capability Sustainment Programme (WCSP). Originally procured in the 1980s from GKN Land Systems to capitalise on the combining of the mobility and troop carrying of APCs, with the protection and firepower of MBTs, the Warrior first saw action in the First Gulf War and also escorted aid convoys during the war in Bosnia. Having been exported to Kuwait, the platform was also utilised in the Second Gulf War and by the British Army in Afghanistan. As part of the CSP, the lessons of these conflicts are being applied with the new version of the vehicle being equipped with modern sensors by Lockheed Martin UK (the prime contractor) to enhance situation awareness whilst efforts are also being made to improve crew comfort. There is also capacity for extra armour to be fitted in a modular fashion, to tailor the protection and mobility level to the theatre it is being deployed in. The other centrepiece of the WCSP is the addition of a new turret with the CTA 40mm cannon. This piece of equipment is credited with a far higher lethality rate than the previous system, able to defeat any other armoured vehicle except an MBT. The WCSP has however been criticised, because fitting a modern turret to a legacy vehicle is reported to be increasing the price of the platform, resulting in fewer vehicles being upgraded, at a time when the British Army is facing more threats with resources diminishing. It is however hoped that economies of scale can be achieved through the CTA being fitted to AJAX. This name was given to the platform at the 2015 edition of the London Defence Security Exhibition International (DSEI) having previously been known as "Scout SV". Before this, it was part of the large scale Future Rapid Effects System (FRES) to replace the aging Cold War era fleet of armoured vehicles. The require-



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Photo: Rheinmetall Defence

The LYNX family of tracked armoured vehicles is at the forefront of a new trend in IFV design toward armoured vehicles with lower unit and through-life costs and reduced complexity. A key principle of the LYNX concept is the integration of proven sub-systems with a high technological readiness level to reduce development time, cost and technical risk.



Photo: Defense Gouvernement

The Véhicule Blindé de Combat d'Infanterie (VBCI, "Armoured vehicle for infantry combat") is a French IFV that entered active service with the French Army in 2008. The 8x8 wheel combination is designed for maximum mobility. The VBCI is also designed to be transportable by the Airbus A400M, with an empty mass less than 18 tonnes.



Photo: US Army

The WARRIOR WCSP tracked vehicle is an older British armoured vehicle. It started life as a project broached in the 1970s. The British Army intends to upgrade its WARRIORS to extend their service life to 2025.

ment was later split with AJAX being meeting the SV section and a "Utility Vehicle" also sought (later replaced by MIV). AJAX is said to bring a significant improvement over the legacy tracked vehicles it replaces, able to network fully with other armoured vehicles, whilst benefiting from the additional firepower the CTA brings. Despite these improvements over preceding systems, AJAX is still criticised as being inappropriate for use as the primary offensive platform of the Strike brigades because its tracked mobility is insufficient for the role envisaged whilst lacking the protection (and firepower) of an MBT. Under "Project Scorpion", France is taking a different approach. JAGUAR seeks to build on the legacy of existing wheeled scout vehicles in the French Army. Because the CTA is also fitted to this vehicle, this forms part of a trend whereby manufacturers are attempting to balance mobility and protection in a highly lethal vehicle. CTA is reported as having greater lethality in a more compact system through the innovative loading system. It also fires different types of ammunition from airburst rounds for destroying light targets, up to armour piercing and programmable ones, the latter of which can engage airborne targets such as light helicopters and UAVs. The US Army is also trying to balance protection with mobility, with a requirement termed the "Mobile Protected Firepower" tank. This is intended to produce a tracked capability with a 105mm main gun and a strong balance between mobility and protection with the capacity for two vehicles to be carried simultaneously in a C17 transport aircraft. Producing a capable, networked platform such as this is in response to growing Russian capabilities. With the clean sheet designed T14 ARMATA tank, and the similar T15 IFV, Russia is placing a great emphasis on deployable forces, mobile forces. Examples included the BUMERANG 8x8 APC, with modular capacity similar to Western platforms and the KURGANETS-25 tracked IFV, highly manoeuvrable with a crew of three, six dismounts also featuring a 30mm cannon, chain gun and anti-tank missiles. This latter platform even features amphibious capability.

Overall, this broad range of vehicles both imported and developed in Europe, show a rapidly changing market for 10-40 tonne armoured vehicles as the merits of wheels and tracks continue to be debated. Although new technology has enabled mobile platforms to become more survivable, we still await a solution to ensure protected platforms benefit from tactical and strategic mobility as continuing issues with modular platforms show. ■

The 6x6 Scenario

David Saw

In terms of wheeled armoured vehicles it all comes down to numbers when making decisions about the type of vehicle necessary to fulfil a particular operational requirement.

Is the right vehicle going to be 4x4, or 6x6 or even 8x8? Of course defining and then selecting the “right vehicle” is a complicated process; there is much more to it than four, six or eight-wheel drive. For our purposes the aim of this article is to look at the current situation of the six-wheel drive armoured vehicle.

6x6 configuration. Operational experience demonstrated that the 6x6 configuration did not provide the required cross-country performance and so the reconnaissance vehicle evolved into an 8x8 configuration. The first four-wheel drive vehicles actually date from the infancy of the motor vehicle, but what we would recognise as the basis

Regarding 6x6 vehicles, once again it was the US automotive industry that would create the basis for the future. In 1939 the US Army issued a requirement for a 6x6 2.5 tonne truck and in 1941 the winning GMC CCKW design went into production; more than 560,000 of these vehicles would be built. The US also produced the Studebaker US6 2.5 tonne truck. This used some CCKW components, and over 190,000 were built, the majority being shipped to the Soviet Union, where they provided the basis for later ZIL truck designs that were in production through to the 1960s. The US6 was also produced by the REO company but their main claim to fame came post-1945 when it developed the successor 2.5 tonne 6x6 truck that was type classified as the M35. The M35, M35A1 and M35A2 remained in production from 1950 to 1988, with the M35A3 in production from 1993 to 1999.

While US developments in 4x4 and 6x6 support vehicles were highly influential, they also made a significant contribution in terms of wheeled armoured vehicles. This was particularly true in the case of the M8 armoured car and its M20 variant. The requirement for the M8 came about due to the fact that the US Army wanted to replace a 4x4 light truck equipped with a 37 mm anti-tank gun, a system that they described as a tank destroyer! The requirement was issued in July 1941 and the Ford T22 design was selected in April 1942. By this point it was understood that the successful vehicle was not a tank destroyer, but was a potentially very effective armoured reconnaissance vehicle. The M8 had a turret mounted 37mm cannon and a .30 calibre (7.62x63mm) co-axial machine gun, with a 0.50 calibre (12.7x99 mm) M2HB heavy machine gun on a ring mount on the turret roof. It had a crew of four, combat weight was 7.89 tonnes and road range was 560 km. The M20 variant did not have a turret. Instead it was fitted with a ring mount with an M2HB machine gun. The M8/M20 was in production at Ford from March 1943 to June 1945. In that time 12,314 were built. Apart from the US, some 45 other countries used the M8



Photo: JB. Tabone/armée de Terre

The AMX-10 is still one of the most formidable 6x6 armoured vehicles. This AMX-10RC is from the 3ème escadron armée of the 4e régiment de chasseurs on a training deployment in Djibouti. The AMX-10 will be replaced by the EBRC JAGUAR from 2020 onwards.

The first point to understand is that there is nothing new in terms of wheeled armoured vehicles having 4x4, 6x6 and 8x8 configurations. In the early 1930s Germany developed a number of wheeled armoured vehicles for the reconnaissance mission; initially these were based on a 6x4 truck chassis that was modified to the

of the modern 4x4 came in the early 1940s with the advent of such vehicles as the 1/4 tonne 4x4 General Purpose Vehicle or as it is most commonly known the JEEP. Originally designed by the American Bantam company, who built the first few thousand, the majority were built as the Willys MB and Ford GPW with over 600,000 produced.

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post-1945 and the vehicle is still in service today in Colombia. France was a major M8/M20 operator, acquiring nearly 900 vehicles, and using them in Indochina and Algeria. The M8/M20 was replaced by the Panhard EBR, a pre-war designed 8x8 vehicle, and by the Panhard AML, a 4x4 vehicle, from the early 1960s onwards. Panhard would go on to develop an AML successor at the end of the 1970s known as the ERC-90 SAGAIE, a 6x6 vehicle. This was adopted by the French Army in the early 1980s to equip its rapid intervention forces in Africa and is still in service today.

Modern Evolution

The French Army had adopted the SAGAIE due to the fact that its primary light armoured vehicle, the AMX-10RC, with a combat weight of 17 tonnes, was too heavy to meet rapid deployment criteria. The AMX-10RC was a 6x6 vehicle, equipped with a 105 mm gun, that entered service in the early 1980s, with France acquiring 300, Morocco 108 and Qatar 12. In 2000 Nexter was awarded a contract to upgrade 256 AMX-10RC to the AMX-10RCR configuration. First deliveries were in 2005, with final deliveries in 2010. Both the AMX-10RCR and the ERC-90 SAGAIE will be replaced in French Army service by the Engin Blindé de Reconnaissance et de Combat (EBRC) JAGUAR from 2020 onwards.

The JAGUAR acquisition is part of a major wheel armoured vehicle renewal programme that will also see the acquisition of the Véhicule Blindé Multi-Rôles (VBMR) GRIFFON. The GRIFFON will replace the existing VAB 4x4 armoured vehicles that have been in service with the French Army since the late 1970s. The EBRC/VBMR are produced by a consortium of Nexter, Renault Trucks Defense and Thales. These are 6x6 vehicles, with JAGUAR and GRIFFON sharing 70% commonality. The JAGUAR weighs 25 tonnes, has a crew of three and has a turret mounting a CTA International CT40 40 mm cannon. It also mounts two MBDA MMP anti-tank missiles with a 7.62 mm machine gun on the turret roof. The GRIFFON has a crew of three and can carry eight dismounts. An RCWS is fitted with either a 12.7mm or 7.62mm machine gun, or alternatively a 40 mm AGL, vehicle weight is some 24 tonnes. In April 2017 the Direction Générale de l'Armement (DGA) placed orders for 319 GRIFFON and 20 JAGUAR vehicles. This first GRIFFON order includes four variants; APC, command, ambulance, artillery forward observer. Subsequent orders will include engineer and recovery variants. In total the French Army requires 1,722 GRIFFON and 248 JAGUAR. In June 2017 the first export order was received from Belgium who is to purchase 417 GRIFFON and 60 JAGUAR in a €1.1 bn contract, these vehicles will replace the existing PIRANHA IIIC and DINGO systems in service.

Making Choices

The British are also working on a number of wheeled armoured vehicle programmes. One of these, the most talked about, is the Mechanised Infantry Vehicle (MIV), which is an 8x8 vehicle. However, below MIV comes another requirement for the Multi Role Vehicle - Protected (MRV-P) which emerged in early 2016. This consisted of two main vehicles; the Troop Carrying Vehicle (TCV), with a crew of two and six dismounts, and the Future Protected Battlefield Ambulance (FPBFA). The TCV would also provide the basis for a number of specialist vehicle variants.

Then the MRV-P programme evolved in a new direction. This led to MRV-P Group 1 which was aimed at acquiring the Oshkosh Joint Light Tactical Vehicle (JLTV), followed by Group 2 that covered the TCV and FPBFA and the Group 3 that covered a recovery variant. In July 2017 the US Defense Security Cooperation Agency (DSCA) announced an offer to the UK of up to 2,747 JLTV systems plus



Photo: Ministry of Defence Belgium

An illustration of the new VBMR GRIFFON 6x6 APC variant; the French Army ordered 319 GRIFFONs (in four variants) and 20 EBRC JAGUARs vehicles in April 2017. In June 2017 Belgium ordered 417 GRIFFONs and 60 JAGUAR vehicles. France hopes to acquire a total of 1,722 GRIFFONs and 248 JAGUARs.

appropriate support valued at US\$1.035Bn. This indicated that Package 1 was virtually resolved, although the British requirement was initially for some 750 JLTV. On the other hand Group 3 had zero momentum

and was making no progress whatsoever. This left Group 2 to be decided. The original requirement called for 150 TCV and 80 FPBFA, with the eventual objective being 300 of each vehicle, if the money can

be found. Initially some 12 companies bid for the programme, but this was then reduced to the Rheinmetall SURVIVOR-R 4x4, the General Dynamics European Land Systems (GDELS) EAGLE V 6x6, the Thales BUSHMASTER 4x4, the Penman METRAS MRV 6x6 and a proposal based on the Mercedes-Benz FGA 14.5 4x4 truck chassis. The number of contenders was then further reduced and a trials programme followed which should lead to a favoured candidate emerging by the end of February 2018.

The French Army EBRC JAGUAR and VBMR GRIFFON have a much more complex mission profile than the British TCV/FPBFA requirement, consequently these are larger, heavier 6x6 vehicles. The British have still to select a 4x4 or 6x6 option, but as they are in a lower weight class and are cash constrained they might well opt for a 4x4 solution.

The fact of the matter is that there are applications for which a 4x4 vehicle remains an operationally sound and cost effective solution. Once you move up the capability spectrum to the operational environment envisaged for the French Army JAGUAR and GRIFFON vehicles, then the obvious solution is for a 6x6 vehicle. ■

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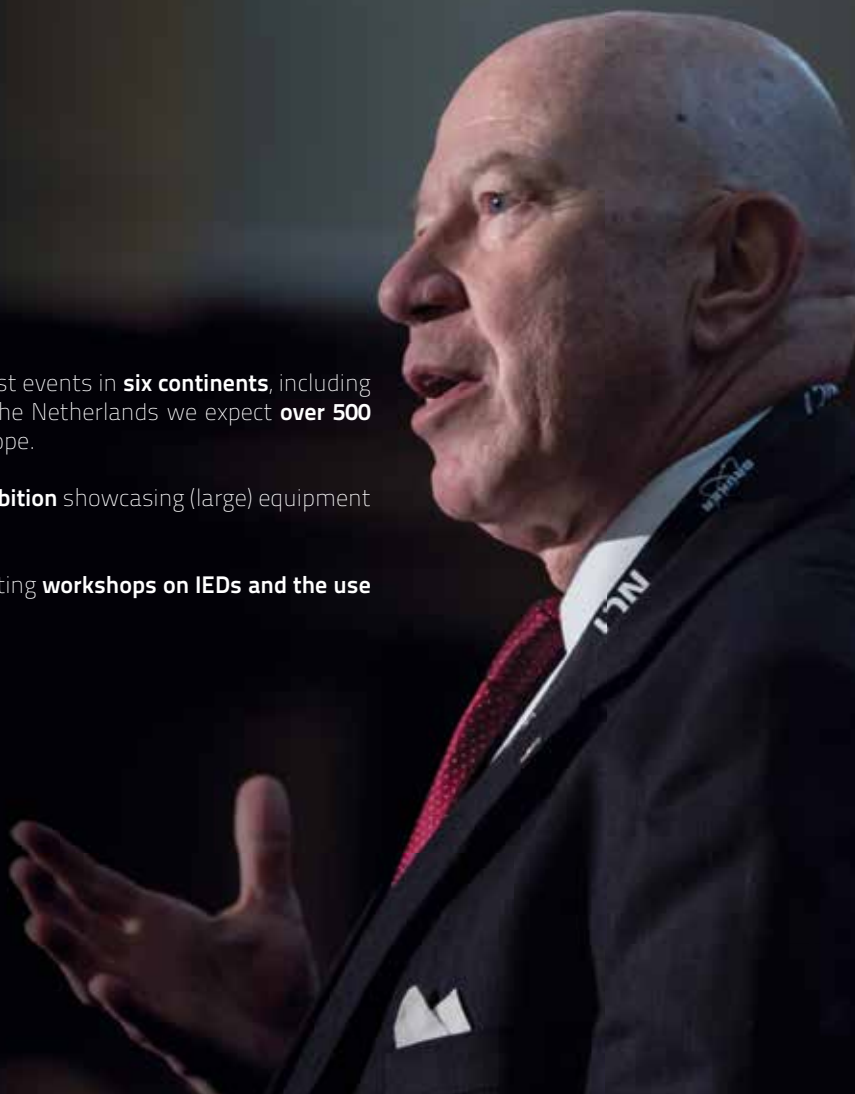
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Extending the Senses – AFV Situational Awareness

Tim Guest

Equipping AFVs with the very latest situational awareness systems will greatly improve their survivability on the battlefield. Real-time data from such devices will extend the senses of those on board, so they can determine what is going on around them and make the best possible tactical decisions, based on that information.

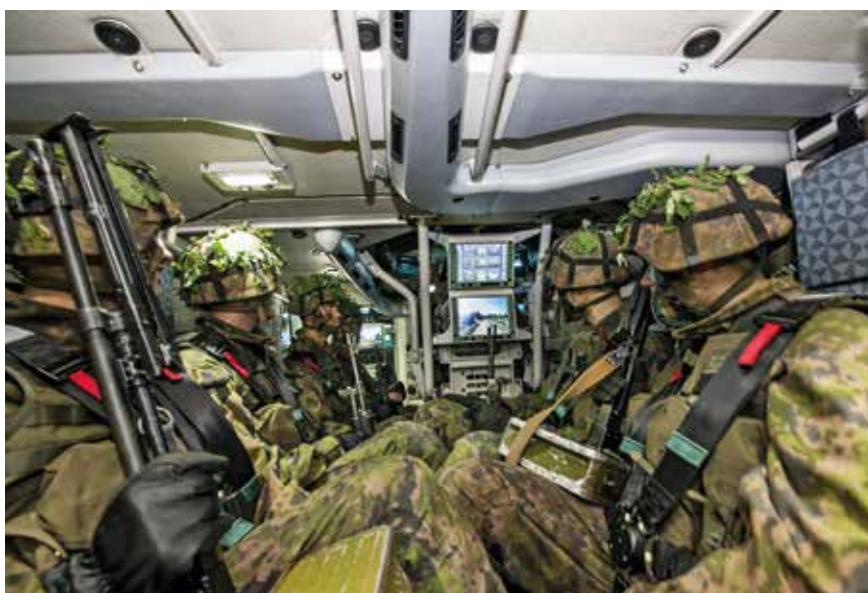
Throughout Western and NATO militaries a wide range of AFV programmes, from AJAX, CHALLENGER II, PUMA, CV90, FENNEK, BOXER, LAV III, US Army ABRAMS BRADLEY, SCORPION and STRYKER are looking into enhancement of these platforms using situational awareness systems. A large number of industry players, including the likes of BAE Hägglunds, General Dynamics, RFEL, Rheinmetall, Patria, QinetiQ, and Thales are all involved in developing such SA systems and solutions that will ultimately improve the survivability of such vehicles and their crews on the battlefield. This article looks at some background thoughts to set the SA scene along with some of the latest SA developments from industry.

The main aim of Situational Awareness (SA) systems in the context of an AFV is to protect both crew and troops, mounted or dismounted, associated with a particular vehicle by providing them with extended visual and sensory awareness beyond the scope of their own individual senses. This additional sensory input, digital and integrated in nature, provides as “all round a view” as possible, one that is not only 360 degrees in a flat plane but also semi-spherical to indicate what is going on above the ground and vehicle, also. SA systems should, at the very least, help vehicle crew and dismounts resolve three questions:

- What is there?
- What is happening?
- What might happen next?

In resolving these questions, an AFV’s integrated sensors and information from its C2 network effectively extend the human

Photo: Patria



User touchpoints throughout a network may find users viewing the SA information either at a workstation, a tablet/LED display, or potentially on a helmet-mounted display.

senses of those onboard. However, adding more and more layers of information from different sources to any decision-making process may end up resulting in cognitive overload if relevant information is not separated from disturbance and irrelevant input. It is, therefore, as important to present the information to all stakeholders correctly, on a need-to-know basis, as it is to sense the local environment and gather SA intelligence in the first place.

Evolving Camera Tech

One kind of sensor in use for quite a long time to give drivers, crew and dismounts a better view of their surroundings, have been vehicle camera systems. At a very minimum, such set-ups have been used as night driving aids and also provided a reversing camera for the driver; a major drawback has been that the commander was unable

to share the same view as the driver. In future, such camera systems/set-ups will have a switching capability enabling distribution of video feeds to all displays: driver, commander, etc. Such systems must be able to distribute video feeds not only from local situational awareness camera systems, but also from weapon sights and off-platform sensors, such as UAVs/UGVs.

One of the challenges of AFV camera system digitalisation is the presence of rival emerging standards as the camera systems move slowly towards digital protocols from analogue signal transmission. Whether one dominant standard remains or the market is divided along NGVA, GVA and GigE Vision standard lines remains to be seen. Certainly, digitalisation brings one clear advantage over analogue systems; displays will be computer-based units with capabilities for digital image processing. From an operator’s perspective, the ability to per-

Author

Tim Guest, is a freelance defence journalist and former officer in the Royal Artillery.

Expanded SA Capabilities for the PUMA IFV

The German Bundeswehr has contracted with the Rheinmetall Group to supply expanded capabilities and additional equipment for the PUMA infantry fighting vehicle (IFV). These expanded capabilities will further enhance the infantry fighting vehicle's combat performance in a number of areas as well as providing improved possibilities for training. Relevant to situational awareness, the expansion package includes among other things the installation of advanced visualisation and display technology, which will see the PUMA upgraded to meet current standards, with the current black and white monitor and accompanying optics being replaced by a state-of-the-art, high-performance colour displays. This will provide the vehicle commander and gunner with a high-resolution, highly detailed view of the surrounding terrain and the current tactical situation. It will also open up greater possibilities for reconnaissance and target engagement. A new infrared searchlight mounted on the rear of the vehicle will enhance the driver's night vision capability. Just awarded, the development order includes sample integration of the visualisation technology into three vehicles, with exercise of a subsequent series production option envisaged for 2020.

The PUMA infantry fighting vehicle is the most advanced system of its kind worldwide. When it comes to combat effectiveness, mobility, C4I capabilities and situational awareness, it sets new standards. Along with modular, high-performance protection, the PUMA possesses a unique degree of battlefield lethality and is fully capable of taking part in network-enabled operations. Roomy enough to carry nine troops, this state-of-the-art IFV can be airlifted to the area of operations in an A400M military transport plane. The PUMA is currently being introduced into the German Army. Delivery of all 350 vehicles, which began in June 2015, is scheduled for completion in 2020. The first units are now undergoing training in the use and operation of the PUMA system.

form image processing will be a giant leap forward. Not only will automation help the operator answer the first of the three questions mentioned above: "What is there?" and without constantly having to observe the image, but it is also likely in some cases that digital image processing will help users solve the even harder third question: "What might happen next?"

Digital Image Processing and Local SA

One leading industry SA player providing high specification signal, image and video processing solutions to government, defence, security and commercial customers is UK-based RFEL. Amongst its easy-to-integrate products and proven designs, developed for technically demanding environments and applications, it has a wide range of digital video processing and image-enhancement technologies, tailored for improving SA for a diverse range of users. These offerings come in the form of off-the-shelf cameras and vetronics management sub-systems for armoured vehicles and include its TRAILBLAZER and FLEXNET systems, as well as plug-and-play video enhancement processor units, such as: ENHANCER and



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ATACAMA, and FPGA IP cores, which the company says can give developers of SA products the competitive edge.

RFEL's solutions help users improve detection, recognition and identification performance, as well as reduce combat operator fatigue; they also mitigate atmospheric turbulence and manage or distribute information from an increased field of view to a system's users. These technologies are underpinned by key video processing capabilities, including stabilisation, distortion correction and visible and infrared sensor fusion, all at standard and fully high definition resolution, and beyond.

TRAILBLAZER, for example, is a GVA-compliant military driver vision aid, which improves driver and crew effectiveness by extending the field of view beyond the normal spectrum, even in adverse weather and low-light conditions. It offers a new, best-in-class driver camera sub-system for vehicle system integrators. In addition to the mandated DEF STAN 00-082 video standard, it offers a simultaneous HD-SDI output interface, in addition to analogue output variants, making it equally easy to integrate in closed-circuit architectures, or even hybrid systems.

This high-performance, driver-aid system compromises both front and rear-facing units and uses a high-definition sensor and optical package, both to deliver the

best possible image quality, but also to provide multiple fields of view and distribute video to multiple users. The inclusion of a high-quality, long-wave, infra-red camera channel further extends the capability into complete darkness; its powerful on-board processing package and RFEL's Video Fusion algorithm, ensure that TRAILBLAZER delivers reliable and continuous manoeuvre capability. This includes good threat and obstacle detection, (downwards, nearby and far away), and a comfortable view of the route, intuitively tuned to the human operator's needs.

Video Fusion is far superior to common blending, or even simpler averaging, or overlay approaches. The RFEL algorithm intelligently generates a composite output video stream on a pixel-by-pixel basis, which preserves higher resolution features from the highest definition sensor, or colour content, and avoids hazing, or clouding due to fusing it with bland and uniform thermal regions from the thermal sensor. Additionally, strong thermal scene information, such as threats, are clearly fused into the daylight image; this way Video Fu-



Photo: RFEL

A new plug-and-play video enhancement offering, ENHANCER is a high performance, real-time, high definition digital and analogue video processor.

sion provides the best possible data from both sensor bands, without compromising either sensor's most valuable features. In addition to Video Fusion, pre-processing techniques further enhance the images. This includes RFEL's Non-linear Image Contrast Enhancement (NICE) algorithm, which is a technique proprietary to the company that also enhances detection, recognition and identification performance by adaptively representing information from dark areas of a visible scene in a manner optimised to the display's output dynamic range, and hence

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to the user. This ultra-high-speed algorithm operates at a latency of less than one ms and can adapt to changes in illumination in under 100 ms, making it ideal for human-in-the-loop applications.

Where cameras and vehicles are combined there has always been the problem of shake; Digital Stabilisation eliminates unwanted camera shake, producing an output that appears to have come from a stable platform. This technology is particularly useful in reducing operator fatigue and can vastly improve the effectiveness of target detection, recognition and identification tasks. This solution offers best-in-class performance, operating at very low latency and offering compensation for global platform roll, alongside vertical and horizontal correction – critical to vehicle applications. The company's new plug-and-play video enhancement offering, ENHANCER is a high performance, real-time, high definition digital and analogue video processor, offering best-in-class video enhancement technology. Also new is RFEL's ATACAMA, a high performance Atmospheric Distortion Correction video processor, which mitigates atmospheric turbulence, such as heat haze, and is ideal for integration or retrofit. Both of these new capabilities are small form factor, and can offer an instant performance boost to security, surveillance and SA systems, directly at the sensor, moving processor load away from over-burdened system host computers, and out to the edge.

RFEL is currently looking into new processor technologies to add more intelligence to all its products and solutions. Included will be the addition of higher raw pixel processing capacity to manage the next generation of military and high-end security sensors at 4K or 8K resolution, as well as expanding its library of standards-based network connectivity in order to bring real-time video capabilities to a wider set of video system architectures and users. This underpins the company's clear vision as to the future of SA for vehicles, unmanned systems and security users. It's a vision that it claims anticipates a need for reliable, real-time, detailed and intuitive 360-degree visibility, close in and at range, in all weathers, and is easily integrated into open architectures without compromise to system physical constraints, such as power and size.

Conceptualising the Threat

Across the defence industry companies have drawn on the experiences of forces during recent conflicts and NATO commitments, particularly in Afghanistan, in developing SA solutions. These conflicts have highlighted the different kinds of threats troops must face and be able to detect during the mounted

phase of the battle. These include visible threats by day and night, including anti-tank rockets triggered 50 to 500 metres away by an enemy deployed along the axis of approach, whose intention it is to neutralise the vehicle and its mounted troops. Improvised explosive devices (IEDs) intended to stop vehicles in their tracks and render them vulnerable to follow-on actions like an ambush are another typical threat considered by SA de-

ANTARES is heralding a new era in vehicle self-protection and has been selected by the French Army for its SCORPION programme.



Photo: Thales



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velopers. Laser range finders or laser target designators announcing an enemy weapon engagement are also standard threats, which need to be detected and for which the right SA system can improve the survivability of an AFV and its occupants.

Until now, to meet these threats, some military forces, including those within NATO, as well as the likes of Russian forces, have integrated Local Situation Awareness (LSA) with split cameras onto their AFVs, as well as Laser Warning Systems (LWS) with split laser detectors. However, not only have such integrated solutions proven expensive to install and retrofit, there have been difficulties attaching and integrating 10 to 16 split cameras to cover a 360° field of view around the vehicle, with both mechanical challenges and processing issues to stitch all the video flows together experienced. Laser detection using such systems has also often relied on a stressful acoustic alert, and in some scenarios has delivered an unacceptable false alarm rate.

Incorporating SA

SA systems are ideally incorporated as early on in an AFV's life cycle as possible; they are integrated with the vetronic infrastructure; in the case of Thales its Thales'

VSYSNet solution is responsible for collecting SA information from the external SA sensors, such as the Thales ANTARES. Such new systems are able to enrich the associated video flow from external sensors with augmented reality overlays, as well as video content analysis, and this can take place before distribution of raw data to the different crew members of the vehicle and/or mounted troops. User touchpoints throughout a network may find users viewing the SA information either at a workstation, a tablet/LED display, or potentially on a head-mounted display. Beyond the vehicle, it is also the responsibility of the vetronic infrastructure to connect sensors over the battlefield, made possible thanks to a new generation of software defined radio. In the case of SA data, a dismounted soldier, for example, may continue to have access to the video flow of the vehicle SA sensors even after leaving and moving away from the vehicle, the vetronics continuing to distribute the video flow not only within, but also outside the vehicle.

