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**Regional Focus:
The Black Sea****Danish Turnaround**

The new Defence Agreement suggests additional funding for the armed forces.

**Force Multipliers**

Combat drones have entered service in several European armed forces.



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Following the Yellow BRIC Road



A lot of water has flowed under the bridge since the world, and not least the world's defence industry, looked to Brazil, Russia, India and China as its economic saviours. The world still seeks truth and certainty in frightening and inconstant times, but it appears to us as interested but clearly uninformed observers that our political elites engender hopelessness and disillusion: our leaders are not up to expectations.

Over the last few years we have seen Brazil's economy surrounded by failure, Brazil itself by no means immune to budgetary hardship, and now a former president behind bars. Russia has become one of the prime drivers of fear and uncertainty in Europe; and India continues to bow to the whims and peccadilloes of social, religious, political and industrial structures that are far from sufficient for a modern, competitive world. Only China prospers, but that is a prosperity that many in the West view with trepidation.

Russia presents something of a dilemma: its actions in the Ukraine and the Crimea continue to be fundamentally illegal, and its support of the Assad regime is not without its detractors; but regarding the latter, there is plenty of evidence of the consequences of well-meaning but misguided regime-change pursuits by "the West," in Egypt, Libya and Iraq for example, and preserving the status quo seems a far better endeavour than anything we have attempted in the region to date.

And on the available logic the latest "chemical weapons" attacks of April 2018 are unlikely to be an act of the regime's forces; so it is equally logical that a hasty Western response will be misinformed and misguided at best.

The Syrian question brings two more players to the fore: Turkey and the USA. In Turkey, Mr Erdogan's own regime-building continues to be effective, but at what cost? Organisations such as the military and the SSM require experts, not bureaucrats, and while locking away critics and intellectuals has certain benefits, it does tend to diminish the credibility of those doing the locking.

On the subject of Western democracy let us address the Brexit question. The framework for the British vote may have been inadequate, and the definition of "victory" left entirely inappropriate, but the result, although tight, was clear. Brexit will happen, and all that Europe and the UK have to do is

make sure that both sides reach a balanced resolution as to the "type" of Brexit we will all enjoy. "Hard" or "soft" there will be people who think they have won, and people who think they have lost. The fact remains that the Brexit vote was never a vote against Europe, but was a vote primarily against Brussels, spiced with a reaction against German-driven refugee policies.

And spice of course brings us back to that sweeping generalisation about India with which we started. An apology is perhaps due, and is duly offered, but considering the dire situation of the Indian military in terms of equipment, training, pensions and support, much of the responsibility for these goes back directly to successive governments. Repeated secession of "non-strategic territory" in the northeast of the country in the face of Chinese expansionism does not strengthen any Indian hand. The apparent inability of the big DPSUs to deliver adequate hardware with which to fight is a reflection of inefficiencies at all levels: the inability of private industry to compete is largely a systemic problem created by the procurement process in India: the inability of the authorities to define, acquire and deliver the necessary materiel is a consequence of an administrative system/burden that has all but brought the country to a standstill – coupled with a malleable approach to "corruption" that is at odds with international (read "Western") standards. It is surely possible to create a system that allows due recognition for services rendered without having to go off the books or under the table – or to jail. But the biggest Indian defence procurement challenge is managing the relationship with foreign industry, and despite numerous attempts to build and then tweak an appropriate legal and practical structure there has always been that one little impracticality: insisting that a foreign partner be wholly liable for the work of its Indian partner was just one example.

With DEFEXPO looming as this edition goes to print, we profoundly hope that Mr Modi's initiatives will bear fruit, and that India will be able to step forward as a major supplier of security and defence both regionally and globally: the essence is clarity and simplicity, which become worthy goals in themselves.

Stephen Barnard

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■ 2G Robotics Launches New LED Strobe Panel

(ck) 2G Robotics, a producer of underwater laser scanners and imaging solutions for the offshore energies, geosciences and defence industries, has launched a new LED strobe panel, named the NOVA. Providing ultra-bright and even illumination, the NOVA enables users to capture crisp images even on very fast AUVs. Based on the RAY single LED currently being used

Photo: 2G Robotics



for marine research and offshore energy inspections, the NOVA combines 36 LEDs to produce a very bright light with a powerful 450 000 Lumen output. Kongsberg Maritime has already purchased 4 units to be used for applications in the defence industry. "Our aim was to create an illumination solution that would allow the industry to complement laser data with crisp images regardless of the vehicle speed or the depth of operations," explained Chris Gilson, Product Development Manager for 2G Robotics. "In order to do this, we needed a product with ultra-bright, even illumination while also maintaining a consistent power draw. The NOVA brings these added values to the market." Each NOVA is produced with a custom LED orientation dependent on the mounting configuration, enabling users to capture evenly illuminated images for specific applications. NOVA features a selectable current limited charging rate which eliminates power spikes and has a maximum 90W continuous power draw.

■ Berlin Police to Buy Red Dot Sights

(ck) The Berlin Police has contracted Aimpoint AB to supply 3800 CompM4 red dot sights. The Berlin Police chose Aimpoint products because they want to increase the speed and shooting precision of their police officers. The sights will be mounted primarily on H&K MP5 carbine. Aimpoint won the contract in an open competition. Deliveries will start later this year. "The CompM4 is a very much appreciated product by the operators for its reliability and ease of use," said Lennart Ljungfelt, President of Aimpoint AB. CompM4 sights are in operation with many military organisations worldwide and have become a standard product for NATO countries. It is a user-friendly and

combat proven sight that increases the effectiveness of the soldier. The CompM4 sight relies on a single AA battery to provide a 'constant on' of up to 80,000 hours or 8 years. Currently, more than 1,500,000 Aimpoint sights are in use by law enforcement and military forces around the world.

■ Qatar Buys NH90 Helicopters

(ck) Qatar will buy 28 NH90 military helicopters to modernise its military helicopter fleet - 16 NH90s in tactical transport (TTH) configuration and 12 NH90s in naval (NFH) configuration. As part of the plan, Qatar will receive 16 H125 light single-engine helicopters in training configuration for the Qatar Armed Forces Air Academy. "The NH90 is a modern and combat-proven asset that will meet Qatar's demanding operational requirements for decades to come, both in troop transport and naval missions," said Ben Bridge, Executive Vice President Global Business at Airbus Helicopters. Leonardo will act as the prime contractor for the programme management with the end customer and Airbus will be responsible for



Photo: Airbus Helicopters

the final assembly and delivery of 16 NH90 TTH aircraft from its facility in Marignane, France while Leonardo will be responsible for final assembly and delivery of the 12 NH90 NFH helicopters from its Venice - Tessera facility in Northern Italy. The NH90 is well suited for demanding operations and has been combat-proven in many theatres worldwide. This contract for 28 helicopters brings the total order book to 543 aircraft. To date, 350 aircraft have been delivered to 20 customers in 13 countries and have accumulated around 170,000 flight hours.

■ FLYWEIGHT Helicopter Seats from Autoflug

(ck) Autoflug, a manufacturer of seating systems for military helicopters, has developed a lightweight, robust and extremely safe helicopter seat called FLYWEIGHT. FLYWEIGHT is a seat family which can be used as a basis to implement a wide variety of modern cabin layouts in civilian helicopters depending on the purpose, desired flight time and comfort level. "Right from

the start, my team was looking for the best compromise between proven technology and innovative approaches," said Björn Kanstorf, Head of the Business Unit Cabin Solutions at AUTOFLUG. The energy absorption system used to achieve crash safety is a proven system, but when it comes to the seat shell Autoflug has used composite materials which make the FLYWEIGHT one of the lightest seats on the market. In the basic configuration the seat has a weight of less than 9 kg. The seats are also characterised by modern design that can be custom-tailored in numerous details.

Photo: Autoflug



■ Patrol Boats for Pakistan

(ck) Karachi Shipyards & Engineering Works have delivered two Damen STAN PATROL 1605 FRP (Fibre Reinforced Polymer) patrol boats to the Pakistan Customs. The vessels were built by KS&EW with technical and material support from Damen. The entire project took eight months. The patrolling boats shall be used for monitoring and enforcement activities in Pakistan's territorial waters. Damen supplied prefabricated material kits along with the hulls to KS&EW. Knowledge transfer was also an integral



Photo: Damen

part of the DTC programme; for this project KS&EW staff received training by Damen's experienced trainers. These are the first Damen vessels to be built for the Pakistan Customs; however KS&EW and Damen have a long history of working together. This has resulted in the delivery of four Damen Stan Tug 1605s for the Pakistan Navy and two more of the same type to the Karachi Port Trust. The

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delivery of the two SPa 1605 FRPs to the Pakistan Customs completes this order; however, the agency is considering an expansion of their fleet in the future.

■ Permanent Eye in the Sky

(ck) The French company Elistair has launched a new version of its tethered drone: ORION UAS is an automated system designed for semi-persistent aerial surveillance and telecommunications needs. As a permanent eye in the sky, ORION can complete missions for law enforcement, private and public safety, national security, assets protection or emergency communications and crisis management. Designed for extended flight times, ORION is based on industrial components. It integrates Elistair's patented micro-tether system Safe-T which ensures a continuous power supply from the ground. With its industrial motors and



Photo: Elistair

multiple redundancies including autopilot sensors, motorisation, power distribution, logical controls, and an emergency parachute system, ORION has been engineered to endure prolonged flight times and fierce winds. ORION's gimbal stabilisation and crystal-clear imagery with low latencies and its X30 optical zoom can detect a moving person over kilometres, which makes the system suitable for persistent aerial surveillance.

■ Flight Simulator for PREDATOR

(ck) The Italian Air Force has commissioned a new mission simulator for its unmanned PREDATOR aircraft. It is the world's first level D simulator for unmanned aerial vehicles. The simulator sets new training standards and makes it possible to completely dispense with training on the real system. The simulator increases the availability of the actual systems for use, which strengthens the operational capability of the Italian Air Force and increases cost efficiency. As a technically demanding innovation, level D simulators must accurately simulate the aircraft type. The data generated during the flight test were integrated into the synthetic training environment. The physical environment corresponds to a real ground control station to ensure a high degree of

realism. A high-quality sensor simulation, a fully interactive tactical environment and the latest geodata architecture characterise the mission trainer in order to optimally prepare the crews for deployment. The level-D MQ-1C PREDATOR A simulator is a joint development of GA-ASI and its Canadian partner CAE, a leading provider of flight simulation technology. In the next months the level-D equivalent training simulator for the MQ-9A PREDATOR B will be ready for acceptance.

■ MBDA to Upgrade UK BRIMSTONE Missiles

(ck) The UK MoD has contracted MBDA to extend the service life of its BRIMSTONE air-to-surface missiles beyond 2030 for £400M. The new BRIMSTONE missiles will replenish the country's inventory. The missiles will incorporate all upgrades that have taken place over recent years, including the Dual Mode SAL/millimetric wave (mmW) seeker, enhanced autopilot, and the new insensitive munitions compliant rocket motor and warhead. The upgrade will also include a memory and processing update to the missile in order to enable all of BRIMSTONE's functionalities and to future-proof the missile. BRIMSTONE CSP will deliver the baseline hardware standard that will be evolved through software enhancements which will result in a common stockpile of identical missiles for use on fast



Photo: MBDA

jets, attack helicopter and remotely piloted aircraft systems (RPAS). The missile will be carried by the Royal Air Force's TYPHOON fighter aircraft and is expected to be carried by the RAF's new PROTECTOR RPAS and the new APACHE attack helicopters. By using BRIMSTONE across different platforms, the UK will receive logistical advantages and cost savings.

■ New Kazakh 8x8 Combat Vehicle

(ck) The Ministry of Defence of Kazakhstan is about to conclude the evaluation of the BARYS 8x8 combat vehicle ahead of acceptance into service by the country's armed forces. BARYS is based on the MBOMBE 8 IFV and is manufactured by Kazakhstan

Paramount Engineering (KPE), the Kazakh joint venture of the Paramount Group, a South African defence company. Recent winter trials of BARYS with intensive factory



Photo: Paramount

acceptance tests to optimise the weapon system, platform and turret, included day and night firing; the BARYS 8x8 vehicle was equipped with a SHIPUNOV 2A42 30mm automatic cannon and a 7.62mm machine gun manufactured by Kazakhstan's 'KAE', which manufactures electro-optic defence equipment. The trials were conducted at a tank test polygon in central Kazakhstan. The BARYS 8x8 is the winterised version of Paramount's MBOMBE 8 with a new form of construction to increase protection while minimising profile. The MBOMBE family of 4x4, 6x6 and 8x8 vehicles share over 80% of common components to reduce through life costs. The BARYS will be produced at KPE's 15,000m² factory in Astana, the largest armoured vehicle factory in Central Asia. The factory has a capacity of more than 200 vehicles per year.

■ Wireless Rechargeable Torch

(gwh) At the IWA Show Peli presented the 7070R as Peli's first flashlight to offer wireless USB charging and Bluetooth programming. Rechargeable lithium-ion batteries can be charged using a wireless charger that prevents water from entering into the flashlight. Alternatively, two CR123 disposable batteries can be used. The 7070R flashlight features a full-time battery level indicator, dual-switch design and high light output of up to 1,219 lumens. Dual switch technology allows the light to be activated either forward (for general use) or backward (for tactical use) by a switch. An intuitive Bluetooth application allows the user to programme up to five switching sequences with different light intensities and/or flashing modes.



Photo: Peli

■ Upgraded Polaris DAGOR

(ck) Polaris has upgraded its DAGOR off-roader with the introduction of the performance-enhanced DAGOR A1, which offers better mobility and operator functionality. Customers include the U.S. Special Forces, the 82nd Airborne Division of the U.S. Army, Canadian Special Operations Forces Command (CANSOFCOM) and several European military and global armed forces. "DAGOR A1 is our answer to the demand for more payload and mobility with an increase in

Photo: Polaris



overall carrying capacity of more than 20 percent," said Mark McCormick, Senior Director of Polaris Government and Defence. DAGOR is a modular vehicle that enables various deployment packages, including Squad Carrier Configuration, Personnel Recovery Kit or Canada's Ultra-Light Combat

Vehicle (ULCV) configuration. New components include fuel or water canister holders that can be mounted in several places with cargo box aircraft rails, HF antenna holders and a tailgate that is aircraft rail compatible for storage options for the tailgate's 227 kg capacity. DAGOR offers high off-road capability, payload and transportability; it can carry up to nine warfighters and their equipment, which corresponds to a total payload of up to 1,814 kg on the DAGOR A1. Increased ground clearance even at full payload provides better obstacle management and improves off-road capability. DAGOR A1 maintains air-drop, sling-load and internal air transportability on CH47 and CH53 helicopters from the original ultralight vehicle platform.

■ MELS Integrated with MARDER

(gwh) Rheinmetall has integrated the modern Multi-Role Light Missile System (MELS) into the MARDER 1A5 infantry fighting vehicle (IFV), replacing the MILAN anti-tank missile, which has reached the end of its service life. At the end of 2016, the Federal Office of Bundeswehr Equipment, Information Technology and

In-Service Support (BAAINBw) commissioned Rheinmetall to conduct a feasibility study on how the vibrations caused



Photo: Rheinmetall

by the vehicle can be taken into account in the scaffolding construction of the MELS. The results formed the basis for an adapted congestion concept. As a highlight of the project, the launch of the guided missiles from the infantry fighting vehicle was successfully tested. The Bundeswehr ordered 44 MELS kits, which were delivered at the end of 2017. Currently 35 IFVs are equipped with MELS and investigations are underway to integrate MELS into the MARDER versions 1A3 and 1A5A1. The Bundeswehr wants to keep up to 196 MARDER IFVs in service for an extended period of time.

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■ Artillery Ammunition for Australia

(gwh) A consortium of NIOA, Rheinmetall Waffe Munition, Rheinmetall Denel Munition, Nitrochemie and Junghans Defence will supply the Australian armed forces with various projectiles, fuses and propellants from the Rheinmetall ASSE-GAI family under the Australian "Land 17 Phase 1C.2 Future Artillery Munitions" programme. The first part of the qualification quantity will be delivered this year; the second part will follow in 2019. The Australian MoD placed the order in late 2017; the contract includes the delivery of the qualification quantity and the in-



Photo: Rheinmetall

put stock and has a value of €65M. After successful qualification, a first five-year delivery phase is started, with the option for additional five-year delivery phases. The total value of the contract is in the three-digit million euro range.

■ BOXER for Australia

(gwh) Australia will opt for Rheinmetall's BOXER 8x8 (MRAV) armoured multi-purpose vehicle as part of its Land 400 Phase 2 modernisation programme. From 2019, 211 wheeled armoured vehicles worth more than €2Bn are to be delivered over a period of seven years. The reconnaissance version of the all-wheel-drive BOXER is equipped with a LANCE turret with a 30 mm gun using airburst technology. Non-lethal systems and anti-tank missiles complete the armament. Rheinmetall will work closely with Australian industry. Rheinmetall will produce the first 25 vehicles in Germany; the remaining 186 units will be produced and assembled in Australia in cooperation with 40 Austral-



Photo: Rheinmetall

ian companies. Australia's BOXER order will continue Rheinmetall's successful commitment in Australia. Since 2013, Rheinmetall's subsidiary RMMV has supplied a total of 2,500 military vehicles. With the SPz PUMA and the new LYNX, Rheinmetall is competing for the Australian IFV. Australia will be the fourth BOXER user nation after Germany, the Netherlands and Lithuania. The order quantity amounts to 927 vehicles in 11 variants.

■ Next Generation Airborne Radio

(gwh) Rohde & Schwarz is expanding its successful R&S M3AR aviation radio family with the R&S SDAR as a high-end instrument. The high data rate of the IP-based radio gives its users information superiority in networked operations with innovative waveforms; it enables broadband, simultaneous voice and data transmission. The open system architecture of the R&S SDAR, which is based on the international SCA standard, means complete independence for government customers, who can independently develop, adapt and port waveforms including encryption. The military aviation radios from Rohde & Schwarz meet military and



Photo: Rohde & Schwarz

civil avionics standards. The R&S SDAR thus offers platform manufacturers a significant advantage in terms of the aircraft's civilian certification capability.