Some years ago, Thales invested in the development of a cutting-edge SA capability, ANTARES, consisting of a single, fixed-optical sensor head coupled with high-end processing, offering three operational functions within a 360° azimuth

and huge elevation coverage to address both open and urban scenarios. The system provides an LSA function with a 360° azimuth and, according to the company, an elevation field of view never previously achieved, with both panoramic and wider-areas-of-interest views represented over colour video. The system also provides a Moving Threat Detection (MTD) function, which allows the automatic detection of moving objects to warn the crew. In addition, an LWS function with a 360° azimuth and an elevation field of view, like its sister LSA system, not previously achieved. This provides a laser alert, with both positional data for the threat and with an accuracy that allows the crew to confirm, or not, a laser-emitting threat and directly feed that information into the ANTARES video flow.

According to Thales, ANTARES is heralding a new era of vehicle self-protection, to provide future early threat detection and feed information into battle management systems controlling hard kill effectors designed to neutralise any such threats from the likes of missiles and rockets.

The company says the system is reliable and easy to integrate with an NGVA-compatibility baseline, and delivering high-end performance with its multi-

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Photo: RFEL



RFEL's Video Fusion algorithm ensures that TRAILBLAZER delivers reliable and continuous manoeuvre capability, including good threat and obstacle detection (downwards, nearby and far away), and a comfortable view of the route, intuitively tuned to the human operator's needs.

function LSA-LWS system. It is also said to be scalable/upgradeable with new processing implementations such as the inclusion of a missile warning system. ANTARES also provides the vehicle crew and soldiers video streaming delivered by the Thales mini UAS Spy'Ranger family. Thales believes that with the single multi-spectral optronic vehicle "lookout" capabilities of ANTARES, the company could, in the coming years, offer not only the eye of the crew and troops onboard, but also a capability to see "through their own armour" and have immediate and real-time local situational awareness. ANTARES has been selected by the French Army for use within the framework of its SCORPION programme.

Conclusion

Whether it's BAE Systems Hägglunds looking into enhanced SA using augmented reality and its Battle View 360 system for the CV90, or Krauss-Maffei Wegmann and Rheinmetall developing SA systems for the Puma IFV, what is clear is that both local and wider area SA will be crucial to increasing the survivability of AFVs and their crews on the battlefields of the future. And from the most basic SA solution to the most sophisticated, augmented reality and advanced digital processing capabilities, being able to see

Photo: RFEL



TRAILBLAZER is a GVA-compliant military driver vision aid, which improves driver and crew effectiveness by extending the field of view beyond the normal spectrum.

what is going on around them in relevant detail will ultimately offer a battle-winning advantage to those whose SA solutions deliver. ■

Acknowledgements:
Thanks go to Patria, RFEL and Thales for their input to this feature.

Evaluating the Eastern European Armour Picture

David Saw

The NATO countries in Western Europe have significantly reduced their armoured vehicle fleets since the early 1990s. Indeed, surplus equipment from Western European NATO nations has been a welcome addition to force structures in Eastern Europe. Now the scene is set to move beyond taking advantage of surplus materiel, towards the acquisition of new equipment.

Many of the states in Eastern Europe are looking to be more than passive consumers of foreign armoured vehicle systems and sub-systems. Indeed, local defence industries can and will play a critical role in both the acquisition of armoured vehicles and their sustainment while in service. While there are those countries, for example the three Baltic States that do not have a suitable defence industrial capability for armoured vehicles, others such as Poland most certainly do. Poland has a virtually full spectrum design, develop and build capability for armoured vehicles, with the exception being automotive components many of which would need to be imported. Smaller countries such as Slovenia also have capability in the armoured vehicle sector. In the Slovenian case there is Valhalla Turrets who offer a range of remote control weapon stations and turrets for lighter armoured vehicles, as well as developing new turret concepts such as the Hildgard 57, compact mobile gun system featuring a 57x348 mm calibre gun. In addition they are offering new turret options for tank upgrade programmes. In this article our intention is to look at how Eastern European nations are developing their armoured vehicle capabilities. Our starting point will be the Baltic States, the three NATO members who find themselves having to face a newly resurgent Russia as a less than friendly neighbour. While NATO itself has moved to demonstrate its commitment to the defence of Estonia, Latvia and Lithuania through deployments of troops and other measures, it is up to these three states to also provide for their own security by expanding their own military capabilities.

Baltic Armour

Estonia has a population of some 1.251 million, according to NATO its defence expenditure for 2017 was US\$519M, equivalent to 2.17% of Gross Domestic Product

Photo: BAE Systems



BAE Systems is offering two different versions of the CV90 to meet the Czech Land Forces' IFV requirement. The first is a CV9030, a CV90 Mk III variant, and the second is the CV9030CZ featuring a modified hull shape to accommodate a Kongsberg PROTECTOR MCT-30 unmanned turret.

Photo: Czech Land Forces



The Czech Land Forces are currently conducting a competition to replace their old BVP-2 IFV systems that were built in the Soviet period. In total the Czech Land Forces are looking for 210 new IFVs in seven different variants, with first deliveries from 2020 onwards.

(GDP), with 19.27% of defence expenditure being spent on equipment. Estonian military personnel number 5,700 according to NATO. Latvia has a population of some 1.944 million, NATO has its defence expenditure as US\$487M in 2017, equivalent to 1.70% of GDP, with 20.29% of defence expenditure being spent on equipment. From 2018 Latvian defence spending will be raised to meet the NATO target of 2% of GDP. Latvian military personnel number 5,700 according to NATO. Lithuania has a population of 2.823 million; NATO lists its defence expenditure as US\$785M in 2017, equivalent to 1.77% of GDP, with 31.09% of defence expenditure being spent on equipment. Lithuanian military personnel number 14,000 according to NATO.

Obviously, bearing in mind the size of the three Baltic States, their economic situation and the size of their military forces, they are limited in terms of development possibilities for their ground forces. However, the strategies that they have developed to grow their ground forces and the corresponding armoured vehicle capabilities are distinctly different and worthy of further analysis.

Estonia has built an armoured vehicle fleet primarily based on the acquisition of surplus equipments from friendly states. Finland delivered 60 SISU XA-180 6x6 APCs modernised to the XA-180EST configuration between 2005 and 2007. Estonia will also be purchasing 12 K9 THUNDER 155 mm self-propelled guns from Hanwha Land Systems in the Republic of Korea (ROK) with delivery due in 2021. This acquisition is linked to the purchase of 47 K9 THUNDER by Finland.

The Netherlands has been a major source of vehicles for Estonia, initially supplying 81 XA-180 APCs. This was followed by two BERGEPANZER 2 ARV and two BIBER AVLb, with two LEOPARD 1 driver training tanks supplied as well. A total of 44 CV9035 IFVs were also acquired from The Netherlands. Norway is the source for 35 CV9030N IFVs, most of these have their armament removed and they are used as armoured logistic vehicles. Britain was the source of seven MAMBA APCs that were used by Estonian troops in Afghanistan. There were also 15 BTR-80UNsh 8x8 APC in service, but these were subsequently transferred to the Estonian Defence League, a territorial defence force. The Latvian Land Forces are at this stage in their development not as armour focused as Estonia or Lithuania, but there are two major armour-related programmes that will add significant capability. The UK Ministry of Defence (MOD) officially confirmed a £39.4M contract in 2014 that would cover the overhaul and refurbishment of 123

CVR(T) series vehicles that were surplus to British needs, with the first vehicles reaching Latvia in 2015. The CVR(T) acquisition covers some 20 SCIMITAR reconnaissance vehicles, equipped with a 30 mm RARDEN cannon, SPARTAN APCs, SULTAN command vehicles, SAMSON ARV and SAMARITAN ambulances. Otherwise there is very little else that the Land Forces operate in terms of protected mobility.

This was followed in 2002 by a much larger transfer that covered 158 M113A1, plus an additional 12 for spares. More vehicles followed including 32 M106, a version of the M113 mounting a 120 mm mortar. Then came 26 M577V2 command vehicles, along with six BERGEPANZER 2 ARV, after which a much larger acquisition of 168 M577V2 command vehicles was agreed. Lithuania was the first of the Baltic States

Photo: Estonia Ministry of Defence



The opening ceremony of the NATO Saber Strike exercise in Tapa, Estonia, held in June 2016. Note in the background an XA-180 6x6 APC of the Estonian Land Forces. Estonia received 60 XA-180s from Finland, later modernised to the XA-180EST configuration, and 81 from The Netherlands.

The most significant recent armoured vehicle development in Latvia occurred in February 2017 when it was revealed that the Land Forces would be acquiring self-propelled artillery. In total Latvia would acquire 47 M109A5Ö 155 mm self-propelled guns from Austria, the purchase include gun systems, artillery command vehicles on the M109 platform and driver training vehicles. These systems will certainly be a dramatic improvement to the firepower available to the Latvian Land Forces. It is worth noting that these M109 vehicles, which had been upgraded to the M109A1/M109A2 configuration, were originally in service with the British Army before the fleet was transferred to Austria in 1994. Many of these vehicles were subsequently upgraded to the Austrian M109A5Ö standard.

Arguably the most significant armoured vehicle force in the Baltic States is operated by the Lithuania Land Forces, with much of the existing fleet being acquired through transfers of surplus equipment from Germany. The first transfer in 2000 consisted of 49 M113A1 vehicles, with an additional 18 M113A1 to provide a source of spares.

to make a significant new armoured vehicle acquisition, on 22 August 2016 it signed a €385.6M contract to acquire 88 ARTEC BOXER 8x8 vehicles. The BOXER will be equipped with Rafael SAMSON RCWS-30 weapon stations and SPIKE-LR anti-tank missiles. As a part of the BOXER acquisition, Lithuania purchased five driver training vehicles variants of the BOXER and the first two of these arrived in Lithuania on 15 December 2017.

The BOXER vehicles have been designated as the VILKAS in Lithuania, and first deliveries of the IFV variants will occur in early 2019, with deliveries to be complete in 2021. According to the Lithuanian Land Forces: "The new IFVs will be designated to the Lithuanian Grand Duke Algirdas Mechanised and the Grand Duchess Birutė Uhlan Battalions of the Mechanised Infantry Brigade Iron Wolf."

Growth Path

This brief review of armour capabilities in the Baltic States has demonstrated three different approaches to building an armour/mechanised force. Latvia by purchas-



Photo: Latvia Land Forces

Latvia turned to Britain to meet its armoured vehicle needs, via a £39.4M contract covering the overhaul and refurbishment of 123 CVR(T) vehicles in 2014. First deliveries were in 2015, with the contract including SCIMITAR reconnaissance vehicles (shown here), plus APC, command, ambulance and recovery variants.

ing the ex-British army CVR(T) obtained a significant armour capability. Obviously these vehicles have their limitations but they provide the possibility to generate a reconnaissance screen and some protected mobility. They will also provide an invaluable training tool for the Latvian Land Forces that will allow it to build its capabilities and understanding prior to selecting a more advanced armoured vehicle family at a later date. The decision to acquire such an extensive self-propelled artillery capability in the form of the 47 M109A5Ö is most interesting as it is seemingly far more artillery than a force of their size ought to need. As such it would appear that the CVR(T) on the one hand, and the M109A5Ö on the other, is a somewhat unbalanced force.

With ground forces roughly equivalent in size to those of Latvia, Estonia has gone about developing its ground forces in a very different way. The acquisition of XA-180 APCs from Finland and The Netherlands provided a substantial force of wheeled APCs, while the selection of the CV9035 provided a highly capable IFV for the force. The CV9030 vehicles acquired from Norway also add to the mobility picture and in the future the arrival of the K9 THUNDER self-propelled guns will be a potent source of fire support. All in all this looks to be a well balanced set of armour options. Finally Lithuania with its profusion of M113s and the delivery of the VILKAS IFV on the horizon appears to be in a good situation, although it is short of mobile artillery support and would appear to need more firepower than the M106 and its 120 mm mortar can provide. A tracked IFV would also appear to be a useful addition to the Lithuanian force mix at some point.

All three Baltic States have anti-tank missile capabilities in the form of SPIKE and/or JAVELIN, but there will come a time when consideration will have to be given to whether to opt for a higher level of armoured vehicle with direct fire capabilities. The cost and complexity of operating a tank capability, especially in the light of the limited personnel resources available to the three Baltic States, makes that a less than immediately attractive option. Another consideration is that other NATO states that

chassis, with tracked or wheeled solutions available. The only downside with this is, once again, cost and finding the personnel to operate and support the vehicles. In the final analysis, much has been achieved in terms of armoured vehicle capabilities for the three Baltic States. However, at this point it is still a matter of building and developing armour capabilities and the ability to support them, within the constraints that the three militaries operate under in terms of people and funding. Given time, and consistent economic growth, the funding should become available to consider adding new armour. There is a negative to economic growth though. This will lead to competition for qualified people further reducing the personnel pool available to the military.

Czech IFV Search

The current Czech government is committed to increasing defence expenditure to the NATO target of 2% of GDP by 2024 and is looking to re-capitalise the equipment of the Czech Land Forces through a series of major procurement programmes. Amongst these is a programme to acquire some 210 IFV, with the selection and evaluation process already underway. Potentially another 100 IFV could be acquired on top of the original 210 vehicle programme. The Czech Land Forces armoured vehicle fleet consists of 107 General Dynamics European Land Systems (GDELS) PANDUR II 8x8

Photo: Lithuanian Land Forces



In August 2016 the Lithuanian Land Forces signed a contract to acquire 88 ARTEC BOXER 8x8 IFVs that will be known as the VILKAS in Lithuania. First deliveries are due in 2019 and will be complete in 2021. Lithuania also ordered five VILKAS driver training vehicles, the first two of which arrived on 15 December 2017.

deploy to the area in support of the Baltic States can provide tank capabilities. One possible solution is a fire support vehicle/light tank, potentially based on an IFV

wheeled vehicles. Originally 199 PANDUR II were ordered in 2006, with options on 35 more, but this contract was cancelled in 2007. Then in March 2008 a new contract

for 107 PANDUR II was signed, with all vehicles having been delivered. In January 2017 the Czech Land Forces ordered an additional 20 PANDUR II (14 signals vehicles + six command vehicles) from Tatra Defence Vehicle who have a production license for the Czech Republic and selected overseas markets.

In terms of tracked vehicles the Czech Land Forces operate the BVP-2 and some BVP-1 remain available. The BVP-1 (BMP-1) and BVP-2 (BMP-2) were manufactured under license in Czechoslovakia during the Soviet era, with the fleet being split on the dissolution of Czechoslovakia into the Czech Republic and Slovakia. Around 200 BVP-2 remain available and a significant number of BVP-1 are in reserve (these will be retired). The intention of the new IFV programme is to replace the BVP-2 in service with the Czech Land Forces; in parallel the aim is to receive technology transfer and significant workshare for Czech companies in the IFV programme in terms of both build and sustainment, as well as other programmes of the winning competitor.

The BVP-2/BMP-2 was a significant improvement on its BMP-1 predecessor. The 2A42 30 x165 mm cannon was capable and the vehicle could also mount either AT-4 FAGOT or AT-5 KONKURS missiles. There was a crew of three (commander, gunner and driver) and seven dismounts could be carried. There are possibilities to extend the service life and modernise the BMP-2. The engine and transmission could be replaced by modern and more powerful units, with the suspension system being modified. The turret could be removed and replaced by an RCWS system, while efforts could be made to enhance vehicle protection. There is no doubt that you could make a better BMP-2, but why would you want to? In the final analysis the BMP-2 has limited space for dismounts and even if you upgraded its mobility, protection and firepower characteristics, you would still have a less than state-of-the-art vehicle.

This then set the scene for the Czech Land Forces to evaluate a number of European IFV designs to meet their IFV needs. BAE Systems have teamed with VOP CZ as their local partner and are offering two distinct versions of the CV90 Mk III to meet the Czech requirement. The C9030CZ is similar to the latest Norwegian Army CV9030, although the armour package is different, the turret mounts an Orbital ATK 30x173 mm Mk44 cannon. The second option, the CV9030CZ r features a change to the hull shape to accommodate a Kongsberg PROTECTOR MCT-30 unmanned turret which mounts the Mk44 cannon. Both vehicles are fitted with rubber-band tracks to meet Czech requirements.

GDELS to Deliver PIRANHAs to Romania

General Dynamics European Land Systems signed a contract to deliver up to 227 PIRANHA 5 wheeled armoured vehicles in six different configurations to the Romanian Armed Forces. The contract has a value of more than US\$1Bn. It is part of the Romanian Army's plan to modernise its legacy wheeled armoured vehicle fleet. The modern PIRANHA 5 vehicles will be produced in Romania under a transfer of technology project between General Dynamics European Land Systems - Mowag and the Romanian company Uzina Mecanic Bucure ti (UMB). Since 2006, the Romanian Armoured Forces have fielded PIRANHA vehicles.

"The Romanian Army is one of the most important PIRANHA users in Europe. We are very honoured by this contract award as it reflects the high confidence and satisfaction the Romanian Army has in our vehicles," said Oliver Dürr, Vice President Wheeled Vehicles and Managing Director of General Dynamics European Land Systems - Mowag. "With this step, we have established a sustainable collaboration with a trusted partner which has a significant industrial footprint in Romania," said Thomas Kauffmann, General Dynamics European Land Systems Vice President International Business & Services. "The transfer of technology and the local production of these vehicles present an enormous opportunity to the Romanian industry."

With more than 11,000 systems fielded, the PIRANHA is one of the most successful 8x8 armoured vehicles in the world.

The previous sale of the PANDUR II to the Czech Land Forces has given GDELS a presence in the country which they hope will open the way for the ASCOD to be selected for the BVP-2 replacement programme. Originally developed to meet the needs of the Austrian and Spanish ground forces, the ASCOD made its breakthrough into new markets through its selection by the British Army under the Scout SV programme with 589 AJAX vehicles to be supplied. In June 2017 GDELS signed an arrangement with its strategic partner Czechoslovak Group (CSG Group) regarding the IFV programme; in addition a Memorandum of Understanding (MoU) was signed with VOP CZ, as well as agreements with Letecké Přístroje Praha (LPP), Meopta Systems and Ray Service. Rheinmetall is competing for the Czech IFV contract with their LYNX vehicle that was first shown at Eurosatory in 2016. Two main variants are available: LYNX KF31 with three crew and six dismounts or LYNX KF41 with three crew and eight dismounts. Both are fitted with the Rheinmetall LANCE turret system. The turret will accommodate the MK30-2/ABM 30x173 mm cannon; it can also be fitted with a launcher for the Rafael SPIKE-LR missile system. The Czech Land Forces already use SPIKE-LR on their PANDUR II vehicles.

The final contender for the Czech Land Forces IFV requirement is the PUMA being offered by PSM Projekt System & Management GmbH (PSM), a joint venture of Krauss-Maffei Wegmann (KMW) and Rheinmetall. The official hand-over of the first PUMA to the German Army was on 24 June 2015,

marking the service entry of the vehicle, and by the end of 2016 PSM had delivered 100 vehicles out of the 350 on order, with deliveries to be completed by 2020.

In mid-July 2017 PSM issued a press release that noted that 135 PUMAs have now been delivered to the German Army and that the full specification PUMA had been displayed at the IDET exhibition (31/05 to 02/06) at Brno in the Czech Republic. Subsequently the vehicle participated in what PSM described as: "mobility, transportability and live firing trials in the Czech Republic." These trials took place over a six-week period. PSM noted that: "the Czech Republic is planning to buy 210 vehicles in seven variants with the delivery of the first infantry fighting vehicles scheduled for 2020." The company also alluded to the fact that the German Army intends to buy more PUMA vehicles and in different variants.

PSM seemed to be very confident that the PUMA had emerged from the Czech trials as the leading contender for the programme and, since July, media reports out of the Czech Republic would seem to indicate that the PUMA is, as things stand at present, in a winning position. Obviously there is more to winning a contract of this magnitude than coming out on top in the trials phase; other factors such as cost and industrial/economic involvement for the purchasing nation come into play as well. A win for PUMA in the Czech Republic, added to Germany committing to a second tranche of PUMA, could have a transformative effect on the PUMA programme and potentially open the way for further export orders. ■

Tracks Support Tracks

Gerhard Heiming

In addition to firepower and protection, superior mobility in difficult terrain is the distinguishing feature of tracked combat vehicles. Combat tanks and armoured infantry fighting vehicles set the standard for the support vehicles as carriers of the battle. With the advance of armoured wheeled vehicles in an increasing number of capability profiles, the decision "wheel or track" almost becomes a question of faith.

After the introduction of tracked armoured vehicles into the battlefield of World War I, tanks dominated the Second World War with well over 100,000 vehicles in all possible configurations. During the Cold War the tank production was in full swing. It was not until the CFE Treaty on Conventional Armed Forces in Europe of 1999 that ceilings were introduced, which were initially implemented by demilitarising vehicles and later fell below them due to other tasks and for budget reasons. For new tasks of the armed forces since the beginning of the century, such as peace-keeping measures and nation-building, wheeled vehicles were used mainly because of the required strategic and tactical mobility over long distances. In view of the threat posed by asymmetric combat, it became necessary to provide protection for the crews, which increased the weight of the wheeled vehicles considerably. With the return to national/alliance defence, battle tanks, armoured infantry fighting vehicles and self-propelled howitzers are once again coming more strongly into focus. Their support vehicles – mainly on wheels – cannot keep up with mobility.

Mobility Requirement

The US Army Training and Doctrine Command (TRADOC) sees mobility as the abil-



Photo: Bundeswehr

Warfighters using tracked fighting vehicles need tracked support.

ity to move freely and quickly in the field to perform combat tasks. The yardstick for mobility is the proportion of the terrain in which the vehicle can be moved (mobile) and the average speed in this terrain. The need for mobility arises from operational and tactical tasks.

In predominantly symmetrical combat - as to be expected in national and alliance defence - when effect and camouflage are in the foreground, maximum mobility of the terrain is required. Obstacles and dif-

ficult terrain must be safely overcome. The optimal use of coverings requires manoeuvrability in the tightest of spaces. In international missions with a focus on patrols, space surveillance, convoy protection and the like, high speeds and long-distance capabilities are particularly important.

Mission Carrier on Tracks

In the national and alliance defence, heavy combat vehicles such as battle tanks and infantry fighting vehicles form the hard core. Their characteristic features are strong armament and high protection for the crew, leading to a combat weight between 40 and 70 tonnes. In addition to powerful drive systems, these vehicles require tracks to be able to operate freely on a wide range of terrain.

Tracks distribute the weight forces over a large track contact area and reduce the ground pressure to typically about one bar. The track can generate large driving and steering forces. Obstacles can be crossed or climbed over. The track running gear is comparatively simple in design



Photo: BAE Systems

The tracked AMPV, here in the ambulance role, will replace the M113 in US Heavy Brigade Combat Teams.

Bren-Tronics Innovative Lightweight Lithium-Ion 6T 24 V Battery

Bren-Tronics has developed the most capacitive 6T Lithium-ion battery on the market in 2015, addressing the three basic requirements of military vehicle manufacturers and customers: energy, weight and space. This 24 V battery replaces two current batteries for one quarter of the weight and half the space and provides all the power needed for starting the vehicle and for silent watch missions.



The United States Army Tank Automotive Research, Development and Engineering Center (TARDEC) has been studying the technology for more than three years and is now releasing a military specification for 6T Li-ion batteries.



Confident in such technology, at the end of 2017 the US army awarded Bren-Tronics an industrialisation contract to mature the design and scale-up manufacturing capabilities in order to produce up to 2,000 batteries per month.

In parallel, many European armies are also in the process of qualifying this technology. Li-ion 6T batteries will enhance greatly the mobility and autonomy of their vehicles, and they have decided that future production vehicles will carry this innovative solution.

and requires little space. This benefits the cabin for personnel or mission equipment with a flat entrance. The silhouette of the vehicle remains low despite the high useful volume with standing height.

Mission Carrier on Wheels

International operations require high strategic mobility for combat vehicles. The weight is therefore limited in terms of air transportability – even for larger quantities. Compliance with the usual weights and axle loads is also advantageous for the use of public roads. As a result, wheeled vehicles rarely exceed the weight limit of 40 tonnes. Wheeled vehicles play out their superiority on roads and paved roads. In the terrain high wheel loads, which are uneven on all wheels, require a technically complex wheel load compensation system to ensure traction on off-road terrain. Due to the design of the axles, the floor of the cabin is high. This results in restrictions on the interior height, as the total height is limited.

Combined Arms Warfare

The Brigade is qualified for the combined arms warfare. The optimal matching of all components is decisive for the effectiveness of the system. In the tank brigade (or in the

US Army: Heavy Brigade Combat Team) the capabilities of battle tanks, infantry fighting tanks and howitzers determine the operation. These derive their effects from mobility, among other things. Their use should only be influenced by terrain form and coverage, but not by road ability. Within the alliance, the combat units are dependent on support from mobile command posts, with logistics and not least by ambulance forces. They must be able to follow them everywhere and reach them at any place. The demand for comparable mobility leads to the consideration of the technology with which the necessary support can be provided as required.

Support on Tracks

In the past, the universal workhorse M113 was used for these tasks. The vehicle from the Vietnam War era is one of the most commonly built tanks and is still used in many armies. Some of them have recently been modernised.

Armoured Multi-Purpose Vehicle

The USA has begun the replacement of the old vehicles with the Armored Multi-Purpose Vehicle (AMPV) project. The US Army is currently testing the new multi-purpose armoured vehicle for support missions. De-

veloped based on the M2/M3 BRADLEY, the mission carrier weighs 35 tonnes and can travel at speeds of up to 60 km/h. Driver and commander are the standard crew. Five versions are planned:

- General Purpose for up to six passengers with remote-controlled weapon station, extensive radio equipment and, if necessary, a stretcher for wounded persons.
- Mortar carrier with 120 mm mortar, 69 rounds ammunition supply, fire control system and radio equipment
- Armoured command tank for network-based operations with two workstations for the operation of a red net
- Medical Evacuation for one paramedic and up to six seated or lying wounded persons
- Medical Treatment for two paramedics, one lying wounded.

At present, troops are testing 29 vehicles. This year, the decision is to be made to start series production of 289 of the 3,000 vehicles required.

Protected Mission Module Carrier

In Germany, the Flensburger Fahrzeugbau Gesellschaft FFG developed the Protected Mission Module Carrier (PMMC) G5 from scratch. The 27-tonne vehicle is powered by a 411-kW diesel engine and reaches up to 74 km/h. With integrated and add-on protec-



Photo: FFG

PMMC G5 provides support all over the battlefield thanks to its rubber compound track

tion, the crew can be protected as required. A rubber compound track reinforced with steel straps gives the vehicle a smooth ride. Acoustic emissions and vibrations are thus greatly reduced. The rubber composite track also reduces fuel consumption and achieves about twice the mileage of steel chains. The driver has a direct view of the battlefield through bulletproof glass supported by day and night camera systems.

A special feature of the G5 is the 14.5 m³ crew compartment, which is completely free for the installation of mission equipment. Depending on requirements, up to twelve people can be transported. Armoured glass, cameras and periscopes with triple redundancy provide the crew with near reconnaissance around the vehicle.

Sample mission modules are developed

for the Ambulance role with a doctor and two paramedics for one or two lying or two seated wounded persons, as well as extensive medical equipment, for the Command role with command and staff workstations, for the Joint Fire Support Team role with equipment for observers and fire control as well as for the role of armoured transport. Further mission modules for mortar carriers, engineer tasks, repair, recovery, reconnaissance, air defence and last but not least infantry combat are planned.

Requirement Assessment

The Bundeswehr and many other armed forces are currently renewing their combat vehicle equipment and peripherals. Time and cost are the main drivers of these processes. Realisation processes compete with the fulfilment of military demands. The project management must find a compromise - if possible in coordination with the customer - to be able to bring optimal systems into the team. New systems need more time to implement. But due to better performance, new systems should be considered for the benefit of the armed forces. ■



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Tactical UAV Requirements

Giulia Tilenni

Although less popular than strategic UAVs (as General Atomics MQ-9 REAPER or IAI HERON), tactical UAVs are raising a growing interest amongst Armed Forces.

Cheaper, smaller and easier than MALE class UAVs (Medium Altitude, Long Endurance), tactical UAVs provide a cost-effective solution for gathering information in 4D scenarios (Dull, Deep, Dirty and Dangerous) without putting human lives at risk. The term UAV refers to heterogeneous systems, from the Flir PD-100 BLACK HORNET 2 (18 g all-up weight) to the Northrop Grumman RQ-4 GLOBAL HAWK (which has a 14,628 kg gross take-off weight). UAVs are usually classified by weight (less than 150 kg, between 150 kg and 600 kg, more than 600) and according to the kind of support they can provide to the user (operational, tactical and strategic).

According to the general definition, tactical UAVs belong to the so-called NATO class II, which includes UAVs weighing between 150 kg and 600 kg. Tactical UAVs' main task is to provide Intelligence, Surveillance and Reconnaissance (ISR) or Intelligence, Surveillance, Target Acquisition, Reconnaissance (ISTAR) to the troops deployed on the ground. In particular, tactical UAVs' provide real-time information to land forces through their operators. These UAVs can fly medium-range missions (200 km line-of-sight) below 10,000 ft. altitude.

In terms of operational use, tactical UAVs have several advantages compared to both NATO class I (<150 kg weight) and class III (>600 kg weight) UAVs. Their size makes them more effective than class I UAVs for twofold reasons. First, tactical UAVs can perform longer missions at a higher altitude. Second, their weight enables the mounting of a number of sensors – for example electro-optical/infra-red (EO/IR), laser target designator, Synthetic-aperture radar (SAR)/Ground Moving Target Indicator (GMTI) radars, SIGnal INTelligence (SIGINT) or communications relay. As a result, these UAVs can gather detailed

Textron Systems



Textron Systems NIGHTWARDEN mounted with FURY precision guided missiles shown at the Paris Air Show 2017

information in areas far from the battlefield. The improved situational awareness derived from the use of tactical UAVs has a positive impact on both mission planning (commanders gather more information) and military operations themselves (as tactical UAVs provide real-time aerial support to land forces during their missions). Moreover, tactical UAVs are easier to deploy compared to class III UAVs, as they have smaller logistic footprints. Tactical UAVs can be transported in standard containers, and they are often catapult-launched (so they do not usually require prepared runways). In addition, tactical UAVs can be operated more easily than class III UAVs, as they are operated by a single land forces' member rather than piloted by an Air Force crew. Furthermore, as tactical UAVs are more affordable than class III UAVs, their fleets are usually larger.

The State-of-the-Art Tactical UAVs in European Countries

The added value tactical UAVs bring to land forces make them attractive. During the last decade, countries such as the United Kingdom, France, Germany and Italy

have formulated operational requirements for this kind of UAVs, which are already in their inventories.

These countries have recognised that owning state-of-the-art tactical UAVs maximises the added value they bring to the battlefield.

France

In 2016, France signed a €330M contract for the procurement of 14 Sagem (later Safran) PATROLLER tactical UAVs (4 of which for training) to replace its Sagem SPERWER fleet, operational since 2005. According to the French Armed forces, the existing fleet has reached the end of its operational life, and has to be replaced with more cutting-edge and better performing tactical UAVs. For what concerns the operational requirements, the French were searching for a modular tactical UAV, easy to deploy and with a limited logistical footprint, able to provide brigades and tactical battlegroups (Groupement Tactiques Interarmes, GTIA) with high quality images and thorough information during external operations.

Safran PATROLLER, expected to enter into service in 2019, perfectly suits these requirements. It can fly 14 to 20 hours

Author

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Photo: Jean-Christophe Moreau / Creative Center / Safran

The SPERWER UAV, produced by Safran

missions within a 150-180 km range, compared to SPERWER's 5 hours missions within 80 km. Thanks to its 250 kg payloads capacity and its modularity, PATROLLER can mount cutting-edge, high-performance optronic systems. As unveiled by Safran at the Paris Air Show 2017, these will include the new-generation EURO-FLIR 410 optronic system. These electro-optical systems weighing less than 53 kg, can mount up to 10 sensors. As a result, it will provide PATROLLER with all-weather, 24/7, multispectral and ultra-long-range capabilities, precise target geo-localisation and designation (illuminator, laser range finder, pointer and designator), and enhanced detection and identification features. Furthermore, the PATROLLER will be equipped with the Leonardo PicoSAR AESA radar, which will provide moving land-based targets detection and the related image and data collection. Leonardo and Safran have been working together to make this radar compelling for French Army's operational requirements. PATROLLER capabilities are further enhanced by its 20,000 ft maximum service ceiling and by its operational range – 200 km line of sight, more than 1,000 km with SATCOM.

UK

Thales UK has been awarded the contract to produce the WATCHKEEPER for UK land forces in 2005. The tactical UAV was intended to replace HERMES 450 (already deployed in Afghanistan and Iraq), which would have reached the end of its operational life in 2010. The aim was to provide unit and formation commanders with real-time tactical level imagery and intelligence in order to enhance prompt and efficient decisions.

WATCHKEEPER has a 150 kg payload (450 kg take-off maximum weight), and it can provide 24/7 ISTAR. In particular, the 15" gimbal and dual sensor capabilities make the system particularly flexible and adaptable to the desired mission profile. According to Thales UK, the sensor package for the British Army units consists of an EO/IR electro-optical sensor including a laser range-finder, target designator and marker, and the Thales I-Master SAR/GMTI radar. WATCHKEEPER's operational range reaches 150 km line-of-sight, with a 12-16 hours endurance depending on the task. The system can reach a 16,000 ft operating altitude and a 65 kn cruise speed.

WATCHKEEPER collects huge amounts of data, which are transmitted in real-time via datalink. In order to help out with analysis and dissemination, this tactical UAV is provided with in-flight analysis tools. Post flight analysis tools are available as well. However, the UK's largest current unmanned air system procurement programme has been negatively affected by delays since the very beginning. Although it was supposed to replace HERMES 450 in Afghanistan, WATCHKEEPERS have been declared operational in theatre in September 2014. In order to mitigate the impact of this delay on military operations, the UK MoD procured new HERMES' 450 UAVs in 2007 as urgent operational requirement. Worse still, the British Army has received only 4 out of 54 WATCHKEEPERS, to be used under a number of restrictions due to several technical problems. In particular, after four incidents occurred between 2014 and 2017 caused by a combination of human and control software's errors, WATCHKEEPER flights have been stopped first, and then continued in July 2017.

To date, the most ambitious UK unmanned vehicles programme, whose units are expected to remain in service for about 30 years, is far from being considered successful. WATCHKEEPER is shaped on operational requirements for the Afghan theatre, where this tactical UAV has had no impact. In addition, the delays and the technical problems made the cost of the whole programme jump from €953M to €1.3Bn.

Germany

German armed forces received their 60 Airbus DS Airborne Solution KZO tactical UAVs between 2005 and 2009. The system was then deployed to Afghanistan. KZO can provide real-time imagery thanks to a thermal imagery system (2 versions) and three-fixed focused cameras. The Bundeswehr defines this UAV as rapid (maximum speed 220 km/h), and quite invisible (thanks to the composite-stealth material). In July 2017, the Bundeswehr announced that the German firm EMT had been awarded with a €63M contract to supply 15 LUNA NG tactical UAVs (3 systems, 5 UAVs each) to be delivered by 2020. The contract includes an option for the procurement of nine additional systems (45 UAVs). The system has been developed by taking into account lessons learned in Afghanistan, and is based on the LUNA UAV, already in use with the Bundeswehr since 2000. In particular, LUNA NG will be made of glass and carbon fibre reinforced plastic, which will make it light (110 kg maximum take-off weight), persistent (12+ hours depending on the mission



Photo: Safran Electronics & Defence

The Safran PATROLLER is based on the Stemme ASP S15 motor-glider. The PATROLLER is a medium-altitude long-endurance unmanned aerial vehicle (MALE). It can fly missions lasting 20–30 hours and carry a 250 kg payload.

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profile) and hardly detectable (low acoustic, thermal and radar signatures). Furthermore, LUNA NG “inherits” modularity and the opportunity to mount up to three different payloads, including: high resolution digital photos/video cameras, SAR, meteorological sensors, data relay, EW payloads, sensors for land mine detection, CBRN sensors. The data-link has a 100 km range, which can be extended by adding a data relay payload. LUNA NG, which is part of the Bundeswehr’s UAS medium range programme, will replace both KZO and LUNA UAVs.

Italy

The Italian Army purchased AAI Corporation (now known as Textron Systems) SHADOW 200 tactical UAVs in 2010. The €54M contract included 16 UAVs (4 systems). SHADOW 200’s first operational use within Italian Armed Forces was in Afghanistan in 2016. The system provides ISR support to land forces, as well as to AW-129 MANGUSTA and UH-90 helicopters. SHADOW 200 can fly up to nine hours long missions within a 125 km range (line of sight). This tactical UAV has a 36 kg to 42 kg payload capacity depending on the version, and it weighs about 210 kg. All of Italy’s SHADOW systems have been upgraded to the V2 variant. The SHADOW V2 is an all-digital system, optimized for new multi-mission, single-sortie profiles and manned-unmanned teaming. The SHADOW V2 offers increased endurance and payload capacity over previous versions of the SHADOW 200 TUAS (Tactical UAS). Although it is unclear which sensors are mounted and/or could be mounted on-board, the main payload is an EO/IR.

Future Requirements

France, Italy and the UK have recently updated their tactical UAVs fleets, and Germany will follow by 2020. However, it is already possible to identify future trends on tactical UAVs requirements. These concern the procurement of rotary wing UAVs (considered tactical UAVs according to their operational use) and the possibility to arm tactical UAVs. Thanks to their VTOL (Vertical Take-Off and Landing) capabilities and their size, unmanned helicopters fit well on vessels, thus being able to gather information across the maritime operational environment. Therefore, they can be considered to be valuable alternatives to manned ISR missions, especially when these involve small vessels only. Moreover, these UAVs could be able to support manned SAR and ASW operations depending on their payload. This is the case for Airbus VSR700 according to the payloads exhibited at the Paris Air Show 2017.

Textron Systems developed a VTOL variant of their Aerosonde System known as the Aerosonde HQ (HybridQuad). At less than 40 kg and no need for launch and recovery equipment, this platform becomes a capable alternative for low logistical footprint and expeditionary mission sets such as on-board vessels or for covert operations.

France is also planning to integrate Schiebel CAMCOPTER S-100 on the Mistral class amphibious assault ship (Bâtiment de Projection et de Commandement, BPC) DIXMUDE. The second essays trial campaign was concluded last October, and a third, and probably last, will follow. CAMCOPTER S-100 has 6 hours endurance and a 200 kg weight, of which 34 kg are payload. Therefore, France is inter-

Photo: Thales Group



The Thales WATCHKEEPER is a UAV for all weather, intelligence, surveillance, target acquisition, and reconnaissance (ISTAR) use by the British Army.

Photo: EMT



LUNA NG is a German unmanned aerial vehicle (UAV) in service with the German Army. It is intended for close reconnaissance, transmitting live video data (visual or infrared) or taking higher resolution still images, but it can also perform other tasks such as particle sampling and ESM, depending on its payload.

The French Marine Nationale is expected to launch a dedicated programme, the so-called Système de Drones Aériennes de la Marine (SDAM). These tactical UAVs will be deployed on-board of the future mid-size frigates (Frégates Taille Intermédiaire, FTI), to be delivered in 2025. However, the operational requirements the SDAM would respond to have not been disclosed, yet. Last summer the Marine Nationale has already conducted trials with the Airbus VSR700 rotary-wing tactical UAVs demonstrator (the prototype is expected for 2018). VSR700 has 10 hours endurance and weighs 760 kg, with a 100 kg payload capacity. According to a partnership announced at Euronaval 2016, Naval Group (DCNS) will take part in this programme by designing and developing the warship-integrated VTOL system, as well as the UAV mission system.

ested in buying both systems, and will likely use the lessons learned from CAMCOPTER S-100 missions as a basis for SDAM operational requirements’ identification. CAMCOPTER S-100 has raised interest in German and Italian navies as well. CAMCOPTER S-100 trials campaign with the German Navy took place in 2008. Diehl Defence, an expert in defence systems and surveillance equipment integration onto German Navy vessels, is working with Schiebel to make this rotary wing UAV compliant with the German Navy’s needs. The German Navy is expected to buy 6 CAMCOPTER S-100 or UMS Skeldar systems to be operated from K-130 corvettes. Italy has been the first European country to operate these UAVs. After a first test campaign in 2012, the Marina Militare and Schiebel signed a contract for a one-year lease of one system (consisting of

2 UAVs) in order to better evaluate its performances in 2014. CAMCOPTER S-100s have been used from LPD San Giusto to support humanitarian interventions within Operation Mare Nostrum (the Italian operation in place in the Mediterranean before the EU-led operations Triton) and Eunavfor Med/Sophia. The leasing contract is still in place, and the Marina Militare operates its 4 CAMCOPTER S-100s for anti-trafficking and migrant recovery missions. The Italian tactical UAVs fleet for naval uses might soon be enriched by the procurement of Leonardo SD-150 HERO, which will likely equip the future frigate class Pattugliatori Polivalenti d'Altura (PPA), expected to enter into service from 2021. This UAV has a 150 kg weight and a 50 kg payload, and can fly 5 hours-long missions.

The unmanned helicopters' concept stimulates interest in British armed forces as well. The UK MoD Rotary Wing Unmanned Aerial System (RWUAS) Capability Concept Demonstration (CCD) has been investigating unmanned solutions for naval purposes since 2013. During the first phase of the programme, which is jointly led by the UK MoD and Agusta-Westland (now Leonardo Divisione Elicotteri), essays have been carried using the SW-4 SOLO, an Optionally Piloted Helicopter (OPH). This OPV weighs 1,800 kg, has a 450 kg payload, and can fly 6 hours long missions. SW-4 SOLO's deployment during the Unmanned Warrior 2016 exercise marked the end of RWUAS CCD Phase 1. To date, the RWUAS CCD programme is in its Phase 2, which is jointly funded by the UK MoD and Leonardo and is expected to last for two years (2017-2018). This phase includes the definition of the operational requirements the systems will respond to, and a study for the potential integration of vertical unmanned aerial systems on the future Type 23 frigates, expected to enter into service from 2023. After 2018, Leonardo might be awarded a new contract to develop a new version of SW-4 SOLO, which will likely be bigger and unmanned operated only.

In addition to the broadening of existing fleets, the impact that tactical UAVs have on the battlefield will likely improve thanks to weaponries. In November 2017, the French Minister of Defence, Mrs. Parly, has declared that despite arming REAPERS remains amongst French top priorities, PATROLLER could be armed as well, maybe in 2020-2022. According to what Safran has shown at the Paris Air Show 2017, PATROLLER will likely mount laser guided missiles as well as an airborne version of the MBDA MMP anti-tank missile. Mounting these missiles will have a twofold impact on French capabilities. First, it will make the PATROLLER able

to perform attack missions when needed, and therefore can be used for some kind of strategic missions as well. In addition, as the PATROLLER is mainly domestically produced (90% of components are French made), mounting French weapons will enhance the country's strategic independence. Although Italy and UK have not exercised this option yet, both the Textron SHADOW V2 and

Tactical UAVs, more affordable and easier to use compared to MALE UAVs, today account for 20% of the global UAV market. However, their market share is expected to expand because of improved technical features that make tactical UAVs deployable for a broader array of missions, including some short-range strategic ones. Miniaturisation is having a crucial role in this development.



Photo: Thales Group

The RQ-7 SHADOW 200 unmanned aircraft system is of a high-wing, constant chord pusher configuration with a twin-tailboom empennage and an inverted v-tail. The aircraft is powered by a 38 bhp (28 kW) AR741-1101 Wankel engine.



Photo: Schiebel

Produced by the Austrian company Schiebel, the CAMCOPTER has a maximum endurance of 6 hours with a maximum speed of 220 kilometres per hour and a ceiling of 5,500 metres.

the Thales WATCHKEEPER can be armed as well. All three, the NIGHTWARDEN, the SHADOW V2 as well as the WATCHKEEPER systems can be armed with Textron Systems' FURY precision-guided weapon.

Conclusion

Tactical UAVs are playing a growing role in today's military operations. The numbers of countries interested in their acquisition is broadening, as well as the number of technical solutions available on the market.

On the one hand, it ameliorates embarked sensors' performances. On the other, it contributes to reducing weights. So, additional fuel and/or weapons can be installed without compromising UAVs' performance. Furthermore, these trends positively affect unmanned helicopters' developments, thus making them more compelling for Naval forces desiderata. As the number of unmanned aerial solutions for the naval environment is expected to rise in the medium term, their market share will likely expand in the same timeframe. ■

Remotely Piloted Aircraft Systems in European Military Services

Peter Austermann

Remotely Piloted Aircraft Systems (RPAS), also known as Unmanned Aerial Vehicles (UAV) or drones, have been used by the Armed Forces of various European nations for decades.

Depending upon their technical characteristics (endurance, range, altitude, size, payloads, and weaponisation) these platforms conduct short, medium and long range reconnaissance and surveillance missions, collect intelligence, and support the war fighters in target acquisition. Additionally, they can act as communication relays and combat attack platforms. The importance of UAVs has been proven in recent conflicts. This article covers drone inventories, future procurements, and changes in concept of operations of select European countries.

Photo: SAGEM



The PATROLLER, manufactured by the French company SAGEM

France

The French Army has been using tactical UAVs for over 50 years. Their current inventory of small, tactical UAVs include 20 SPERWER Mk 2 systems. Recently, the Sagem PATROLLER was selected as the SPERWER replacement. PATROLLER is based on the German Stemme S-15 civilian aircraft. Fourteen systems will be delivered to the customer in 2018.

The French Air Force procured its first MALE (Medium Altitude Long Endurance) UAV in 2008. Four HARFANG UAVs were procured to conduct strategic reconnaissance and tracking missions deep in the battlefield. HARFANG is based on the Israeli IAI EAGLE 1/HERON TP design and is manufactured by Airbus Defence and Space and IAI. The system replaced the RF-Q5 HUNTER. Between 20013 and 2015, this fleet was augmented by 3 MQ-9 REAPERS. Operational deployments of the HARFANG in vast regions like Libya and Mali established that speed was critical. HARFANG, with a maximum of 207 km/h, was too slow. However, the Air Force intends to extend its service life beyond 2017.

Between 2013 and 2015, this fleet was expanded by 3 additional MQ-9 REAPER systems, currently deployed in the Sahel-Saharan region. Three more systems will be introduced to service by 2019. The initial delivery consisted of Block 1 aircraft. The

Photo: callips / Wikipedia CC



The HARFANG, manufactured by EADS

next order will have the Block 5 upgrades. The French Ministry of Defence is considering retrofitting all platforms to Block 5 configuration.

On 6 September 2017, the French Minister of Defence announced the decision to arm French surveillance UAVs. First in line are the in-service REAPERS. Specific ammunition was not discussed but the AGM-114 HELLFIRE missile and MBDA's BRIMSTONE are likely candidates. The Minister declared that the future European MALE, presently under development by Dassault, Airbus, and Leonardo, will be armed. The UAV is not expected to enter service prior to 2025. All future MALE systems will be integrated in a "combat cloud" system, which allows them to link up with manned platforms, like the RAFALE or MIRAGE 2000, or the

projected Unmanned Combat Air Vehicles (UCAV). A full-scale Future Combat Air System (FCAS) demonstrator, developed by BAE Systems and Dassault, started in 2017. By choice, the French Armed Forces do not have a High Altitude Long Endurance (HALE) UAV but with the deployment of the NATO RQ-4 GLOBAL HAWK at Sigonella Air Base in Italy, this system will be available to the French forces.

French Special Forces, both army and air force, have a plethora of mini drones in their inventory. They include Elbit's SKYLARK 1 and 1-LE, the French DRACULA, Thales' SPY ARROW, and AeroVironment's WASP, to name just a few. The army deploys Cassidian's DRAC UAV in Afghanistan and Mali. In 2017 the French MoD announced that the initial contract for 70 SKY

RANGER small UAVs has been amended to a total number of 105 systems to replace the DRAC. Completion of delivery is expected in 2019.

The French Navy has a requirement for an unmanned ship-borne Vertical Take-Off and Landing (VTOL) rotorcraft. In 2009, Schiebel signed a contract to lease its CAMCOPTER S-100 to the navy in order to conduct comprehensive experimental flight tests. These trials ended successfully in 2010. During the ongoing modernisation of the fleet and the arrival of three new MISTRAL class Projection and Command (BPC) amphibious assault ships, integration of a VTOL platform is paramount. In 2017, the CAMCOPTER participated in flight tests to confirm Ship Helicopter Operating Limits (SHOL) and integration into the BPC. In June 2017, the rotorcraft completed qualification. The BCPs are designed to accommodate future MALE



The ScanEagle, manufactured by Boeing Insitu

closed.

In the mid 1990s, the Netherlands purchased four SPERWER systems, manufactured by the French company Sagem. These systems were bought to provide target acquisition and battle damage assessment in the Northern European theatre. SPERWER has a speed of 90 km/h and an endurance of 4 hours. Size and weight of the platform require a catapault rail launch,

lands leased AEROSTAR UAVs from the Israeli manufacturer Aeronautics. Eventually, three ScanEagle UAV systems, built by Boeing Insitu, were procured. The first operational deployment was on board HNLMS ROTTERDAM on an anti-piracy mission in Somali Waters.

The Dutch Ministry of Defence approved the procurement of the three RQ-21 INTEGRATOR UAV systems as replacement for the ScanEagle. The systems will be operationally deployed and maintained by the 107 Aerial Systems Battery of the Joint Intelligence Surveillance Target Acquisition Command (JISTARC) of Army Command (CLAS). The INTEGRATORS will be launched from land and ship. First delivery is expected this year and the fleet should be operationally available at the end of 2018. The Board of Ministers of The Netherlands decided on 17 November 2017 to go ahead with a proposal to amend and increase the defence budget in order to solve the most immediate issues within The Netherlands Defence Force. One of these topics is the acquisition of four MALE UAV systems like the RQ-1 PREDATOR in order to increase intelligence-gathering capabilities.



Photo: US Marine Core

The BLACK HORNET nano UAV in service with the US Marines

and UCAV operations.

Additionally, the French government defence procurement agency (DGA) contracted Airbus Helicopters and Naval Group to identify, deploy and test technologies required for the integration of tactical UAVs. This contract is in preparation for the Navy Airborne Drone System (SDAM), which has a projected in-service date of 2025. The demonstrator system is based on Airbus Helicopter's VSR700 rotorcraft drone system. The platform can exceed 10 hours of flight and has a payload capacity of up to 150 kg. First flights are expected in 2018.

The Netherlands

In the 1960s, the Dutch Army and Royal Netherlands Navy started to use RPAS for anti-aircraft gun practise close to Den Helder Naval Base. Two types of air vehicles were used, namely the OQ-19 (land launched via rail), followed by the KD2R5, both built by Northrop. The programme ended in 2004 and, as a result of a defence reorganisation and force reduction, Den Helder range was

which means a significant logistical footprint. In 2011, SPERWER was phased out due to high maintenance and operational costs; its final flight was in June of 2011. But SPERWER had proven that UAVs are a great added value for achieving operational objectives. Due to ongoing operations in Uruzgan, the Dutch Armed Forces decided to procure five ALADIN small UAVs from the German manufacturer EMT as an interim solution. As a result of a full and open competition for a small UAV in 2008, AeroVironment was awarded a contract to supply the RQ-11B RAVEN systems. With a range of 10 km, an endurance of one hour, and electro-optical/infrared (EO/IR) payloads, the RAVEN fit the bill. As the "End Life of Type" (ELOT) neared, the RAVEN system was upgraded with a digital data link and a new gimballed camera. To complement the small UAV fleet, approval was given to acquire two additional types of the same family of systems, namely the RQ-12A WASP AE and the RQ-20B PUMA. In order to bridge the operational gap after SPERWER's final deployment, The Nether-

United Kingdom

In 2008, the UK Ministry of Defence procured the first batch of its DESERT HAWK Mk 3 fleet, manufactured by Lockheed Martin. DESERT HAWK is a small UAV designed to conduct intelligence, surveillance, and reconnaissance (ISR) missions up to a range of 15 km with an endurance of one hour. A total of 221 air vehicles are in service. The original procurement was executed with Urgent Operational Requirement (UOR) funding to support the wars in Iraq and Afghanistan. British Army chiefs are hoping to keep this system in their inventory until 2021. Future planning is looking for a procurement solution that may involve a partnership with industry to deliver replacement hardware under a 10-year service agreement that allows for a high rate of technology upgrades.

In 2009, another augmentation to the British fleet of small UAVs was added. The RQ-16A T-HAWK (TARANTULA HAWK, build

by Honeywell) is a small rotorcraft used mostly to protect convoys and identify IEDs (Improvised Explosive Devices). The system is suitable for backpack deployment and single-person operation.

In 2013, British Armed Forces received a first delivery of 160 BLACK HORNET nano UAVs. The BLACK HORNET is manufactured by the Norwegian company Prox Dynamics (now owned by FLIR Systems). Its small size and weight of only 0.5 ounces allows the rotorcraft to be easily stowed in the war fighter's battle dress. An endurance of up to 30 minutes allows the operator to identify close range targets and gain the necessary situational awareness by "looking around the corner". As one British soldier stated: "It's a cool piece of kit. The pictures are amazingly clear and we can see who is a local civilian and who is a Taliban fighter and whether any weapons are stored there." The BLACK HORNET is primarily deployed in Afghanistan.

The British government placed a contract with Thales UK for the WATCHKEEPER MALE UAV program. However, the initial in-service date of 2010 could not be met which is why another UOR procurement was created to bridge the operational gap. The British Armed Forces initially leased two HERMES 450 MALE UAVs, manufactured by Elbit in Israel. Three more systems were added later. In Helmand province, Afghanistan, the systems provided persistent intelligence, surveillance, target acquisition and EO/IR reconnaissance (ISTAR) data at a range of up to 150 km. In 2013 HERMES had completed 70,000 flight hours in Afghanistan, which corresponds to 8 years of non-stop flight. HERMES 450 is no longer in service.

Today, WATCHKEEPER, manufactured by Thales UK/Elbit, is the British Army's newest MALE UAV. The WATCHKEEPER is based on the HERMES 450 design. Improvements include new propulsion and payloads, such as synthetic aperture radar and ground moving target indicator radar. A total of 54 UAVs will be procured. WATCHKEEPER is cleared to fly in segregated UK airspace. It requires a runway for take-off and landing. Former British Defence Minister Mark Francois said: "WATCHKEEPER will create a persistent and flexible all-weather capability with the ability to conduct surveillance through cloud and obscurity."

Another MALE UAV in service is the MQ-9 REAPER by General Atomics. The first aircraft was delivered to the Royal Air Force (RAF) based in Afghanistan in 2007. The initial procurement foresaw an unarmed version. After six months of operations it became evident that the platform needed to be capable of striking at fleeing targets and of providing Close Air Support (CAS)

to engaged land forces. The REAPER is one of a few UAVs able to carry weapons and conduct air-to-ground strikes. Arming the UK REAPER was a contested issue. News of "targeted killings" by the United States, for example in Pakistan and Yemen, gave rise to questions about their legality, utility and morality. Finally, a decision to arm the platform was reached with the following

PROTECTOR rather than its original name to change the public perception of these "killing machines".

The only UAV which is operated by the Royal Navy/ Royal Fleet Auxiliary, is the ScanEagle. It was commissioned in 2014 and deployed on HMS SOMERSET in the Gulf. This was the first time the Navy had deployed a naval UAV.

Photo: US Airforce



An MQ-9 REAPER UAV of the US Airforce

Photo: Nisse / Wikipedia CC



The WATCHKEEPER UAV, the British Army's newest MALE UAV, produced by Thales

provisos: An armed UK REAPER cannot fly in British air space; the system cannot be autonomous, it requires human-in-the-loop command and control; weapon release decisions cannot be autonomous. In order to meet these requirements, the RAF deployed one squadron to Creech Air Force Base (AFB) in Nevada, USA. Training for pilots is conducted at Holloman AFB in New Mexico. Operations are conducted as follows: the REAPER UAV is launched from an airfield in Afghanistan by in-theatre crews. Once airborne, the mission is flown by British crews at Creech AFB by secure satellite communication. After the mission control is transferred back to the crew in theatre for landing. All current aircrew have to be qualified to fly other manned aircraft in service.

The British MoD has disclosed that it intends to double its fleet of armed surveillance drones. In 2016, it awarded General Atomics a contract to deliver the Certifiable PREDATOR B (CPB) by 2023. This UAV is based on the REAPER and is expected to have a service ceiling of 45,000 feet and an endurance of 40 hours. Compared with the REAPER's five external store stations, the CPB has nine. It will probably be called

MoD announced in 2016 that it has ordered a third ZEPHYR-S UAV. It awarded a contract to Airbus Defence and Space, Farnborough. ZEPHYR-S is the latest version of a series of ultra-light UAVs. It has a service ceiling of up to 70,000 feet and an endurance of 45 days. It is referred to as a High Altitude Pseudo Satellite (HAPS). The platforms will not be deployed in theatre. As an operational concept demonstrator, they are flown to determine, among other things, whether a permanent surveillance capability can be maintained indefinitely.

Summary

The above-mentioned nations testify to the fact that RPAS have "arrived" in the modern war room. The importance of unmanned platforms for carrying out "dirty and dangerous" missions is undeniable. They act as force multipliers and force protectors and keep the warrior out of the way. Continuous further development of the technology enables future, more versatile applications and an increased use of RPAS. More European user nations will be featured in future editions. ■

Drones – How to Mitigate the Threat?

Stefan Nitschke

The explosive growth in advanced unmanned aircraft technology is inspiring industry to develop and market concepts and products to detect and stop unlawful drone flights.

Most systems apply passively or actively (hard and soft kill), depending on the system used. Classified as a 'low-slow-small' target set, detection and discrimination of smallish air vehicles remain problematic with current military radar systems, leading to a new market niche for purpose-designed solutions.