■ MTU 8000 Engines for French Frigates

(gwh) The French shipbuilder Naval Group has contracted Rolls-Royce Power Systems with the delivery of a total of 20 MTU Series 8000 engines with 16 cylinders (Type 16V 8000 M91L), each with an output of 8,000 kilowatts. The engines are built and supplied by MTU Friedrichshafen in Germany. They will power five new FTI (Frégates de taille intermédiaire) frigates of the French Navy from 2023. The 16V-8000 engine has a low total cost of ownership and high power density and is environmentally friendly. The engine complies with the IMO Tier II and EPA Tier II emission guidelines and can also meet other, more strict requirements. The



Photo: Rolls Royce Power Systems

American Bureau of Shipping (ABS) has awarded the Naval Vessel Rules (NVR) certificate to all engine variants of the 8000 series. For each of the FTI ships, four 16V-8000 engines in a combined diesel and diesel propulsion system (CODAD) will provide the propulsion. With the CODAD drive, two diesel engines are connected to each of the two drive shafts. The propulsion system has a total output of 32 MW and can accelerate the frigates up to 27 knots. The range of the ships is up to 5,000 nautical miles. Delivery of the engines will begin in late 2020 to be completed by 2027.

■ Safran under Contract for LAKOTAs

(ck) The US Army has contracted Airbus Helicopters to deliver a total of 51 UH-72A LAKOTAs, for which Safran Electronics & Defense supplies critical avionics systems. Since 2005 more than 423 LAKOTAs have been equipped with Safran's avionics package consisting of the autopilot system, the



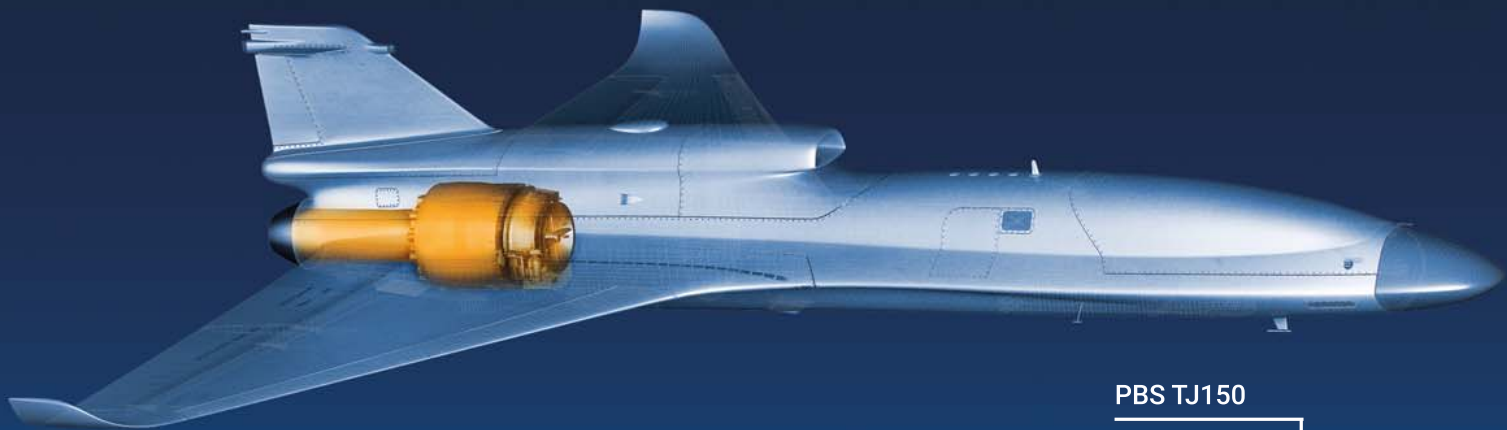
Photo: Safran

Attitude & Heading Reference System (AHRS) and a data acquisition unit. "We are proud to be a part of the LAKOTA programme and to partner with Airbus Helicopters to deliver on-cost and high-quality avionics equipment," said Trice Smith, President and CEO of Safran Electronics & Defense. Last year, Safran earned the "Best On-Target Quality Performance 2017" award from Airbus Helicopters for successfully delivering "first-time-right" units.

■ Australia to Test CAMCOPTER

(ck) Schiebel has demonstrated the heavy fuel variant of the CAMCOPTER S-100 Unmanned Air System (UAS) as part of its customer acceptance programme with the Royal Australian Navy (RAN). Under the directive of the Navy Minor Project (NMP) 1942 to procure a vertical takeoff and land-

PBS Velka Bites / UAV engine producer



PBS TJ150



1,500 N
19.6 kg
Ø 272 mm

PBS TJ100



1,300 N
19.5 kg
Ø 272 mm

PBS TJ80



900 N
12 kg
Ø 235 mm

PBS TJ40



395 N
3.3 kg
Ø 147 mm

2018

UMEX UAE	25 - 27 February
Defexpo India	11 - 14 April
XPONENTIAL US	01 - 03 May
Helirussia RU	24 - 26 May
Eurosatory FR	11 - 15 June
Farnborough UK	16 - 22 July
AAD South Africa	19 - 23 September
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Airshow China	06 - 11 November
INDO DEFENCE	07 - 10 November



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ing Maritime Tactical Unmanned Aircraft System – Interim Capability (MTUAS-IC), the RAN has sought a platform for shipborne intelligence, surveillance and reconnaissance (ISR). Selected for its capability profile, the CAMCOPTER S-100 UAS completed its flying programme for the RAN verification customer acceptance programme at the Jervis Bay airfield facilities in New South Wales. In a series of tests, the JP-5 (NATO F-44) heavy fuel powered CAMCOPTER S-100, equipped with a Wescam MX-10S payload and at ranges of up to 60 miles and altitudes above 10,000 feet, delivered crisp imagery to commanders. RAN Contract Manager Kevin Beare commented, “The heavy fuel

Photo: Schiebel



variant of the S-100 has performed very well during the validation and verification programme and the RAN looks forward to utilising this platform to achieve NMP1942 project objectives over the coming years.”

■ Thales Rockets for TIGER Helicopters

(gwh) Thales will equip the German and Spanish TIGER combat helicopters with unguided 70 mm missiles. The TIGER can carry launchers for 7 or 19 missiles under its stub



Photo: Thales

wings. Spain will procure 1,000 missiles for its TIGER HAD for the first time. Germany expands its stock by 10,000 training rockets. These missiles are equipped with the modified rocket engine FZ90 Mod. 4. 70mm guided missiles have yet to be procured.

■ Rapidly Deployable Bridges for Australia

(gwh) Bridge specialist WFEL, a subsidiary of Krauss-Maffei Wegmann, has supplied Australia's armed forces with the first rapidly deployable bridges as part of the Australian Land 115 programme. These include



Photo: WFEL

self-supporting bridges (Dry Support Bridge, DSB) with a load-bearing capacity of 120 tonnes, integrated on a HX 45M truck from Rheinmetall MAN Military Vehicles (RMMV) with five powered axles and protected cab. The DSB can be erected within 90 minutes by a team of eight to bridge trenches/water up to a width of 46 metres. The second bridge system supplied is the Medium Girder Bridge (MGB), which is assembled on site. With two construction levels (two-storey) and reinforcing elements, the bridge can span 48 metres and with further pillars and clamping elements up to 76 metres. The load capacity depends on the span and is between 20 tons (48 m) and MLC 70 (31 m). “The adoption of the DSB not only provides the ADF's Manoeuvre Commanders with the ability to cross significant wet or dry gaps quickly and efficiently, it allows a level of inter-operability with an ever-growing user base,” said Ian Wilson, Chief Executive of WFEL. WFEL will complete final delivery of the bridges by September 2018.

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Gatekeepers and One-Way Gateways: Secure Gateways, Diodes and Security Labels for Secure Data Transmission within NATO



When NATO sends troops to conflict areas, effective and efficient communication is essential and the protection of confidential information must be guaranteed at all times.

Neither of these goals has so far been achieved without restrictions. The German IT security specialist INFODAS GmbH has developed a product family called "Secure Domain Transition," which enables the secure transfer of digital information across the boundaries of security domains and meets NATO requirements.

NATO's digitisation is progressing rapidly. This fact increases the need to protect secret information from cyber attacks. One of the biggest challenges is the interconnection of differently classified networks processing classified and less sensitive data, in particular the interconnection of NATO mission networks and national networks of NATO partners. The required separation makes communication within the multinational forces considerably more difficult. Until now, the only way to make information from secret networks available in subordinate networks was to manually verify the data via a so-called "swivel chair interface": a slow, inefficient and above all, unsafe procedure.

Secure Communication between Differently Classified Networks

"The military intelligence service needs the highest possible protection - but also a flexible communication structure," explains Carsten Schulz, Managing Director of INFODAS GmbH. "This is only possible with special gatekeeper systems that detect whether information originates from a secret network, but is not per se confidential." With conventional firewalls, such a differentiation of content is not possible. However, the "SDoT Security Gateway" from INFODAS checks all data contents before transmission. If the data contains secret or particularly sensitive information, it is blocked by the gatekeeper and does not leave the higher classified domain. How does the gateway distinguish between classified and unclassified information? Basically, there are two approaches. Structured data - e.g. XML files, but also many military data formats - can be

filtered using rules. To define such a set of rules, the structure of the information must be known in advance. The gateway uses the rules to check whether the information is allowed through or not. If the data is not or only insufficiently structured, security labels are used. "Security labels contain the confidentiality of information - cryptographically protected against manipulation," explains David Riehl, head of SDoT product development at INFODAS GmbH. "The SDoT Labelling Service product generates such security labels. Every file, whether e-mail, text, image or video, can be labelled. SDoT products implement the NATO standard for XML security labels. The use of these labels ensures interoperability with other alliance partners.

INFODAS GmbH is one of the pioneers in the field of IT security for the military and other authorities. For over 40 years the company has been advising public institutions and armed forces on the implementation of legal security requirements. The company regularly demonstrates its improved products in military exercises, for instance during the NATO exercise CWIX. INFODAS will return to CWIX in 2018.

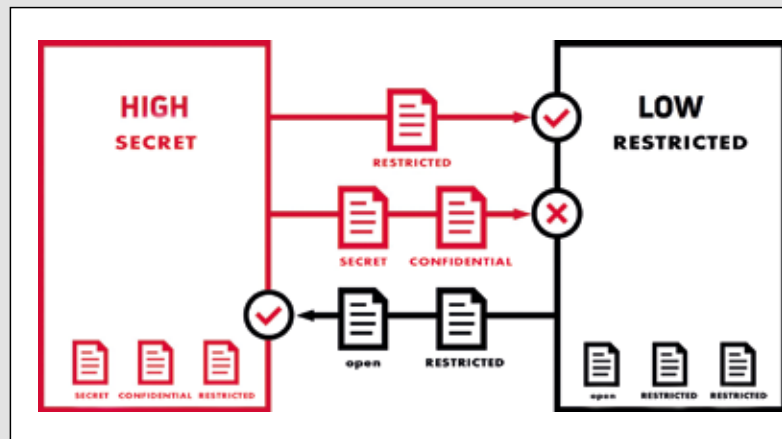
High-Speed Data Transfer

As speed plays an important role in data transmission, in addition to security, INFODAS GmbH also offers a network diode as a "one-way" gateway. With a data throughput of up to 9.1 GBit/s, the SDoT diode is currently the fastest GERMAN SECRET approved diode solution on the market. "Dig-

itisation means that enormous amounts of data are collected every day," explains Carsten Schulz. "The military and the authorities must ensure that relevant information is also available in sensitive, hermetically sealed networks."

INFODAS GmbH also offers a low-latency solution for bidirectional data transmission: the Express version of the SDoT Security Gateway now enables the secure transmission of large amounts of data with very low-latency. Sensor data or mis-

Grafik: INFODAS GmbH



INFODAS GmbH offers solutions to move data across differently classified networks.

sile control commands coming from a radar must be transmitted in real time. This information is transmitted in rapid succession in the form of so-called "telegrams." For secure transfer between two domains a fast content check is necessary. The Express version of the SDoT Security Gateway is optimised for high-performance, low-latency testing and transmission of these telegrams.

SDoT Security Gateway, SDoT Labelling Service and the SDoT Diode are approved by the German BSI up to GERMAN SECRET and listed in the NATO Information Assurance Product Catalogue.

INFODAS GmbH presents its SDoT product family at NITEC from May 22 to 24 in Berlin.

New Trends or Post-Soviet Heritage?

Slovak Security Policy in 2018

Tomáš Čížik

Slovak society is struggling to cope with new security challenges.

This year, Slovakia will also celebrate its 14th anniversary of the NATO (March) and EU (May) membership. However, in 2018, Slovakia is remembering many more adversaries – the end of World War I and the establishment of the first Czechoslovak republic in 1918, the Munich Agreement of 1938, the invasion of the Warsaw Pact armies in August 1968 and the Constitu-

tion warfare, which are definitely new and atypical ways of warfare. Without the adoption of the new strategic documents and the development of counter-measures, the inability of Slovak politicians to take the necessary measures will endanger not only the security of Slovakia but also the security of our partners and allies.

A Changing Security Environment

Most Slovak politicians and experts recognise the changes in the security environment in Europe following the annexation of the Crimean Peninsula by the Russian Federation in March 2014. The aggressive Russian policy is an immediate threat to the

tion warfare, which are definitely new and atypical ways of warfare. Without the adoption of the new strategic documents and the development of counter-measures, the inability of Slovak politicians to take the necessary measures will endanger not only the security of Slovakia but also the security of our partners and allies.

However, the new draft security strategy reflects all major changes in the security environment, including hybrid and information warfare, and is also highly appreciated by security experts in Slovakia and its allies. The inability of Slovak politicians to agree to the new strategic documents may be due to the nature of Slovak domestic policy and the different opinions of Slovak political parties on the country's Western orientation, which clearly damage Slovakia's image in the eyes of its partners and allies.

The Slovak Security Strategy 2017

The draft of the Slovak Security Strategy (2017) "underlines the importance of Slovakia's active membership in international organisations, in particular in the European Union (EU) and the North Atlantic Treaty Organisation (NATO), which constitute the most important pillars of its security and natural space for the implementation of its security policy". Paragraph 7 of the draft recognises that "the security environment in which Slovakia has fulfilled its security interests has changed significantly. It [security environment] is changing rapidly and unpredictably, it is influenced by internal and external factors that are closely related[...]"

In addition to traditional threats such as terrorism, weapons of mass destruction, rogue states and organised crime, the draft Slovak security strategy also reflects new threats - hybrid warfare, information wars and disinformation campaigns, cyber attacks, psychological operations and paramilitary groups. The draft recognises that conflicts in Europe no longer necessarily have to take the form of a "direct military conflict between states," but that conflicts can

Photos: Ministerstvo Obrany SR



In October 2017, Slovakia received its first C-27J SPARTAN aircraft.

tional Act on the Czechoslovak Federation in October 1968, the end of Mečiarism in 1998 and many more.

Since the end of Mečiarism, Slovakia made significant progress in terms of good governance, development of democratic institutions and human rights. In foreign and security policy, Slovakia has definitely become a Western-oriented country. In domestic politics, however, the "post-Soviet" heritage

security of Slovakia and its partners. On the other hand, Slovak politicians were not able to reflect these changes in new Slovak strategy documents. So far, the Slovak Parliament has still not approved the new security or defence strategy, although the Slovak Government adopted draft documents in October 2017.

Slovakia's security policy is based on strategic documents from 2005, which are highly irrelevant in 2018. Slovakia is the last country in the entire region without new strategic documents. In general, strategic documents provide guidelines for government actors on how to respond to different situations and threats. Slovakia faces new security threats and challenges such as hybrid and informa-

Author

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take place in hybrid forms of fighting. The draft emphasises that hybrid warfare "polarises society, creates insecurity and thus undermines the legitimacy, trustworthiness and capacity of state institutions and democratic order, which has a negative impact on the security interests of the Slovak Republic."

The draft also confirms Slovakia's commitment to increase its defence spending to 1.6% of GDP by 2020 and to 2% of GDP in the near future (the 2% threshold is expected to be reached in 2024). Overall, the draft Slovak Security Strategy can be considered to be of high quality as it openly addresses the changes and challenges of the new security environment for Slovakia.

Security Challenges for Slovakia

Slovakia's biggest security threat is certainly the Russian Federation and its aggressive policy. Taking into account Slovakia's geographical location, its border with Ukraine and its geopolitical orientation, the Russian annexation of the Crimean Peninsula has had a significant impact not only on the security of Slovakia but of the whole of Europe. However, a direct military attack by the Russian Federation on Slovakia or other NATO member states is unlikely, but the Russian hybrid and information war poses an immediate and direct threat to Slovakia and its partners and allies.

Hybrid warfare can be defined as a combination of conventional and unconventional measures to exploit the opponent's weaknesses to achieve an attacker's strategic goals. Hybrid warfare consists of information operations, psychological operations, cyber attacks and the use of Special Forces. Slovakia's main problem are information and psychological operations that have a significant impact on public opinion on critical and sensitive issues of Slovak foreign and security policy. Studies by Globsec (Globsec Trends 2017) show that only 21% of Slovaks support Slovakia's Western orientation, while 9% of Slovaks support an Eastern orientation. In the same study, 42% of Slovaks wanted to belong "somewhere in between." Of seven countries (Hungary, the Czech Republic, Poland, Bulgaria, Croatia, Romania and Slovakia), Slovak support for Western orientation is the lowest. Support for NATO membership among the Slovaks is also the lowest of these seven countries. According to Globsec research, 56% of Slovaks "agree, rather or completely, that membership of NATO is important for their security."

Disinformation Campaigns

In Slovakia, so-called "alternative media" use disinformation campaigns, conspiracy theories and hoaxes to create chaos in the minds of citizens and undermine their trust in democratic and European institutions. The most important platform for the spread of disinformation and conspiracies is social media. These alternative media often use anti-Western, anti-EU, anti-NATO and anti-US narratives in which they portray the West as corrupt and Russian-phobic and ruled by individuals who want to destroy our traditional way of life and traditions. The activities of these alternative media are clearly organised and coordinated as they use the same themes and tropes, such as the Brussels dictatorship, NGOs as Soros and US agents, the EU as promoter of homosexuality, NATO encircling Russia and so on.



In February 2017, the Czech and Slovak defence ministers signed a treaty on mutual airspace protection thanks to which the air forces of the two countries can guard their airspace together. If one of the countries is unable to protect its airspace, the other will assist it.

In recent weeks, one of these stories has also been used by Slovak Prime Minister Robert Fico and his party SMER-SD, who argued that George Soros would organise and support protests against the government to instigate a "Maidan" in Slovakia. This is quite dangerous, considering that according to Globsec 52.2% of Slovaks believe that secret societies rule the world. In addition, studies by the Centre for European and North Atlantic Affairs (CENAA) show that almost 70% of the young generation use Facebook as primary source of information, making them the most vulnerable group in Slovakia. Due to a lack of critical thinking and improper education, they are unable to verify the information they have read.