Continuing Threat

The use of drones by criminals or terrorists represents huge risk. Their deliberate use in a large number of incidents around the globe has provided evidence that they can inflict harm that was largely unmitigated due to the absence of effective drone detection technology. As quoted by FBI Director Christopher Wray before the US Senate Committee on Homeland Security & Governmental Affairs in Washington, D.C.

both opportunities and threats. Both the positive and the negative aspects of drones have been widely discussed in recent years. According to Jörg Lamprecht, CEO of San Francisco, California-headquartered De-drone Inc., some 400,000 drone systems from a growing number of manufacturers are currently sold, globally, every month and their capabilities are increasing all the time. Lamprecht insisted that in the hands of inexperienced users, they can present significant problems, including potential collisions with aircraft. Pilot sightings of UAVs have more than doubled between January and September 2017, with more than 690 reports in this period in the United States alone, compared to 238 in all of 2014. European authorities claimed in November 2017 that the number of similar incidents has risen to nearly 445 in 12 EU member states.

England, may only be the start of a trend in the United Kingdom, if not worldwide. If things keep up, prisons in most EU member states may have to set up nets and other anti-drone defences, including alerting devices like DroneShield.

Industry Rethinks Counter-Drone Technologies

The fact that commercially available drones have flooded global markets has led to a plethora of high-tech drone detection and defence systems that are a matter of interest for homeland security, police, military, and even private security. Many solutions have been designed to help combat this threat, from radio frequency (RF) technologies to physical interceptors. While RF technologies can be used to great effect to disable UAVs, the safety implications of us-



Photos: HENSOLDT



Left: The XPELLER counter-UAV product family is able to protect sensitive areas against illicit intrusions of small drones, combining sensor data from different sources with the latest data fusion, signal analysis, and jamming technologies.

Right: The NightOwl IR camera formed part of the recent demonstration of XPELLER at Airbus' Hamburg-Finkenwerder Airport.

on 26 September 2017, terrorist drones are "coming here imminently." This testimony follows a series of videos released by ISIS and the press showing actual deployment of drones by the terror organisation. From a security perspective, Unmanned Aerial Vehicles (UAVs) or drones represent

In the hands of criminal gangs or terrorist groups, Lamprecht warned, miniature drones can be used for anything: smuggling contraband, cell phones, and weapons into prisons are only a few examples. Recent incidents as at HMP Bedford, a Category B prison located in Bedfordshire,

ing powerful RF technology, particularly in built-up civilian areas, are serious but rarely talked about.

The majority of commercially available drones use three communication types, ISM bands in the range below 10 GHz, WiFi, and L-bands used to internally sync

waypoints with GPS. Brian Barker, Senior Vice President of Business Development at ZATHRAS Technologies, Inc., a firm that designs and produces a radar-based drone detection system, explained non-kinetic means of disrupting drone operations. This includes control system hacking attacks, overwhelming a drone's control frequency, targeting the L-band, or use of passive RF to take over the drone's controls. According to Barker, the company's Z-200 radar is directed at the low-level atmosphere, 1.2 miles and below. Its hardware and patented algorithms enable discrimination between a small drone and a bird. "The waveforms we put out can distinguish natural from mechanical movement; it's a software-defined radar that can utilise a number of frequencies, detecting up to 1,000 items per second, and our algorithms enable a low signal to noise ratio."

drones until their batteries or electronics are destroyed. According to the scientists, these weapons could be deployed in a truck to provide protection for events at public places with lower risk to people and property on the ground than a chain gun or small missiles.

Another solution is offered by HENSOLDT, formerly Airbus Defence and Space (DS) Electronics & Border Security (EBS). The company detailed a newly developed drone detection solution in November 2016. Joining forces with the US firm Dedrone Inc., the company is continuing to develop the new system consisting of the company's long-range radar and jamming functions and Dedrone's multi-sensor platform for "covering both urban and extra-urban areas," a recent announcement said. The new system will be able to identify a hostile drone and assess its threat potential

technology" to help close an important security gap, which can not only affect military installations and airports but also nuclear facilities. Company representatives also confirmed that secure facilities can be protected with the technology. Drones delivering contraband into prisons are creating headaches for corrections officials who acknowledge that they have few, if any, ways of stopping them.

In January 2017, the manufacturer also stated that it has added a portable jamming system to its family of counter-UAV products that detects illicit intrusions of small drones over critical areas and offers electronic countermeasures. After several enhancements, the completed product family is named XPELLER. It was noted at the Consumer Electronics Show (CES) in Las Vegas in January last year that, "Together with our partners, we have created a modular counter-UAV system which is extremely effective." This addition to the XPELLER product line, according to the company, is a lightweight jamming system from South African HENSOLDT subsidiary GEW Technologies, completing the capability range of the existing portfolio. XPELLER has been tested extensively at HENSOLDT's own premises and during customer presentations in Germany, France, and Switzerland. The manufacturer confirmed that an operational system is available on the market with delivery time depending on the required configuration. Up to now, the modular XPELLER product family consists of HENSOLDT's own products – radars, infrared (IR) cameras and long-range jammers – close-in RF detectors from Danish partner company myDefence and short-range optical-acoustic RF sensors from US partner Dedrone Inc.

At DSEi 2017 in London, Delft Dynamics unveiled its newly developed drone interception system, named DroneCatcher. It is capable of eliminating rogue drones by catching and removing the threat in the air and by bringing it to a harmless place. Development of DroneCatcher is supported by the Royal Netherlands Marechaussee (Military Police), the Dutch National Police, and the Dutch Ministry of Safety and Justice. DroneCatcher is a multicopter that is armed with a netgun to safely remove illicit drones from the air. After detection by radar, visual lookouts, or by an acoustic sensor, the counter-drone solution is able to quickly approach hovering or moving threats. With the use of multiple on-board sensors, the netgun can then be locked on the target.

The industry achieved considerable progress with developing a number of other solutions for detecting, tracking, and neu-



Photo: Delft Dynamics

The DroneCatcher system catches a rogue drone by firing a net to trap it.

TNO researchers in The Netherlands found that small drones, especially those using autonomous navigation, could be stealthy, accurate, and potentially deadly weapons, and the probability of their use is rapidly increasing. The recent launching of a flame-throwing RPG (rocket-propelled grenade)-launching drone by the Russian manufacturer United Instrument Manufacturing Corporation – unveiled at the Robots Exhibition held at Kubinka near Moscow in February 2016 – shows how the new generation of small military drones are capable of carrying weapons. The "anti-tank attack multicopter can shoot both vertically and horizontally," said company official Maxim Skokov.

The best answer to defend against the drone threat, according to Klaas Jan de Kraker and Rob van de Wiel of TNO Defence Research, might be laser and high-power microwave directed energy solutions, which could be used to heat up the

at a range in excess of seven to eight kilometres. This system also includes a countermeasures capability, with a jammer based on smart responsive jamming technology also developed by HENSOLDT.

ESD was told that the jamming signals may block only the relevant frequencies used to operate the air vehicle while other frequencies in the immediate vicinity remain operational. Based on a threat library and real-time analysis of control signals, the jamming device interrupts the link between the drone and the pilot or its navigation. The direction finder tracks the position of the "pilot", who can then be subsequently approached and arrested.

HENSOLDT describes the solution as a "quick-response" protection system with "extremely low" false alarm rates. According to the company, the combination of sensor data (obtained from different operational sensors), data fusion, signal analysis, and jamming methodologies is the "ideal

tralising drone threats: Rheinmetall Electronics GmbH, developing UMIT (Universal Multispectral Information and Tracking); Black Sage Technologies (promoting the UAVX detection system utilising a combination of X-band radar, artificial intelligence, and long-range video tracking); Controp Precision Technologies (offering TORNADO, a panoramic, 360-degree IR

effectively counteracting microdrone activity, this solution also offers the capability of integration into higher-order networked systems or flexible security systems, according to Rohde & Schwarz.

Additionally, SteelRock UAV in the United Kingdom introduced a new counter-UAV system at last year's Dubai Air Show. The firm has created the NightFighter counter-

technologies and non-lethal effectors from Rohde & Schwarz, Robin Radar Systems BV, Diehl Defence, and ESG, linked-up by ESG's C&C system TARANIS.

According to Robin Radar Systems, it contributed a radar-based tracking system that is able to distinguish micro-UAVs from birds. Being deployable within 30 minutes, it has a 360-degree monitoring

Photo: Black Sage Technologies



Black Sage's UAVX detection system is helping commercial facilities, proprietors, governments, and large-scale venues actively monitor and secure their premises from unwelcome threats and liabilities.

camera using software algorithms that automatically detect and track small UAVs in addition to rotary-wing and fixed-wing aircraft); Corax Concept's DroneDefence business developing the DRONE DEFENCE NET GUN X1; DroneShield (promoting a tiny device that can be mounted near exterior and interior perimeters); Elbit Systems (revealed the ReDrone system at Israel HLS & Cyber Conference); ESG Elektroniksystem- und Logistik-GmbH; Israel Aerospace Industries (IAI)-Elta (designed the DRONE GUARD detection and disruption counter-UAV system for both military and civilian applications); MBDA Deutschland (successfully tested a new high-energy laser effector against airborne targets); RADA Electronic Industries Ltd.; Telespazio VEGA GmbH (a subsidiary of Telespazio SpA, owned by Leonardo and THALES, which participated in the DIDIT Distributed Detection, Identification and Tracking study for the Dutch Ministry of Security and Justice); and Rohde & Schwarz. The latter presented its ARDRONIS counter-microdrone solution at Indodefence in November 2016. The R&S ARDRONIS counter-microdrone system enables users to identify microdrone control signals early on, and locate the UAV's operator and disrupt the control link. In addition to

UAV system, a highly focussed, directional antenna system for use in military and civil protection applications that can override, repel, capture and/or take-down UAVs. NightFighter was designed and manufactured to maximise the safety of the system's operator, as well as the immediate infrastructure and surroundings. By using a highly directional antenna, the NightFighter minimises the surrounding environment's exposure to RF and, as importantly, shields the operator from the dangerous RF exposure levels that are experienced with other counter-UAV RF systems. In a recent controlled UAV take-down at range, the RF exposure to the operator was measured at 10 percent of the permitted EU limits – far exceeding design safety expectations.

In a presentation at the recent DWT conference and exposition in Bonn, Germany, about "Applied Research for Defence and Security in Germany", ESG and Diehl Defence revealed how they – together with technology partners – contributed to the protection of the G7 summit in 2015 at Schloss Elmau with an anti-UAV defence system. Especially aligned for threats posed by mini- and micro-UAVs (<25 kg), the modular system combines detection

range, including the option to define regions of interest (ROI). Rohde & Schwarz itself contributed a sensor system which detects radio waves and/or the electromagnetic field produced either by the UAV or the remote control, the latter allowing, in combination with a direction finder, exact localisation of the owner of the drone. In case of positive identification, either a smart jammer produced by Rohde & Schwarz or the HPEM (High-Power Electro-Magnetics) system produced by Diehl Defence would have been called into action. HPEM is an interference pulse that disables or disrupts electronics components as used not only in UAVs, but also in IEDs, land and sea vehicle engine electronics, computers, control systems, and intelligence equipment.

According to Zvi Alon, RADA Electronic Industries' CEO, "The issue of the UAVs, especially low, slow and small (LSS) ones, is one of today's most burning concerns, since they have become a growing threat to tactical units, strategic sites, and commercial aviation. A number of recent incidents have shown that mini- and micro-UAVs have the potential to cause significant damage – making an immediate solution crucial."

A Wider Look

(sb) The Kelvin Hughes SMS-D is “The first integrated medium-range radar based surveillance system to address the need for the detection and tracking of small aerial threats” according to the company. The Single Mast Solution (SMS) offers 360° situational awareness, providing a seamless radar and E/O picture in a complete, fully integrated and scaleable package. The system provides Unmanned Aerial System (UAS) situational awareness, with Bearing, Range, Altitude and Velocity data presented to the operator, and optionally distributed to other systems, enabling “informed response decision-making”. SMS-D combines these benefits with integrated video tracking to provide a cost-effective solution for tracking the real-time position of aerial targets ranging from small commercial drones to helicopters which may pose a threat to infrastructure, vehicles or personnel. Kelvin Hughes’ intuitive CxEye™ display and control software has been enhanced for SMS-D to include aerial surveillance-specific features. Built around proven SharpEye™ X-Band solid state radar transceiver technology, the SMS concept continues a tradition of addressing evolving operational challenges with robust, original and practical solutions.

In the meantime the German company Aaronia focuses on the extended range at which its ARTOS Drone Detection System can detect both drones and their operators – up to five kilometres – and on the system’s mobility and speed: detection begins as soon as a remote drone controller is switched on. In France the ECA Group, using its IT180 UAV, presented a working counter-drone system that focuses on detecting the operator of an unwelcome UAV/UAS. The system was introduced in 2015 and has been successfully demonstrated to the French government.

ReDrone from Elbit, mentioned briefly in the main body of the article, is designed to detect, identify, track and neutralise different types of drones that are flown within a range of RF communication protocols. The system can also host Elbit Systems’ SupervisIR™, an advanced infra-red, wide-area persistent ISTAR system, giving ReDrone full-scale Signal Intelligence (SIGINT) and thermal imaging detection capabilities. After detecting a target – the system detects and tracks both the operator and the drone – the ReDrone disrupts the drone’s communication with its operator, blocks its radio and video signals and GPS positioning data, and sends it off track, preventing it from carrying out its intended missions.

As a consequence, the company’s proven man-portable counter-UAV solutions of its MHR family – MHR, pMHR, eMHR and ieMHR – provide multiple missions on each platform, and offer unprecedented performance-to-price ratio. The radars are compact and mobile, delivering ideal organic, tactical surveillance solutions for force and border protection applications such as counter rockets and mortars, counter UAVs, ground/surface surveillance, and air surveillance, according to the company.

Grand Plan: Countering Multi-Rotor Threats, Swarming Attacks

QinetiQ Target Systems (QTS) recently introduced a new service to the Royal Canadian Navy (RCN) by emulating the threat posed to large naval vessels by small multi-rotor drones. QTS’ Managing Director Peter Longstaff warned, “Commercially available technologies, like off-the-shelf drones, are becoming more advanced and more accessible to those who wish to use them to cause harm.”

Photo: Controp Precision Technologies



The TORNADO panoramic, 360-degree IR camera can be operated locally or remotely from a command & control centre as a standalone system or integrated with other systems such as radar and electro-optical observation systems.

QTS conducted a live demonstration last November from a HALIFAX class frigate under an unmanned targets repair, overhaul and engineering contract that was awarded in 2015. The company flew its SNYPER multi-rotor target alongside Lockheed Martin’s IN-DAGO quadcopter using QinetiQ’s Universal Target Control Station (UTCS). It facilitates the operation of multiple unmanned systems from a single command centre. QTS’ General Manager continued, “[QTS] simulates these new and emerging threats to help the armed forces understand how to protect their people and assets.”

According to QTS, the RCN has operated fixed-wing aerial targets and marine surface targets using its UTCS for more than 20 years, but the introduction of rotary-wing targets is a first for the service. The SNYPER target is one of several QTS technologies designed to help customers tackle threats from small unmanned aircraft, including the OBSIDIAN detection system and the laser weapon currently in development by the Dragonfire consortium that will be capable of destroying drones mid-flight. Simon Nadeau, DNR-2 Unmanned Systems Section Head Commander, RCN, noted: “The information and results obtained during the demonstration are vital for the RCN’s development of remotely piloted systems use at sea, and the evaluation of ships’ critical defence systems [...]”

There is urgent demand to talk about another threat – robotic swarms. Many of the innovations that enable swarming – low-cost uninhabited systems, autonomy, and networking – are driven by the commercial sector, and thus will be widely available, said Paul Scharre, Director of the 20YY Warfare Initiative at the Center for a New American Security (CNAS). According to him, increasing numbers of State and non-State groups may be more eager to embrace them than the military.

While radar remains a traditional detection method, drone discovery, classification, tracking, and disabling can involve multiple techniques, including audio (which is limited in urban areas and has low effective range); video detection (utilising algorithms to help distinguish birds from drones and establish positive optical identification); high-powered microwaves (to disrupt or destroy electronics); and communications jamming. The latter can be an effective means of disrupting a swarm by preventing coordination among individual elements, “collapsing” the swarm so that it disintegrates into many disparate, uncoordinated elements. While such jamming would not destroy individual swarm elements, it would prevent swarm elements from fighting cooperatively, potentially making individual elements easier to target and eliminate, Scharre concluded. ■

A Software for All Seasons?

Command & Control in Civilian Environments

Tim Mahon

Command and control (C²), decision support and seamless communications lie at the heart of successful management of complex operations. In the military environment, those operations are conducted by armed forces, the majority of whom have enjoyed times of plenty in the past (though not recently) and have mostly had the benefit of evolving successful, reliable and repeatable doctrine during times of relatively minor conflict. In the civil environment – which constitutes agencies responsible for law enforcement, public safety, disaster management, border security, crime prevention, counter terrorist activities and public health management, to name just a few of the domains affected – the more common story is one of being starved of resources, ignored by authority until a disaster occurs then expected to perform miracles with paperclips and sealing wax rather than with effectively managed capabilities and appropriate resources.

As with most generalisations, that statement is not entirely true. But it contains a kernel of truth. Civilian agencies since the fourth quarter of the last century have come under increasing pressure to face and deal effectively with a vastly expanded threat envelope as global warming, organised crime, environmental and natural disasters and the incidence of terrorist-inspired events proliferate. In this they are no different from their military brethren, and therein lies the point: broadly speaking, their requirements are the same, yet in the civilian world – despite a more open-minded approach to new technology – it seems that solutions to the fundamental issues of command and control and decision support have been even slower at coming to fruition than in the armed forces. There are exceptions. In advance of the G7 Summit in Taormina, Sicily, in May 2017, Leonardo deployed a communications network based on Tetra technology at very short notice, and incorporating a level of integration that the local authorities had not seen since... well, had never seen in fact. That network coordinated the activities of more than 2,000 individuals from a score of agencies and brought together new and old devices in radio, telephone, computer and mobile device categories, with over a dozen different operating systems and

Photos: Systematic



As well as headquarters installations and briefing facilities, the Operating Picture capability of the BMA will need to feed individual and hand-held devices with regularly updated analysed information.

more than twice that number of operating procedures. Although implementation was rushed and encountered more than one hair-tearing set of problems, by the time the summit was over the entire security communications community associated with it was well-satisfied. Leonardo is now reportedly attempting to leverage that solution as the core of a C² solution for civil agencies.

Saab in the UK has developed a sophisticated capability known as SAFE, which it describes as “a coherent, next-generation security management system for role-based situational awareness and distribution between users.” Encompassing applications from first responders to prison security and featuring an integrated C² system through-

out, SAFE brings to the civilian agency market a suite of capabilities and a raft of efficiencies that have been unavailable till now. At its heart lies the C² function, but its true value to users in constrained circumstances is the fact it is (more or less) platform-agnostic and relies on open architectures to achieve the seamless functionality that has won it several customers among British regional police forces, who use it in a ‘control room’ scenario.

By comparison, on the military front, there is the 800-pound gorilla in the room. The grandmother and grandfather of all loosely defined C² systems – at least in the current European market – must be Project MORPHEUS, the so-called Battlefield Management Application (BMA) on which the UK

Author

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Ministry of Defence (MoD) is reportedly to spend approaching GB£3.2Bn (€3.5Bn). MORPHEUS, which the MoD describes as providing Britain's armed forces (and, potentially, some of its more demanding and first response security agencies) with "the next generation of Tactical Communication and Information Systems (TacCIS) capability," is essentially a suite of one or more software applications and services that will provide a variety of facilities to commanders at all levels, including Geospatial Services, Operating Picture and Mission Planning and Execution. Flexible enough to be operated in fixed or deployed headquarters, in vehicles, or carried in the personal equipment of dismounted soldiers, MORPHEUS will feature computing platforms ranging from PCs through laptops and tablets to smaller mobile devices, including smart phones. Indeed, according to Helen Birchall, Senior Manager Business Development for Systematic in the UK and someone with former direct experience of the MORPHEUS programme from inside 'the machine,' it could be termed a "bring your own device" solution. Wherein lies one of the significant challenges associated with the successful implementation of MORPHEUS across an institution that has a history of missteps and poorly implemented megaprojects, despite the very best of intentions and aspirations...

Enter MORPHEUS

The MORPHEUS network infrastructure will feature high and low bandwidth wired and wireless bearers, using HF, VHF and UHF frequencies. The BMA will take full but appropriate advantage of the services accruing from the Evolve to Open (EvO) Tactical Integration Framework (TIF), a GB£330M contract already awarded to General Dynamics UK. This will allow operational optimisation across the network, the efficient use of common core services and development of a subset of those services as part of the TIF for exploitation by other client applications. More importantly, MORPHEUS will be vendor-independent, to ensure value for money; will be evergreen and employ open architecture to permit rapid, agile development and cost-effective growth margin for the future; and will be interoperable by design to allow joint, coalition and inter-agency cooperation and collaboration in all circumstances and operating environments. In meeting these criteria, UKMoD believes MORPHEUS will successfully deliver the tactical element of the Single Information Environment, which will enable decision support and information superiority for commanders throughout the land battle

space as a result of its ability rapidly to exploit emerging technologies to maximise user agility and reduce both delivery lead times and cost by eradicating vendor lock-in. Perhaps with a tongue slightly lodged in cheek, the Ministry hopes this will "enable the UK MoD to become Masters of their own Destiny."

It is worth examining the expected output of MORPHEUS in a little more detail, since many of the requirements and expectations will resonate with those of managers and executives in the various civil agencies defined earlier. The tangible aspects of the output fall into the three facility sets to be delivered to unit commanders: geospatial services, operating picture, and mission planning and execution.



Vehicle mounted installations will be as common, though not, perhaps, as numerous, in civil applications as in the military. The proliferation of response vehicles in most civil agencies demands more effective distributed command and control, observers believe.

Geospatial Services embraces digital mapping - importing, distributing and providing access to foundation geospatial intelligence (GEOINT) from multiple sources and in multiple formats; display - rendering and visually displaying GEOINT in ways that "contextualise" it for the operator and provide the facility for further manipulation; user-initiated analysis of the GEOINT, such as terrain analysis and planning for inter-visibility; route planning - manual and/or automatic route planning for a wide variety of force elements, each of which has unique and differing characteristics that require detailed preparation; and route following, providing feedback and alerts.

The Operating Picture (OP) will require the selected solution to provide: Inputs - objects emanating from multiple sources will need the facility for information to be attached

and for new classes of objects to be defined and associated with appropriate symbology; Engine - also known as Picture Processing - the means by which the OP is validated, de-conflicted and synchronised between users; Manipulate - use of the OP to derive data such as distance/bearing between force elements, to initiate other services such as voice or data communications, or to change the user view through aggregation of alternative force elements perspectives; Display - with the same definitions as for Geospatial Services; Save and Archive - self-explanatory functionality but critically important for after action review, mission rehearsal and training, doctrine development and for operational and institutional records.

Mission Planning and Execution embraces a number of doctrines the definitions of which may be unique to the British Army but which are broadly similar to the requirements, challenges and proven solutions of civilian agencies faced with similar tasking. These include: Plan - formal aids for command decision making - in the army these are known as the Operational Estimate, the Tactical Estimate and the Combat Estimate - the BMA should support the last two of these; Refine - alterations to the plan as a result of further analysis, additional input or changing circumstances - alterations range from no change through minor alterations to wholesale creation of a new plan; Execute - once orders have been distributed and refined where necessary, execution commences; and Evaluate - measure the emerging event against its expected evolution as



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Although the temptation is to believe that MORPHEUS is the brainchild of a displays manufacturer, the proven ability of visual data to speed and empower decision-making lies at the heart of MORPHEUS' potential utility.

it was planned for, allowing adjustments to mitigate or exploit the changes identified. None of this is rocket science. And none of it should be considered brand new. The requirement for MORPHEUS recognises decades of military and security agency experience in managing anticipated and unexpected situations – arguably, perhaps, that experience dates back to the creation of formal styles of government. That does not mean, however, that the solution is an easy one. Paul Fielding, also a Senior Manager Business Development for Systematic Software Engineering, explains how the company deals with challenges facing its clients in implementing the company's Sitaware solution. "Sitaware is a framework – a fully featured application suite in which openness and extensibility are key features," he told ESD. "In most instances it has three core iterations: a headquarters level, an 'in vehicle' level – which in the case of MORPHEUS could be an armoured command and control vehicle but in other circumstances could well be a fire engine or a helicopter – and a dismounted level – an individual soldier, a border guard or a disaster management official."

Common Goals and Common Procedures

The common areas of interest between the military and the world of civil disaster management, emergency response and 'blue light' services are significant. The differences in requirements for a common operating picture are that in the military there tends to be an attitude that it is 'assets' that need to be monitored, directed and controlled, whereas civilian agencies pay more attention, perhaps, to individuals. That said, the civil environment needs to be able to account for – and be responsible for – a wealth of assets ranging from fire

engines to aircraft and from weapons to drones. On both sides of the civil/military divide the rationale is the same, though the implementation may differ. The primary role of Sitaware is C² – which for the military is at what should be defined as the tactical level. Running a very close second, however (and there are some, Fielding acknowledges, who would argue the two functional domains are co-equal) is decision support. In military applications decision support tends to be at high level, though MORPHEUS and its successors and peers may enable devolution of that decision support to a lower level – perhaps even that of the 'Strategic Corporal' beloved of US Marine Corps General Charles Krulak. That, however, is extremely unlikely to happen, even if all concerned agree that is a desirable outcome (which is far from the case) until one major stumbling block is overcome.

"The real challenge is the necessity to change mindsets," says Birchall, whose company, Systematic, is the only dedicated software company bidding for the BMA portion of the next phase, worth some GB£40M. "The idea that the BMA is basically a function of software and is not dependent on a specific hardware device is a difficult one to drive home in an environment that is as resistant to change as the defence procurement field." No matter how open minded and well-intentioned individuals may be – and it is evident that UK MoD and associated agencies are doing their level best to embrace new thinking – it is extremely difficult to get broad consensus in so conservative a market segment. And without that consensus, there will be little effective recognition and/or exploitation of the fact that the BMA can be – indeed, should be – a software solution. "Trying to get the mindset changed to encompass the fact that this truly is a 'bring your own

device' party – that it doesn't matter what platform the solution is to work on, provided it is an open enough architecture to be able to deal with the application – is a long and sometimes frustrating process," Birchall told ESD. There are indications, however, that all the work that is being put in is not in vain.

UK MoD suffers from an entire community of critics who seize on the Ministry's failings – of which there are sufficient – and point to egregious waste and ponderous procurement. But insufficient credit is given to the attempts that Defence makes to be responsible and responsive, agile and aggressive in the sponsorship, development, procurement and implementation of sorely needed capability. It is obvious to even the most cursory observer that MORPHEUS has been both subject and object of a huge amount of intellectual effort in defining the need, specifying the requirement and engineering the preferred solution. It remains only to cover the last mile and to engender a spirit of open minded engagement; to generate a true military-industrial partnership; and to gird metaphorical loins to take the risk of doing something new because it is the right thing to do. That is not an easy road to follow but there are signs that it is beginning to happen.

This will be A Good Thing. MORPHEUS, if it emerges from the procurement sausage machine looking anything like the concept that entered it, "will bring a whole new level of capability and enable decision making and agile battle management at a much lower level than ever before – a true capability for the requirements of twenty-first century operations," in Birchall's words. And it will do so not just for the military but, inevitably and hopefully, for other agencies in Britain and beyond that require the agile, deft and graduated levels of responsiveness that characterise today's complex operations. Those operations might centre on clearing an Afghan village, restoring law and order to an area of civil insurrection, dealing with a flood of political or economic refugees or stemming a tide of illegal drugs or contraband goods. They might be conducted by men and women in uniforms sporting headgear of black, blue, khaki, white or yellow – or no uniforms at all. Whatever the case, they will require decision support, C² protocols and reliable structures to support the men and women we expect to solve our anticipated and wholly unexpected problems. MORPHEUS, per se, is not a panacea. It is, however, undoubtedly a step in the right direction and may point the way to a brighter, more integrated and, dare one say, a more efficient future for our armed, security and emergency services. ■

Small Arms Ammunition

Thomas Nielsen

In the world of small arms ammunition for military and security forces, the days of preparing for the Cold War to turn hot are long gone. Nations are increasingly involved in “brushfire” and “intervention” type wars against (nominal) states and/or rebel and terrorist groups, and over the past decade it has become more and more clear that new types and kinds of ammunition are needed.

At the same time, and as a relative consequence, national police and security forces have had to increase the focus on the threat of fifth-column and terrorist attacks, with a commensurate increase in the probability of well-trained, motivated, heavily armed and body-armoured threats.

There are certain important features distinguishing military from law enforcement (LE) ammunition. One difference is technical/tactical: LE ammunition is typically used in a civilian setting, often in urban environments. This leads to more emphasis on reduced over-penetration risk and limited ballistic range. This is less of a concern for military ammunition, where the emphasis tends to be more on effective range and penetration against tactical barriers. Another difference is logistical: Military ammunition tends to be produced, procured and consumed in far greater quantities than LE ammunition. This means that the more sophisticated, and therefore more expensive, ammunition designs tend to be of less interest to military customers than to LE and security forces. Of course, there is a substantial amount of potential and actual overlap between the two user groups.

Against this background the article will try to present a survey of recent and future developments in small arms ammunition, as well as provide the author's comments on some of these developments. The main part of the article is broken down according

to weapon classes, and there is necessarily some overlap and repetition, for which the author asks for the readers' understanding. The article focuses mostly on western/NATO developments since this is where the most reliable data is available.

Hand Guns

The breaking news in the world of military handguns in 2017 has been the US Army's Modular Handgun System (MHS) competition, and the selection of a modified SIG Sauer P320 as the new handgun for the US Army. The MHS project includes two types of ammunition: A standard service round of the full-metal-jacket (FMJ) type and a “special” round, presumed to be intended for Special Forces. For the MHS competition, SIG Sauer teamed up with Winchester, the latter offering the ammunition. Recently, Winchester revealed their XM1153 “special” round and, based on its appearance, it is of jacketed hollow point design, but very little else has been revealed

at the time of writing (December 2017). The design of the ammunition would seem to indicate potential use by military police (in a “peacekeeping” LE role) as well as Special Forces.

From the start, the MHS pistol was intended to be adaptable to multiple calibres, although the issue versions of the pistol



Graphic: Anthony G. Williams, www.quarryhs.co.uk

Examples of the THV ammunition, developed as a police duty round. Note the characteristic reverse-ogive shape.



Photo: Author's collection

7.5 FK Field Pistol and ammunition, produced by FK Brno. Note the bottleneck cartridge cases.

Author

Thomas Nielsen serves in a technical capacity with the NATO Support and Procurement Agency's Ammunition Project, with a particular focus on technical audits and inspections. Much of his recent focus has been in support of small arms ammunition requirements. He worked previously for the Danish Ministry of Defence, and holds a degree in engineering from Aalborg University in Denmark.

would appear to be exclusively 9x19mm. Throughout the MHS project, several commenters had voiced a desire for something more “powerful” than the 9x19mm, in terms of terminal ballistics. Many of these commenters were Americans, and it is not surprising that the desired calibre is the .45ACP. The author is happy to accept that the .45ACP enjoys a degree of superiority over the 9x19mm in terms of soft-target terminal ballistics, but the vast superiority that some .45ACP proponents would like us to believe tends to be based mostly on anecdotes and wishful thinking. And if the “stopping power” of the individual round of ammunition was the primary selection criteria for service pistols, the armies of the world (including the Big Green Machine) would issue Magnum Research Desert

for its calibre, but at the same time reduces the momentum of the projectile, leading to a rapid loss of velocity in air, thus limiting the hazard range in case of a missed shot. The high speed combined with the shape and material of the projectile gives it the ability to penetrate tactical barriers and soft body armour, and the reverse-ogive shape results in considerable hydrostatic shock on impact with a soft target. The ammunition was produced in calibres from 7.65mm Browning (.32ACP) up to 7.62x51mm, but production ceased after about a decade. Very similar ammunition was produced in the Slovak Republic and in South Africa, but it has never been a commercial success. This was mostly due to cost and the fact that functionality in semi-automatic weapons was something of a touch-and-go af-

ballistic gelatine. It is for now difficult to say whether these new European JHP offerings constitute a genuine shift in police service ammunition among European authorities, or merely represent the producers wishing to have this ammunition available “just in case”.

In terms of completely new and novel developments, this area has not been 100% fallow. As an example, at the IWA exhibition in Nürnberg in 2015, the company FK Brno presented their new 7.5 FK calibre, driving a 6.67 g spoon tip FMJ projectile to over 600 m/s. FK also presented their Field Pistol to shoot the 7.5 FK, the intend of the system being to provide a handgun with a genuine 100 m effective range. To what extent FK Brno has achieved this remains to be seen, but the company is reportedly in full production with both pistols and ammunition, so one must suppose there are buyers for this. To what extent the 7.5 FK offers any genuine advantages over the existing 5.7x28mm and 4.6x30mm calibres is of course a completely different issue.

Submachine Guns and Personal Defence Weapons (PDWs)

In many ways there is a natural overlap between handguns and the submachinegun/PDW class of weapons, since they often use the same ammunition. As such, most of the developments in this area have already been covered above; however, a couple of additional points can be made:

Back in the “good old days”, it was not uncommon for ammunition producers to offer a special “submachine gun load” version of their standard military service round. As an example, the Swedish M/39B round, introduced to enhance the performance of the CARL GUSTAV M/45 submachine gun, was designed to launch a 7 g steel-jacketed FMJ out of an M/45 submachine gun at approx. 420 m. Of course, the chamber pressures required to achieve this exceeded normal levels for the 9x19mm PARABELLUM, leading to accelerated wear on the weapons, and to potentially dangerous situations if the ammunition was fired from a pistol.

The modern-day incarnation of this type of ammunition is the Russian 9x19mm 7N21 and 7N31 series of cartridges. Intended to enable 9x19mm pistols and submachine guns to better defeat body armour, they not only operate at higher pressures (for increased energy), but also sports composite projectiles with a steel penetrator insert in a bimetal jacket.

Parallels can invariably be drawn to Federal Ammunitions’ (unsuccessful) bid, partnered

Graphic: Anthony G. Williams, www.quarryhs.co.uk



Range of traditional and “new” sniper calibres for comparison

Eagles in .50 Action Express. The point is that there are quite a few other factors that need to be taken into account with regard to calibre selection, such as penetration, size and weight of the gun, shootability, magazine capacity and, last but certainly not least, ammunition availability and interoperability with allied forces. So although the nostalgic in me would have loved to see the US Army return to the .45ACP, the pragmatic realises that the 9x19mm is the best choice for a military service pistol.

On the police, security and law enforcement front, it seems that police and security forces, at least in Europe and the US, are quite content with the current selection of ammunition.

To what extent this will change, in view of the spectre of body-armoured terrorists and the regrettable increase in the use of motor vehicles as terror weapons, remains to be seen. One ammunition type that could have potential is not even a new development: The Tres Haute Vitesse (THV). The THV was developed some three decades ago in France, specifically as a police duty round. The ammunition is non-expanding, using a very light projectile with a reverse-ogive shape. The light weight gives the projectile a very high muzzle velocity

fair. Also, last but certainly not least, one has to understand that many LE officers have been reluctant to carry a duty ammunition that penetrates their own body armour. However, in the author’s opinion, the THV remains a valid design that could have applications in today’s security environment.

Traditionally, police ammunition in Europe has focused on minimising overpenetration and ballistic range (danger area), and maximising energy transfer to the target –at the expense of soft target penetration. This kind of traditional ammunition is exemplified by the Action series from RUAG Ammotec, and the similar QD series from Metallwerk Elisenhütte Nassau (MEN). Over the past few years, several producers have developed and are offering more traditional expanding ammunition of the Jacketed Hollow-Point (JHP) type. The latter type has long constituted the traditional police ammunition in the US, ever since the infamous FBI “Miami Shootout” back in 1986. The ballistic studies conducted by the FBI following this episode lead to a focus on sufficient penetration, even when shooting through intermediate barriers, which again resulted in the current FBI emphasis on a minimum of 300mm of penetration in

with Glock, for the US Army MHS. Little hard data has been released about their Enhanced Barrier Round but apparently it looks like the Russian 7N21 and 7N23.

Cartridges of this type, in standard calibres but with enhanced performance, could also be an answer to the increasing risk of police and security forces of encountering criminals and terrorists with body armour. When it comes to the specific PDW calibres, notably the 5.7x28mm and the 4.6x30mm, most of the developments in this area have been for new ammunition producers to start offering the PDW calibres, in the traditional FMJ and armour piercing ammunition types.

Service Rifles and Rifle-Calibre Machine Guns

When it comes to ammunition developments in the world of military service rifles, the driving impetus behind this has been a growing dissatisfaction with the 5.56x45mm SS109, due to its supposed limitations in terms of tactical barrier penetration, terminal ballistic effects and effective range.

In an attempt to overcome some of the claimed shortcomings of the 5.56x45mm, the US has introduced the M855A1 round, to replace the existing M855. The M855A1 uses a lead-free projectile, with a steel penetrator insert similar to the SS109. However, due to the increased length of the projectile (caused by its reduced density), it is ballistically superior to the M855, and it supposedly provides for superior performance in all respects.

Other NATO nations continue to soldier on with the NATO standard SS109, either because they are genuinely content with its performance, or because they do not find the alternatives to offer sufficient improvement to warrant a change.

However, improvements to the 5.56x45mm will only bring you so far, and it is perhaps telling that at least three current NATO service rifle projects have, as a minimum, included the option for 7.62x51mm. According to rumour, the Russian Army is also slowly moving away from their standard-up-to-now 5.45x39mm and back to the 7.62x39mm.

Which of course brings us to a discussion of the alternatives to the 5.56x45mm. An old military saying tells us that "Amateurs think tactics – Professionals think logistics". Were we to adapt this to the current discussion, it would read "Amateurs think ballistics – Professionals think logistics". And what does the author mean by that? Simply that you can have the best rifle cartridge in the world, but if you cannot supply it in sufficient quantity to your troops, it is irrelevant.

The change from one standard service calibre to another is not something to be undertaken lightly, considering the required logistic effort - the change from the 7.62x51mm to the 5.56x45mm took some 15-20 years to complete. The point here is that, before deciding on a change, we should make sure that the replacement cartridge is significantly better than the 5.56x45mm to make the effort of changing worthwhile. And not just in terms of changing the weapons, but also in terms of tooling up to produce the new calibre in the quantities that today's armed forces require.

Many of the proposed replacements for the 5.56x45, most notably the 6.8mm Remington SPC, the 6.5mm Grendel and the .300 Blackout, while being superior to the 5.56x45mm in terms of ballistics, are currently produced in sufficient quantities to stand in for the 5.56x45mm in the near term.

So where does this leave the forces looking for an improvement over the 5.56x45mm? Back with the 7.62x51mm, of course. The old stand-by is currently the only genuine alternative to the 5.56x45mm: Weapons chambered for it are in production and available, and the ammunition is being produced in the kind of quantities that the military end users need.

The current work being done on the "service cartridge after next" is dealt with in the "Future Developments" section below.

Law enforcement and security users seem to have less of an issue with the 5.56x45mm, most likely because

- a) engagement ranges tend to be shorter and
- b) law enforcement is not restricted to Hague Convention compliant ammunition types.

Previously, we have mentioned the prospect of law enforcement and security forces facing body-armoured threats, or vehicles used as terror weapons. Partly in response to this, more than one producer is now offering "barrier blind" ammunition that, at least supposedly, maintains its trajectory and performance after penetration of tactical barriers like car bodies and windscreens.

Sniper Rifles

Sniper rifles are in many respects a separate class of weapon, even if they use the same nominal calibre as the standard service weapon(-s). Snipers typically use specialised loadings, optimised for precision (and therefore significantly more expensive than the standard service rounds).

In this arena, the Open Tip Match (AKA Hollow Point Boat Tail) type round remains the most common, almost regardless of calibre,

Photo: Author's collection



Another example of dedicated training ammunition: the SYNTech ammunition from Federal, with a polymer-jacketed projectile intended to reduce wear on and fouling of the weapon

since it is a design with proven accuracy and ballistic performance.

The real development in sniper ammunition has been the increased use of new calibres. As mentioned above, snipers have traditionally used "accursed" versions of the standard service calibre, such as the .308WIN (7.62x51mm), the 7.62x54mmR and the 12.7x99mm, with the area between these two being the habitat of calibres like the .300 Winchester Magnum (WinMag).

The last few years have seen a shift from the .300 WinMag towards the .338 Lapua Magnum, since the latter gives a significant increase in ballistic performance in return for only a limited increase in weapon bulk and weight. As an example, the German Bundeswehr is now introducing the .338 LM G29 sniper rifle (Haenel RS9) into service, as a replacement for the .300 WinMag G22 (Accuracy International AWM-F).

Part of this shift to the .338 LM can also be explained by the fact that the .338 LM was developed as a military precision/sniper cartridge, and is therefore optimised for this role. This move towards "made-for-the-job" sniper calibres can also be seen from the increased interest in the military sniper com-

munity for more “exotic” offerings, chief among these the Cheyenne Tactical (CheyTac) calibres. The original .408 CheyTac has since been joined by the .375 CheyTac, and both these cartridges offer supersonic ranges in excess of 1,900 m (depending on barrel length and exact loading), which translates into reduced flight time and increased terminal effects.

The .375 CheyTac and the .408 CheyTac have not (yet) achieved the popularity and commonality of the .338 LM but, if the current trend continues, this could be a matter of time.

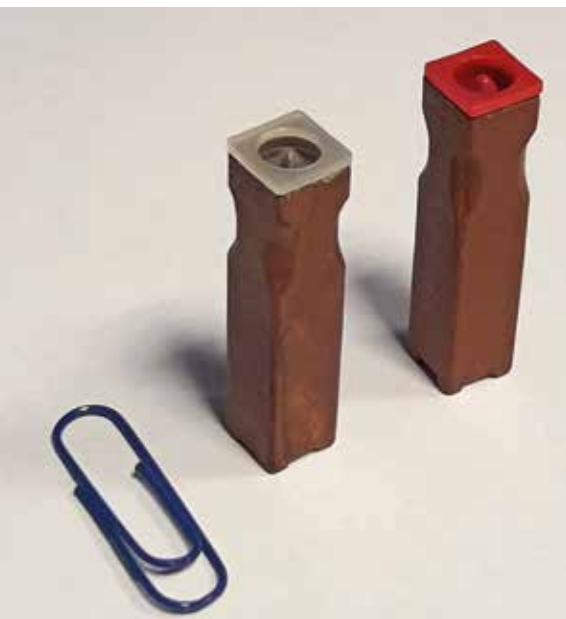


Photo: Author's collection

The progenitor to the current caseless LSAT effort: The 4.73x33mm caseless ammunition, ball on the left and tracer on the right, intended for the G11 rifle, with paperclip for size comparison

And at this point, someone will almost certainly raise the issue of ammunition commonality – why introduce yet another calibre into the military supply system? If we stay with the .308WIN (7,62x51mm) and the 12.7x99mm, the snipers can use the same ammunition as the regular troops. Except that the snipers are already using specialised loadings, using projectiles that are optimised in terms of ballistics and accuracy, so the introduction of a new calibre just for sniper use will be less of a logistical burden that one might think.

Training Ammunition

As per the introduction to this article, the change in the types of war being fought and contemplated has also forced nations to re-evaluate their ways and means of training. This, naturally, has increased the focus on and need for training ammunition.

So why are specialised ammunition types for training use required? First of all, and as always, there is the issue of cost. One way to reduce cost is to use steel or polymer instead of brass for the cartridge cases. The former Warsaw Pact nations produced and used steel cased ammunition for decades, but recent history has seen traditional “western” ammunition producers offering steel-cased ammunition specifically for training use, as exemplified by Hornady's Steel Match line. Another area that has seen development is in force-on-force training ammunition. The armies of the world have also realised the need for more realistic training in infantry combat. Force-on-force training is the natural answer to this, but this of course requires a new type of ammunition that will not only allow soldiers to safely shoot at each other, but will also give reliable indications of a hit, both in terms of impact force (it hurts to be hit) and of marking. Paint-ball type ammunition for military and LE training use is not exactly new; producers like FX Simunition and Ultimate Training Ammunition (UTM) have existed for several years. These traditional producers have, however, continued to expand their product ranges to include more and more weapons and calibres, and they have also been joined by other producers hoping to cash in on the trend.

A further “old” ammunition type that has seen increasing use and importance is the limited range training ammunition – ammunition that matches the ballistics of the standard service ammunition out to a certain range, but at the same time having a reduced maximum ballistic range (safety template).

As an example, the General Dynamics Ordnance and Tactical Systems Canada Short Range Training Ammunition in 5.56x45mm will function reliably in un-modified service weapons, and will match the ballistics of the standard SS109 ball round out to approx. 100m. However, the maximum range is only approx. 600 m, whereas the SS109 (depending on exact loading and weapon) is closer to 3,500 m.

Since military training areas all over the world are suffering from encroachment by civilian facilities, the limited range training ammunition allows more extensive and elaborate training to be conducted, while avoiding endangerment of nearby civilian installations. This is even, in some cases, an argument for the use of limited range ammunition for operational use, in cases where a missed shot could pose a serious hazard.

The Future

The Danish nuclear physicist Niels Bohr and the likewise Danish author, painter and cartoonist Robert Storm Pedersen have both

been credited with the saying that “It is tough to make predictions, especially about the future”. Keeping that in mind, the author will still try to take a look in the crystal ball, at some of the things we might see in the world of small arms ammunition, looking beyond the developments discussed above. Considering that the US armed forces were instrumental in the introduction as NATO standard of the 7.62x51mm and the 5.56x45mm, it should not be a surprise that developments in the US deserve a look in this regard. Chief among these is the Lightweight Small Arms Technologies (LSAT) effort, the stated goal of which is to significantly reduce the weight of small arms and their ammunition.

This effort has branched into two primary lines of development, both focusing on case-telescoped ammunition, where the ammunition is cylindrical in shape, with the projectile buried completely in the cartridge case.

One branch of development focuses on the use of polymer cases, these being lighter and less expensive than brass. Another branch focuses on dispensing with the case completely, and using caseless ammunition. While using novel cartridge case designs and materials could certainly provide a paradigm shift in small arms design and performance, the author remains sceptical with regard to caseless ammunition. Although admittedly lighter and potentially less expensive than cased ammunition, and offering the prospect of simpler weapons' designs, the cartridge case of small arms ammunition serves as more than just a disposable propelling charge container. The case acts to seal the chamber on firing, and it acts as a heat sink, both protecting the propelling charge against the heat of the chamber, but also taking significant amounts of that heat with it when it is ejected. Additionally, caseless ammunition needs to achieve sufficient mechanical strength to withstand repeated and extensive field handling as well as adequate heat and moisture resistance. As such, the author's considered opinion is that, by the time caseless ammunition has been developed to the point that it is a practical alternative for general service, hand-held rail guns or directed energy weapons will be valid propositions. ■

Disclaimer: The opinions expressed in the present article are those of the author, and do not represent the opinions or standpoints to the NATO Support and Procurement Agency or associated entities. The mention of specific products or producers in the present article is not to be taken as an endorsement or recommendation by the author, the NATO Support and Procurement Agency or associated entities.

Ground-Based Joint Fire Support Trends

Waldemar Geiger

"When learning lessons from the Ukraine conflict the joint fire support (JFS) capabilities involving the combat troops, mortars, artillery assets, close air support and naval gun fire support require new assessment."

The massive deployment of Russian counter-artillery capabilities against Ukrainian artillery forces, the use of a large variety of drones for the reconnaissance of Ukrainian fire posts and the control of own indirect fire operations led to significant Ukrainian casualties. Ukrainian mortar and artillery fire was detected by counter-artillery radars and instantly answered with massive artillery fire (tube and rocket). The protection of the Russian frontline with modern air defence assets was an obstacle for the deployment of the Ukrainian Air Force so that close air support (CAS) to the ground forces could not be provided to a sufficient extent. To cope with the new situation, it is not sufficient for NATO forces to re-establish the Cold War structures and just increase the quantity of JSF forces. Future JSF el-

Photo: Hirtenberger



To increase the survivability of dismounted firing units, the implementation of modern fire control systems, like Hirtenberger's ARC-FIRE, seems to be a promising solution.

The Mortar Company.



hirtenberger
Defence Systems



ements have to master both symmetric and asymmetric conflicts, as well as cyber warfare environments.

Technology Trends

Target Acquisition

Reconnaissance and target acquisition are the first step in the deployment of JSF forces. Extended theatres of operations constitute a permanent problem for military leaders, both in stabilisation operations and high-intensity combat. This can only be responded to with a modern sensor network. That is why there is a strong focus on the modernisation of existing capabilities and the integration of new skills.

Nobody can take advantage of a precision bomb, grenade or rocket if the target coordinates are corrupt or when hostile indirect fire is identified late, falsely, or not at all. As a result, improvements to range and the resolution of portable target acquisition devices or counter-artillery radars are being expedited.

As an established element of CAS, the physical separation of observation and effect cannot be applied to indirect fire operations in total. While the Joint Tactical Air Controller (JTAC) can drop bombs from an HQ, artillery and mortar fire is still subject to command and control by qualified observers in theatre. The reason for this is in technology rather than in dogma. While in CAS operations both the JTAC and the pilot are capable of exchanging image, sound and text data via link communication, such a capability is only available in indirect fire operations with the use of drones. Looking at ground-based sensors the observer does not have access to the image of a main battle tank commander or a remote weapon station operator, as both do not have the capability for the exchange of real-time data.

Both in industry and the forces there are presently intense considerations as to how to establish such a cross-sectional "sensor-to-shooter" capability.

Speed

The speed term covers two aspects. The first one is mobility of the JFS elements. The threat of the own position being rapidly detected by hostile airborne reconnaissance or own indirect fire being detected and quickly answered by hostile artillery strikes requires that the fire positions be moved into only shortly before the fire operation and be left immediately afterwards. This is the "shoot and scoot" principle. Currently, it is assumed

that own fire is responded to by hostile counter-artillery forces within three minutes. This cannot be achieved with dismounted mortars or towed field artillery. That is why modernisation efforts primarily consider integrated or self-pro-

Firstly, target acquisition. For safety reasons, for instance, target coordinates generated with such target acquisition means as laser rangefinders are counter-checked in the scope of an analogue map/terrain comparison. That involves marking the target



Photo: Michael Horst

Autonomous Mortar Systems, like RUAG's COBRA, are highly mobile, accurate and capable of Multiple Rounds Simultaneous Impact (MRSI).

pelled autonomous mortar and artillery systems. Dismounted systems will remain only with airborne troops or be deployed in low-intensity conflicts with no threat imposed by counter-artillery elements. To increase the survivability of dismounted firing units, the implementation of modern fire control systems seems to be a promising solution. Such systems allow the calculation and transfer of individual data for each gun/mortar. This gives the commanders the opportunity to place the systems further apart. To suppress such a unit, the adversary has to use more systems and ammunition. Disadvantages of such an approach are increased coordination and logistical efforts.

As the opponent's mobility is also subject to continuous improvement, the second aspect of speed addresses the time required from target identification until the impact of the first grenade/round at the target. Here, the acceleration of several process steps shall be considered.

coordinates on a map and comparing the position on the map with the position of the target on the terrain. Only if both results match, are the target coordinates forwarded to the fire direction centre. This process may seem complicated and unnecessary, but it is very important, because with the use of a laser rangefinder you can hit either the target or a bush 500 metres before it. With digital and realistic 3D maps, on which the target is automatically projected after target acquisition, this process can be significantly accelerated, which facilitates verification by comparing maps and terrain.

Secondly, data transfer. Many forces are still using voice communication to send target coordinates from point A to point B, as they cannot take advantage of stable radio networks required for data communication. Data transmission requires higher network stability, as data packages are either forwarded in full or not at all. On the other hand, in voice communication only a syllable or a word might be omitted

or unintelligible, but the rest of the message would arrive. In response to this requirement, many forces have embarked on tactical communication modernisation programmes.

Lethality

In terms of effect, the trend is towards quality and quantity. On the one hand, there is a substantial requirement for conventional, cheap and simple bombs, grenades and rockets for cross-sectional wide-area deployment.

On the other hand, there is a requirement for smart and improved sorts of ammunition for all weapons, especially for use against high-value targets and point targets in the full spectrum of military operations.

Various measures increase the lethality of different weapon systems. While guided and extended range munitions are a development priority for artillery forces, there is a strong short-term trend for lethality enhancement of mortar bombs by means of pre-fragmentation, which can double the effect of a mortar bomb in a cost-effective manner. Alternatively, one could think of the development of smart mortar munitions. Although fully developed guided mortar bombs already exist, they are significantly more expensive than their simple counterparts and have a reduced effect, as part of the bomb's space is used for the guidance system. One should consider that the small fins of this type of ammunition increase the bomb's radar signature, thus making them easier to be detected and referenced back by counter artillery radar than conventionally shaped munitions.

As more effect can be achieved not only by increased but also by more precise damage potential, measures in support of precision enhancement contribute to improved effect. Here, one has to distinguish between accuracy and precision. Accuracy improvements are primarily achieved by the above measures for target location and guidance. Precision is achieved by dispersion optimisation; it is distinctively more cost-effective and is primarily achieved through improved production techniques.

Robustness

Last but not least, the evaluations of the conflicts in Syria, Ukraine and Iraq have revealed that operations in an electronic warfare and GPS-denied environment will play a crucial role in modern warfare at all intensity levels. Here, based on respective expertise, even technologies implemented in COTS solutions can be used to completely jam or – even worse – spoof GPS signals. Spoofed coordinates referring to own forces or the target can lead to an increased level of friendly fire and/or collateral damage to civilian populations or infrastructure. In response to this threat, modern and smart weapons are fitted with redundant guidance systems. Apart from GPS guidance, semi-active laser homing heads are used. Laser target illumination can be provided both from airborne platforms and ground forces. Crypto measures and signal enhancement of the military GPS signals contribute to resistance against jamming and to a distinct level of usability in GPS-denied environments.

As the effectiveness of joint fire forces is mainly dependent on the interoperability of the individual elements, EW measures of the opponent mainly affect communication assets. To harden communication links, redundant systems are used here, too. Therefore, equipping observers and firing elements of modern forces with redundant communication means is a priority for many NATO forces. If, for instance, a frequency or a complete band is jammed in the VHF band, one can switch to UHF or satellite communication. Where feasible, one may even think of cable communication or analogue messenger services. That is why “back to basics” and “old school is good school”, like working with compasses, maps and plotting boards, are the mottos in training JFS elements across NATO. ■

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Small Arms Training

From Live Rounds to Lasers

William Carter

Where live rounds are used in training, targets can be static or mounted on carriers which can be on wheels, rails, or mounted on a frame so that they can pop up and then go down again. After firing, bullets can be stopped by traps or mounds of soft material such as sand.

Targets can be designed for “Judgemental Training” when the shooter has to quickly decide whether to fire or not. Examples of such targets include a picture of a man in what appears to be a threatening pose, but who is just holding a cigarette lighter, and a picture of an attractive young woman who is actually aiming a gun. However, for interactive tactical training where troops and targets are in the same area,

of the exercise. Coding of laser pulses allows the use of individual weapons to be recorded. In small ranges, other functions can be recorded such as trigger and butt pressures, aim points and so forth. In large-area ranges, the exercise computer not only records hits on individual receivers but also calculates damage effects on targets, whose behaviour in the exercise can then be adjusted. Exercise control can

laser detectors. For vehicles, Weapon Effects Simulation (WES) can be used where flash/bang and smoke devices are used to increase realism, such as to simulate a hit on a vehicle. These devices can be triggered by a laser “hit” or through the TES system computer that is monitoring activities. The US Army Multiple Integrated Laser Engagement System (MILES) sets a standard and has been through a number of improvements over the years. Compatibility of other systems with the latest version of MILES is therefore desirable.

Urban Operations

Urban operations have always been difficult. Fighting a determined and fanatical enemy in towns and cities has always been dangerous. Well-equipped professional forces may not necessarily prevail, at least in the short term. A classic example is the Stalingrad battle of 1942–43, and there are many others including Baghdad, Fallujah and more recently in expelling militants from towns and cities in Iraq and Syria.

Military Operations in Urban Terrain (MOU) not only include active conflict but also general operations such as patrolling, policing, search and convoy operations. Threats include snipers, ambushes, Improvised Explosive Devices (IEDs) and other types of booby traps. There is also civil opposition, overt and covert hostility, insurrection, uprisings and riot. There may also be a language problem and incidents can be due to a lack of communication and understanding. There are different social and behavioural patterns in many countries, such as the status of women and how to behave towards them. Dress of local civilians is important, particularly when loose clothes can hide weapons or even the gender of the wearer. The local population needs to be modelled in training exercises. Suitably clothed role-players can be briefed to behave in a manner appropriate to the situation, from friendly through indifferent to hostile, aggressive or rioting. In such training scenarios, the language of the country should be used by the “locals”. Indeed, language training is crucial. This varies from the use of standard English for communication between allied forces, to an understanding of the local language of

Photo: USMC



MOU training at USMC Camp Lejeune

personnel are in the firing line, and casualties continue to occur in live-fire training exercises. Indeed, in 2016 the UK forces had no casualties in action, but at least two deaths in training on ranges with live rounds. This graphically illustrates why the laser is now extensively used. It is not only safer, but is also less expensive than using up stocks of real rounds, and it enables more realistic training scenarios.

In laser-based Tactical Engagement Simulation (TES) systems, hits and near misses are recorded by laser receivers mounted on individual soldiers, vehicles, helicopters, other aircraft – even ships if they are part

record a complete kill, a mobility or armament kill (for AFVs) or simulated injuries for infantry. All this can be recorded in detail for After Action Review (AAR), which in some exercises can take a longer time than the exercise itself. This is appropriate when units and individuals are gaining experience or are involved in a particularly complex exercise or mission rehearsal.