Another challenge for Slovakia's security is low defence spending. Slovakia's defence spending has declined since joining NATO in

2004. According to the World Bank, Slovak defence spending amounted to around 1.7% of GDP in 2005; in 2010 it was only 1.27%. In 2013, Slovak defence spending reached its low point - 0.98%. Since Russian annexation of Crimea in March 2014, Slovakia like other NATO member states promised to increase defence spending at the NATO-Wales Summit. In 2017, Slovak defence spending rose to 1.19% of GDP and is expected to reach 1.22% by 2018. The long-term underfunding of the Slovak Armed Forces means that most military equipment is obsolete and in poor condition and needs to be modernised, including jet fighters, armoured personnel carriers and military radars. In order to achieve Wales' commitment to spend 1.6% of GDP on the military, it is necessary to include modernisation expenditure in the Slovak Republic's total defence expenditure. In May 2017, the Slovak government approved €1.2Bn for the purchase of 81 8x8 armoured vehicles and 404 4x4 multi-purpose vehicles.

In February 2018, the Slovak Ministry of Defence announced that Slovakia is considering acquiring either American F-16s or Swedish GRIPEN jet fighters in order to replace its Russian-made MiG-29s. Overall, Slovakia will spend about €6.5Bn by 2030 to modernise its military.

In 2015, Slovakia signed an agreement with the United States Department of Defence to acquire nine new UH-60M BLACK HAWK helicopters. Two of them were delivered to Slovakia in June 2017; two BLACK HAWKS are due to be supplied in 2018 and another five in 2019. In October 2017, Slovakia received its first C-27J SPARTAN aircraft. The other one is expected to be delivered in 2018. It is necessary to state that without extensive spending on modernising the Slovak military, it will be almost impossible to reach the 2% goal of defence spending by 2024. Another challenge to Slovak security is the

new transatlantic relationship, because the Trump government has decided to pursue a more isolationist foreign policy than its predecessors. Such a policy has logically created uncertainty among European countries which have decided to strengthen the European Union's defence capabilities by creating the Permanent Structured Cooperation Initiative (PESCO). PESCO aims to improve and strengthen cooperation with the military forces of the EU Member States. Slovakia has joined PESCO with other 23 EU Member States, but will not compete with NATO. Slovakia's decision to join PESCO also represents Slovakia's aspiration to belong to the "core of European integration."

Visegrad cooperation has strengthened the voice of the small V4 countries in the European Union and NATO, but the confrontational politics of Hungary and Poland against the EU and their slow but steady move towards illiberalism could have a significant impact on Slovakia's future cooperation with these two countries.

Conclusion

To sum up, Slovakia's foreign and security policy is clearly pro-Western. Slovakia is actively involved in EU and NATO mis-

sions. Slovakia is committed to contributing to NATO's reinforced presence in the Baltic States, where Slovakia will deploy 152 soldiers in June 2018, while two troop changes are under consideration. Slovakia is also part of the fight against the Islamic state in Iraq, where 47 Slovak military advisors are training Iraqi military personnel. Slovakia is also fulfilling its commitment to increase military spending, is acquiring military hardware that is interoperable with its NATO partners and reduces dependence on Russian spare parts.

However, Slovakia, like other EU and NATO member states, does not take the threat of hybrid and information wars seriously. In the long term, information wars and disinformation campaigns can dissolve societies across Europe. Studies show that support for democracy is declining and support for totalitarian regimes is increasing. Disinformation campaigns will reinforce and accelerate this negative trend. Compared to the Russian Federation, EU and NATO initiatives dealing with disinformation are understaffed, underfunded and unorganised. In the case of Slovakia, the Foreign Ministry Stratcom team consists of three people who will do everything to minimise the influence of Russian propaganda in Slo-

vakia, but without cooperation at international, regional and national levels, it will be impossible to achieve much.

Last but not least, Slovak politicians are struggling to openly formulate Slovakia's strategic interests in the area of foreign and security policy. This would definitely help anchor Slovakia in the transatlantic structures and it would send a clear message to its partners and allies that Slovakia takes its commitments seriously. It would also help to dispel the doubts of Slovak citizens about Slovakia's Western orientation. Politicians have sufficient media attention and thus, the opportunity to explain in detail every decision taken in the area of foreign and security policy and thus, make it more difficult for alternative media to misuse information for their purposes.

As mentioned in the introduction, Slovakia celebrated its 25th anniversary of independence in 2018. Slovakia is a young democracy that has overcome difficult times during the reign of Mečiar and is facing new challenges. Slovakia has demonstrated its ability to take drastic measures to achieve its strategic objectives and there is no doubt that Slovakia's commitments can be taken seriously and that it is a reliable partner. ■

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Viewpoint from Berlin



New Government, Old Problems

Wolfgang Labuhn

Security and defence are not top priorities of the renewed coalition government in Berlin. The government programme signed by Christian Democrats and Social Democrats deals at length with social and economical issues, digitisation, housing, social cohesion, and of course with all the problems caused by the influx of refugees and migrants.

Europe, too, ranges high on the agenda whereas "Germany's responsibility for worldwide peace, freedom and security" is only outlined towards the end of the voluminous document. The Bundeswehr, Germany's armed forces, is described as "guarantor" of Germany's security and promised "the best possible equipment." But increased defence spending will now be subject to preconditions. When Chancellor Angela Merkel explained the priorities of her fourth term in office she stressed that there cannot and should not be any repetition of the sort of exceptional situation posed by the wave of refugees in 2015 and 2016. She called for more support for the World Food Programme and the UNHCR to stop migration by means of more local assistance. Safeguarding Germany's security interests with armed forces as part of the NATO alliance is now considered to be but one element of a more comprehensive approach to define security. Angela Merkel declared that Germany needs operational forces with modern equipment, and Christian Democrats and Social Democrats in Mrs. Merkel's coalition government are certainly committed to spend more on defence than previously planned. But any additional funds are to be met by exactly the same amount for foreign aid until the OECD's official development assistance target of 0.7 percent GDP is reached by Germany. As additional spendings on this "comprehensive security" will only amount to €2Bn from 2018 until 2021, the annual increase of the German defence budget will be a mere €250M. Total defence spending is to be increased to €42.4Bn by 2021. However, Germany's economic growth projects that defence budget would amount to just 1.15 percent of GDP – less than now and a far cry from the 2 percent target agreed by all NATO members. Thus, Germany's customary defence problems remain unsolved. In his most recent report, the Parliamentary Commissioner for the German Armed Forces doubted the combat readiness of the Bundeswehr due to a considerable lack of modern equipment, maintenance

problems, and severe understaffing - despite of all attempts of Defence Minister Ursula von der Leyen to turn around procurement, recruitment, and defence spending after many years of downsizing the Bundeswehr. Even the Chief of Staff, General Volker Wieker, admitted "capability gaps" which will take ten years to close although all NATO commitments including leading the Very High Readiness Joint Task Force again in 2019 would be fulfilled. Within NATO's Enhanced Forward Presence programme along its Eastern European borders, Germany is leading a multinational battalion deployed in Lithuania. According to Defence Minister von der Leyen, Germany is also prepared to accept more responsibility for its own security and defence capabilities as well as the continued support for international peacekeeping missions. Despite all equipment and personnel shortages, one of the first decisions of the newly formed Berlin government has been to extend the deployment of large numbers of armed German troops in Iraq, Afghanistan, Mali, and in the Mediterranean. Germany will also continue its participation in a number of other United Nations peacekeeping missions albeit with far fewer troops. In Iraq the Bundeswehr has been training Kurdish Peshmerga forces to fight against IS terrorists. As the IS has been largely forced back in Northern Iraq, the German training mission will be ended and replaced by a new mission across Iraq to provide training for security forces and advisory services. This mission is considered to support the international anti-IS coalition "Inherent Resolve" which Germany also supports with mid-air refuelling and TORNADO reconnaissance aircraft. Germany provides crews for NATO's AWACS aircraft, too. In Afghanistan, the number of German troops to be part of the NATO-led "Resolute Support" mission is to be raised from currently 980 to up to 1,300 soldiers. They will continue to train, advise and support the Afghan National Defence and Security Forces. In Mali, the ceiling on German troops to be part of the MINUSMA stabilising mission will be raised to 1,100 troops. Up to 650 German soldiers will continue to be part of the NATO-led "Operation Sea Guardian". But critics have warned not to overstretch the Bundeswehr before it has increased in size again, and received more modern equipment. And whether all these German efforts are sufficient to placate US President Donald Trump is a different matter altogether.

Can CEFTA Be the Lifeboat for Georgia and Ukraine's EU Membership?

Beka Kiria and Gunther Fehlinger

Brussels has serious reservations as regards the Russian influence on Yerevan, Baku and Minsk. The EU must choose between values and geopolitics as a basis for decision-making.

The EU's initiative to develop relations with Georgia, Ukraine, Belarus, Moldova, Armenia and Azerbaijan has led to the establishment of the Eastern Partnership (EaP) Platform - a framework aimed at creating a venue for discussions on visa arrangements,

In a nutshell, DCFTA gives Georgia, Moldova and Ukraine access to the European Single Market and allows EU investors to enjoy the same regulatory environment in the associated country as in the EU. In the case of Azerbaijan, Armenia and Belarus, the EU is

ervations as regards the Russian influence on Yerevan, Baku and Minsk. It confronts the EU with a complex issue and challenges it to choose between values and geopolitics as a basis for decision-making. A firmer stance on values would disconcert Yerevan, Baku and Minsk officials and make it more attractive for them to focus their foreign policy on Russia.

There are now positive and progressive steps towards the EU in these countries.

One possible solution would be to maintain the EaP initiative for those countries that are interested in closer cooperation with the EU, but whose domestic reforms and foreign policy are constantly being adapted to Moscow's pressure. Such an approach would allay Russia's concerns about the EaP initiative. Meanwhile, the dialogue between the EU and the Eastern Partnership countries would remain alive and active.

For example, the Eastern Partnership as a primary and Central European Free Trade Agreement (CEFTA) as a secondary agreement would bridge the gap between the EU's values and geo-strategic interests.

CEFTA would be a pool of non-EU successful countries whose EU accession prospects have not yet been decided upon (7 existing member states plus Georgia and Ukraine).

In addition, such agreements will release much greater economic benefits from cooperation between developing and transition countries under CEFTA, rather than trying to find ways of working together as EaP members at different speeds.

As far as trade is concerned, Eastern Partnership countries joining CEFTA would have greater trade potential and economic benefits, thus gaining more opportunities to strengthen their economies. CEFTA could thus become a road towards EU membership.

The Case of Georgia and Ukraine

In the case of Georgia and Ukraine, the debate on the next step of EU integration is in full swing. When it comes to the issue of EU enlargement, member states are divided in their opinions as the process of enlargement is perceived as challenging for the EU's elites and voters. For Georgia and Ukraine, it is



Photo: European Parliament

Is Ukraine's membership in CEFTA a first step towards EU accession?

free trade agreements, economic strategy and strategic partnership agreements. The trade policy dimension of EaP covers trade between the EU and its Eastern European partners and trade between these neighbouring countries as well. However, among the EaP countries only Georgia, Moldova and Ukraine are signatories of an association agreement with the European Union, which stipulates the creation of deep and comprehensive free trade areas (DCFTA).

holding one-on-one talks on various options for mutual trade, investment protection and compliance with trade-related international standards, including the modernisation of economies and the improvement of intellectual property legislation.

However, despite the promising trade-related dialogue with these countries and their potential for reform, the Eastern Partnership policy aims to ensure respect for human rights, the rule of law, good governance and democracy. The lack of adaptation of Azerbaijan, Armenia and Belarus to the objectives of the Eastern Partnership poses a serious dilemma for the EU.

On the one hand, the EU must decide whether the integration of these countries in European processes is more important than values and compliance with standards. On the other hand, Brussels has serious res-

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both appropriate and pragmatic to follow the successful path of the countries of Central Europe towards EU integration.

Currently, Georgia and Ukraine are in a similar situation as the six EU candidate and potential candidate countries from South Eastern Europe.

Together, they must all stand in line as they reform at home and convince EU member states of the benefits of enlarged membership. The model of the "EU queue" has its list of priority countries, depending on the progress of reforms at home. In concrete terms, the decision on progress towards EU membership will be based on the achievement of concrete milestones and success in the reform process.

It will be a very similar path as the Nordic, Baltic, Benelux and Visegrad countries have taken, based on the "reform and pass" logic. Under the European Treaty, all European countries are entitled to apply for EU membership if they have met the Copenhagen criteria for democracy, the rule of law and a market economy. However, the question arises as to how a country can join the EU most effectively.

In the case of Georgia as a successful EaP country, which has been positively acknowledged by the EU for its progressive steps, particularly its participation in the preparation of proposals for the working document "Eastern Partnership - 20 results for 2020," there are still a number of milestones to be reached.

The country still needs to show tangible progress in the democratisation process, human rights and, in particular, good governance, including public administration reform, which began in mid-2017 with a six-month delay. Given that Georgia is facing a de facto paralysing annexation of its territory by Russia, its further membership in CEFTA would bring Tbilisi closer to the EU.

In the case of Ukraine, we have seen an effective and rapid implementation of the Free-Trade Area Agreement, which shows a clear path for Ukraine's political association and economic integration with the EU. In addition, Ukraine continued to carry out structural reforms and generated positive trends in the economic and social sectors despite strong internal and external challenges. However, considerable efforts are still needed to implement the anti-corruption efforts. Taking into account Russia's hostility to Ukraine and the annexation of the Crimea, which goes hand in hand with the post-Maidan crisis, Kiev's progress towards accession to the EU must be underpinned and consolidated. Ukraine's application for CEFTA membership is proposed as the next step on the road to EU membership.



Photo: Wiki CC

Central European Free Trade Agreement (CEFTA): dark blue: current members; light blue: former members who joined the EU.

CEFTA – A Running Bicycle

Historically, the Central European Free Trade Agreement (CEFTA) played a very positive and important role for the Central European countries on their way to EU integration. As early as 1992, Poland, Czechoslovakia and Hungary established CEFTA as a preparatory instrument for final EU membership. Since the countries have joined the EU, they have left CEFTA, while other countries intending to join the EU have joined CEFTA. Slovenia, Romania, Bulgaria, and Croatia all joined CEFTA and left when they got "upgraded" to full EU membership.

At present, CEFTA has seven members - Albania, Bosnia-Herzegovina, Kosovo, Macedonia, Moldova, Montenegro, and Serbia - all of whom joined in 2006-2007. Membership in CEFTA requires membership in the World Trade Organisation (WTO), an Association Agreement with the EU and a Free Trade Agreement with current CEFTA members. It facilitates trade between these countries and prepares them for EU accession.

Instead of trying to develop a new Eastern Partnership Free Trade Agreement (EPFTA), Ukraine and Georgia should rather join an already functioning and successful model - CEFTA. To be specific, EPFTA with Armenia, Azerbaijan, Belarus, Georgia, Moldova, and Ukraine could have a limited scope of functionality since Azerbaijan and Belarus are not members of the WTO, unlikely to join for many years.

As far as Armenia is concerned, the long-running and exhaustive conflict with Azerbaijan put an end to Yerevan's WTO membership. Moreover, Armenia and Belarus are also members of the Eurasian Economic Union founded by Russia, which prevents them from participating in free trade agreements with the EU. From a technical point of view, only three countries - Georgia, Moldova and Ukraine - qualify for further rapprochement with the EU, thanks to their membership of the WTO and their association agreements with the EU.

In the wake of the illiberalist forces throughout Europe and the increasing hostility of Russia, Moldova's foreign policy was successful in using CEFTA as a

lifeboat for EU accession. There is therefore a legitimate question: why do Georgia and Ukraine not follow Moldova and join CEFTA? To date, CEFTA membership has successfully reduced the concern of EU candidate countries not to be recognised by all EU member states.

Trade and Economic Benefits

The Western Balkans countries are seeking to integrate their economies into the Regional Economic Area agreed at the Trieste Summit in July 2017. Discussions are currently underway on the establishment of a customs union between the Balkan six. Against this backdrop, Georgia and Ukraine's future membership would bring to CEFTA a huge market, Ukraine's natural resources and technological capabilities, as well as Georgia's impressive reform experience, to the benefit of all participating states. This would allow CEFTA members to build a prosperous market, including the countries of South-Eastern and Eastern Europe, and to accelerate the pace towards EU accession.

Rather than thinking about setting up an EPFTA, the fastest way for Georgia and Ukraine would be to join the already existing CEFTA (a running bicycle), a successful free trade agreement with a solid track record of progress made by eight former members who have become full EU member states.

When the other EaP countries meet the criteria for CEFTA membership, they could also join the pool of EU candidates and enjoy significant economic benefits before they acquire EU membership. The accession of Georgia and Ukraine to CEFTA as a successful European free trade area could trigger active geopolitical changes in the enlarged Eastern Partnership and encourage Belarus, Armenia and Azerbaijan to reorient their foreign policy.

Finally, an enlarged CEFTA would significantly improve the economies of all member states and facilitate the EU accession process. CEFTA could be the next important building block for further EU integration of Georgia, Ukraine and other EaP countries. Its enlargement has a strong potential to change old geopolitical decisions in the wake of the illiberalist order. ■



Viewpoint from Athens



Political and Social Tensions in Greece

Dimitrios Angelopoulos

The Greek people, who have suffered from the forced austerity measures and enormous unemployment over the last eight years, are in complete despair.

At the same time, the Greek public is certain that the EU is not showing solidarity with Greece in the recently escalated Turkish provocation and aggression against the sovereignty of Imia, the contested islands in the Aegean, and in the dispute over Macedonia's name.

Greece's current EU rescue programme, the third since 2010, ends in August, and the left-wing government has cut pensions, increased taxes and implemented unpopular reforms to meet the targets. Greece is ready to set off on its own initiative without support, while it wants the "cleanest" exit from the financial assistance programme when it ends this summer, Finance Minister Euclid Tsakalotos recently said.

The Greek government says that the country has turned around, but that is not the experience of the little guy on Main Street. People can't see the light at the end of the tunnel.

Athens, like most urban centres, has been hit hardest by a crisis in which the country's economic performance has fallen by a devastating 26%. Various social researchers have found that about 20% of the population earn below the extreme poverty line. In 2009 it was no more than 2.2%. According to the Bank of Greece, the net wealth of Greek households fell by a steep 40% over the same period. Unemployment, the most damaging effect of the austerity measures, is around 22% and is by far the highest in the EU despite a decline of 5% in the last two years. Tensions between Greece and Turkey have intensified in the eastern Aegean after a Turkish coastguard frigate rammed a Greek coastguard ship into Greek territorial waters. According to Greek Foreign Minister Nikos Kotzias, Turkey is systematically violating international law and crossing the red lines. Greece complained to Turkey that a Turkish ship carried out "risky manoeuvres" by the Greek coast guard who patrolled the contested islands in the Aegean, but Turkey denied that the Turkish ship was at fault.