During an exercise, umpires can reset targets that have been ‘killed’ or damaged and manage a realistic battlefield exercise with many weapons and targets. For dismounted soldiers, a body harness and helmet strap is generally worn, which carries



Photo: Bundeswehr

The Bundeswehr training area in Altmark (GefechtsÜbungszentrum; GÜZ) includes a MOUT facility.

the region either directly or through an interpreter. The enemy has often realised that it is pointless to engage in a battle in open terrain, but transfers activities to what is essentially guerrilla warfare in dark alleyways and closely packed buildings, which gives advantage to the insurgent even with the best trained army. Add suicide bombers and remotely detonated explosive devices to the mix, and the difficulties for the pacifying force become extreme, as we have seen in Afghanistan, Iraq, Syria and other places. It takes higher force levels to control and pacify a country which continues to contain fanatical opposition than to initially defeat it in battle. Before the war against Saddam Hussein in Iraq, US Army Chief of Staff General Eric Shinseki, said to the US Senate Armed Services committee that "several hundred thousand soldiers" would probably be required to handle post-war conditions. Secretary Donald Rumsfeld and Deputy Secretary of Defense Paul Wolfowitz publicly disagreed with this, but Shinseki has been proved correct. It seems to have been an error to disband Saddam's Iraqi army, compared to putting its remnants under firm allied control once the set battles had been won and using it to keep control of the country.

Tactical Engagement Simulation (TES) and Weapon Effects Simulation (WES) are ideally suited to MOUT training. Dummy building complexes can be constructed specifically for such training and examples are given later. However, the building must reflect the environment to which the troops are to be deployed. It is not as valuable to train in a dummy Western-style village if troops are to be deployed to the narrow alleyways of a Middle-Eastern town with buildings of entirely different construction.

There are also cultural factors. For instance, a suspected male opponent may have fled to the female area of a household and may be wearing a Burqa, perhaps with a suicide

belt or other weapon. Other male opponents could be dressed in garments that conceal weapons or bomb belts. How does one deal with a hostile crowd or even a riot, without shooting innocent civilians? There is no easy answer but such situations need to be trained before the real situation is confronted.

Military convoys are prime targets to insurgents, and a number of simulators have been developed for convoy operations in hostile territory. Some are mounted in custom-built simulator buildings, but others are in large trailers so that they can be deployed to the area of operations. Some have screen projection, others have Head-Mounted Displays to show urban and other scenes. The simulators with screens have sections of dummy vehicles and simulated weapons for extra realism. Situations trained can include snipers, explosions, IEDs, hostile locals and so forth, and scenarios can be modified to include simulations of real incidents.

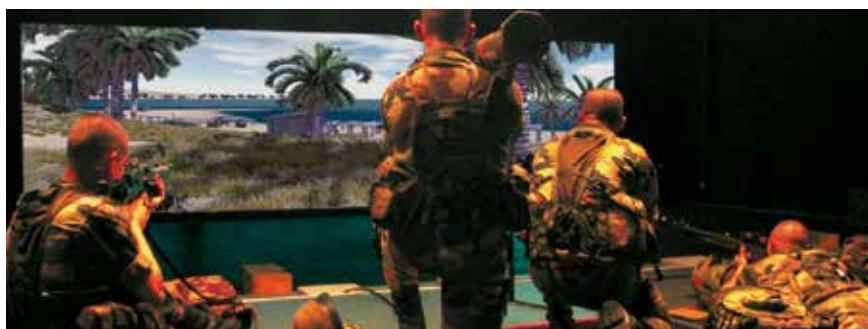
Particularly in urban training, participants must be closely tracked so that the action

Photo: Thales



SAGITTARIUS EVOLUTION from Thales, shown here is the mobile version, provides both virtual and live firing training capability for individual and unit training.

Photo: RUAG



SITTAL from RUAG, a simulator dedicated to the training of small arms operators at the individual and collective levels, is widely used by French forces for initial and refresher training.

can be recorded for After-Action Review (AAR). Tracking devices attached to each soldier and each weapon are used both outside and inside buildings. Inside buildings, extra receivers can be used so that continuous tracking is possible and small inertial units can achieve continuity of tracking between points sensed by other methods such as laser, IR and radio.

Training areas with specialist buildings are needed for this type of operation. In Germany, there is a MOUT facility at the Bundeswehr training area in Altmark (the GefechtsÜbungsZentrum (GÜZ)) and the US Army has a MOUT facility at its Combat Maneuver Training Center at Hohenfels. In the Altmark training area, the "Schnögersburg Training City" has over 500 buildings in a 6-square-kilometre area, a metro system, an industrial zone, a 22-metre-wide river, and can train up to 1,500 soldiers at a time. There are even underground sewers, to practise what happens in real urban battles such as the "Warsaw Uprising" at the end of 1944. In the UK, the Copehill Down Village is part of the British Army Salisbury Plain Training Area (SPTA), originally constructed to model a town in south Germany but now a Middle East urban model has been added. In Israel "Baladia City" in the Negev is an Urban Warfare Training Centre. In the USA there

Photo: Theissen Training Systems



Target System from Theissen Training Systems

are at least eight MOUT training facilities. These include the Joint Readiness Training Center at Fort Polk, Louisiana; the MOUT

Assault Course at Fort Pickett, Virginia; "MOUT City" at Camp Ripley, Minnesota; the McKenna MOUT Site at Fort Benning, Georgia; the Urban Combat Training Site at Fort Knox; the "Yodaville" Urban Target Complex at Yuma, Arizona; the US Marine Corps MOUT Facility at Camp Lejeune, North Carolina; and a US Army Reconfigurable MOUT Training System.

FN® EXPERT Marksmanship Training Solution

Belgium-based FN Herstal introduced the FN® EXPERT marksmanship training system at this year's IDEX trade show in Abu Dhabi. Designed and developed by Noptel – an FN Herstal subsidiary that specialises in optoelectronic systems – FN EXPERT is an advanced marksmanship training solution that can be attached to any rifle or carbine to provide dry, blank and live fire training for shooters and trainers operating in the defence and security environment. By providing shooters using their own service weapon with instant feedback on their per-

formance, FN® EXPERT is to accelerate improvements in fundamental marksmanship skills (holding, aiming, breathing and triggering), as well as developing muscle memory. It also facilitates instructors' coaching skills by providing objective tools to measure shooter performance. FN® EXPERT measures rifle movement during aiming and triggering, detects the shot, shows the location of both the hit and miss, and shows and analyses the shooter's performance in a simple, graphical and numerical way.

According to FN® the EXPERT system can be used everywhere, indoors with simulated shoot-

ing distances or outdoors with life-size targets and real shooting distances up to 300 m, even in confined spaces, including unconventional training areas such as deployed operating bases, warships or police stations.



Photo: FN Herstal

Head-Mounted Training Devices

A Head-Mounted Display (HMD) can be used to show an operational scene. This, in combination with the use of an instrumented weapon, can be used for training without having to deploy to a TES or MOUT facility. Instrumentation records when the weapon is fired and in what direction. Results are recorded for AAR together with the virtual scene together with enemy and friendly forces. In a relatively small training facility, a small squad can train together using HMDs, body tracking and recording of fire.

The Marketplace

Here are some recent projects in infantry and related training, in alphabetical order of country or region.

Asia Pacific Region

Cubic Global Defense, headquartered in

San Diego, California (www.cubic.com), is to deliver three mobile combat training centres to a customer in the Asia-Pacific region under a US\$25M contract. Cubic will supply laser-based simulation for soldiers, vehicles and various weapons for deliveries in 2018 and 2019.

Canada

Cubic Global Defense has a US\$4.5M contract to upgrade Canadian Weapons Effect Simulation (CWES). This is for the Canadian Data Communications Network (DCN) and Exercise Control Centre (ExCon). CWES is employed at the Canadian Manoeuvre Training Centre, Base Wainwright, Alberta.

Estonia

Saab Security and Defence Solutions, headquartered in Järfälla, Sweden (www.saabgroup.com), is to supply company infantry kit and eight BT46 CV9035 vehicle simulator kits to the Estonian Infantry and Armour School for delivery in 2018. Saab's new MANPACK 300 system will be used for control and monitoring of exercises up to 300 players.

Germany and Italy – US Army

Tapestry Solutions, a Boeing company headquartered in San Diego, USA (www.tapestrysolutions.com), has a US\$58M contract with the US Army's overseas 7th Training Command. This will include training exercises at the Joint Multinational Readiness Center in Hohenfels, Germany, the Joint Multinational Simulation Center (JMSC) at Grafenwoehr and its satellites in Kaiserslautern, Germany and Vicenza, Italy. Tapestry designs and conducts computer-based simulation from unit-level to joint and multinational exercises in classroom and range environments. The team led by Tapestry includes Capstone Corporation (www.capstonecorp.com), Metro Productions (www.metro-productions.com), and Visual Awareness Technology & Consulting, Inc (www.vatcinc.com).

The Netherlands

Bagira Systems, headquartered in Holon, Israel (www.bagirasys.com), is to supply a Joint Fire Training Exercise and System (JFTES) to the Netherlands Army. This will use the company's Joint-Fires BattleSpace Simulator (JOBSS), used by Israeli Defence Forces since 2016. The system will train individuals up to Joint Fires Support Team training with a dome display.

Peru

Bagira has delivered its MAGNET system to the Peruvian Army. This is a laser infantry weapon training system, controlled by an

Android-based Instructor Field App (IFA). The Peru system will include training for the GALIL assault rifle and PANZERFAUST 3 anti-tank weapon.

UK Army – Area Weapon Effects

Cubic has a US\$35M three-year contract for an Area Weapons Effects Simulator (AWES). This is used at the Salisbury Plain Training Area (SPTA) in the UK, and the Brit-

the US Army Combined Arms Center, and the US Army Program Executive Office for Simulation, Training and Instrumentation (PEO STRI).

USA – Convoy Training

Raydon Corporation of Daytona Beach, Florida (www.raydon.com), has a \$20M contract for 10 new Virtual Convoy Operations Trainers (VCOT) for the US Army.

Photo: Bagira



Bagira's JOBSS system was successfully launched at the IDF Land Forces Training Centre in February 2017.

ish Army Training Unit Suffield (BATUS) in Alberta, Canada. AWES includes weapon and NBC effects, and tracks the actions and positions of more than 1,400 soldiers and 250 vehicles using GPS. It also records hits, kills and misses using Cubic MILES.

UK Army – TES

Saab has a three year contract extension for Tactical Engagement Simulation for the British Army, with a value of SEK210M. This is for maintaining and updating Saab's Deployable TES used by the British Army in the UK and in exercises abroad.

USA – Augmented Reality

The US Army is developing an augmented reality Synthetic Training Environment (STE) utilising One World Terrain (OWT) based on real geospatial data. A recent forecast from Frost & Sullivan predicted that by 2020 nearly all training exercises will include mixed real and synthetic reality. The STE/OWT project is being developed by the Army Research Laboratory (Orlando), the University of Southern California Institute for Creative Technologies,

VCOT was first delivered in 2004 and 114 units are now in service. The current model is said to be a fourth generation system and trains up to company level.

USA – Live Training

Lockheed Martin Corporation, headquartered in Bethesda, N side of Washington DC (www.lockheedmartin.com), has a US\$288M contract to update US Army live training, together with Saab. The new Instrumentable Multiple Integrated Laser Engagement System (I-MILES) Tactical Engagement Simulation System will integrate with older MILES systems. The new system is smaller, lighter, and with simpler components.

Conclusion

Realistic training needs time, resources and the use of modern training technology with comprehensive After-Action Review. Such technology is available, as described above. Personnel can now be trained realistically before they deploy to an area of conflict, particularly in the difficult area of operations in urban terrain. ■

Sniping Developments in Europe

David Saw

There has been increased emphasis on developing enhanced sniping capabilities in Europe in recent years for both Special Operations Forces (SOF) and conventional forces. An important driver for this sniping emphasis has been operational experience gained in Afghanistan and Iraq, as well as in ongoing asymmetric conflicts in other parts of the world.

In early November the Danish Defence Acquisition and Logistics Organisation (DALO), located at Ballerup, Denmark, issued a contract notice for sniper rifles. DALO is looking to acquire what they describe as a Precision Rifle Short (PRS) in 7.62x51mm NATO and a Precision Rifle

Denmark already has a comprehensive set of sniper weapons in its inventory that fulfil similar requirements to the PRM and PRS currently being sought. In the PRM category Denmark operates the Sako TRG 42 in .338 LM, with the Heckler & Koch HK417S in 7.62x51mm NATO filling the PRS role. In addition Den-

In the Field

The depth of sniping capabilities in Europe/NATO was illustrated in September 2017, when the US Army Europe organised the second Best Sniper Squad competition at Grafenwoehr. The first competition in 2016



A Danish soldier takes aim with the Heckler & Koch HK417S 7.62x51mm Precision Rifle Short (PRS) during the European Best Sniper Squad Competition in 2016. Denmark is looking to acquire new PRS and Precision Rifle Medium (PRM) systems, with evaluations in early 2018.

Medium (PRM) in .338 Lapua Magnum (LM). DALO wants each potential supplier to deliver two units each of the PRS and PRM, with 300 rounds of ammunition in each calibre; the weapons are to have an approved suppressor and a bipod. The PRM must have a muzzle brake, while the PRS must have a flash hider. Both the PRM and the PRS must have NATO Accessory Rails STANAG 4694 or equivalent to allow the mounting of standard equipment such as sights and sensors. In total five suppliers will be considered for the contract, with evaluation/firing trials to take place in Denmark between February and April 2018.

mark has the Barrett M97 in 12.7x99mm (.50 BMG) for anti-materiel applications and EOD by the Danish Engineering Regiment. More recently Denmark added to its sniping capabilities after DALO issued a requirement for what was described as a 'Long Range Precision Rifle' to be used by Danish SOF, army snipers and later by the Danish Engineering Regiment. The rifle was to have an effective range of between 500 and 2,000 metres, with competitive trial and evaluation being carried out between April and July 2015. In 2016, DALO announced that the Accuracy International AX50 rifle in 12.7x99mm (.50 BMG) had been selected for the long range requirement.

had been won by the sniper team from Norway, with Sweden in second place and Belgium in third. For 2017 there were two US Army teams entered, as well as international participation from Belgium, Bulgaria, Canada, Czech Republic, Germany, Italy, Latvia, Lithuania, Poland, Portugal, Spain, Sweden and the UK. The 2017 competition was won by Belgium, with Sweden in second place and the Czech Republic in third. Belgium is another country that has enhanced its sniping capabilities, with some 287 FN SCAR-H PR rifles in 7.62x51 mm NATO having been acquired; these have a 20-inch barrel and are described as 'precision rifles'. There is also the Accuracy Inter-



In 2016 Denmark announced that it had selected the Accuracy International AX50 system to meet its Long Range Precision Rifle requirement. The AX50 is a 12.7x99mm (.50 BMG) calibre weapon and will be used for engagements at ranges of between 500 and 2,000 metres.

national AW in 7.62x51mm NATO, although this is due to be withdrawn, another Accuracy International system in use is the AXMC in .338 LM, with the Barrett M107A1 in 12.7x99mm (.50 BMG) at the top end of the Belgian inventory.

In comparison, Norway uses the Heckler & Koch HK417 in 7.62x51mm NATO as a designated marksman weapon. For anti-materiel applications the Barrett M82 in 12.7x99mm (.50 BMG) is used. The next step was to acquire a weapon that would fit in between the HK417 and the M82 in capability. After evaluating a number of different options in 2013, Norway decided to acquire the Barrett MRAD in .338 LM, with first deliveries in 2015, this bolt-action weapon offered the best performance characteristics for the Norwegian requirement. The decision to opt for the .338 LM calibre came after a study by the Norwegian Defence Research Institute comparing various different sniping calibres.

For those seeking sharpshooter/sniper weapons, the list of potential rifles is extensive, as is the choice of calibres and the choice of sights. European companies remain highly competitive in terms of weapons, ammunition, sights and other associated systems, which is all to the good as the importance of sniping capabilities is set to increase. ■

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The Challenge of CBRN Standoff Detection

Dan Kaszeta

CBRN sensors can be broadly divided into two categories, point sensors and standoff sensors.

Point sensors represent the vast majority of CBRN detection on the market and detect, measure, and/or identify CBRN substances within the instrument (many pull air samples into the hardware) or very close to the instrument. Standoff sensors, on the other hand, collect information at some distance from the threat material, sometimes at distances measured in kilometres. Standoff detection and identification is technically more challenging. Standoff detection takes place among a dirty background of dust, smoke, fog, and many obstacles to line of sight. In addition, most CBRN materials are heavier than air and are found close to the ground. Geom-

forces or protected infrastructure can give valuable time to take protective action. Even a handful of seconds can save lives. Various technologies and products are available.

First, it is important to mention remote use of point detection. The oldest form of standoff chemical detection was to put point detectors well upwind of friendly forces and connect them by wire to the front lines. The same could be said of various kinds of unattended sensors dropped well away from friendly forces communicating by radio or other means. Advances in point detection have meant that detection instruments are getting smaller, more rugged, and cheaper. The actual detection

close to the ground. While this approach is certainly possible, there appears to be few, if any, who have adopted this tactic.

From a purist perspective, taking a point sensor and putting it upwind is not really a standoff sensor. Also, there are systems that are technically standoff detectors, but work at small distances, as in one metre or less, from the target. There are many interesting products in this space, but for the purposes of this article they are really not true standoff sensors. True standoff sensors collect information at a significant distance from the sensor, typically hundreds of metres or more. Such sensors are divided into two categories: passive and active. Passive sensors only receive information. For example, a telescope is a passive standoff sensor that works in the visible light spectrum. Active sensors emit some sort of energy and await the return of information based on this emitted energy. Radar is a type of active sensor.

The majority of chemical standoff detection systems are passive infrared sensors. To simplify somewhat, these sensors combine a very sensitive infrared imaging system with various data analysis techniques to collect information about gases and vapours at some distance. Generally, these devices use a process called Fourier transform infrared (FTIR) spectroscopy. This approach works on the basis that there is a lot of ambient infrared light, even in the darkest night, and this light travels through the air. When it passes through clouds or plumes of gas, vapour, or aerosols (finely divided mists of solids or liquids), some of that infrared energy is absorbed. By looking at the background infrared light and comparing it the infrared that has passed through a cloud, a smart sensor and some computing power can derive the "absorption spectrum" – which serves as a unique fingerprint for chemicals. At a minimum, such devices can serve to detect suspicious clouds. When they work well, they can identify chemical warfare agents kilometres away. However, such a system has

Photo: US Dept of Defense, 2014



Prototype biological standoff detector system testing in Utah

etry and geography are often conspiring to make it difficult to see CBRN threats at a distance even before one considers the technical challenges.

The majority of the products and technologies for standoff detection are aimed at detecting chemical threats. Detecting chemicals while they are at some distance from friendly

hardware inside a US JCAD (produced by the UK's Smiths Detection) is smaller than a packet of cigarettes, and a JCAD only costs a few thousand US dollars. Standoff sensors tend to be priced in the hundreds of thousands. One could literally buy one hundred JCADs for the price of a single standoff sensor. So, one feasible approach to standoff detection is to proliferate cheap and disposable chemical detectors around the battlefield and have them communicate. Small chemical detectors could be put on drones. This has disadvantages because chemical warfare agents, almost without exception, are heavier than air and stick

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shortcomings. When there is a lot of confusing background, such as smoke or dust, they do not work as well. When there is restricted line of sight, such as forests or urban areas, they work only at very short range. Because they are, by definition, passive sensors, they cannot accurately work out the range to the cloud, but only the left, right, top, and bottom, as seen from the sensor. A small dense cloud close to the detector looks very much the same as a diffuse cloud much further away. There are methods to get around these shortcomings, but they involve sensor integration and the use of multiple sensors looking at the threat from different directions. Not every end user has the infrastructure and expertise to make this kind of integration work well on the battlefield. Performance and reliability issues have plagued every developer in this sector. There is not a single product on the market that has not been troubled by performance issues, particularly false alarms.

Standoff detection has been a market segment with lots of fluidity and volatility. Not every player in CBRN detection has entered this space, and some have entered and left. There are solid reasons why many firms have not devoted significant effort in this area. For one thing, the technology is less mature than point detection. Point detection for chemical warfare works and works well. Emphasis is on incremental improvements to make the products better. In standoff detection, it is a matter of making the product work at all and the hurdle of "making a good product smaller and cheaper" is still in the future. Another reason is the market dynamics aren't the same. Point detectors are sold in quantity, with contracts in the thousands of units not unheard of. Standoff detectors are sold in much smaller quantities, often single unit sales to small specialised military teams. The military market drives standoff detection production development; whereas there is a large and still-growing emergency response and civil protection market for handheld sensors. Economics heavily influences procurement decisions. A smaller army like that of Slovenia or Belgium could equip every combat platoon in their force structure with good point detectors. Or for the same money, they could equip a single reconnaissance platoon with several standoff systems. It is not difficult to sell point detectors over standoff sensors in this environment. The civil market is less mature for standoff sensors. The current technologies are less useful in dense urban areas, due to obvious line of sight issues. All of these factors combine to limit the market. Various products, often made by smaller specialty

firms, have already entered the market and quickly departed, never to be seen again. Other products were mooted but never materialised from presentation slides. Within the passive standoff detector space, there are a handful of products on the market. As with other parts of the CBRN industry, the United States leads the market, by virtue of spending more money. The first fielded chemical standoff system was the M21 Remote Sensing Chemical Agent Alarm, made by Intellitech (US) and fielded

to the US Army in the mid 1990s. Although it was nominally good for ranges of up to 5 kilometres, it had a poor reputation among its users and earned its nickname of "Rascal". It could only work while stationary and was prone to numerous false positives. The author's own experience with the M21 was that it nearly continuously alarmed in urban environments on several demonstrations in the late 1990s. An Australian MoD study in 2008 claimed that the lifetime of the system averaged only 277 hours of operation.



The NBC reconnaissance variant of the US Army STRYKER vehicle has a Joint Service Lightweight Standoff Chemical Agent Detector (JSLSCAD).



The standoff detector "FALCON" by VYVOJ Martin. FALCON is a laser sensor which detects chemical warfare agents using absorption of laser radiation caused by molecules of CWA and biological warfare agents by evaluating particle size distribution using DISC (differential scattering) technology. This technology enables not only the detection of aerosol clouds, but also the discrimination of bio/non-bio particles. FALCON was used in the Gulf War.

If true, this is truly a poor piece of equipment. A similar shipboard system, the AN/KAS-1, was adopted by the US Navy, again with a mixed service history and reputation.

The Joint Service Lightweight Standoff Chemical Agent Detector (JSLSCAD) was developed as a replacement to the M21 by General Dynamics (now Chemring) and represents the key American entry in this market space for military end users. However, it is not an ideal system. The original JSLSCAD specification was for a range of 5 kilometres, with 10 kilometres as an ideal aspiration, yet the commercial specification sheets from the manufacturer claim that its effective range is 2 kilometres. While it works in a 360 degree arc, it is still not a miracle worker, and end users will tell you that its claims to work to a distance of 2 kilometres is optimistic and requires ideal conditions rarely found on the battlefield. It is no secret that early testing of this system at the US Army's Dugway Proving Ground was halted by unacceptable rates of false alarms. In addition, the same Australian study mentioned above let slip that the JSLSCAD's limit of detection for various nerve agents is much higher than lethal

concentrations, leading to some obvious questions about its tactical utility. To be fair, this study was based on information from a decade ago and Chemring has made various improvements since. Chemring's I-SCAD is a very similar product for international sales, although the product literature does not clearly show what has been removed to make it more compliant with export controls. In 2013, Chemring received

European products have a significant footprint in the standoff market. Germany's Bruker Daltonics makes the RAPID, a standoff detector available since the late 1990s. In ideal conditions, it can detect and identify up to 90 different chemical compounds at ranges up to 5 kilometres. It costs in the neighbourhood of US\$300,000. A number of militaries have acquired this system for standoff detection use. Earlier versions of

France's Bertin makes a product called the Second Sight. This passive detector claims an operational range out to 5 kilometres and was selected by the Australian Army as its chemical standoff detector. One was sighted at the 2017 Boston Marathon. As expected with a French manufacturer, it has reasonable market penetration in its own home market.

Canada deserves mention in this arena. Canadian government efforts have gently prodded development for a long time through projects by Defence Research and Development Canada (DRDC). Two Canadian firms, Telops and ABB, have worked with DRDC to develop a useful standoff detector. The CATSI detector, developed by DRDC, is manufactured and marketed under licence by ABB and numerous versions have been fielded. However, market uptake outside of Canada is difficult to discern. It is worth noting that two CATSI systems were used at the Vancouver Winter Olympics in 2010.

There is at least one detector system out there which is, essentially, a hybrid between an active and a passive system. The "Chemsight" is made by the US firm AVIR Sensors. It is essentially a passive detector paired with a special infrared light source, but only operates at ranges of up to 45 metres. It is designed for fence lines and perimeters, and its military applications are somewhat limited, as is its apparent market penetration in defence and security markets.

Active detectors are a different type of product. In simplistic terms, they emit energy and await the return of that energy. Active chemical standoff detectors tend to work by shining an infrared laser. There are many reasons why active systems are far rarer than passive systems. Constantly emitting a laser is a way of saying "I am right here, please shoot me" on the modern battlefield. Eye safety is often an issue as well. Some systems purport to be "eye-safe" but not everyone believes them and militaries do not want to have the eyes of pilots damaged. Some active detectors work in the infrared spectrum, while others work in the ultraviolet spectrum.

The only product family of note in the active chemical sensor category is the Falcon series produced by Slovakia's Vyvoj Martin and SEC technologies. The Falcon uses two tuneable infrared lasers to interrogate the atmosphere, detecting and identifying chemical hazards. The manufacturers claim to be able to detect (but not identify) biological warfare agents as well, although that is a much more difficult thing to do. SEC claims a 5- or 6-kilometre range for the device, depending on which source

Photo: Bertin Instruments



The SECOND SIGHT standoff detector from Bertin Instruments:
It is a passive detector with an operational range of up to 5 kilometres.
SECOND SIGHT was selected by the Australian Army as its chemical standoff detector.

a US contract for over 100 JSLCAD systems for use on the CBRN reconnaissance variant of the STRYKER vehicle. Other US products are in the development pipeline, and there are standoff components in the "Next Generation Chemical Detector" development programme, but given the history of this field over the last 25 years, a radical new product would be surprising.

the system were problematic and end users still complain of false alarms. Bruker's SIGIS 2 is a similar product using a similar technology, designed for permanent mounting, such as infrastructure protection or on ships. Bruker has market penetration in a number of countries and their RAPID has been seen in such places as India, Romania, Sweden, and Kuwait.

one believes, with a 2-kilometre range for biological agents. By necessity, it has a narrower field of view than a passive system. However, there has been little uptake for this family of products outside Slovakia, despite years of working the trade show and exhibition circuit. Poland has shown some interest, and bought a system for evaluation some years ago, although a follow-up buy has not been seen yet. The system has been deployed to Iraq with the Slovak army.

This article mostly emphasises chemical standoff detection. Biological and radiological standoff detection are still very much in their infancy as emerging technologies, with few products on the market. Passive techniques have proven fairly worthless in detecting biological aerosols, in part because the natural background is full of organic material, and the challenge of telling an anthrax spore apart from a naturally occurring particle of tree pollen is a daunting technical task. If there is to be a useful biological standoff detector, it will need to be an active sensor. Both infrared lasers and ultraviolet lasers have been used in this area.

The US military has been pushing for standoff biological detection using active sensors since the early 1990s, with some of the earlier systems being basically unusable due to eye safety. The initial system, the "Long Range Biological Standoff Detection System" was mounted in a helicopter and could, in theory, see clouds of biological aerosols at distances of up to 30 km. The current programme is the Joint Biological Standoff Detection System, which has been around for over a decade. Various demonstration and prototype systems have competed for the various phases of this project. Detection and characterisation of biological clouds at distances of several kilometres seems feasible, and many of the laser safety issues of the 1990s are now mitigated. Developments continue in this area, but work has been progressing slowly and it has been over 20 years since the serious work began. LUSTER is a DARPA programme to seek newer and better lasers, with the intent of using them in biological detection. Recently, DARPA awarded a US\$4M contract to the Tennessee-based firm Hexatech. The USA is one of the few countries with a test range capable of doing large-scale long-distance testing in this arena, and numerous tests have occurred (using harmless simulants to mimic biological agents) at Dugway Proving Ground in Utah. Other than some claims by the Slovakian product mentioned above, standoff detection seems to be a US government-only arena so far.

Standoff radiation detection is heavily limited by physics. The energy emitted by a radiation source decreases rapidly over

distance. Depending on one's perspective, basically all radiation detection instruments are standoff sensors as they detect at a distance from the radioactive material. But if this distance is centimetres or metres, this is not really the same thing as standoff detection in the sense of chemical detectors. Detecting radiation sources at hundreds of metres or kilometres is not really a feasible task any time soon, particularly in systems and products for a defence or security purpose. The US Department of Homeland Security inadvertently confuses the issue by selectively defining mobile radiation detectors on vehicles as "standoff" systems. Some work is being done in this area, sometimes through finding interest-

ing ways in which radiation interacts with the environment, and finding ways of seeing that interaction from a distance. Watch the US Domestic Nuclear Detection Office closely to see what emerges, as they are known to be spending money in this area. A system called "SORDS" using radiation imaging technology is under development, but few details are available.

As far as practical capabilities that end users can actually buy right now, the standoff market is still limited to a handful of chemical detection products, none of which address all of the ideal requirements. This particular area of defence technology is one where much improvement is needed. ■

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Will Indo-European Defence Relations Turn a New Page?

Bindiya Carmeline Thomas

The European Union has constantly reaffirmed its commitment to strengthen its strategic partnership with India, despite the latter's long neglect. And with new global imperatives, New Delhi is on course to explore new avenues of defence cooperation with Europe.

Last year marked 55 years of diplomatic relations between the world's two largest democracies – India and the European Union. Their relationship can be traced back to the early 1960s when India became one of “the first countries to establish diplomatic relations with the European Economic Community,” as India's Ministry of External Affairs (MEA) notes. Since then EU-India cooperation has increased manifold and now spans numerous areas, including foreign policy and

ce 2000, EU-India relations have evolved significantly, with the formation of the EU-India Strategic Partnership in 2004. To underpin that Strategic Partnership, the EU-India Joint Action Plan was adopted at the 2005 Summit and subsequently updated in 2008. Summits, ministerial-level, expert-level and sectoral meetings have extended cooperation between the European Union and India on a broad range of issues. In addition, regular parliamentary exchanges have ta-

Background: Indo-European Defence Ties

India's foreign policies have usually dictated its defence procurement strategy. India aligned itself with France in the early 1950s in an effort to wean itself off British equipment and subsequently acquired aircraft such as OURAGAN, MYSTERE and ALIZE, AMX tanks and air-to-surface and anti-tank missiles. India also license-produced French ALOUETTE helicopters in the 1960s and procured LAMA helicopters in the 1970s.

During the Cold War, India began a fruitful relationship with the Soviet Union — one that continues to thrive even today. The Soviet Union essentially furnished the Indian Armed Forces with everything from tanks and armoured vehicles, missiles and submarines to fighter and transport aircraft. Suffice it to say, India was overwhelmingly dependent on the Soviet Union for its defence requirements but continued to sporadically acquire European arms as well.

“The types of defence imports broadened by the early 1980s when India began to acquire arms from West European countries, including MIRAGE aircraft from France, submarines from Germany, and the Anglo-French attack aircraft, SEPECAT JAGUAR. This trade was mostly towards Western Europe. Central and Eastern European countries such as Poland and the Czech Republic also got a share of India's defence market, primarily as a legacy of India's defence trade with the Soviet Union,” Gateway House notes in a study published in 2016.

Fast Forward to the New Century

Over the last decade, India has become a force to be reckoned with. Robust economic growth coupled with crackdowns on corruption increased Foreign Direct In-



Photo: CCO Public Domain

In an effort to shake off British influence, in the 1960s India bought French and Soviet military equipment like the French ALOUETTE helicopters shown here. India license-produced ALOUETTE helicopters for many years.

security issues, trade and economics, sustainable development and modernisation, research and innovation as well as people-to-people contacts. “The 1994 EU-India Cooperation Agreement provides the legal framework for EU-India relations and has boosted political, economic and sectoral cooperation. Sin-

ken place, the last one being a triple visit of three committees from the European Parliament to India in February 2017,” according to EU sources.

India has established trade relations, in varying degrees, with individual member states most notably with France, the UK, and Germany. The EU is the second largest investor in India (after Mauritius), with an investment stock valued at €51.2Bn in 2015, and is the primary destination for Indian foreign investment.

However, the untapped potential truly lies in India's brimming aerospace and defence industry.

Author

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vestments (FDI) and initiatives to revamp regulations have positioned the South Asian country to become a superpower by 2020.

Under Prime Minister Narendra Modi's leadership, the country's military expenditure grew by 8.5% to US\$55.9Bn in 2016, according to the Stockholm International Peace Research Institute's (SIPRI) 2017¹ report on defence spending.

In the last four years, India's imports were far greater than those of its regional rivals China and Pakistan, SIPRI added in its 2017 report.

Among the most notable initiatives is the Make in India programme which aims to decrease dependence on foreign defence imports by promoting private sector participation. The government's decision in June 2015 to withdraw the excise and customs duty exemptions enjoyed by state-run defence manufacturers has also increased its appeal internationally. "This will provide a level playing field...by taking away the strategic advantage with PSUs for quoting lower rates in open bids," the ministry of commerce and industry said in an official statement.

The move addresses a key demand of the private sector and foreign original equipment manufacturers (OEMs) such as Boeing, Airbus, Lockheed Martin and BAE Systems, which are actively exploring the scope of future investments in India, the statement added.

While efforts to become self-reliant have been daring, the Indian defence industry is still plagued by setbacks, lack of skilled labour and delays in procurement – all of which have unwittingly contributed to increased dependence on imports.

In fact, approximately 70% of its defence requirements are met by foreign contractors and the rest by domestic companies. In the last three years, 58 contracts worth US\$19Bn were signed with defence contractors, India's Minister of State for Defence Dr. Subhash Bhamre told the Parliament last year, and added that the government is taking measures for modernisation the Armed Forces and is actively inducting new equipment and upgrading existing equipment and systems. The most prominent illustration is, of course, Modi's decision to scrap the long-winded MMRC competition in favour of buying 36 RAFALE fighter aircraft from France's Dassault Aviation in fly-away condition for US\$8.7Bn.

For five straight years (2012-2016), India has enjoyed the notorious status of being the world's largest weapons importer – accounting for 13% of global arms sales. Russia holds the distinction of being India's largest weapons supplier taking home

approximately 75% of the windfall in sales of fighter aircraft, main battle tanks, missile systems, aircraft carrier, submarines, etc. Israel and the US follow close behind with sales of Unmanned Aerial Vehicles (UAVs), radars, air-defence systems and P-8 maritime patrol aircraft and C-17 GLOBEMASTER and C-130 SUPER HERCULES heavy lift aircraft respectively. In 2013 alone, the trio accounted for 90% of all imports to India. As part of his ambitious plan to transform India and stave off foreign dependence, Modi

ker MBDA announced a joint venture with India's Larsen & Toubro (L&T) to develop and supply fifth generation anti-tank guided missiles (ATGM) "to meet the growing potential requirements of the Indian armed forces."

The JV is reportedly still awaiting confirmation from the Indian Ministry of Defence to "finalise negotiations to design and co-produce short-range surface-to-air missiles (SRSAMs) in India," the Hindu reported in February 2017.



The Indian multi-role combat aircraft (MRCA) competition of 2011-12 was India's single largest defence deal; it was won by Dassault RAFALE.

earlier last year pledged US\$250Bn to modernise the Indian Armed Forces by 2025. India's shopping list of arms includes assault rifles, helicopters, submarines, UAVs, tanks and fighter aircraft among others. Despite India's efforts to diversify its defence equipment imports, Europe has been largely left out in the cold.

Europe's Prospects – Will They Shrink or Shine?

Europe's amalgamated share of the Indian arms market has shrunk to less than eight percent for the period 2009-2013. This is a far cry from the 1970s and 1980s, when the United Kingdom and France were the second and third largest arms suppliers to India respectively, capturing about a quarter of all Indian arms imports; additionally, these two countries provided the majority of licensed-production agreements with India, the S. Rajaratnam School of International Studies explains in a study published in 2014. Eager to catch up with rivals Russia and Israel, European arms manufacturers, the study noted, "have genuinely embraced the idea of the joint venture as a means of breaking back into the Indian arms market." For example, in 2017, missile ma-

L&T and MBDA are convinced that it is the right time for the relationship to mature into a JV given the conducive policy environment in the defence sector in India, according to a joint statement. To begin with, the JV company will look to develop and supply fifth generation Anti-Tank Guided Missiles (ATGM5s), missiles for Coastal Batteries and high-speed target drones. The SRSAM systems are intended to replace the Indian Navy's Israeli BARAK-1 air defence systems.

SNECMA, as part of the RAFALE aircraft deal, has teamed up with India's Research and Development Organisation (DRDO) to help revive and certify the KAVERI engine, to power the indigenous Light Combat Aircraft (LCA) TEJAS in 2018.

In June 2017, Thales and Reliance Defence Limited announced their intent to form an Indian Joint Venture (JV) "to develop Indian capabilities to integrate and maintain Radar and Electronic Warfare sensors."

Thales has previously collaborated with the state-run Bharat Electronics Ltd (BEL) manufacture military radars for the Indian Air Force. According to local reports, Thales will supply six of the 19 Ground Smarter low-level transportable radars that the Indian Air Force (IAF) has ordered from France,

with the other 13 will be assembled in BEL's facility at Ghaziabad.

In September, Saab and India's Adani Group followed up with a similar announcement to support Modi's "Make in India." The intended collaboration would encompass design, development, and production of GRIPEN for India and other high-tech products of national importance for India and also the creation of joint ventures in India. GRIPEN would be offered to the Indian Government as the best solution for India's single-engine fighter aircraft programme. The collaboration would also include projects, programmes, and technologies of national importance to India. The parties plan to develop the relationship into a structure of joint ventures in India for the execution of the programmes, including the single-engine fighter programme, in order to support the Make in India policy and exhibit the parties' long-term commitment to be jointly successful. In addition to the GRIPEN, the new JV intends to supply the Indian armed forces with unmanned aerial vehicles and helicopters.

France

France has always maintained a strong foothold in the Indian Aerospace & Defence sector thanks to its favourable foreign policies toward India. Their strategic partnership is mirrored by the lion's share of contracts awarded to French companies. In 2012, Dassault Aviation won what was then called the Mother of all Contracts—the now-defunct MMRCA deal for 126 medium multi-role combat aircraft worth approximately US\$20Bn. Dassault's RAFALE beat competitors Boeing F/A-18E/F SUPER HORNET, Eurofighter TYPHOON, Lockheed

Martin F-16 Fighting FALCON, Mikoyan MiG-35, and Saab JAS 39 GRIPEN.

In lieu of the MMRCA, India and France have settled on a government-to-government deal to buy 36 RAFALE aircraft in flyaway condition worth €7.87Bn.

With the first deliveries expected to begin in 2019, Dassault is already vying for new contracts.

In September 2017, Eric Trappier, CEO of Dassault Aviation told Reuters that the company "is still in discussions with India over a possible purchase of additional twin-engine RAFALE fighter jets."

"A separate tender by India for a single-engine fighter jet was independent of the RAFALE order and would not impact negotiations," he was quoted saying. "We're talking about additional jets. Nothing is decided, but we're not going to stop at 36." Incidentally, France now holds the distinction of being India's largest investor in the defence sector under the Foreign Direct Investment (FDI) thanks to the RAFALE fighter jet deal.

Dassault has a long history in India. In 1982, the IAF ordered 36 single-seat MIRAGE 2000Hs and 4 twin-seat MIRAGE 2000THs, and in 2011 contracted Dassault and Thales to upgrade the 49 MIRAGE 2000 aircraft in a deal worth US\$2.4Bn.

In 2004, the Indian government approved the purchase of an additional ten Mirage 2000Hs with improved avionics, upgraded RDM 7 radar. India is also reportedly in talks with France to acquire 31 grounded strike fighters previously used by the French Air Force.

France scored another major win in 2005 when it won a US\$3Bn deal to construct six SCORPENE submarines. Other projects include the US\$6Bn MAITRI Missile Project

Photo: Georges Seguin



India wants to replace its outdated Israeli BARAK-1 missiles for the Indian Navy with SRSAM systems. Meanwhile, India has cancelled the SRSAM competition and, in keeping with the government's 'Make in India' initiative, opted for the domestic AKASH system instead.

with the DRDO and MBDA and development of the Light Combat Aircraft (LCA) KAVERI engine with SNECMA, as mentioned previously.

The United Kingdom

Several factors ended Britain's reign as India's top weapons supplier during the Cold War. In the 1950s, the UK accounted for over 64 % of India's total arms imports. "CENTURION tanks, a contract to establish a factory to produce the VIJAVANTA tank based on the CHIEFTAIN design, factories to produce ammunition and ADEN guns—all for the Army; a cruiser and an aircraft carrier for the Navy and SEA HAWK aircraft for the Fleet Air Arm; and a range of aircraft for the Air Force including SPITFIRES, TEMPESTS, VAMPIRES, HAWKER HUNTERS, CANBERRA bombers, AVRO transports, PERCIVAL PRENTICE trainers, and GNATS (which were also licence-manufactured in



Photo: Rajan Manickavasagam

The HAL TEJAS is an Indian-made single-seat, single-jet engine, multirole light fighter produced by Hindustan Aeronautics Limited (HAL) for the Indian Air Force.

India)", the Institute for Defence Studies and Analyses (IDSA) notes.

It would be a long time until the UK received any major contracts. India decided in 2013 to buy 66 HAWK AJTs from Britain worth US\$1.7Bn and added a follow-on contract for 57 additional HAWKs worth US\$1.1Bn to be built by HAL.

In 2015, the Indian Navy selected JFD "for the provision and long-term support of its submarine rescue capability." The

license from Dornier GmbH in 1981, for the Indian armed forces. However, in December 2017, the Indian Directorate General of Aviation decided to allow the aircraft to be used for commercial purposes.

More recently, exports to India have waned. In 2016, Germany's ThyssenKrupp Marine Systems (TKMS) signed a US\$38.4M contract for the modernisation of two out of four SHISHUMAR class (Type 209/1500) diesel-electric attack submarines in service

It added that it "will not refrain from assessing the situation given the limited size of the on-going business in the country."

The blacklist affected various deals including an Indian Navy contract to procure 98 BLACK SHARK torpedoes worth US\$226M from WASS (the contract was awarded in 2014) for the installation on its SCORPENE submarines.

Germany's Atlas Elektronik is expected to benefit from the scandal as it appears to be the front-runner to replace WASS although no deal has been signed yet.

Finmeccanica has previously supplied guns for naval ships and radars for helicopters and warships.

Current Programmes

European arms makers will have plenty of opportunities to win large contracts in the coming years. India recently announced the "mother of all underwater defence deals" to build six advanced stealth submarines for an estimated US\$10.9Bn in collaboration with an Indian shipyard. The RFI for programme Project-75 (India) was issued in 2016 and sent to shipbuilders, Naval Group-DCNS (France), ThyssenKrupp Marine Systems (Germany), Rosoboronexport Rubin Design Bureau (Russia), Navantia (Spain), Saab (Sweden) and the Mitsubishi-Kawasaki Heavy Industries combine (Japan).

India also plans to buy an unknown number of missiles for its Russian KVADRAT Self Propelled Air Defence System.

A global tender has been issued to Russia's Rosoboronexport, Thales and Eurosam (France), Raytheon (US), Israel Aerospace Industries, Rafael Advanced Defense Systems, Tetraedr of Belarus, South Korea's Doosan Group and LIG Nex1, Diehl Defense of Germany and the pan-European MBDA last year.

The Indian Navy is also expected to issue an RFI to buy 24 multi-role helicopters worth US\$1.8Bn to be used for anti-submarine warfare and operations by the Marine Commando (MARCOS) special forces. The navy also plans to issue an international tender for purchasing 123 Naval Multirole Helicopters (NMRH) later this year. Meanwhile, the MoD has approved a proposal to purchase 111 naval utility helicopters for its requirement to replace its vintage CHEETAH/CHETAK aircraft. Sikorsky and Airbus Helicopters are expected to receive a global RfP later this year.

Indian Navy Chief Admiral Sunil Lanba told reporters late last year that the Indian Navy is likely to issue a RfP to acquire 57 multi-role combat fighter jets for the aircraft carriers by mid-2018. ■



Two Dornier Do 228 of the Indian Navy patrol Indian coastal waters.

GB£193M contract includes the design, build and supply of two complete submarine rescue systems, and a 25-year all-inclusive annual maintenance contract.

Germany

In 1999, Germany became India's fifth largest weapons supplier having sold everything from submarines (such as the Type 209) to sonars and much more.

Germany's Howaldtswerke-Deutsche Werft (HDW) beat competitors France's DCN, Sweden's KOCKUMS, The Netherlands' NEVESBU, and Vickers in the United Kingdom in 1981 to win a deal to supply four SHISHUMAR-class (Type 209/1500) diesel boats with an option for an additional two units.

Three years later, India exercised that option for two units to be built locally. However, not long after, allegations of corruption surfaced forcing India to end its relationship with HDW and ultimately blacklisting the company, thus paving the way for France's SCORPENE submarines to make their mark in India.

India also produces the DORNIER 228 aircraft, having bought the production

with the Indian Navy. The upgrade of the two license-built SSKs, aimed at extending their operational life by ten years, will also take place in Mumbai, according to a TKMS press release. TKMS's contract with the Indian Navy entails fitting the boats with a new weapons suite—Boeing anti-ship UGM-84L HARPOON Block II encapsulated missile systems.

Italy

The bitter relationship between India and Italy appears to be on the mend after years of diplomatic tensions, which included the arrest of two Italian marines in 2012 for killing two Indian fishermen in Indian waters. Relations between the two took another hit following the VVIP helicopters scandal involving AgustaWestland and the subsequent blacklisting of the parent company, Finmeccanica, and its subsidiaries. "Despite the context of uncertainty, Leonardo-Finmeccanica has over the past few years continued to supply India with the components and services essential to ensuring the operation of platforms and equipment for the country's armed forces," Finmeccanica said in a statement in 2016.

Intellectual Capital Protection by Patents

The Ultimate but Hidden Base of Europe's Defence Industrial Competitiveness

Heiko Borchert and Christian Helmenstein

Contemporary defence industrial strategies are driven by the assumption that innovative defence systems require global defence supply chains. Evidence based on patents filed by Boeing and Airbus suggests otherwise.

This paper understands patents as a significant building block of industrial ecosystems that have hitherto been conspicuously absent from the discussion about defence innovation. Our exploratory work compares patent filings by Airbus and Boeing. We find that the strategic relevance of international cooperation to produce innovation is not as straightforward as commonly perceived. It seems that patent filings in this sector are more important to protect product development and market shares rather than to genuinely enable innovation work. This finding is important in view of Europe's strive for defence industrial competitiveness.

Graphics: The authors

Setting the Scene: Investment and Innovation Motives

In the second half of the 20th century, cross-border investment flows were primarily characterised by cost arbitrage. For the most part, companies have chosen their (new) locations based on two factors: an optimal cost-productivity balance for the required production factors or the need to build up local presence as a prerequisite for market development. Local presence will continue to drive cross-border investment in the 21st century, in particular against the backdrop of a new

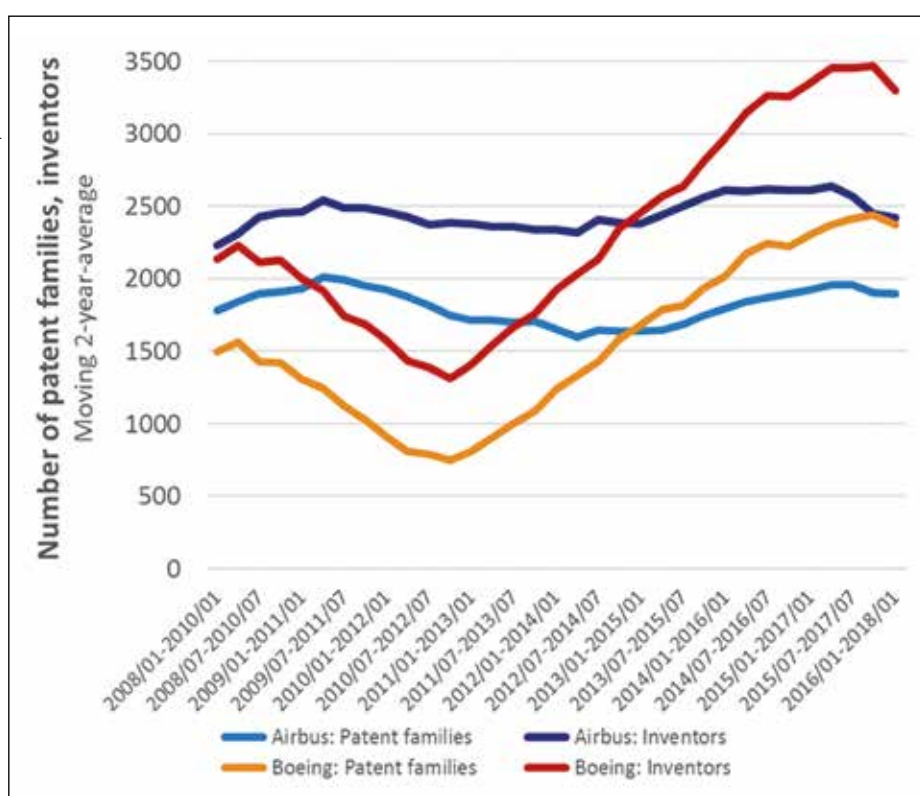


Figure 1: Airbus versus Boeing, number of patent families and inventors

wave of protectionism. Under protectionist trade regimes, substantial shares of local sourcing may turn out advantageous to maintain and expand a company's market position. The cost-oriented motive, by contrast, will need to be balanced against the rise of two additional investment motives. Companies invest in locations where resources essential for manufacturing are readily available and/or locations that provide a stable and low-risk regulatory framework that supports innovation. Both motives are of crucial importance for the aerospace and defence industry. Currently, geostrategic changes set the aerospace and defence industry on a new trajectory for innovation. The transatlan-

tic community looks at geostrategic competitors and recognises that their military ambitions are about to erode the West's long-held strategic advantages, in particular with regard to power projection. This has prompted a serious debate about how to adapt the armed forces of NATO and European Union (EU) countries in order to maintain advantages or to catch up in areas where competitors already seem to have taken the lead. Defence innovation is a complex undertaking that requires a close interplay between operational requirements, cultural predispositions, organisational and resource needs as well as technological options. The defence industry is a vital

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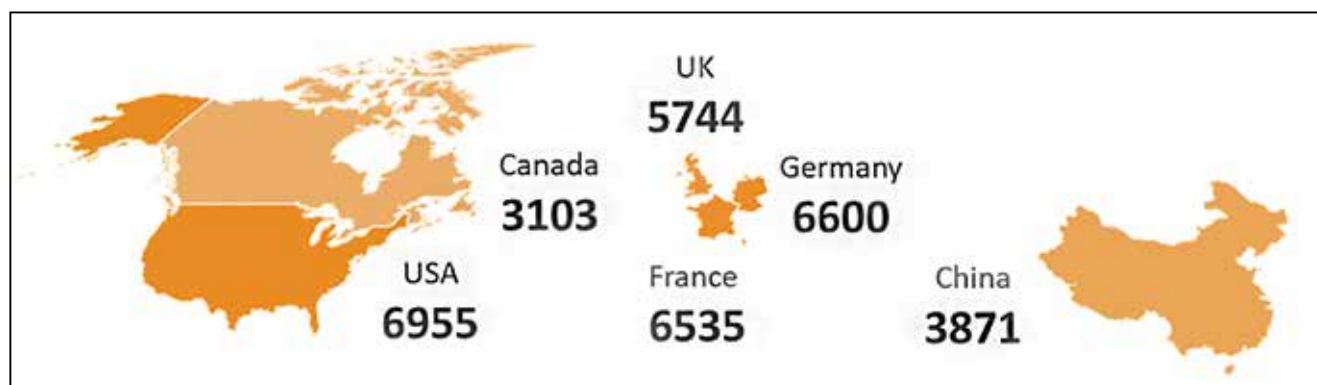


Figure 2a: Airbus – Worldwide distribution of protection rights.
Darker shades of orange illustrate more patent filings.



Figure 2b: Boeing – Worldwide distribution of protection rights.
Darker shades of orange illustrate more patent filings.

player in the innovation game. That is why the European Commission presented the European Defence Action Plan (EDAP) in 2016 as a key initiative to advance Europe's military capabilities and to improve the competitiveness of the European defence industry. This plan foresees establishing a European Defence Fund that supports defence research and acquisitions, fosters investment in defence-relevant small and medium-sized companies, and strives to strengthen the Single Market.

Much of the current thinking is about investing in technologies and prototypes that help maintain and expand critical military capabilities. If and to what extent Europe is actually able to develop the required technologies depends on funding, industrial capacities, and human skills. In a condensed form, the latter are materialising as intellectual property rights (IPR), in particular patents. IPR are the key building blocks that are hardly addressed, and they deserve in-depth inspection as they are the ultimate layer of Europe's defence technological expertise.

Patent Analytics

The proprietary patent analysis tool used for this paper builds on one of Europe's largest patent databases, which covers more than 80 million documents from over 90

worldwide sources to provide insight into the innovative strength of 195 countries and their inventors. With an average time-lag of around six weeks between the public filing of patents and their representation in the database, the tool covers innovation-related activities worldwide almost in real time. Most customary patent assessments rely on the number of patents assigned to companies and other organisations recorded nation-wise. Such an approach is prone to distorted findings, as the entities that register patents and the original inventors may reside in different countries. By contrast, we draw upon individual inventors and groups of inventors and their respective affiliations to analyse patent-related innovation activity. This provides a superior understanding of national and corporate competitive strengths and sheds light on the dynamics in industry sectors as well as regional and cross-national clusters. This kind of patent analysis can inform strategic decision-making with regard to

- determining relative market shares of individual firms in specific technologies or entire technology fields;
- analysing the anatomy of complementary and rivaling technology networks to understand the level of competition among different defence supply chains as well as the dependence on singular suppliers;

- gaining a better understanding of the size and dynamics of the human capital base relevant for defence innovation.

Comparing Airbus and Boeing: Fasten Your Seat Belt as You Will Be Surprised

To illustrate the relevance of these generic aspects, we study the patent-related innovation ecosystems of Airbus and Boeing, both leading aerospace and defence players with a global footprint. For a start, let us look at raw data, which is already quite impressive. Altogether, we recorded 9,036 patent filings for Airbus and 8,028 Boeing-related entries. In total, there are 8,490 inventors affiliated with the Airbus innovation network, as compared to 7,537 inventors in the sphere of Boeing, with some of them being related to both.

The raw data, however, mask a very distinct underlying dynamic. At the start of our inquiry covering the period from 2008 to 2017, both networks hosted a similar number of inventors. On an annual basis, Airbus filed around 150 patent families more than Boeing. Patent-related productivity, i.e. the number of filings per inventor, was in favour of Airbus. In the aftermath of the great recession of 2007/08, company-specific patenting dynamics started

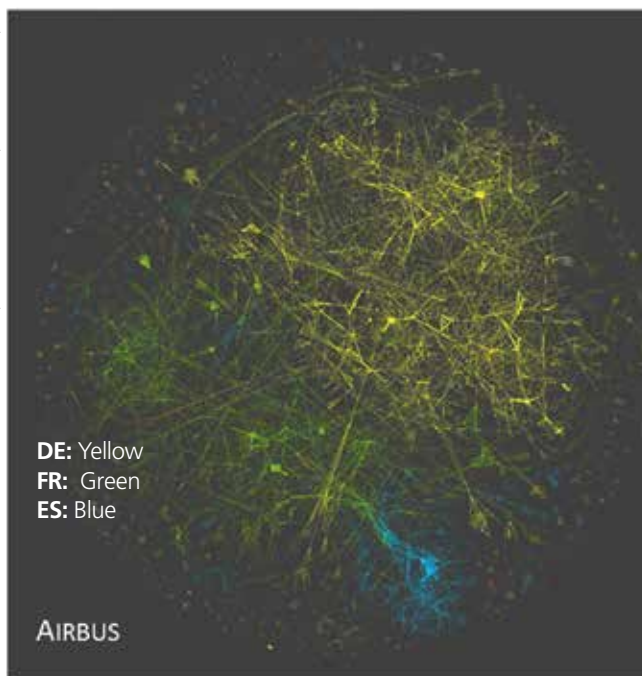


Figure 3a: Airbus – Co-Inventor Network

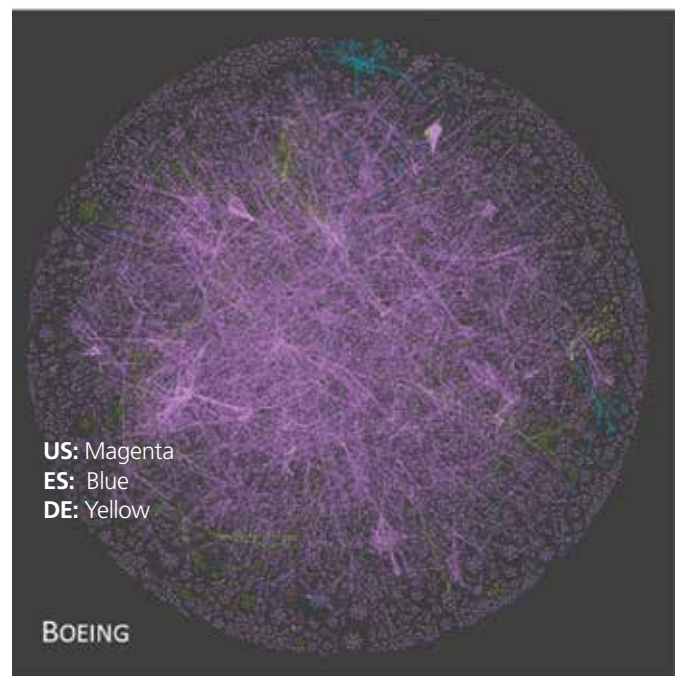


Figure 3b: Boeing – Co-Inventor Network

to diverge significantly. Whereas Airbus maintained its level of patent filings by and large, Boeing suffered an exact halving of its figures for patent filings and investors until around 2011 (Figure 1). Thereafter, Boeing's patenting performance caught up and surpassed the number of patent filings by Airbus after 2014 (growth from 2011 to 2014: 227%). It has only been very recently that Boeing's figures started to slightly decline again.