"Dangerous incidents like this, which endanger human lives, are the result of Turkey's escalating and provocative behaviour in recent days," the Greek Foreign Ministry said in a statement. Turkish Prime Minister Binali Yildirim said on 14 February, adding that the Aegean Sea should be a "friendship" between the two countries. In an interview with the media Yildirim said: "We have told Greek Prime Minister Alexis Tsipras that it is better to avoid tensions in relations between the two countries." His comments came the day after he and Tsipras spoke on the phone and discussed recent developments in the Aegean.

Last month, the Turkish coast guard prevented the Greek Defence Minister from approaching these Greek islands to lay a wreath there.

NATO Secretary General Stoltenberg calls for a de-escalation of tensions in the Aegean. NATO and Washington fear a possible Aegean incident between the two NATO allies that could destabilise the Alliance's south-east wing.

A war between Greece and Turkey is unlikely under present circumstances, but the possibility of such an incident must be taken seriously. In an extensive interview with Greek SKAI television, US Ambassador Geoffrey Pyatt said he feared a "terrible incident" between Greece and Turkey in the Aegean, where "deadly, complicated military systems" are facing each other.

On 5 March, a Turkish court rejected an application for the release of two Greek soldiers arrested "after crossing the Turkish border." Also on 5 March, the lawyers formally requested their release from custody. A Turkish court arrested the two Greek soldiers on 2 March after they illegally entered Turkey, while a potential espionage scenario is being investigated, risking a renewed flare-up of tension between Ankara and Athens. The court in the north-western province of Edirne ordered the two Greeks to be charged with "attempted military espionage" and "entry into a forbidden military area," the state agency Anadolu reported. The Greek Army said the two soldiers got lost in bad weather when they patrolled the area around the Evros River that separates the two countries. The soldiers also said they got lost because of the weather. The



Photos: via Author

More than 100,000 Greeks gathered to protest against the use of "Macedonia" in the name of the former Yugoslav republic, saying it implied a territorial claim on Greece.

Macedonian name dispute is a political dispute over the use of the name "Macedonia" between Greece and the former Yugoslav Republic of Macedonia, a region within Yugoslavia. The background is a complex dispute and armed conflict from the early 20th century, which was part of the background of the Balkan Wars.

Greece says that the name "Macedonia" implies a territorial claim to its own northern region of that name. The two countries agreed this month to renew efforts to resolve the 25-year dispute that has blocked attempts by the former Yugoslav Republic, NATO and the European Union to join.

Athens and Skopje will hold a new round of talks with a United Nations mediator. The Greek side also seems to be open to new discussions. Greece opposes this official name, which in Greek opinion gives false impressions of the history and heritage of old Macedonia and poses the danger of future irredentist claims against its own northern region of Macedonia.

The majority of the Greek people reject the use of the name "Macedonia." Hundreds of thousands joined the Macedonian name protest in Athens and Thessaloniki. The demonstrators are against any compromise by Greece in the long-standing dis-

pute over the official name of the former Yugoslav Republic of Macedonia. Shouting "Hands off Macedonia" and "Macedonia belongs to Greece," the demonstrators gathered at Syntagma Square in front of the Greek Parliament.

A potential deal with the United States to upgrade dozens of Greek F-16 fighter aircraft should not affect fiscal progress and should not worry EU lenders, a Greek government spokesman said. "The deal is not expected to affect the country's progress on fiscal targets or budget balance," spokesman Dimitris Tzanakopoulos told reporters.

Greece has about 160 F-16 fighter planes. Any deal would involve upgrading about 85 to 95, he added. The upgrade is not expected to cost more than €1.1Bn (US\$1.3Bn), a sum that would be paid in annual instalments of approximately €110M over a decade. "It is the cheapest and most suitable solution to improve our air defence," he said, adding that Athens has paid tens of billions of euros over the past decades to buy such jets. The Greek daily Kathimerini recently reported that the Greek government will start talks with France on the procurement of two FREMM frigates. Contacts between Greece and France will initially be established at the military level, and from February the newspaper explains, citing well-informed sources. According to Kathimerini, this step follows an oral agreement between Prime Minister Alexis Tsipras and French President Emmanuel Makron during his last visit to Athens last September. If an agreement on the frigates cannot be reached because of their cost, the discussion will probably pass to the Gowind Corvette. Political tensions between government and opposition are increasing. On 22 February 2018, Greek MPs approved a special parliamentary investigation into the alleged consequences of a bribery scandal with the Swiss pharmaceutical company Novartis involving ten former high-ranking officials of the main opposition parties New Democracy and PASOK, including two former prime ministers. The allegations of corruption and bribery extend over a decade from 2006 to 2015 before the current government took office. New Democracy, the main opposition party, has decided to postpone for a few days, its proposal to form a committee of inquiry to investigate the role of Defence Minister Panos Kammenos in a recent failed deal to sell ammunition to Saudi Arabia. Turkey's provocations in the Aegean and developments in the Exclusive Economic Zone of Cyprus (EEZ), relations between the EU and Turkey, the former Yugoslav Republic of Macedonia and Greece's relations with Albania were at the centre of the meetings Prime Minister Alexis Tsipras held on the sidelines of the informal meeting of the 27 EU Heads of State and Government in Brussels on 22 March 2018.

However, despite the diplomatic efforts of the Greek Government, there is no guarantee that, if push came to shove, the Greek people would show the same patience towards the EU and any European country that repeatedly deviates from EU solidarity standards in the face of challenges such as the Turkish provocations and the Macedonia naming dispute.

In Limbo: Russia's Policy in the Nagorniy Karabakh Conflict

Gayane Novikova

The Nagorniy Karabakh conflict erupted in the last years of the Soviet Union. Soviet authorities were unable to prevent its transformation into an overt military conflict.

Photo: The President of Armenia



The Nagorniy Karabakh conflict began in 1988 and escalated into a full-scale war in the early 1990s.

A Few Introductory Remarks

Russia's involvement in the Nagorniy Karabakh (NK) conflict dates back to the very last years of the Soviet Union, when this conflict erupted on the territory of then-Soviet Azerbaijan. The central authorities of the Soviet Union were unable and unwilling to prevent its transformation into an overt military conflict between the Azerbaijani authorities and the ethnic Armenians living in the Nagorno-Karabakh Autonomous Region of Soviet Azerbaijan. Soviet Armenia became an indirect party to this conflict, providing full support to its fellow Armenians. A proclamation of independence by Armenia, Nagorniy Karabakh, and Azerbaijan in autumn of 1991, and the following three-year war, transformed this conflict into an international one. As a strategic ally of Armenia, a strategic partner of Azerbaijan, and co-chair of

the OSCE Minsk Group, Russia has become (and it has been viewed as) the most active external actor in the NK conflict settlement process.

However, these three dimensions, combined with various geopolitical challenges, significantly complicate Russia's interaction with the direct parties to the NK conflict. Russia tries to preserve political and military balances between Armenia and Azerbaijan, to prevent a new full-scale war between these two states, to avoid its own direct military participation in the conflict, and to continue cooperation with the US and France (that also represents the EU) within the format of the OSCE MG. Any miscalculation can cause a significant diminution of its role in Eurasia; Russia also cannot endanger its national security by taking sides or obviously shifting its position regarding the settlement of this conflict.

Russia's Approach

Russia has defined itself in global politics as a "self-standing great power with global reach" that operates in the rapidly changing and less friendly international environment. According to Russia's National Security Strategy adopted in December 2015:

"The strengthening of Russia is taking place against a backdrop of new threats to national security that are of a multifarious and interconnected nature[...] The West's stance aimed at countering integration processes and creating seats of tension in the Eurasian region is exerting a negative influence on the realisation of Russian national interests." Owing to the quickly shrinking spheres of cooperation between Russia and the West, the preservation of a certain level of cooperation is of a great importance for both sides. The OSCE MG can be viewed as such a platform. On the one hand, a consensus among the mediators in the NK conflict settlement was confirmed in the most recent (Nov 2016) Russian Foreign Policy Concept: "Russia strongly advocates a political and diplomatic settlement of conflicts in the post-Soviet space, specifically, Russia works[...] to settle the Nagorno-Karabakh conflict by working together with the other States that are co-chairs in the Minsk Group of the Organisation for Security and Cooperation in Europe (OSCE) and basing on principles set forth in joint statements by the Presidents of Russia, the United States of America, and the French Republic in 2009-2013." On the other hand, Russia's presence in the South Caucasus is considered by its Western counter-partners as important owing to the fact that Russia has been involved in the settlement of the NK conflict from its outbreak in the late 1980s and beginning 1990s. Russia significantly contributed to the only ceasefire agreement signed by all three parties to the conflict - the Nagorno-Karabakh Republic, Armenia and Azerbaijan - in May, 1994.

In the meantime, the mediators silently agreed to establish another mediation track under the aegis - and with direct participation - of Russian Presidents (first, D. Medvedev in 2008-2012, and, since 2012, V. Putin). In this dimension Russian diplomacy had two important contributions. It brokered the verbal ceasefire agreement that ended the four-day April war in 2016. Later, at the presidential meeting in St. Pe-

Author

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tersburg in June, 2016, the parties to the conflict agreed on measures aimed at stabilising the situation in the conflict zone: The number of staff of the Office of the OSCE Secretary General Personal Representative should be increased in order to involve additional international observers in the area of the conflict. The distinction between the Armenian and Azerbaijani positions should be emphasised clearly: For several years the Armenian side has been insisting on introducing additional security measures along the Line of Contact for monitoring a ceasefire and to investigate violations, while the Azerbaijani side, considering these measures unnecessary, has been bluntly rejecting any changes.

Russian diplomatic activity has provoked speculations about the so-called Lavrov Plan, the very existence of which was denied on many occasions by the Minister of Foreign Affairs of Russia. Rumour has it that Armenian forces would withdraw from some territories around Nagorno Karabakh in exchange for its postponed status. In the course of his press conference on 15 January 2018, Sergey Lavrov once again clarified the Russian position in the NK conflict: "The Russian Federation cannot have any concrete plans to solve this problem because it can only be solved by the parties themselves. Russia, along with the United States and France as the three OSCE Minsk Group co-chairs, is doing its best to create conditions for this settlement. ... This problem cannot be solved once and for all by just one document. We need a stage-by-stage approach reflecting an understanding with regard to what is possible now and defining the ways of working on matters that require additional discussions in the interests

that have been approved by all parties, but the devil is in the details. If the parties agree on what the solution should be, it is important, at different stages, to coordinate a number of very complex details affecting issues that are highly sensitive for each party, including domestic political issues."

Strategic Partner vs. Strategic Ally: Trapped in Between?

Russia's position as one of the leading external actors in the NK conflict is quite complicated: Obligated to be nonpartisan in the implementation of its mission as a mediator, Russia has special – and in many ways internally conflicting – ties and relationships with Armenia and Azerbaijan. Russia's differentiated approach to Azerbaijan as a strategic partner, and to Armenia, as a strategic ally became more structured during Vladimir Putin's second tenure.

There are several factors which define Russia's policy in managing its relationships with these two South Caucasus states. In the context of this analysis, the most important are military, economic, and geopolitical aspects.

Russia's Relations with Azerbaijan

In Russia's relations with Azerbaijan, a pragmatism began to prevail based on the intention to minimise the possibility of Azerbaijan's transformation into an alternative supplier of energy resources to the West bypassing Russia. A desire to develop a strong partnership and broad cooperation has required more caution from Russia when dealing with Azerbaijan.

Photo: OSCE



At a OSCE Council meeting in Vienna, Ambassador James Warlick (right), representing the three Co-Chairs of the Minsk Group, and the Personal Representative of the Chairperson-in-Office, Ambassador Andrzej Kasprzyk, informed the OSCE-participating states about recent developments in the Nagorno-Karabakh conflict, 5 April 2016.

80%.) Among them are multiple rocket launchers TOS-1 SOLNTSEPYOK, SMERCH MRL, and SPIKE anti-tank systems. Azerbaijan used them for the first time in the April 2016 war against the non-recognised Republic of Artsakh.

Against the background of US and EU sanctions, arms exports will remain one of the major sources for Russia's budget replenishment. Therefore, it will try to reach a new agreement with Azerbaijan regarding weapons and military equipment supplies. However, according to an Azerbaijani analyst, there is no indication that Baku is going to maintain the same level of cooperation with Moscow in the defence sector: Oil revenues continue to allow Azerbaijan to diversify weapons suppliers.

The economic ties between these two states are also significant: Russian direct investments in the Azerbaijani economy reached US\$3.7Bn in 2017. In the same year Azerbaijani investments in the Russian economy were over US\$1Bn. A further increase can be expected.

Russia's Relations with Armenia

Russia's relations with Armenia are also complicated. Because this state was perceived by Russia a priori as a partner and friendly country (and Armenia has been and still is positioning itself as such), the Armenian-Russian relationship was considered by the Russian political establishment as taken for granted. Russia did not undertake special efforts to establish a strategic partnership; rather, it preferred to impose the conditions for bilateral cooperation.



Photo: US Embassy Baku

On 20 June 2016, Russian President Putin met with Serzh Sargsyan, President of Armenia, and Ilham Aliyev, President of Azerbaijan, to discuss the NK conflict.

of achieving a final settlement, including that of the status of Nagorno-Karabakh." In the meantime, Lavrov was the first to add a new aspect into the conflict settlement, pointing out internal processes in the states, directly involved in the confrontation: "Naturally, there is a general array of principles

Further developments in the Russian-Azerbaijani bilateral relationship were marked, first of all, by an increase of supplies of Russian offensive weapons to Azerbaijan on the basis of the intergovernmental agreement signed in 2010. (Russian share in total arms purchases of Azerbaijan is about

The defence and security domain is of high importance for Armenia due to its direct military confrontation with Azerbaijan and the hostile political-diplomatic relationships with Turkey. Therefore, in Armenian society at large, Russia has been widely viewed as a guarantor of Armenian defence and security (together with the Armenian Army). As a strategic ally of Russia and as a member of the Russian-led CSTO, Armenia has some preferences in purchasing weaponry. The most recent loan in the amount of US\$100M was received from Russia in 2017 to purchase modern Russian weapons. There are also several important bilateral military agreements. In August 2010, the two states agreed to extend the operation of the Russian military base in Armenia until 2049. With the amendments to the Treaty on the Russian Military Base in Armenia, not only the length of stay was extended but also the area of its geographical and strategic responsibility. The new version of Article 3 of the Protocol states that, in addition to defending the interests of the Russian Federation, it will provide, in co-operation with the Armenian Armed Forces, security of the Republic of Armenia across

2008 index. The US and the EU sanctions imposed on Russia directly affect the economic situation in Armenia. The reduction of Russian investments (together with a decrease in remittances from labour migrants in Russia) contributed to an increase of poverty throughout the country.

Geopolitical Deadlock or Nothing but Business?

After losing Georgia to the West, being directly involved in the Ukrainian, Transnistrian, and Syrian conflicts, and evaluating the developments along its western and south-eastern borders as direct security threats, Russia needs to keep both Armenia and Azerbaijan in its orbit to prevent any further military escalation in the Nagorniy Karabakh conflict, thereby maintaining relative stability in this area.

Owing to the fact that Azerbaijan invests significantly in the economies of Russia, Belarus, and Kazakhstan, which are - together with Armenia - members of the Russian-led Eurasian Union, Russia on the one hand, could be interested in offering membership to Azer-

tacks on Armenian territory. A facilitation of the oral ceasefire agreement by Russia did not constrain the latter from implementing its "business" plans to provide weapons to both parties to the conflict.

The April war stimulated the growth of mistrust in Armenian society to the extent that the Armenian ruling elite has been forced to reconsider the state's subordinate status in Russia's geopolitical games. The first serious step in this direction was the "EU-Armenia Comprehensive and Enhanced Partnership Agreement," signed in November 2017. However, it is obvious that Armenia cannot leave Russia's orbit in the mid-term perspective without losing Nagorniy Karabakh.

Concluding Remarks

- Armenia, Russia, and Azerbaijan are tightly bound together by the unresolved Nagorniy Karabakh conflict.
- Both Armenia and Azerbaijan understand that the situation in the conflict area can, under certain circumstances, be transformed into a full-scale war with significant losses on both sides.
- Russia cannot make a choice between its strategic ally Armenia, and its strategic partner Azerbaijan. Intensification of contacts with one of the parties to the NK conflict will inevitably complicate the relationship with the other.
- Any attempt to shift its position regarding the resolution of the NK conflict will come at a high cost for Russia, endangering its integration projects in Eurasia as well as its position as co-chair of the OSCE Minsk Group.
- Although Russia significantly contributes to the continuing militarisation of the South Caucasus region, yet it remains simultaneously interested in preservation of the status quo in the conflict area.
- In the meantime, military supplies to the parties to the conflict strongly contribute to growing doubts regarding Russia's role as a strategic ally and strategic partner in Armenian and Azerbaijani societies, respectively.
- Russia's strategic interests in the Middle East, especially its relationships with Turkey and Iran, to a certain degree depend on stability in the South Caucasus.
- The status quo in the NK conflict can be changed only if the balance of powers in the South Caucasus changes.

The question to be answered is the following: For how long will Russia be able to secure its strategic interests in the South Caucasus while balancing between Armenia and Azerbaijan? Neither Armenia nor Azerbaijan can make any concession regarding Nagorniy Karabakh. Nor do they want to. ■

Photo: The President of Armenia



Military parade dedicated to the 25th anniversary of the independence of Armenia.

the entire perimeter of its borders. This agreement was followed by two others: On a Joint Air Defence System, ratified by the Armenian Parliament in June 2016, after the April war, and on a Joint Military Unit in November 2016, ratified by the Armenian Parliament in October 2017.

I would argue that Armenia does not have - at least at this stage - any security guarantor alternative to Russia.

Russia is still the main investor in the Armenian economy, the most important sectors of which either belong to Russian state companies or are partially under their control. Foreign direct investments in Armenia amounted to US\$130.4M in 2016, which was almost eight times less than the

bajian in this organisation. However, such an offer would definitely complicate, if not endanger, Russia's relations with Armenia.

On the other hand, Azerbaijan has been implementing a non-participation strategy: It avoids membership in any political-military and economic organisation that can compromise its position in the NK conflict. Moreover, it prefers to act through bilateral agreements which provide more manoeuvring space, and also allow Azerbaijan to control and limit the cooperation of these states with its adversary: Armenia.

The outcomes of this policy became visible in the April 2016 war: Members of the Eurasian Union - Kazakhstan and Belarus - did not even condemn Azerbaijan's artillery at-



Security Developments in the Wider Black Sea Region

Priorities of the Romanian Armed Forces

Nicolae-Ionel Ciucă

Photo: MoD Romania



Author

General Nicolae-Ionel Ciucă
has been Chief of Defence of the
Romanian Armed Forces since 2015.

Our world is experiencing an unprecedented level of complexity in terms of challenges to national and international security. In the Euro-Atlantic area, we are confronted with multiple challenges and threats, hybrid, conventional and asymmetric in nature, which are interconnected - from the North Atlantic to the Black Sea Region, from the Baltic Sea to the Mediterranean Sea.

These are in addition to those created by non-state actors or failed states, as is the case in large parts of the Middle East and North Africa.

Geographically, Romania is located both in the wider Black Sea region and in South-eastern Europe, and we believe that it is our responsibility to contribute to the stability and security of these regions. Ensuring regional security requires a continuous

awareness of national decision-makers in the region, but also of Euro-Atlantic security forums and organisations. In my considerations, I will offer perspectives on the existing link between evolving security challenges and the Romanian Armed Forces transformation, taking place both at national level, and within NATO and EU. During the last two decades, the Black Sea region gradually transformed itself from an

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area defined by win-win opportunities, to one of a zero-sum game. In this region, economic, political and military interests always collided, while a number of mechanisms and tools have been established to facilitate dialogue, cooperation and understanding between the various actors at regional level and in the wider context of NATO and the EU. Recent developments in the Black Sea region point to a deteriorating security situation as a result of various triggers, including Russia's actions and its military stance, the

are implemented within the framework of the national defence planning documents, namely the National Defence Strategy and the Government Programme. Based on these, the White Paper on Defence states the objectives of defence policy: to develop robust defence capabilities, to increase strategic credibility within NATO and EU, to strengthen strategic partnerships, to develop international and regional cooperation and to provide interagency capabilities designated to support public authorities in

Summit, to achieve a robust deterrence and defence posture, denote probably the most consistent reinforcement of NATO's collective defence since the fall of the Berlin Wall. By implementing these decisions, the Alliance cohesion, credibility and the transatlantic link were clearly strengthened, and we can see how this works today.

Romania has assumed an active role within NATO. Following NATO Wales Summit, Romania has devoted a great deal of effort to contribute to NATO's cohesiveness, determination, and robustness. Since 2016, two allied command and control elements, namely the Multinational Division South-East HQ and the Romanian NATO Force Integration Unit are up to speed. In 2017, both MND-SE HQ and the Romanian NFIU participated in NOBLE JUMP and SABER GUARDIAN exercises. These exercises demonstrated Allies' capability to project forces in the area and reinforce deterrence measures in the Black Sea Region.

At Warsaw Summit in 2016, the Heads of States and Governments decided on a set of measures designed for a predictable and credible Allied deterrence and defence posture, including establishing an Allied enhanced forward presence – eFP, for the Northern part of the Eastern Flank of NATO and a tailored forward presence – tFP, for the Southern part.

The implementation of the Forward Presence is progressing well. The Multinational Battle Groups are operational in Poland, Estonia, Latvia and Lithuania. As part of Romania's commitment to the Allied decisions, we are contributing a company-level unit to the US-led Battle Group operating in Poland, alongside US and UK soldiers, within the enhanced forward presence framework.

There are also positive developments in implementing the Forward presence in the Black Sea Region, in all land, air and maritime initiatives. The Multinational Brigade South-East, based in Craiova will reach final operating capability in 2018. A number of Allies contribute with staff and with affiliated troops to train together. In the Air Combined Training Initiative, in 2017, United Kingdom, Canada and Portugal have already contributed to enhanced air policing in the region and trained with our air forces, flying allied fighter jets from Romanian Airbases.

In the maritime domain, a Regional Maritime Coordination Function for the Black Sea was established in Allied Maritime Command, supporting coordination among current contributing Naval Forces HQs. Also, the NATO Combined Maritime Framework for cooperation in training, interoperability and maritime situational

Photo: Petrică Mihalache, MoD Romania



Mihai Fifor, Romanian Minister of Defence, visiting Romanian troops in Afghanistan in December 2017

ongoing crisis in Ukraine and the increasing transnational threats originating from terrorist activities and migration.

The rise of violent non-state actors and criminal networks builds up additional pressure for the region. Other issues of concern are related to threats generated by ongoing crises in the Middle East. Furthermore, the Balkan region serves as a transit area for radical elements heading towards Western Europe and there is the risk that such radical elements could plan terrorist acts in the receiving states.

Against this background, we consider that the Black Sea Region will remain an area defined by a complex, unstable security environment and by multiple security challenges, which increase the risks and threats not only for the riparian countries, Romania included, but also for the entire NATO Eastern flank.

In order to adequately address these challenges, substantial and continuous efforts to transform and adapt the Romanian Armed Forces were planned and implemented. In order to give you a better understanding of the ongoing adaptation and transformation of Romanian defence policy, I will briefly address some key aspects of our national security and defence framework.

The objectives of Romanian defence policy

are oriented both towards developing national capabilities and implementing Romania's commitments within the regional and international organisations.

In our view, the security developments in 2014 marked a turning point in NATO's approach to collective defence. NATO decided to address the security concerns and adopt an enhanced deterrence and defence posture as a means to protect and defend the Allied territories and populations. The measures adopted by the North Atlantic Alliance are defensive and proportionate, in line with international law and commitments assumed by the member states.

Solidarity is NATO's centre of gravity. NATO decided to stay strong and united, in agreement with the principle of indivisibility of security of its member states. The essence of an enhanced deterrence and defence posture on the Eastern Flank can only emphasise the cohesion and unity of NATO members and underline that any action against any ally will be treated as an attack on all allies.

Let us recall that the Allied decisions made at Wales Summit to implement the Readiness Action Plan, following Russia's illegal annexation of Crimea, and then at Warsaw

awareness has been established. In the area of training and increasing interoperability, the Combined Joint Enhanced Training, designed as a regional platform for cooperation through participation in exercises and training activities, keeps progressing towards ensuring a continuous Allied presence in the region.

However, the security situation from the Baltic Sea through the Black Sea and into the Mediterranean is not seen merely as a regional issue, but it is of concern to the entire Alliance. NATO has pledged to protect the Eastern Flank and the eFP and tFP are linked, building on a continuous and coherent set of NATO measures on the whole Eastern Flank.

To contribute to the security of the Alliance as a whole, Romania has made a very responsible commitment by strengthening NATO's deterrent and defence stance, participating in missions and operations, supporting NATO partners and building new capabilities.

Moreover, Romania is also concerned about emerging security threats and actively contributes to establishing NATO's role in countering new threats and challenges to allied security – terrorism, proliferation of weapons of mass destruction, cyber attacks, and energy security risks.

Romania's security relies on developing the national instruments of power, as well as on our membership in NATO and the European Union, and on our strategic partnerships. It goes without saying that Allied deterrence and defence is based on the capabilities of the individual member states, which is why we believe that defence begins at home.

At the Romanian Armed Forces' level, based on the provisions of the defence planning documents and correlated with the defence planning objectives assumed in NATO, we are implementing the Programme for Armed Forces Transformation and Development by 2026 and beyond. The programme provides for developing the capabilities we need for tomorrow, and ensures the ability and flexibility to constantly adapt capabilities to developing challenges. The programme has a 10-year horizon and is reassessed periodically to optimise the AF response to evolving risks and threats. It also aims at developing stronger cyber defences and a robust response to hybrid warfare, including through increased resilience and civil preparedness.

By streamlining capability development across various planning documents, the programme better connects national defence plans to NATO plans, provides for developing more effective operational capabilities and a force structure better aligned with the evolving security challenges, contributes to increasing interoperability and ensures the ability to optimise training to increase operational capability and readiness.

Turning to fulfilling the commitments assumed by Romania in NATO and the EU, the Armed Forces contribute to missions and operations in Afghanistan, in the Western Balkans and in Africa to promote international security and stability. We stand committed to the stabilisation of Afghanistan where Romanian Armed Forces will continue to be a major contributor in 2018. We also support the International Community's efforts for the security and stability of Iraq and Syria, and for the neutralisation of DAESH and terrorist and extremist organisations. In Afghanistan, more than 26,000 Romanian soldiers have been sent to this theatre of operations over the last 15 years. The Resolute Support Mission continues to be the main operational priority for us in terms of contributions to operations abroad. Romania is the fourth NATO contributing state, with almost 700 soldiers deployed in Afghanistan.

Romania is also actively promoting concrete actions at the

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regional level, to foster and strengthen multilateral cooperation among the countries in the area. I would like to emphasise that we are firm supporters of stability and security in the Balkans. Maintaining military cooperation and support would help the countries in the region to build effective institutions and to reform the security and defence sector in order to deal with issues like poor economic environment, social and ethnic tensions, terrorism, and the presence of foreign fighters.

Turning to our priorities in 2018, I want to emphasise that it is a very important year for the Romanian Armed Forces. Our objectives are to keep developing effective defence capabilities, to respond to all types of threats including hybrid ones, continue implementing our commitments within NATO and EU and provide the forces for missions and operations abroad, provide support to civil authorities for crisis situation management and for increasing resilience. In the larger perspective, the

with other effects and capabilities of the operation, in order to achieve synergy in a joint environment. We are in the process of establishing a Cyber Defence Command which is to achieve its initial capability by the end of 2018. Additionally, we develop cyber capabilities in accordance with the assumed NATO capability targets and we participate in NATO and national cyber exercises.

Moreover, Romanian Armed Forces continue to develop its intelligence, surveillance and reconnaissance (ISR) capabilities, in order to improve situational awareness in the region. In this regard, the specific force structure has already been adjusted accordingly and we keep working in doctrine, training and in procuring modern equipment, to build effective and interoperable ISR capabilities, in support of national and Allied operational requirements.

The transformation of Romanian Armed Forces, sustained by procurement of modern defence systems and enhanced training

Consequently, we will see new pieces of equipment in our units sooner. New types of armoured personnel carriers, unmanned aerial vehicles, anti-tank man-portable systems, long-range target acquisition radars, multirole aircrafts, multirole floating fighting assets, wheeled transport platforms, and other capabilities are on our agenda.

This year we are initiating eight major procurement programmes: multi-purpose corvettes, mobile anti-ship missile launchers; modernisation of infantry fighting vehicles, modern armoured personnel carriers, C41 system with ISTAR Integration capabilities, PATRIOT advanced surface-to-air missile systems; SHORAD-VSHORAD integrated weapon systems; and last, but not least – HIMARS long range multiple launcher rocket systems.

Let me offer just a few examples. The PATRIOT systems will enter into service of the Romanian Land and Air Forces in 2019. The procurement of such ground-based air defence capability will provide for a strengthened national and regional security, serving as a deterrent against some of the challenges of the security environment.

The acquisition of three HIMARS (High Mobility Artillery Rocket Systems) battalions answers to the requirement to have effective, interoperable, modern artillery equipment. HIMARS is a reliable deterrence capability and one of the most precise combat support systems tested and used in real missions, which conveys technical superiority and operational advantage.

Romania also consolidates its naval defence capabilities. The procurement of new corvettes offers the Romanian Naval Forces the operational ability and confidence to accomplish their assigned missions. The Romanian Naval Forces are planning for a modern, credible and balanced force structure, similar to the other states bordering the Black Sea Region.

In my considerations, I intended to stress Romania's strong resolve to contribute to the security of the whole Alliance. The Romanian Armed Forces independently and together with the North Atlantic Alliance are capable and determined to defend national and Allied territory and population. Either by strengthening the deterrence and defence posture on NATO's Eastern flank and in the Black Sea region, or by participating in operations, in building adequate capabilities, we are very responsible in addressing the challenges to national and international security. Through all our contributions to maintaining peace and stability, Romania is recognised today as a reliable and robust partner in the Allied and international community. ■

Photo: USMC



US Marines with Black Sea Rotational Force (BSRF) salute alongside NATO forces for the opening ceremony of Exercise Platinum Lynx at Babadag Training Area, Romania, on 19 September 2016. The BSRF is a multilateral security cooperation in the Black Sea, Balkan and Caucasus regions designed to enhance collective military capacity, promote stability and build relationships with partner nations.

inter-institutional cooperation has greatly increased, in terms of operating and training and exercising together.

In order to effectively counter all challenges, the Romanian Armed Forces aim at developing a modern force structure, better correlated to the challenges we face, based on the resources allocated for defence. Such an example is the new Special Operations Command, which has just been established on 1 March 2018 as part of a deeper transformation of the Romanian SOF.

Another example is related to cyber defence. Recognising cyberspace as an operational domain underlines the need to synchronise cyberspace operations effects

programmes, support the development of national defence capabilities and increase readiness, preparedness and interoperability, in order to prevent, deter and defend against external aggression. The procurement of modern defence systems, combined with the upgrades of existing systems, will ensure that our Armed Forces are better prepared to achieve their main task, the defence of the national and NATO territory and populations.

A noticeable effort is Romania's commitment to allocate 2% of GDP to the defence budget. In 2018, the share allocated to major acquisitions and Research & Development is 37%, above the NATO guideline level of 20% of the defence budget.



Bulgarian Armed Forces in the Context of Security Challenges in the Black Sea Region

Andrey Botsev

Geographically, the Black Sea plays an important role both as a separator and as a bridge between Europe and Asia, the "East" and the "West". It is a border for NATO and the EU. Ten years ago, the Black Sea region was perceived as marginal for global geopolitical processes.

However, due to the dynamic interactions on the international stage, the importance of the Black Sea is increasing, as growing economic and military activities in the region demonstrate.

Significant changes in the geopolitical situation worldwide and in the Black Sea region in particular have led to a shift in the political, military and economic interests of countries and international organisations around the world.

Gradually, the region is taking on the role of an energy hub, with more and more energy projects being completed or under development. This brings many actors with economic interests into the region. These processes increase the value of the region as a strategically important region, both for Europe and Asia and globally. The importance of the region has been stressed time and again at NATO and EU summits.

Another peculiarity of the Black Sea area is that it borders a number of conflict areas, which are called "low intensity" or "frozen" conflicts. In addition to the situation in Crimea and Eastern Ukraine, there are similar conflicts in South Ossetia, Abkhazia, Nagorno-Karabakh and Transnistria. While we are all looking forward to a peaceful resolution of these conflicts, their long history suggests a more pessimistic perspective for their resolution. It is therefore more realistic to expect them to remain a challenge to security in the region.

There have been considerable changes in the strategic security environment in recent years. New forms of military action

have been demonstrated, the activities of extremist and separatist groups have increased, and new risks and threats have arisen from politically unstable states, frozen conflicts and mass migration.

All of them have a direct impact on the countries at the Eastern and Southern borders of the Alliance, including Bulgaria, located on the crossroad between Europe and Asia.

The changing security environment has led NATO and the European Union, as the main guarantors of security and stability in Europe and the world, to seek ways and approaches to respond to emerging challenges by building capabilities appropriate to new risks and threats.

A key element of NATO's Assurance Measures is the strengthening of its Forward Presence in the Eastern and South-Eastern parts of the Alliance's territory. NATO's Forward Presence in the Black Sea region is defined as a tailored Forward Presence aiming at preventive deterrence of potential use of force in crises resolution.

Bulgaria pursues a balanced and pragmatic regional policy with the aim of creating lasting stability in South-Eastern Europe (SEE) and the Black Sea region and consolidating common European standards in relations between the countries of the region. With regard to the surrounding conflict and destabilisation areas, Bulgaria as



From left to right: The President of the Republic of Bulgaria and Supreme Commander-in-Chief of the Armed Forces, Rumen Radev, the Deputy Prime Minister for Public Order and Security and Minister of Defence, Krasimir Karakachanov, the Chief of Defence, Lieutenant General Andrey Botsev, and the Commander of the Navy, Rear Admiral Mitko Petev, at the Distinguished Visitors Day of the BREEZE 2017 national naval exercise with international participation

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the external border of the EU and NATO is an intersection of two strategic directions: Strategic Orientation OST and Strategic Orientation SOUTH.

In the military aspects of security, particularly in national defence, it should be noted that it is planned, prepared and implemented within the framework of the collective defence of NATO and the EU's Common Security and Defence Policy.

work Brigade to which Bulgaria has affiliated military formations. This initiative strengthens the Alliance's deterrence and defence on its South-Eastern border and enhances the situational awareness and force interoperability.

To prove its continued adaptiveness and relevance to the changed security environment, NATO has established several Force Integration Units (NFIUs) located in the

territorial sea waters, they deter them and respond adequately to the threat. If necessary, they render support to the structures of the Ministry of Interior to protect the maritime borders, participate in the protection of the sovereign rights when jurisdiction and control in the adjoining area, the continental shelf and the exclusive economic zone of the Republic of Bulgaria need to be exercised.



Photo: MoD Bulgaria

Live firing at BREEZE 2017

The current focus is on the practical implementation of the defined measures for NATO's tailored forward presence. These include the deployment of a multinational division and a multinational brigade headquarters in Romania, to which Bulgaria has declared a contribution, an increased number of joint NATO exercises with land, naval and air force units in Bulgaria and Romania, and a stronger presence of NATO permanent maritime groups in the Black Sea.

NATO takes a balanced and effective approach to meet the challenges while avoiding unnecessary confrontation and escalation. The increasing number of deployments of Standing NATO Maritime Groups in the Black Sea and regular exercises with member state navies in the region ensure a high level of operational readiness and preparedness of the armed forces to operate in the specific environment of the Black Sea basin. These measures have the necessary deterrent effect and are effective in reducing tensions, avoiding confrontation and increasing security in the region while ensuring that the armed forces maintain their readiness for rapid deployment in case of escalation.

Part of the tailored Forward Presence is the Romanian initiative to establish a Multinational Division Headquarters (MNDHQ) "Southeast" and a Multinational Frame-

work Brigade to which Bulgaria has affiliated military formations. The responsibilities of these formations are: maintaining situational awareness, facilitating coordination in training and exercises as well as the rapid deployment of NATO forces by coordinating their reception, stationing and onward movement on the territory of the host-country and supporting collective defence planning and its synchronisation with the national planning processes.

Their continuing task is to guarantee the sovereignty, security and independence of the country, to protect its territorial integrity and - together with the allies to deter the enemy forces and to keep threats away from the state borders while contributing to the maintenance of peace and international security.

Currently, the Armed Forces missions - "Defence", "Support for International Peace and Security" and "Contribution to National Security in Peacetime" - remain unchanged but the spectrum of employment of the Armed Forces to protect national security is becoming wider.