We reckon that patent filing performance follows corporate strategy and thus reveals important differences. Airbus seems to have relied on a strategy of organic innovation dynamics. Boeing, by contrast, tended to add intellectual assets to its portfolio by mergers and acquisitions. It is rather unlikely that Boeing's increase in patent-related performance results from organic activities in the airplane and spacecraft business, only as the lead time for innovation in these sectors amounts to several years. Thus, the patent filing uptick would have had to occur much earlier. In comparison, we find a rather limited hike in Airbus' patent filing activity, which very likely results from partial production offshoring, in particular geared towards the Chinese market. This leads us to a second most interesting finding related to patent protection. As Figure 2a illustrates, Airbus pursues a rather balanced global protection rights strategy and counts even more patent filings in the US than in France or Germany. Boeing, by contrast (Figure 2b), is heavily US-focused. The UK, which is the second most important country for Boeing's patent filings, accounts for only about half as many filings as in the US. And most interestingly, if compared with the US, Airbus' patenting activity on the Chinese

market is about one-third higher than Boeing's activity. This leads us to assume that Airbus has a strategic interest in protecting its market position in a country that is slowly but steadily growing into the role of a future aircraft manufacturer. Canada is another case in point. Here, Airbus already has a stronger patent filing position than Boeing. Acquiring a majority stake in Bombardier's C-series will likely reinforce this position and suggests that Airbus seeks to buy itself into innovative ecosystems.

The third major finding relates to know-how acquisition. Figures 3a and 3b illustrate the network typology of all Airbus and Boeing-related co-inventors. Knots represent individual inventors, and distance or proximity to the core of the network illustrates the degree to which each inventor is integrated into the network's activities. The most striking commonality is the fact that, in both cases, internationalisation of innovation has been limited to peripheral rather than core activities. Otherwise, the knots representing foreign co-inventors would be positioned much closer to the centre of the networks. This suggests that both companies can be understood as innovation co-coons. However, these cocoons result from very different approaches:

- Airbus' innovation ecosystem rests on three main pillars, as constituted by innovation activity in France, Germany and Spain, whereas the core of Boeing's ecosystem is entirely US-centric.
- With co-inventors in 38 countries, Airbus maintains an ecosystem that is more internationally diverse than Boeing's ecosystem that numbers 22 international partners. But the level of cooperation

intensity (5.8 linkages per knot) is considerably higher in Boeing's ecosystem than in the innovation network operated by Airbus (3.9 linkages per knot).

- Boeing's network features a couple of extremely strong knowledge hubs as compared to that of Airbus, thus rendering Boeing's network more "hierarchical".

Overall, these network topologies suggest that Airbus has accomplished its core mission as a truly European champion of innovation transmission across different regions. Apart from the three core countries, five of the top six contributors of knowledge in the Airbus network, as measured by bilateral IPR balances, are European nations (ranking: UK, Austria, Italy, The Netherlands, and Poland). The US, the only non-European country in the top six, is at the helm. Boeing, by contrast, draws upon a transcontinental knowledge network with Spain, Germany, Australia, Canada, and Poland as the top five partners. Strikingly, the overall gain of IPR that the US acquires thanks to the network of Boeing outstrips the consolidated IPR gains of France and Germany by around 75%.

Conclusion

Based on the two case studies, we find that the IPR balance for the US as well as for France and Germany is positive. Hence, these countries benefit most from the innovation network of both companies. Most strikingly, all three countries gain rather than lose IPR from countries like China, Brazil, Russia, and South Korea. Established defence exporters may indeed come under pressure from rising competitors, but to date this appears to be more relevant for production volumes, export market access,

and value creation than for co-innovation. At least in the case of Airbus and Boeing, our results also suggest that international co-innovation work is not as relevant as commonly perceived in developing research-intensive defence systems.

Whether Boeing's innovation network might be subject to strain stemming from an increasingly protectionist domestic trade policy remains to be seen. Although Boeing cooperates more intensively with international co-inventors than Airbus, this cooperation seems less relevant for Boeing's core innovation activities. This would suggest that Boeing could be well prepared to cushion negative effects of protectionism. If, however, major technology developments occur outside the existing innovation ecosystem, the US-centricity of Boeing's innovation network might turn into an obstacle that effectively hinders the integration of outside activities into Boeing's core.

Airbus, by contrast, maintains a broader, regionally diversified co-innovator portfolio. But as the US and the UK, which are the two prime innovation partners, undergo difficult political transition processes, Airbus faces challenges as well. Airbus is

dependent on seamless intra-European cooperation. As such, Airbus has a crucial interest in maintaining a healthy European ecosystem for aerospace and defence, while being vital itself for intra-European innovation diffusion. But toughening regulation, continued segmentation of the EU Single Market, and a general public risk aversion – as reflected by a dominance of the precautionary principle over the innovation principle – could endanger Airbus' intra-European hub function and prevent the company from benefitting maximally from its global innovation ecosystem.

Against this backdrop, the analysis of Airbus also offers important insights for the implementation of the EDAP. First of all, analysing patent filings and co-inventor networks underlines the strategic role of human capital. If Europe does not have the researchers with the right skills, Europe's strive for defence industrial competitiveness and excellence will fail. A comprehensive patent mapping provides important insight, such as the number of patents by individuals in relation to industry/science cluster structures or corporate age. This, in turn, provides opportunities for the tailored use of Europe's structural funds. These

funds are instrumental in advancing smart specialisation across Europe and could enhance defence industrial competitiveness by developing adequate skills.

In addition, the current belief in top-down consolidation of Europe's defence industry should be reconsidered. The EU has made resilience a guiding principle of the new EU Global Strategy that provides the background for the EDAP. But a substantial body of literature suggests that resilience depends on diversity, rather than homogeneity, which would result from consolidation. If Europe is serious about a competitive defence industry, it should address strategic industrial resilience also by sustaining different regional clusters of expertise. This seems a prudent approach given the current degree of geostrategic uncertainty. But for distributed expertise to be of strategic benefit to Europe, Europe-wide transmission mechanisms are needed, as Airbus' co-inventor network underlines. Future EDAP programmes could thus identify the critical hubs in Europe's defence innovation network and adopt specific policy measures that bolster and expand existing hubs and create new hubs. Patent analyses can inform decision makers on how to achieve this alignment. ■

Note: No thematic filter was applied here; that is, figures for Airbus and Boeing encompass commercial and defence-related activities.

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I/ITSEC – The Largest World Military Simulation and Training Event

William Carter

The 2017 International and Industry Training, Simulation and Education Conference (I/ITSEC) was held, as usual, at the Orange County Exhibition Centre in Orlando from 27–30 November.

Nearly 17,000 people attended the exhibition, and over 400 organisations were represented on the exhibit stands. One hundred and twenty-nine papers were presented, mainly from the USA but also from 15 other countries from Brazil to the UK. There were 22 tutorials and 21 special events. The military keynote address was by General David Perkins, Commander, US Army Training and Doctrine Command (TRADOC), for which there was a full house with people standing at the back. The job of TRADOC is to "train people how to train," he said. In the 1980s, National Training Centres were created that were used for Brigade-level exercises, but under this system a particular unit could only take part about once in every 2 years – this was inflexible and led to what he called "the tyranny of training." What we want, he said, is training at home-base that exploits modern Live, Virtual and Constructive (LVC) technology. Training should embrace all en-

vironment, then improve them after use and feedback from military operations. Single system training "stovepipes" are no longer acceptable; multi-domain LVC is needed. This not only gives better training but can save lives both in operational training with live equipment and then in combat itself. Within TRADOC, he said that Leavenworth graduates were being sent to units to "spread the word" about future LVC. Finally, he suggested to the audience that "all of us at I/ITSEC have a duty" to push for further use of modern Simulation and Training technology. This was a forward-looking address and showed enthusiasm for the exploitation of technology to obtain the best possible military training. The industry keynoter was Don Ariel – founder and CEO of Raydon Corporation, who said that industry needs to understand how warfighters operate so that training can be applied in the best way. We should look at companies like Apple and Google

recent formation of US Army Modernization Command. Although simplicity has merit, he quoted Einstein as saying that "effective people can make complex things seem simple." Turning to industry, he said that it should standardise, for instance using "open platform" technology rather than many different proprietary systems that are incompatible with each other. Industry should revel in, and embrace, innovation by different companies. He suggested that, as a principle, "good now" should win over "better later", although he emphasised that "good now" means the best possible, not the average or past systems. Finally, he said that the S&T industry "should not do this to make money, but to make money so that it can do this". This was another forward-looking address recognising the future potential of LVC systems.

The military and industry keynote addresses were followed by the usual Flag and General Officer Panel. Fred Drummond, Deputy



Photos: William Carter

Aircraft simulations at I/ITSEC 2017

vironments, not only Land, Sea and Air but also Space and Cyber. We don't want "one-trick ponies" in training, adding that the Cyber environment is complex and interacts with other domains. The US Army has a National Simulation Centre at Fort Leavenworth that promotes a "Single Live/Synthetic Training Environment." In our training progression, we first educate about the basics, progress to the use of modern

and see how they deal with IT and associated technologies, in particular in being able to make rapid change where it is needed. On money, future military budgets may be difficult, and he quoted Winston Churchill as saying "now we have run out of money, we have to think." Applying this to military training, we must look to a "modern acquisition budget" that takes advantage of information technology, and he noted the

Assistant Secretary of Defence for Force Education and Training, listed the priorities of Secretary of Defence Mattis as readiness, alliances, and business reforms. In the past, he said, the DoD had been too slow to take advantage of progress in technology and exploit industry capabilities, in particular the LVC area, and this must change. Vice Admiral Paul Grosklags, Commander, Naval Air Systems Command, said that

interoperability is vital, but not the way that we have gone about it in the past. Currently, training systems lag behind operational equipment. For instance, aircraft simulators may not have the current aircraft software. This must change. He mentioned the Naval Integrated Fire Control Counter Air programme (NIFC-CA) that links Navy ships and air systems such as the F-35 in a single network. For programmes such as this, LVC should be built in, and "from day one we should have the training end in mind." Our overall policy should be "interoperability, interoperability, and more interoperability".

Lieutenant General Michael Lundy, Commander, US Army Combined Arms Centre, Fort Leavenworth, said that we need joint training, but currently we are not joint enough. Multinational interoperability is also important, and more use of Virtual in training is needed at all levels "from squad to staff." Simulator characteristics must not lag behind the operational equipment, and there should be commonality of training requirements for similar equipment in other services, adding that there is a recent MoU between the Army and Marines for this purpose. Another example is training for vehicle drivers, the live training component of which has caused a number of accidents, some fatal, showing the need for better driving simulators that can cover potentially dangerous areas of military vehicle operation.



The General Officer Panel at IIITSEC 2017.

essential. The training that we need today "drives us to simulation" because it can include complex scenarios not possible in live training. There is also the cost factor, and in aircraft like the F-35, "lots of training flying will break the bank, therefore more simulation is needed." We have a window of opportunity, he concluded, and are looking to the simulation industry for solutions.

Major General Kevin Liams USMC, Commander, Marine Corps Training and Education Command, said that the fighting domains of the Corps include sea, air, beach, urban and cyber. Presently, we conduct "Infantry Immersion Training" which includes role players for civilians and potential terrorists, but cost is becoming a problem and future infantry training will include Avatars and Simulation. Marines were now being issued with laptops for training purposes, and future training should be flexible, with free-play scenarios including uncertainty and risk, including adverse outcomes. We need to train not only in barracks but also aboard ship, and

more repeat" to learn the lessons. Overall, he concluded, we need to embrace simulation to a level not seen before.

After the keynotes on day one there were many other panels, including several from the US Navy. This followed the US Navy panel at last year's IIITSEC led by Chief of Naval Operations, Admiral John Richardson, in which he emphasised the need for state-of-the-art simulation in future Navy training. This year his deputy, Admiral Bill Moran, was the senior US Navy officer at IIITSEC, and said that he had been "incredibly encouraged by what I see here." In the past, he continued, we moved at what he called "a bureaucratic pace", and we now need to increase the pace. Our capability is well ahead of the training that we do, and this year we lost 17 sailors in ship collisions in the west Pacific. What we need is training that is in advance of capability, and in the next couple of years, "we'll be into this in a big way."

There were many other presentations, but there is no space to record them all. However, the general theme was the same – we must exploit the latest in LVC technology including links between training devices, discard old training systems and old ways of doing things. The technology is there, and we must use it – it could even save money over live training.

The exhibition was impressive, with many different types of visual systems from dome displays to head-mounted systems, high-resolution imagery, training systems for many different weapons, plus some complete simulators for Land, Sea and Air vehicles. A small selection is in the pictures that accompany this article.

If your organisation has an interest in seeing examples of the best training systems now available, plus high-quality panels and papers, plan to spend at least one day at the next IIITSEC in Orlando from 27–29 November. There is also the smaller European ITEC event 15–17 May at the Landesmesse conference centre, Stuttgart.

In conclusion, there is no doubt that military training using simulation is "on the up" – as Major General Liams said, "we need to embrace simulation to a level not seen before" and, as Admiral Moran said, "we'll be into this in a big way." ■



Photo left: General David Perkins, Commander of the US Army Training and Doctrine Command (TRADOC) as keynote speaker at IIITSEC 2017.

Photo right: Don Ariel, founder and CEO of Raydon Corporation, was the industry keynote speaker at IIITSEC 2017.

Major General Scott Smith, US Air Force Director of Training and Readiness, said that training systems need to be built in from the start, but our acquisition system for training aids still lives in the past. Aircraft simulators must be concurrent with the aircraft modification state, and connectivity between simulators at different bases is

Marine Air-Ground Task Forces (MAGTF) must train people from individual Marines up to Task Force Commanders. The Marine Corps Synthetic Training Environment (MCSTE) allows networking across multiple domains, and after realistic exercises using this system we need in-depth debrief, followed by "repeat, repeat and

Upgrades to AARGM Missile for Surface-to-Air Threats

(ck) The US Navy has contracted Orbital ATK to upgrade its AARGM missile. The AGM-88E AARGM is a supersonic, air-launched tactical missile system that upgrades legacy AGM-88 High Speed Anti-Radiation Missile systems with the capability to destroy enemy air defence. After the upgrade, the AARGM-ER will have extended range and survivability. It integrates existing AGM-88E AARGM sensors and electronics with an upgraded rocket motor and tail control system. The AARGM-ER will be compatible with the F/A-18E/F, EA-18G and F-35. "We are committed to increasing the effectiveness of the warfighter to suppress and destroy enemy air defence threats while remaining safe," said Cary Ralston, Vice President and General Manager of Orbital ATK's Defence Electronic Systems division of the Defence Systems Group. The AGM-88E AARGM is currently used by the US Navy and US Marine Corps, employed on the F/A-18C/D HORNET, F/A-18E/F SUPER HORNET and EA-18G GROWLER aircraft.

New Marketing Director at Allison Transmission



(ck) Allison Transmission, a manufacturer of automatic transmissions for medium- and heavy-duty commercial vehicles and a producer of hybrid-propulsion systems for city buses, has promoted Otto Szalavari to be the new Managing Director of global

marketing. Szalavari's responsibilities are global marketing, brand management and communications, developing value propositions, developing sales tools, and assessing markets for new product development. Szalavari joined Allison in February as Director, Global Marketing Information and Product Strategy, with a focus on international and domestic business and commercial sales agreements. Szalavari holds a Bachelor's degree in mechanical engineering from Moscow Polytechnic University and a Master's degree in business economy and international marketing from Budapest Business School.

New President at DSM Dyneema

(ck) Royal DSM, a company manufacturing innovative materials, has appointed Wilfrid Gambade as President. Wil-

World Counter Terror Congress

The organisers of next year's UK Security Week have announced that Richard Barrett – the former **coordinator of the Al-Qaeda/Taliban Monitoring Team** of the United Nations Security Council – will chair its renowned World Counter Terror Congress from 6-7 March 2018.

One of the world's foremost experts on terrorism, from 2004 to 2012 Barrett headed the Al-Qaeda and Taliban Monitoring Team at the United Nations (UN). During this time, he helped establish a working group on terrorism that became the UN Counter Terrorism Implementation Task Force, and before that he worked for the British government.

His addition to the programme is further evidence that the conference is the premier location to learn about the latest international threats and discuss future operational strategy. In what will be the most international speaker line-up in its history, over two days, he will introduce **security leaders from the UK, USA, Canada, France, Germany, Belgium, Sweden, Norway, Finland, The Netherlands and Denmark, as well as NATO, Europol and the EU Intelligence and Situation Centre.**

Barrett will open the World Counter Terror Congress by highlighting the issues that face the world when it comes to combating the rise of terrorism, before handing over to Assistant Chief Constable **Terri Nicholson, Deputy National Coordinator - Counter Terrorism Policing National Operations Centre**, who will give an exclusive host nation review of the lessons learnt from recent terror attacks during her keynote address.

Richard Barrett commented: "I'm delighted to be chairing the next World Counter Terror Congress. For many years the event has brought together leading figures from across the CT community and has proved invaluable in helping to protect nations from adapting threats. The programme in March will take a truly global look at the security situation and will present different approaches to preventing attacks and countering extremism. There is no better place for the CT community to share and shape future policy for national security."

Examining the key areas of prevention, pursuit and protection from international terror threats, delegates attending the World Counter Terror Congress in March 2018 will be able to exclusively hear how the FBI is detecting, deterring, and disrupting terror threats to the United States. Showcasing the best thinking from around the world, the Danish Security and Intelligence Service will also explain how it counters radicalisation and violent extremism, while the Swedish Police Authority will highlight its latest initiatives and key learning's from the attack on Drottninggatan.

The World Counter Terror Congress is produced for individuals working in government; police and law enforcement; intelligence and security agencies; border agencies; military; emergency services; critical national infrastructure; and businesses. For more information please visit: <http://bit.ly/WCTC2018>.

UK Security Week will run from 6-7 March 2018 and will also include a number of networking events. For more information and to register for access to all the week's events, visit www.sctx.co.uk/registration and use guest code UKSW18.



Photo: DSM Dyneema

frid Gambade joined DSM in 2009 and was responsible for the Composite Resins business in Europe before moving to the role of

President Composite Resins & Synres in 2011. Over the past three years, he has led DSM's Personal Care business. Mr. Gambade, a French national, holds a BSc in Polymer Chemistry from ITECH, Lyon, and has 25 years of international experience in general management, sales and marketing in the cosmetics and chemical industries.

VBCI 8x8 for Qatar

(ck) The armed forces of Qatar have carried out more tests with the VBCI 8x8 armoured vehicle produced by Nexter. The tests focussed mainly on the performance and ergonomic qualities of the 40mm turret,

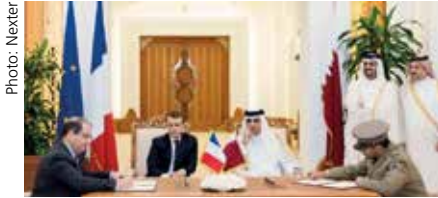


Photo: Nexter

equipped with the 40CTA gun, and shooting was carried out in different weapon system configurations. A few days after the testing campaign started the Emir of Qatar, Sheikh Tamim bin Hamad Al-Thani, and French President Emmanuel Macron signed a Letter of Intent for the acquisition of 490 VBCI. The letter marks the choice of Qatar in favour of Nexter for its Armoured Infantry Combat 8x8 Vehicle programme. Stéphane Mayer, CEO of Nexter, said he was "proud of the confidence of the Qatari armed forces and committed, as well as the entire Group, to finalise the contract in the near future."

IAI to Consolidate its Structure



Photo: IAI

(ck) The Board of Directors of Israel Aerospace Industries (IAI), chaired by Harel Locker (pictured), has approved the proposal by Joseph Weiss, CEO of IAI, to transform the company. The proposal aims to create a single aviation group for all IAI aviation businesses. IAI is currently divided into six independent groups, each with a turnover of several hundred million dollars. The consolidated aviation group will generate sales of more than US\$1Bn and concentrate on four business areas: development and manufacture of aircraft; development and production of aircraft assemblies; conversion and improvement of aircraft; and aircraft maintenance. Yossi Melamed, Executive Vice President, has been appointed General Manager of the new group. IAI exports most of its products, which is estimated at about US\$4Bn per year. With the new structure, IAI intends to strengthen the existing synergies between the various business units. The decision to restructure the company was made following the record contracts signed by IAI last year, which significantly increased the order backlog.

Invisio to Supply Danish Army

(ck) Invisio will supply communication systems for the Danish Army. Invisio has signed a corresponding agreement with the Danish Defence Procurement and Logistics Organisation (DALO). The agreement has a term of five years. In 2012, the Danish Armed Forces integrated Invisio's communication system into the new tactical radio of the Armed Forces in order to increase the security and operational readiness of soldiers and reduce the risk of hearing damage. "DALO places high demands on effective solutions that are integrated into the soldier's equipment and contribute to our continuous innovation efforts," said Lars Højgård Hansen, CEO of Invisio. Invisio's communication system provides good hearing protection while maintaining situational awareness in harsh environments. The systems consist of headsets and control units connected to an external team radio or a vehicle's intercom system.

Jenoptik to Partner in LEOPARD Upgrade

(ck) Jenoptik will participate in the ongoing modernisation of the German Armed Forces' MBT LEOPARD 2 fleet. The Jenoptik Defence & Civil Systems segment will supply digital electric gun turret drive systems with a total value of more than €12M. Deliveries will begin in mid-2018 and will continue until 2022. Electric turret head drive systems keep the turret and weapon of the tank stable during the ride; Jenoptik's GT drives are largely maintenance-free and generate less heat inside the tank. The conversion of the LEOPARD 2 tanks is carried out by a major German system provider for the Bundeswehr. Jenoptik is a partner for upgrading the LEOPARD 2 with modern electric turret drives, after Jenoptik has also received orders for modernisation and new production programmes for the tank in recent years. Jenoptik works closely with national and international system providers on the basis of long-term partnerships.

ixblue to Deliver Navigation Systems to French Navy

(ck) Naval Group has selected ixblue, a specialist in maritime navigation and positioning, to equip five new 4000-ton frigates for the French Navy with MARINS inertial navigation systems and NETANS data distribution & processing units. Naval Group is responsible for building these vessels. "This contract is the outcome of a long-standing collaboration with Naval Group with whom we are working on several export programmes," explained Thomas Buret, Head of the Inertial Systems and Applications Division. Already selected by the British and German navies in

2016, the MARINS units offer inertial navigation systems meeting the requirements of modern combat ships. Based on ixblue fibre optic gyroscope technology, the MARINS inertial navigation systems provide accurate position, heading, roll, pitch and speed information regardless of the environment, including GNSS denied environments. At the heart of the navigation system, the NETANS data distribution & processing unit interfaces with the ship's sensors, acquiring, analysing, correlating and then distributing data to all onboard systems. The NETANS range provides reliable and accurate navigation information in challenging operating environments. Integrated onto a single platform, MARINS navigation systems and NETANS distribution & processing units match the exacting requirements of major combat vessels in terms of performance, capacity and cost of ownership. ixblue navigation systems equip 35 navies and coast guards around the world, including a number of French naval vessels. The French fleet is also equipped with WECDIS navigation software produced by ixblue (SENIN).

ENGIE Acquires Noske-Kaesar

(ck) The French ENGIE Group has taken over Hamburg-based Noske-Kaesar Maritime Solutions GmbH. The German Federal Cartel Office approved the takeover: the Hamburg head office and subsidiaries in Australia, India, Malaysia and Turkey are now part of ENGIE Axima, headquartered in Paris, which is responsible for the Group's global shipping and oil & gas activities. For more than 135 years, Noske-Kaesar has been developing innovative solutions for heating, ventilation and air conditioning (HVAC) for marine vessels. Since the 1970s the company belonged to the Hamburg-based shipyard Blohm+Voss. Noske-Kaesar produces cooling systems, fire extinguishing technology, piping technology, electrical engineering and CBRN protection systems. The latest product is the CBRNflex3600 protection system, which protects military and civil vessels against attacks using various types of warfare agents. One of the largest orders for Noske-Kaesar came from the Australian Navy in 2016, ordering air-conditioning systems for its eight existing frigates to operate under tropical conditions. ENGIE is active in power generation, natural gas supply and energy services. The group was formed by the merger of the French companies Suez and Gaz de France (GDF) in 2008 and was renamed ENGIE in 2015. With revenues of €66.6Bn and EBITDA of €10.7Bn, ENGIE is one of the largest European energy providers. The subsidiary ENGIE Axima is part of the Energy Services Division and is a market

leader for air-conditioning, cooling and fire extinguishing systems in France.

New General Manager at L3

(sb) Serge Buchakjian has been appointed General Manager of L3 Warrior Sensor Systems' International Solutions division. Buchakjian will be responsible for the company's growth in international defense, security and law enforcement markets. He has worked in the defence industry for over 25 years, with industry leaders such as Oshkosh Defense, Honeywell Aerospace and Smiths Aerospace, successfully establishing international brands and opening up new markets. Serge Buchakjian holds a Master of Business Administration from Northeastern University. L3 Warrior Sensor Systems develops night vision and electro-optical systems, and components for the US military and law enforcement and allied nations around the world. The company employs approximately 38,000 people worldwide and reported sales of US\$10.5Bn in 2016.



Photo: L3

U.T.SEC 2018: Conference on Unmanned Technologies

Following its launch in March 2017, preparations are ongoing for the second U.T.SEC – Unmanned Technologies & Security – Expo & Conference. On Wednesday 7 and Thursday 8

March 2018, experts in drones and unmanned systems will meet at the Nuremberg Exhibition Centre to learn about developments regarding the use of these technologies, and how to defend against them. The Bavarian State Ministry for Economic Affairs and Media, Energy and Technology will assume patronage for the event. U.T.SEC, to be held annually at the Nuremberg Exhibition Centre, is the world's first exhibition to focus on security using unmanned technologies and protection against them. The focus is on both technical and legal aspects relating to the use of, and protection against, drones and other unmanned vehicles in public places, in industry, and in security-related fields. The conference is an opportunity for firms, authorities and civilian facilities to discuss security in the context of unmanned systems. The range of products and services covered by U.T.SEC includes unmanned systems, communications, data transmission, positioning, perimeter protection, electronic fencing, optics, optronics, lighting, training, service, resources, technical systems for crisis management, analytical equipment, and UAV defence. U.T.SEC is held in parallel with EnforceTac, the international trade fair for command, control and operational equipment used by security agencies, where another 200 exhibitors and 3,800 trade visitors are expected. ESD is a media partner for U.T.Sec.



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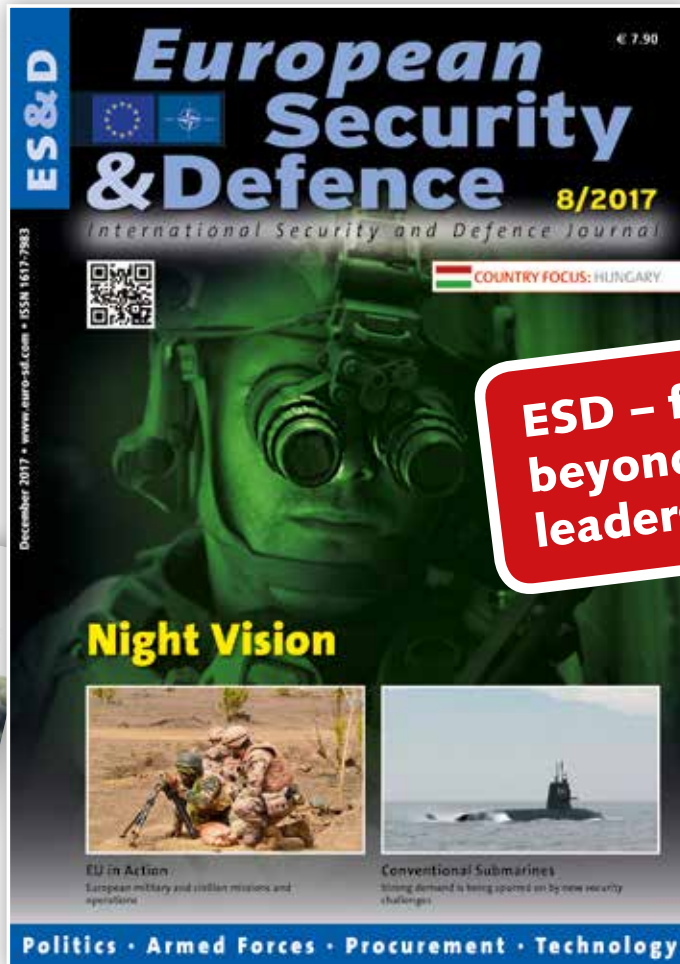
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