The Armed Forces are carrying out reconnaissance and surveillance and maintain a full and informed awareness of the situation in the maritime spaces of the Republic of Bulgaria. In cases when military vessels fail to respect the legal status of the ter-

ritorial sea waters, they deter them and respond adequately to the threat. At the same time, the unprecedented refugee crisis and mass migration flows in the wake of conflicts in the Middle East and North Africa have made it necessary to assign new tasks to the Armed Forces in assisting the Ministry of Interior on safeguarding the state border. The new developments have demanded a change in the training of the Armed Forces and a more intense mode of interaction, coordination and conduct of joint exercises with the MoI and other structures from the National Security System.

Another significant security risk for Bulgaria stems from the possibility of infiltration of individual foreign military fighters and possible establishment of extremist/terrorist cells. To counter such threats the Armed Forces have been assigned additional counter-terror tasks.

The increasing number of military flights close to the borders of our national airspace has necessitated some changes in national legislation enabling Air Policing in the airspace of the Republic of Bulgaria to be carried out by the Bulgarian Armed Forces alone or jointly with allied Armed Forces.

Other strands of work related to the improvement of homeland security are: introducing military training for secondary school students, exploring possible options for in-

stituting voluntary military service and improving the capacity of the military reserve. To meet the challenges, the Armed Forces are developing and maintaining balanced capabilities to plan and effectively conduct operations, prioritising combat effectiveness, information support, command, control and communication.

To develop and adapt the Armed Forces' defence capabilities to the changed security environment and to better coordinate national planning with NATO, a Programme for Armed Forces Capabilities Development until 2032 will be drafted. The first step, the development of a Roadmap for the 2032 Programme, has already been taken.

In order to achieve an optimal balance between the necessary defence capabilities and the execution of the missions and tasks of the Armed Forces, defence spending in 2018 will be kept at a level not below the level achieved.

A gradual increase in defence spending is projected for the period 2019-2024, depending on the country's economic growth.

In compliance with the decisions of the NATO Summit in Wales in 2014, the Council of Ministers has adopted a National Plan to increase defence spending to 2% of GDP until 2024.

The plan contains two annexes relating to the implementation of NATO commitments and EU Permanent Structured Cooperation commitments. One of the key objectives of the country is to spend 20% of its defence budget on new and NATO-interoperable weapons and equipment at the highest technological level.

The Republic of Bulgaria uses the potential of various regional initiatives and mechanisms to strengthen confidence in the region and regional cooperation. In this context, active efforts are being made to intensify regional initiatives to make the necessary progress on the security issue in South-Eastern Europe and the Black Sea.

The process of the South-Eastern European Defence Ministers' Meeting (SEDM) is a mechanism for interaction between countries in the field of defence and strengthening regional stability and security.

Over the years, the number of the SEDM countries has increased to fifteen and Moldova has an observer status. The priority objectives of regional cooperation in this format are:

- Enhancing mutual understanding, confidence and transparency among the South-Eastern European countries;
- Supporting the processes of Euro-Atlantic integration and building defence capabilities in accordance with NATO standards;

- Building capabilities for participation in peacekeeping and humanitarian operations;
- Cooperation with international organisations (NATO, EU, UN, OSCE).

The main initiative within the SEDM process is the establishment of the Multinational Peace Force in South-Eastern Europe (MPFSEE).

One of the major areas of defence cooperation are the joint exercises and training of the Armed Forces (with Romania, Turkey, Georgia, Ukraine, FYROM, Serbia, Montenegro, Bosnia and Herzegovina, Albania). This is an important form of interaction because joint exercises and training improve the troops' skills and experience to operate in a multinational environment and also to enhance interoperability among the countries' armed forces.

When it comes to multinational regional formats, there are three initiatives in which Bulgaria cooperates with all countries from the region: the SEDM Process, the Balkan Countries Chiefs of Defence Conference and the Multinational Peace Force South-Eastern Europe (MPFSEE). Practical examples in this field are the "Seven Stars" Exercises conducted by the South-Eastern Europe

ian institutions in response to crises of non-military nature. Joint military exercises and training are also conducted in the framework of NATO and with partners from the NATO Partnership for Peace Programme.

For Bulgaria it is important that NATO and EU keep their strong commitment to stability and security in the region as well as to the European and Euro-Atlantic integration of the Western Balkans. In this regard, the Government of the Republic of Bulgaria has placed the European perspective of the countries from the Western Balkans region high on the main priorities list of the Bulgarian Presidency of the Council of the EU. This opportunity for the countries is an important driver for domestic reform and of key importance for regional and common European security and stability.

The development of the regional cooperation in the security and defence area and bilateral military cooperation among the countries from the region is a precondition for advancing the overall process for improving the security environment and the prosperity of the Black Sea countries.

The growing importance of the Black Sea region for international security increases the obligations of the Republic of Bul-



BREEZE 17 followed a specific scenario of crisis response with forces from the NATO members Belgium, Bulgaria, Canada, France, Germany, Greece, Italy, Norway, Poland, Romania, Turkey, the UK, the US, and from Georgia, the Republic of Moldova, Sweden and Ukraine as signatories of the Partnership for Peace programme.

Brigade (SEEBRIG), the Field Exercises and Command Post Exercises as well as the SEESIM exercise series – computer assisted exercises of the countries from Southeast Europe and the Black Sea region with the training goal to define, analyse and test rules and procedures for military support to civil-

garia as an external border of NATO and the EU and requires the development of interoperable and modern armed forces that respond effectively to current risks and threats and have capabilities adapted to the changing security environment and national resources. ■



Defence Reform in Ukraine

Alex Horobets

The latest reform of the national security and defence system of Ukraine began at the end of 2014.

The reform of the armed forces should be sustainable and there are indications of improvement in Ukrainian legislation and expert committees in recent years. The main difference to the past lies in the fact that previous attempts at reform have been unsystematic and declarative.

have been blocked for many years by negative factors inherited from the Soviet system which have never been overcome. This led to a situation in which, because of the inefficient reforms, the state security authorities themselves could become a threat to national security.

accession to the North Atlantic Treaty. As early as 1997, the Ukrainian Verkhovna Rada adopted the "National Security Concept", which defined the country's vital national interests and the means of protecting them. At the same time, international treaties with neighbouring states guaranteed Ukraine's borders, and the "Charter for a Special Partnership between Ukraine and NATO" defined Kiev's Euro-Atlantic course.



Photo: NATO

Pavlo Klimkin, Minister of Foreign Affairs of Ukraine, and NATO Secretary General Jens Stoltenberg opening the meeting of the NATO-Ukraine Commission on 31 March 2017

Experts at the National Institute for Strategic Studies point out that the defence sector is the primary authority responsible for national security and for protecting citizens' rights and freedoms, state sovereignty, territorial integrity and constitutional order.

The Institute's analytical paper "The State and Perspectives of Security and Defence Sector Reform in New Political Realities" notes that Ukraine's defence capabilities

The aim of this article is to provide readers with up-to-date information on defence sector reforms in Ukraine and their practical implementation.

Let us begin with the analysis in 2004, the last year in which President Leonid Kuchma was in power. After the Orange Revolution (a campaign of protests, demonstrations, strikes and other actions of civil disobedience in Ukraine organised and carried out by supporters of Viktor Yushchenko), the inauguration of the new President of Ukraine took place on 23 January 2005. Yushchenko was known to support Ukraine's European and Euro-Atlantic integration. In the military arena, the format of the Accelerated Dialogue was adopted as a first step towards Ukraine's

Civil Society Involvement

The administration of Ukrainian national defence has remained unchanged for a long time and, despite the constitutional reform of 2004 and changes in the defence sector in 2004-2007, there has been no progress at the strategic level.

At that time, however, the transition from quantity to quality was long overdue. If any innovations were made, they were low impact; attempts at reform failed to bring all components of the security and defence sector up to European norms and standards. The most pressing issue for the Ukrainian Army was the optimisation of the structure and strength of the armed forces, their deployment as well as the creation of a system of automated troop control.

It took until 2010 for civil society to develop an awareness of armed force control and defence issues.

As early as October 2006, 13 NATO countries and Ukraine met in the Portuguese city of Sintra to launch a project titled "Ukraine-NATO Partnership Network to Raise Civilian Awareness Society" led by the NATO Secretary General. The aim of the project was to develop a strategic partnership between civil society and Ukrainian law enforcement authorities.

In 2007, the Swiss government asked the NATO Communications Office in Ukraine to invite the Geneva Centre for Democratic Control of Armed Forces to the "Ukraine-NATO Partnership Network to Raise Civil Society Awareness" as one of the executive bodies of the project. In 2010, the Geneva Centre for Democratic Control of Armed Forces published the "Almanac of Management in the Security Sector of Ukraine 2010" and "Integrity

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Education and Fighting Corruption in the Defence Sector" in Ukraine. The aim of the publication was to familiarise Ukrainian law enforcement agencies with a comprehensive approach to fighting corruption.

Finally, on 11 May 2017 a panel on Ukraine's "Defence Legislation" was presented in Kiev, which was also prepared in cooperation with the Geneva Centre for Democratic Control of Armed Forces. This was the sixth expert panel in the last ten years on the theoretical foundations of Ukrainian defence sector reform, and the publication of the conference proceedings in English and Ukrainian provided an opportunity for dialogue between Ukrainian and Western experts.

During Viktor Yanukovich's presidency, the development of the security and defence sector was mainly in the hands of the Head of State, and he had clear priorities. The armed forces' reform proposal, developed by the Ukrainian MoD, proposed to reduce the number of Ukrainian troops from 192,000 down to 70,000 in 5 years. According to the "Reform Concept for the Armed Forces of Ukraine", this should have been achieved by 2017. At the same time, the army had to be converted to consist of contracted servicemen, a reform project which had been one of the priorities since V. Yanukovich came to power. The main argument for the reform was that there were no major military threats at the time.

In theory, the Ukrainian experts' ideas for reform of the defence sector were correct, but they lacked awareness of the threat posed by the neighbouring country. Since the independence of Ukraine, the authorities did not consider it necessary to have a strong army, which made sense at the time; after all, Ukraine's allies at that time were the United States, Russia, the EU and neighbouring countries. The army could only alleviate potential conflicts with Turkey and Romania, and conflicts with Russia were unimaginable.

The Crimea Crisis

One turning point was in 2014, when all the theoretical reform proposals were put into practice. NATO demonstrated its support for Ukraine when the crisis in Ukraine became a key issue at the NATO summit in Wales on 3-5 September 2014. A series of emergency legislation has been adopted to strengthen national military security, improve defence mobilisation and promote measures to combat corruption. The aim of the reforms was to modernise the military equipment of the Ukrainian armed forces,

restore their technical readiness, improve military training and optimise their structure. Efforts have also been made to bring military personnel closer to NATO standards. The expected end point of this modernisation was the year 2020.

As early as 2004, the division of the Ukrainian armed forces into three components was proposed: the combined rapid reaction forces, the main defence forces, the supporting and reinforcing forces. The creation of a special unit within the army, called "Special Operations Forces", is currently particularly successful. The formation of these separate forces is laid down in the Ukrainian Strategic Defence Bulletin of 2016; the designated implementation timeline of the document's provisions is 2020.

The Special Operations Force includes special-purpose units and information-psychological special operations units.

On 28 November 2017, NATO's military representative in Ukraine publicly told Lieutenant General Vladimir Askarov that the Ukrainian Special Forces could join NATO's reaction forces in 2020. For this purpose, the Special Operations Force 2019

of this important document, the country's defence sector was analysed and the experience of anti-terrorism operations (ATO) assessed. This has shed light on a number of problems in the deployment of defence forces against existing and potential threats, including problems with the management of defence forces, regulation, cyberspace threats, corruption and the incomplete transition to the treaty principle for soldiers.

Another important document is the "Concept for the Development of the Security and Defence Sector in Ukraine", a framework of views on the medium-term development of Ukraine's defence capabilities, adopted in 2016. The goals of the concept include

1. Restoring territorial integrity within the internationally recognised national borders of Ukraine;
2. The establishment of a national crisis response system;
3. Timely detection, prevention and neutralisation of external and internal threats to national security and cybersecurity.

Photo: EUCOM



US Marines secure a beach after an amphibious landing in Nikolaev, Ukraine, during exercise Sea Breeze on 19 July 2017.

is now being certified. Representatives of the Alliance also noted the progress made in the development of the Ukrainian Special Forces.

The Strategic Defence Bulletin 2016 referred to above provides a basis for achieving the strategic goals. For the adoption

This development concept for the Ukrainian defence sector provides for a broad involvement of non-state organisations with the purpose of contributing to national security and state defence. The potential scope for getting such organisations involved is large: they can provide

services for the peacekeeping tasks of the armed forces or set up research institutions dealing professionally with security and defence issues.

The Presidential Decree "On the Doctrine of Information Security" of 29 December 2016 spelled out Ukrainian interests in the information sphere and it defined threats and priorities of state policy in cyberspace. The decree was urgently needed, because of the emergence of threats to national security in the information sphere. This is why the Ukrainian State Centre for Cyber Defence was established. In many respects, the Ukrainian experience of countering disinformation campaigns is unique; foreign experts have repeatedly agreed. The centre currently develops national algorithms and procedures to protect electronic information on the basis of NATO standards and ISO/IEC.

Cooperation with NATO

Countering information wars is one of the potential areas of cooperation between Ukraine and NATO. To date, both Ukraine and NATO countries are constantly confronted with a huge flow of fake information and propaganda which can be used both separately and in combination with economic and political pressure, energy blackmail, and so on. That is why threats in the information sphere need coordinated interstate opposition.

A priority of defence sector reform is the command and control system which, for many years, has not been in the hands of a single centre. With the creation of the Military Office of the National Security and Defence Council (NSDC) and the Main Situation Centre of Ukraine, the mechanisms for steering the defence sector have already been improved. By now, the Ukrainian defence sector is an integrated system under a single leadership.

In May 2017, Sergey Maslovsky, head of the Main Directorate for Defence and Mobilisation Planning of the General Staff of the Armed Forces of Ukraine, said that the General Staff had developed a new control system for the armed forces, and he also said that the principle of separating functions which has been adopted in the armed forces of the NATO countries is a promising management system. In the fall of 2017, about 40 percent of the General Staff's subdivisions were organised in the structure of NATO headquarters, the Ministry of Defence of Ukraine reported.

In 2018-2020, the operational management of the Land Forces, the Air Force and the Navy of the Armed Forces of Ukraine needs to be optimised, along with a new distri-

bution of tasks, functions, powers, responsibilities and accountability. The National Security and Defence Council, headed by the President of Ukraine, is monitoring the implementation of the defence reform.

In 2017, practical cooperation with NATO was intensified, and, throughout the next year, the Armed Forces of Ukraine will continue to transfer to NATO standards. On 17 January 2018 in Kyiv, the Ministry of Information organised a round table on "Ukraine – NATO – 2018. Forecasts and Expected Events." In 2017, Ukrainian units participated in 17 multinational exercises (three on Ukrainian territory and 14

The same effort should be spent on increasing the mobility of the troops, optimising their management and increasing the civilian component of the Ministry of Defence of Ukraine.

It is crucial that the citizens of Ukraine and authority representatives need to be aware that they live in conditions of constant military aggression, a threat to national security and territorial integrity. And, in such conditions, reforming the national security and defence system is the most important element to preserve and develop an independent Ukrainian state.



Opening of the NATO-Ukraine Commission chaired by Ukrainian President Petro Poroshenko on 10 July 2017

abroad). More than 13,500 servicemen of the armed forces were involved in the exercises. Additionally, 303 representatives of the Ukrainian Army took part in 170 NATO events in 2017. Thanks to foreign advisers in Ukraine, in 2017, 240 standards were developed, which are based on NATO standards, and work continues on another 250 standards. In 2018, Ukrainian Army Representatives plan to participate in 19 multinational exercises.

The priorities of Ukrainian defence policy before 2020 are as follows:

1. Restoring territorial integrity;
2. Establishing an effective security and defence sector;
3. Improving combat readiness;
4. Reform and development of intelligence, counterintelligence, law enforcement agencies;
5. Expanding the partnership with NATO;
6. Ensuring national security in the foreign policy sphere.

To date, Ukraine has made significant progress in reforming the defence sector. Key laws of the reform are the National Security Strategy of Ukraine, the Strategic Defence Bulletin of Ukraine, the Military Doctrine of Ukraine, the Law on the National Guard, the Law on the Legal Regime of Martial Law, the Law on Amendments to the Laws on the Armed Forces of Ukraine and the Defence of Ukraine, and so on.

But we should be realistic and understand that the successes achieved are not final, and in the years to come the systematic strengthening of the country's defence capability must continue. Ukraine is a nuclear-free country and the first country in the world which voluntarily abandoned its huge nuclear arsenal. In addition, Ukraine declared its desire to become a member of NATO, and it achieved significant progress in this regard. Considering the difficult situation from which Ukraine has emerged, the experience of this country is unique. ■

The Black Sea Region: Turkish Interests and Strategies

Korhan Özkilinc

At the crossroads between Europe, Eurasia and the Middle East Turkey is playing a growing role in the Black Sea region. This changes the geostrategic balance.

The Black Sea is the third largest sea on the borders of the European Union, after the Mediterranean and the Baltic Sea. Although the Black Sea has almost become an inland sea, it connects Southern Europe, the Middle East and Southern Russia. The strategic importance of the Black Sea is even more evident when we take a closer look at its geographical location: through the Bosphorus Strait and the Dardanelles you can reach the Aegean and the Mediterranean Sea; through the Strait of Kerch you can reach the Sea of Azov; through the Rhine-Main-Danube Canal the North Sea, and through the Volga-Don Canal and the Eurasian Canal the Caspian Sea. The riparian countries of the Black Sea region not only have complex economic interests, but also a different understanding of security policy which complicates international relations among them.

Photo: U.S. Navy



USS CARNEY in the Bosphorus Strait before entering the Black Sea in January 2018

Russian-Turkish Relations

A brief historical overview: On 8 December 1991 the Presidents of Russia (Boris Yeltsin), Ukraine (Leonid Kravchuk) and Belarus (Stanislav Shushkevich) signed the Treaty of Minsk, which officially dissolved the Soviet Union and founded the Commonwealth of Independent States on 21 December 1991. In the years following the dissolution of the Soviet Union and the collapse of its economy, there were armed conflicts and wars in the former Soviet regions, particularly in the Caucasus and Central Asia.

NATO exploited the unstable situation by expanding eastwards; on 12 March 1999, Poland, the Czech Republic and Hungary joined NATO, and on 29 March 2004 Bulgaria, Estonia, Latvia, Lithuania, Romania, Slovakia and Slovenia became members of the alliance. These accessions moved NATO's Eastern border to the Russian border. But prior to this, on 27 May 1997, Russia and NATO had signed an international memorandum, the "NATO-Russia Founding Law," to create an equal and

stable partnership and to abandon the deployment of combat troops.

In April 2005 and shortly after NATO enlargement, Russian President Vladimir Putin said in his state-of-the-nation address that the disintegration of the Soviet Union was "the greatest geopolitical catastrophe of the past century," a statement that revealed his aspiration to restore Russia's role as a superpower. Three years later he implemented his intentions in the case of the Caucasus War (2008), the Ukrainian crisis (2013) and the annexation of Crimea (2015). Within a short time, Russia's coastline in the Black Sea had nearly reached its old size.

Energy and Security

From a security policy point of view, the Black Sea is of enormous importance for Russia for two reasons: energy security and military security. As far as energy security

is concerned, Russia has very far-reaching ambitions: Russia is trying to control the energy resources of Azerbaijan, Kazakhstan and Turkmenistan with the aim of influencing the international energy markets.

Russia wants to keep the upper hand in the Black Sea and therefore relies on military strength. This is particularly evident in the construction of defence systems along strategic coastlines, for example in the S-400 anti-aircraft missile system in Crimea and the latest 3K55 BASTION coastal missile systems with a range of well over 500 km near Anapa. In addition, the Black Sea Fleet will be equipped with the latest frigates, corvettes and submarines by 2020. Moreover, Russia is pursuing a strong power policy in the Eastern Mediterranean by enlarging Tartus Naval Base in Syria. This naval base is the strategic gatekeeper of the Black Sea, which protects the Russian Navy's connections to the Indian Ocean and the Atlantic.

What is Turkey's Role?

This raises the following question: What is Turkey's role as an important NATO ally and candidate for EU membership in relation to Russia in the Black Sea? It would be naive to believe that Russia wants to guarantee Turkey's maritime security. But Russia will co-operate with Turkey, and possibly also with NATO and the United States, depending on the political situation, but Russia's real interests are based on dominance, which was also the case in Russia's earlier history. Despite mutual rivalry, Russia is dependent on Turkey for two geostrategic reasons: Firstly, the Russian energy infrastructure depends on Turkey's central location, and secondly, with the Montreux Convention of 20 July 1936 Turkey controls the straits; this treaty regulates, among other things, the presence of warships of non-riparian countries in the Black Sea.

The differing intentions of the two countries with regard to the Black Sea are also evident in Syria. Unfortunately, the different views led to the crisis on 24 February 2015, when a Turkish aircraft shot down a Russian SU-24 fighter over Turkish territory near the Syrian border, one of the two pilots being killed by Syrian rebels. This incident brought relations to an all-time low. On 11 May 2016, Turkish President Recep

Above all, Russia is trying to divert the Turkish government's attention from the Black Sea to Syria. On 1 March 2018, in his state-of-the-nation address, President Vladimir Putin unveiled new missiles and nuclear weapons directed against the Western Alliance, and on the same day Armenia ended the Protocol "Improving Bilateral Relations" with Turkey - a clear message to Turkey. But overall it is interesting to observe how relations between the two countries develop.

US-NATO-Turkish Relations

After the collapse of the Soviet Union, the United States launched the "New Silk Road Initiative" to increase its hegemonic power in world politics, and the Black Sea is an important part of it. Due to its strategic position in relation to the Caspian Sea and Central Asia, the Black Sea is of great importance for the US not only in energy terms but also militarily.

Since 1999, an American oil pipeline has been transporting oil from Baku to the Georgian port city of Supsa. This pipeline was later supplemented by the Baku-Tbilisi-Ceyhan pipeline, which has been in operation since 2005; it bypasses the Russian Baku-Grozny-Novorossiysk pipeline. Russia has now successfully cooperated with Turkey on the major "Blue Stream" pipeline

as initiator in April 2001. BLACKSEAFOR's partners are the Black Sea countries Bulgaria, Georgia, Romania, Russia, Turkey and Ukraine. BLACKSEAFOR's main tasks are maritime security, the fight against terrorism and humanitarian missions.

A few years later, in March 2004, Turkey founded "Black Sea Harmony" (BSH) as a supplement to BLACKSEAFOR, which aims not only to combat international terrorism but also asymmetric threats. BSH has similar tasks to NATO's operation "Active Endeavour" in the Mediterranean region. Russia participated in 2006, Ukraine in 2007 and Romania in 2010.

Because of Russia's aggressive policy and Russian measures against Ukraine, NATO reacted very decisively at the summit in Wales in September 2014. NATO decided to confront the new challenges and concluded the NATO Readiness Action Plan, which is based on the two pillars "adaptation and security measures" and "2% target." As a result, NATO's Multinational Division Southeast Headquarters in Bucharest, Romania, was established in 2015 and two missile defence bases were built in Deveselu in southern Romania, which are now part of NATO's missile defence shield.

The system consists of a radar station in Turkey, many frigates in Spain and a command centre in Ramstein, Germany. Shortly



Photo: Turkish Navy

The Turkish Navy and the US Navy at the US-Ukraine co-hosted multinational maritime exercise Sea Breeze 2016 in the Black Sea

Tayyip Erdogan told foreign generals: "During NATO Secretary General Jens Stoltenberg's visit to Turkey, I told him: You are not visible in the Black Sea. And your invisibility turns the Black Sea into a Russian lake." Currently, relations have improved and are based on mutual benefit. It is obvious that Russian President Putin is trying to remove Turkey from NATO through the sale of missile systems S-400 and energy activities.

project, and the pipeline project "Turkish Stream" is under construction.

The United States is trying to expand its influence in the Black Sea both on its own and with NATO. There have been plans to extend "Operation Active Endeavour" from the Mediterranean to the Black Sea, which has not been approved by the Turkish side. In return, Turkey appointed the Black Sea Naval Cooperation Task Group

thereafter, in June 2017, a NATO manoeuvre for the deployment of the VJTF (Very High Readiness Joint Task Force) took place in Romania. The manoeuvre was developed in response to the Russian annexation of Crimea.

Due to the anti-Turkish attitude of the US Congress, considerations were made to replace Ankara with Bucharest as a privileged partner in the Black Sea. From

a military point of view, this would be completely wrong as Turkey's military is superior to the Romanian military and the economic strength of the Turkish arms industry in particular is worth mentioning. But the situation is different in Bulgaria: the country's opposition disapproves of

the Black Sea. It is obvious that Turkey is using the Montreux Treaty as a strategic instrument for its policy toward NATO and as a tool to reconcile with Russia. It is also paradoxical that Turkey is preventing the confrontation of the two powers in the Black Sea.

Unfortunately, the relationship between the two countries is strained, because the US is trying to establish more than two dozen US military bases in Northern Syria with the help of the Marxist-Leninist Kurdish militia PYD, a member of the PKK. This situation is known in the past; the US has cooperated with Kurdish militias in Northern Iraq, and we all know the result today. The current US approach is heavily criticised by the Turkish population and the Turkish military. The differences between the two countries extend to the Black Sea. Nevertheless, the United States will continue to maintain productive relations with Ankara; the PYD, a PKK henchman, is unable to satisfy the far-reaching regional ambitions of the US. It will take several years for relations to improve but the divide could be used very intelligently by the EU and NATO.

Photo: Gazprom



A pipe-laying ship in the Black Sea operated by the Russian state-owned company Gazprom. The Turk Stream pipeline will connect Russian gas resources to the Turkish gas transportation network, delivering energy to Turkey and South and South-East Europe.

NATO's military presence, which shows that Russia still has influence on its former Warsaw Pact allies. Nevertheless, NATO warships have free access to Bulgarian ports but Romania will be able to exploit the weakness of neighbouring Bulgaria for its advantage in NATO.

A Difficult but Reliable Partner

Turkey is a difficult but reliable NATO partner, even if Turkey's economic interests sometimes outstrip NATO strategies. This has been the case with the Montreux Convention: Turkey has controlled the straits since 20 July 1936. Many Western countries, especially the US, reject the Montreux Convention; in 2006, the US Senate did not confirm the Montreux Treaty because the US felt it should be adapted to the present conditions. On 23 March 2006, US Ambassador Ross Wilson told several journalists in Ankara that the Montreux Treaty was open for re-negotiation and that US ships would have the right to navigate in the international waters of

But the status quo of the Treaty of Montreux could soon change, because the ruling AKP party is planning the crazy "Istanbul Canal" project, an approximately 50 km long canal parallel to the Bosphorus, which will link the Marmara Sea with the Black Sea. Currently, environmental studies are being conducted, and according to environmental associations the environment would be severely affected and the costs are estimated at more than US\$50Bn. Recently, Minister Ahmet Arslan of the Ministry of Transport, Maritime Affairs and Communications issued a statement on the size of the vessels for the canal: tankers may have a maximum length of 275 m and 48 m width at 145,000 DWT; for container ships the maximum length is 340 m and the width 48.2 m at 120,000 DWT. Of course the government hopes for income, but the Istanbul Canal will allow for the passage of warships of non-neighbouring states into the Black Sea which might affect the status quo in the entire region. Conflicts are inevitable; the presence of 100,000 tonnes of American diplomacy in the Black Sea is only a question of a minor contractual change.

EU-Turkish Relations

Very early on, Turkey recognised the economic potential of the Black Sea region and founded the regional economic organisation "Organisation of the Black Sea Economic Cooperation (BSEC)" in Istanbul on 25 June 1992 on its own initiative. BSEC consists of six riparian countries Bulgaria, Georgia, Romania, Russia, Turkey and Ukraine as well as the six non-riparian states Albania, Armenia, Azerbaijan, Greece, Moldova and Serbia. The EU and a dozen countries have observer status only. The main objective of BSEC is to contribute to peace, stability and prosperity and to promote cooperation between the countries of the region. Over time, the objectives will be extended to environmental protection, energy, science, logistics and agriculture, but security is also high on the agenda, notably the fight against organised crime and terrorism.

Black Sea Synergy

The BSEC was supplemented in 2007 by the EU initiative "Black Sea Synergy," which was initiated to exert more influence in the region. Black Sea Synergy aims at far-reaching regional cooperation between the Black Sea countries and between the Black Sea and the EU. Turkey attaches great importance to Black Sea Synergy, as the internal programmes have also led to EU membership; Russia is considered a strategic partner. Since 2009, the EU has strengthened and expanded "Black Sea Synergy" through its "Eastern Partnership" with the post-Soviet states of Armenia, Azerbaijan, Georgia, Moldova, Ukraine and Belarus. From now

on, Russia gradually lost its dominance in the Black Sea to the EU. The Russians did not take countermeasures until five years later. In 2014, under the patronage of Russia, the Eurasian Economic Union (EEU) was founded as a bulwark against the EU. Currently, the EEU consists of Armenia, Kazakhstan, Kyrgyzstan, Russia and Belarus. Particular attention is being paid to the dozens of candidates for enlargement, the most interesting being Nagorno-Karabakh (Azerbaijan), Transnistria (Moldova), Abkhazia and South Ossetia (Georgia), the People's Republic of Luhansk and the People's Republic of Donetsk (Ukraine).

It is obvious that Russia is exploiting the cultural diversity of the Black Sea region as a potential weakness to transform the region as it sees fit, but Russia should not forget that its own country comprises almost 200 ethnic cultures. Russia's policies create a buffer zone against the West and bring two strategic advantages: on the one hand, preventing Western influence in the Black Sea and, on the other, preventing Ukraine and Georgia from joining NATO and the EU. Despite all Russian resistance, Turkey is conducting military exercises with both alliances.

Whether Turkey and Azerbaijan will ever be accepted into the promising EEU is still

written in the stars; Armenia's hostility has increased enormously since the Nagorno-Karabakh war, and we should expect Armenia's veto against it. But we must not overlook the fact that many countries of the EEU have remained on the right track in the democratisation process. Although Turkey and Azerbaijan's fundamental rights are based on Western values, the likelihood of accession to the EEU's Free Trade Agreement is high, given current relations with the EU.

The EU has committed itself to the Black Sea as a geostrategically sensitive area through peaceful projects and it appreciates the value of the sea basin strategy. But for at least five years everyone has been talking about the defence of Europe and the future security and defence policy of the EU (PESCO/Framework Nations Concept). It is only a matter of time before the EU acts independently of NATO in the Black Sea. In the short or long term, Turkey will find its strategic place in the West in such a complicated multilateral situation.

Conclusion

The Black Sea offers Turkey enormous opportunities to become involved in international politics, but the difficult tasks will

require enormous efforts. The national security strategy is multi-faceted and covers maritime and regional security as well as energy security. The development and control of international energy pipelines and trade routes from Eurasia to Europe are top priorities, as is the fight against international terrorism and the suppression of migration flows from Asia to Europe. After the military coup of 15 July 2016, Turkey occasionally sought to resolve the conflict between its neighbours Russia, Ukraine and Georgia and, despite everything, saw the resolution of the Nagorno-Karabakh conflict between Azerbaijan and Armenia as a national responsibility, but Russia's territorial claim in the Caucasus is pushing peace far away. Turkey's cultural heritage contributes to bringing political and economic influence from the Black Sea via the Caspian Sea into the Eurasian region, so that the country gains international importance in Central Asia. Turkey's strategic advantage could be of great importance to the EU as a bridge. Overall, a dynamic and agile Turkey at the geostrategic crossroads between Europe, Eurasia and the Middle East is desirable not only in the sense of "ANIMUS IN CONSULENDO LIBER," but also to secure world peace. ■

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Status Report: The Ukrainian Navy

Eugene Kogan

Undoubtedly, the Russian annexation of Crimea in March 2014 caused serious damage to the Ukrainian Naval Forces. About 70 per cent of the fleet has been lost and what remained is in poor shape and in need of repairs.

The resulting conflict in the Eastern part of Ukraine drew attention, energy and resources away from the difficult state of the Ukrainian Navy towards the urgent needs of the army and air force. The perilous state of the economy has further decreased financial support for the Navy's needs. In addition, a debate on the conceptual vision of the Navy divided the expert community and top naval personnel for about 15 months. In February 2017, it was agreed that the concept of the Mosquito fleet would be pursued until 2020 and then be replaced by a concept of blue and littoral waters. It remains to be seen whether the concept agreed upon will remain valid. Still, both concepts require funds for repairs, construction and purchase of foreign vessels. In addition, Ukrainian shipbuilding facilities urgently need to be modernised, which requires additional funding. In other words, the road to the renewal of the naval forces, including the modernisation of the country's shipbuilding facilities, is a complicated but not impossible one.

The State of the Fleet

In November 2015, the Ukrainian Navy consisted of 11 warships and 39 auxiliary vessels, most of which were in need of repair. At that time when Russia annexed the Crimea in March 2014, Ukraine was deprived of many bases, including the largest base in Sevastopol, and lost about two-thirds of its fleet, including two mine-sweepers and a coastal mine hunter. There is no point in the Ukrainian Navy accepting an offer by Russian President Vladimir Putin in January 2018 to take back the ships that have been lost in Crimea. Repair and maintenance of what was lost back in March 2014 would be more costly than construc-



Coat of arms of the Ukrainian Navy

tion of a new fleet. This is by all means a clear case of economic considerations outweighing Russia's political niceties. It appears that in the meantime Odessa has become the provisional harbour of

Navy is estimated at only a quarter of its former strength and capabilities, with slightly more than 7,000 sailors and officers in total. And while other segments of the Ukrainian Armed Forces are doing considerably better in March 2018 than they were in 2014, the Ukrainian Navy is still struggling to regain its footing, strength and capabilities.

What is more, the Navy's budget in 2016 amounted to just 2% of the MoD's total budget (US\$2.2Bn) or US\$44M, while only 0.5% of the total budget or about US\$11M is spent on procuring weapons and military equipment for the fleet. Even though, according to various estimates, the MoD budget in 2017 rose to between US\$2.4Bn and US\$2.6Bn, data for the naval budget in 2017 were not disclosed. Stepan Poltorak, Ukraine's Minister of Defence said in October 2017 that the budget of the



On the Day of the Ukrainian Navy, Stepan Poltorak, Minister of Defence of Ukraine, honouring Ukrainian Navy servicemen who had taken part in combat operations in the east of Ukraine

Author

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the Ukrainian Navy. However, Odessa was and still is a commercial rather than a military port as it lacks a maritime infrastructure to support and maintain the fleet effectively. Four years after the annexation of the Crimea, the Ukrainian

ministry in 2018 would become a "development budget" without further elaborating on the issue. The MoD felt that it would be good for them to receive US\$5.4Bn in 2018, but only US\$3.2Bn or 2.56% of GDP were allocated in the draft State Budget.

Photo: Ukrainian Navy



The frigate HETMAN SAHAIDACHNIY is the current flagship of the Ukrainian Navy.

In April 2017 the Navy had only three combat ships, several artillery gunboats and one minesweeper to protect the country's 1,350 kilometres of coastline. Most but not all of these naval platforms were designed and built in the late 1970ies and early 1980ies; they are outdated and cannot adequately face the challenges of modern naval warfare. Only one ship, the frigate HETMAN SAHAIDACHNIY, has anti-submarine and missile- and air-defence capabilities, and two new GURZA-M missile-capable patrol boats can be considered modern. With just several

(FMS) programme, in 2015 US manufacturer Willard Marine delivered five 7/11-metre Rigid Hull Inflatable Boats (RIB)-like crafts to the Ukrainian Navy, and in March 2015, Willard Marine shipped spare RIB parts and materials to Ukraine. In November 2016, it was reported that Ukraine was refitting its naval fleet, including repairing its flagship, the frigate HETMAN SAHAIDACHNIY. Repair work is still ongoing, helped by US\$30M worth of US support, which is part of a US\$500M package provided by Washington for the Ukrainian military.

Photo: Ukrainian Navy



A Ukrainian Navy GURZA-M Class boat.

Ka-27 helicopters operational, Ukraine's obsolete naval aviation also has limited capabilities. Finally, the development of the Navy was further hampered by continuing uncertainty about the country's optimal naval concept and a lack of balance between tasks, skills and resources. Both topics are discussed in detail below. Despite the gloomy news, the Navy's sea component was recently expanded. Under the US Navy Foreign Military Sales

Following lengthy acceptance trials designed to resolve some technical challenges, on 6 December 2016, the Navy commissioned two GURZA-M missile-capable riverine patrol boats. The commissioning is part of a wider programme to rebuild Ukraine's naval force structure. In December 2017, four further GURZA-M-boats were built and put into operation, and three more have been commissioned. In addition, back in May 2016,

the Ukrainian MoD signed a contract to build two CENTAUR class coastal assault landing craft that are fitted with guns, grenade and rocket launchers, and are capable of transporting up to 32 troops. They are scheduled to enter service by 2019. In November 2017, the Ukrainian Cabinet of Ministers finally approved construction of four corvettes to be delivered to the Naval Forces between 2022 and 2028. In the same month, Vice-Admiral Ihor Voronchenko, the Naval Forces' commander, said: "The Ukrainian Navy will develop a mine-defence capability (MCM) to regenerate the Navy by 2020."

In addition to upgrading its fleet, Ukraine is increasing the level of training of naval personnel and creating new units of coastal defence forces. The training to combat the separatists in Donbas has increased the professionalism of the personnel of the Navy, and in particular the naval soldiers. Vice-Admiral James Foggo III, then commander of the US Sixth Fleet, in a visit to Odessa in September 2015, commented positively on what he saw of the professionalism of the officer corps of the navy. Part of the training is also being carried out in NATO member countries such as France, Italy and the UK. In addition, as Oleksandr Turchynov, Secretary of the Ukrainian National Security and Defence Council (NSDC), said in November 2016: "We are ready to cooperate with NATO countries in joint patrols in the Black Sea." And last but not least, Ukraine's active participation in the maritime Sea Breeze exercise in the Black Sea enhances Ukraine's and NATO's interoperability and improves skills of seamen and officers. Thus, it can be said that things are slowly but surely moving in the right direction.

In addition to fleet repair and the commissioning of new vessels, the expert community and naval personnel agreed on a fleet concept. Although, as highlighted below, both sides have reached a kind of compromise, the scope and nature of the concept can be revised after 2020.

The Fleet Concept

In 2015, a heated debate on the naval capabilities that the country really needs divided the Ukrainian expert community. One group of experts led by Vice-Admiral Serhiy Haiduk, then Naval Forces commander, proposed a blue and littoral waters concept, arguing that Ukraine was in need of a classic naval force. Apparently, this group forgot that the implementation of their concept would be very expensive and that the country has no means for such extravagance for the next decade.

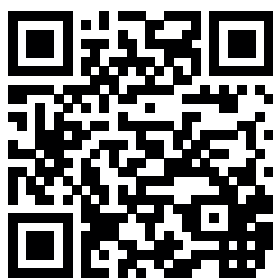
The Soviet mentality, however, is still strongly ingrained in the minds of Ukrainian top naval brass. They should accept the new reality and finally understand that the construction of the post-Soviet Ukrainian Navy requires a different way of thinking and a different approach, a concept of blue and coastal waters is not only a thing of the past, but should be completely discarded. Another group of experts proposed the so-called Mosquito fleet concept. With the aim of solving the pressing security problems in Ukraine's coastal waters, this structure of troops would adopt an asymmetric approach and prioritise the fleet's tasks on the basis of available resources. The Mosquito fleet concept envisages purchasing about 30 small- and medium-sized combatants as the centre of a new naval force structure it aims to have in place by 2020. According to Captain (N) Andriy Ryzhenko, the Navy's Deputy Chief of Staff, and one of the authors of the mosquito fleet concept, the concept is viewed as a more cost- and time-effective option for maintaining presence at sea when compared to a more traditional naval force structure. These small vessels would act asymmetrically to exploit the adversary's vulnerabilities and prevent the adversary

to approach the country's coastline. In other words, defending harbours and ports, securing critical infrastructure and countering landing operations of an adversary are the main tasks of the Mosquito concept. The aforementioned GURZA-M and CENTAUR combat boats appear to constitute a sizeable proportion of the fleet that is currently under construction. The latter naval concept ultimately secured support from the high command. In late February 2017, Vice-Admiral Voronchenko, who replaced Haiduk in July 2016, referred to the Mosquito fleet concept as "the best option for the Navy up to 2020." However, in November 2017 Voronchenko added that: "the Mosquito fleet concept is intended as an interim solution for the short term, until building a classic fleet becomes sustainable." This structure will "allow us to perform the core tasks of our navy, namely coastal defence, general, and offensive operations." It appears that Navy officials failed to reconcile with the Mosquito fleet concept which they considered as an interim solution only. Still, it would be premature to say that the interim solution will be off the navy agenda by 2020. The final concept of the fleet will be work in progress.

An Interim Solution

To conclude, the current state of the Ukrainian Navy seriously hampers its ability to deter and defend the country against the types of sea threats that Russia is currently practicing. What is more, a lack of modern equipment precludes Ukraine from conducting effective anti-surface, anti-submarine and air-defence warfare as well as mine-countermeasure missions or Ukrainian harbour protection operations. In addition, Ukraine requires modernising its shipbuilding sector that was left struggling over the last decade and longer. A successful implementation of the Mosquito fleet concept should go hand-in-hand with developing and enhancing the Ukrainian Naval Forces' interoperability with NATO. All this requires funds that are currently in short supply but that is no reason not to seek to build new boats, to strengthen cooperation between the Navy and NATO countries and to steadily improve the state of the shipbuilding industry. US military assistance is important since naval systems delivered under FMS programmes save funds for procuring non-US funded equipment. As for the construction of naval aviation this one remains a long-term objective that requires a steady allocation of financial resources. ■

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The Romanian Air Force

Georg Mader

The Romanian Armed Forces, and in particular the Romanian Air Force (Forțele Aeriene Române) cannot be compared with larger Western European air forces, but they are more visible than others in the region.

NATO's decision at the Warsaw Summit in July 2016 to step up defence and deterrence on the Eastern flank in response to Russia's aggressive behaviour in Ukraine and elsewhere has increased Romania's strategic exposure as a key NATO ally in the Black Sea region. In recent months, US President Donald Trump and NATO Secretary General Jens Stolten-

berg have repeatedly cited Romania as a NATO ally already meet the 2% target, and yesterday Romania announced they will also meet the target this year, adding one more European nation to those meeting the goal.

Moscow's hybrid and open intervention in Ukraine from 2014 sparked concerns about Russia's intents in the region which in turn prompted military spending

equipment is old or obsolete and urgently needs to be upgraded or replaced." And air forces operating combat aircraft are often the most expensive branch of the armed forces today - if there are no large warships. Subsequently, not only the acquisition costs, often reduced by offset payments or cheaper second-hand aircraft, but also a hefty operating budget must be made available. Otherwise you may have a number of modern platforms but without allocating appropriate operating costs you may end up like Austria, the author's home country. While Romania is much poorer than neutral and non-aligned Austria, which spends a ridiculous 0.7% on defence and where thousands of Romanians migrate to for work or even for begging, Bucharest has surprisingly overtaken its wealthier neighbours, at least when it comes to available platforms.

Combat Aircraft: Dwindling MiGs

Retirement of the swing-wing MiG-23 in 2000 and a failed attempt to upgrade the MiG-29s with the SNIPER programme by circumventing the Russian OEM led the Romanians to team up with Israel's ELBIT Systems to upgrade 112 MiG-21 FISHBED to the LANCERS from 1995 on. Until 2002, a total of 111 were modernised, 71 of which were -M and -MF/MF-75 variants modernised under the LANCER-A designation (for ground attack), 14 were -UM variants designated as LANCER-B (trainer), and another 26 MF/MF-75 versions were modernised under LANCER-C designation (air superiority), able to use both Western and Eastern ordnance such as the R-60M, R-73, MAGIC-2, or PYTHON-III WVR AAMs. Of all these aircraft, only 26 LANCER-B/C are still operational since December 2016.

When Bulgaria and Romania joined NATO, Bulgaria swore to replace its MiG-21 and -29 and to acquire eight new fighter aircraft by 2016, but even two years after that date nothing has happened. After it appeared that SAAB would make the



Photo: Georg Mader

Romania's inauguration of its first F-16 by former Defence Minister Mihnea Ioan Motoc

berg have repeatedly cited Romania as a "model student" of determination and political will to raise defence spending to a NATO-specified GDP target in the next decade.

Stoltenberg said at the Munich Security Conference in February: „Several Europe-

to increase by 7% in 2017. From 2014 to 2017, defence spending among East European states has increased by 34% in real terms. Romania and Bulgaria also increased defence budgets by 26.9% and 24% respectively. According to Romanian military sources, Bucharest will spend around €10Bn (US\$12Bn) on defence procurement in the next decade, which is remarkable in light of a US\$197Bn GDP in 2017.

More than a decade after the collapse of "Conducator" Ceausescu's Communist regime, a document from the Romanian General Staff stated that "75% of military

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race with eight Gripen' -C/D in 2017, the new Bulgarian Minister of Defence only this month made another proposal to procure new fighter aircraft to replace the remaining - too little flown - MiGs and to seek new offers for new and used aircraft.

The situation in Romania is very different; the Romanian MiG-29 were phased-out back in 2003. Only recently, however, the annexation of the Crimea by Russia vis-à-vis the Romanian Black Sea coast has made the modernisation of Romanian air defence evident. When the Kremlin built up its forces on the peninsula, Russian aircraft began to patrol the Black Sea. Romanian aircraft have been forced to intercept these Russian planes when they approach the country's air space. However, it is not particularly credible to intercept or deter Su-27S/30SM FLANKERS or Tu-22M3 BACKFIRE bombers with ageing MiG-21s. This is why Bucharest asked NATO to step in and assist for an interim period, and since 2016 US, Canadian, Portuguese and British jets have been bolstering Romania's air defence on a rotational basis. Last August, the author witnessed "Operation Biloxi" with RAF TYPHOONS flying out of Mihail Kogălniceanu Air Base near Constanța on the Black Sea. The author was told by local RAF officers that two TYPHOONS had been scrambled by Russian VKS Tu-22M3s the day before.

48 Carpathian Ghosts

For the reason that the acquisition of a substantial number of newly-built, latest generation platforms is out of question, Romania turned its sights on used and overhauled fighters, while never-



Photo: Georg Mader

An upgraded IAR-99C SOIM based at Bacău Air Base



Photo: Georg Mader

A Romanian IAR-330 PUMA, a licensed version of the Aerospatiale SA-330 transport helicopter

theless making the change to Western and NATO-compatible equipment. With a first contract signed on 30 September 2013 between Romania, Portugal and the US, Romania acquired 12 used but overhauled and upgraded F-16AM/BM (two-seater) aircraft. Technically, they were bought via "C N Romtehnica" under the "Peace Carpathian" programme, with third-party transfer authorisation coming from US authorities. The total contract volume was €628M, VAT included. At the time, the Portuguese defence minister explained that the agreement was for the sale of nine used Portuguese and three ex-USAF F-16. Romania paid €108M for the aircraft and another €78M to Portugal for their modernisation, provision of training and logistics. Additional costs of €442M included the renovation of Fetești Air Base, the adaptation of the infrastructure to new aircraft, procurement of weapons and additional electronic equipment. The first six F-16 were delivered in late September 2016 in a distinctive grey paint-scheme called "Carpathian Ghost", followed by three more aircraft in December. The last three aircraft were delivered in October 2017

and they formed the 53rd "Warhawks" Squadron at Fetești Air Base.

In addition to the 12 aircraft, Romania also bought the following equipment: 60 AIM-9M SIDEWINDER WVR-AAMs with a number of captive training-missiles (CATMs), 30 AIM-120C AMRAAM BVR-AAMs with five CATMs, 18 AGM-65H MAVERICK ATGMs with four CATM, 10 guided GBU-12 bombs, three sets of AN/ALQ-131 ECM-pods, 15 airborne and two terrestrial sets of MIDS Link 16 datalink-terminals, 13 inertial satellite GPS/INS-sets and 48 LAU-129-launchers. The package also included spare parts, maintenance tools and all other possible logistics.

Romania is aiming for a further expansion of its combat fleet, following the government's decision to implement the aforementioned 2% of GDP for defence purposes in 2017. Former Defence Minister Benjamin Les told the parliament: "My intention is to make the decision for another 20 F-16 fighters this year. We need more jets to strengthen our air force capability. Romania intends to buy another 20 F-16 fighters from the US." In March 2017, the Parliament and Supreme Defence Coun-

Factbox Forțele Aeriene Române

Founded: 1913

Current Commander:

MajGen Laurian Anastasof

Strength: ~9.500

Flying inventory: MiG-21 LANCER (26), F-16AM/BM (12), IAR-99 "Soim" (18), IAR-330 (~50, of which 24 SOCAT), IAR-316 (6), Yak-52 (12), C-130B/H (4), C-27J (7); GBAD: MIM-223 HAWK, S-75 (SA-2), 2K12 "Kub", GEPARD mobile AAA;

Air Bases: Câmpia Turzii, Fetești, Bacău, București-Otopeni, Boboc, Constanța/Mihail Kogălniceanu, Timișoara/Giarmata, Brașov (GBAD), Capu Midia (range).

cil (CSAT) approved the decision for the procurement of another 12 to 20 F-16s. Although the legal process could soon be completed, it is unclear where these airframes would come from, as F-16 production at Fort Worth was ended in favour of the F-35. And while new-built F-16V for Bahrain are in the pipeline, a future Block-70, merely existing as an artist's impression, is offered to India.

other 36 second-hand F-16s from the US. Discussions with our US ally are already under way," Tutuianu explained. And on 20 February 2018, Mihai Fifor, another successor in the Department of Defence, also held course when he explained that it was a major concern to expand the fighter fleet, citing the dwindling readiness of the remaining 26 LANCER MiG-21s. Fifor also mentioned the procurement of pos-

carefully looked into. I also spoke to my Portuguese colleague in Brussels. They can't even sell us four more, but they are willing to support us with aircraft from the US, as they did with the first 12".

While Lockheed-Martin has been awarded a US\$24M contract (confirmed by the Pentagon in April 2017) to provide the FAR with a Block 15 training system, logistics support and software development until April 2021 as a 100% FMS sale, disadvantages remain: Used aircraft are a good choice for countries with small air forces and tight budgets, but carry the risk of higher maintenance costs and faster obsolescence in the long term. Politicians need to explain to the media and the public how second-hand military equipment can increase the nation's defence capabilities. It remains to be seen whether the current acquisition strategy, which, as Romanian sources suggest, sees the "Fighting Falcon" as a bridge to the final purchase of the F-35, can ever become reality for a nation like Romania, or whether the price of the F-35 will ever decline to a level affordable for Eastern European economies.



Photo: Georg Mader

A former German GEPARD anti-aircraft artillery system at Campia Turul Airbase

In contrast to Bulgaria, where an incoming new government totally turned the selection (for GRIPEN) upside down, the new Romanian defence minister Adrian Tutuianu confirmed the procurement decisions taken earlier; next to GBAD (ground-based air-defence) additional F-16s will be among the nation's three top defence procurement priorities: "We need more jets to face the threats. We need 48 aircraft; Romania will buy an-

sibly up to 36 F-16s. In an interview with Evz.ro, he explained that, "General Nicolae Ciucă, the Chief of Staff and the Forțele Aeriene believe that they can set up a serious defence when they have what we need: Three squadrons of 16 planes each." He discusses the issue in the US in early 2018, knowing that the F-16s are no longer manufactured. "So they will be second-hand, but while they might come from US surplus, their status and flight record will be

Leonardo Upgrades SOIM

Even during the communist era, the Romanian aviation and aerospace industry cooperated with Western manufacturers, which was very unusual at the time. Examples are the French-licensed Aerospatiale helicopters produced since 1968 or the collaboration with Yugoslavia's SOKO with the light strike-jet IAR-93 ORAO. This tradition continues to this day, with the latest example being a modern Italian radar by LEONARDO integrated into the domestically designed and operated jet-trainer IAR-99 SOIM (Hawk). Announcing the deal on 29 August, the European sensor provider said the VIXEN 500E AESA radar has been chosen by Romania's National Institute for Aerospace Research (INCAS) for its new trainer demonstrator programme IAR-99 TD. The project is based on the basic IAR-99, which will be modified by INCAS and the aircraft manufacturer AVIOANE CRAIOVA. The company identified the aircraft as the third prototype of the SOIM programme. The Romanian Air Force operates an active fleet of 18 IAR-99s which are between 16 to 29 years old. The service is the only operator of that aircraft which has a Rolls-Royce VIPER engine, similar to the Czech L-39 ALBATROS.

According to Catalin Nae, General Manager at INCAS, TD means to fully test and further develop technologies for an



Photo: Georg Mader

A French ALOUETTE helicopter license-produced in Romania



Photo: Alabama ANG

A Romanian Air Force MiG-21 LANCER in a dogfight with a USAF F-16

advanced trainer, with enhanced sensing and combat capabilities. LEONARDO believes a successful outcome could lead to further opportunities: "The sale of the VIXEN 500E might lead to Romania's fleet of IAR-99s being retrofitted with the new radar as part of a wider upgrade programme. We further see commercial potential outside of Romania and are looking forward to working with INCAS to address this," LEONARDO's Airborne and Space Systems managing director Norman Bone explained.

Carpathian PATRIOTS

Long-range GBAD systems may compensate for the lack of fighter aircraft while complementing the existing force. Interoperability with the US and other NATO allies operating such systems (Germany, The Netherlands) or plan to acquire them (Poland, possibly Sweden) played a significant role for Romania when the country also opted for the PATRIOT air and missile defence system in late 2017. During exercises with US forces, PATRIOT proved interoperable with Romania's current MIM-23 HAWK systems. The deployment of missile defence assets to Deveselu in Romania as part of the European Phased Adaptive Approach (EPAA) was another argument in favour of PATRIOT, as they can complement Standard SM-3 missiles. Finally, the PATRIOT system was cheaper than other alternatives, such as MBDA's SAMP/T system or MEADS.

On 29 November 2017 Raytheon announced that Romania had signed a letter of acceptance to buy the PATRIOT air defence system from the US. The agreement paves the way for Romania's PATRIOT force to rapidly reach its initial operational capability and for contract negotiations to go forward between the US government and Raytheon, while a first

payment of US\$910M to the estimated US\$4.6B was made in November 2017. Then defence minister Adrian Țuțuianu has stated that Romania intends to field the new missile system already this year when the first battery arrives. Romania will receive seven PATRIOT Configuration 3+ fire units, 56 GEM-T, and 168 PAC-3 interceptor missiles, according to the US Defence Cooperation Agency.



Photo: NATO

A MiG-21 LANCER flying low over the Black Sea

According to Raytheon representatives, Aerostar Bacau has the opportunity to deliver components for Romania's PATRIOT systems, as well as for the entire global PATRIOT inventory, which consists of about 220 units owned by 14 countries.

Helicopter Modernisation

As mentioned above, Romania was unique among the Warsaw Pact nations in developing its aeronautical industry not strictly along Warsaw Pact rules. In 1968, France licensed helicopter production to the state-run IAR Ghimbav factory near Braşov. Two types have been produced locally for 30 years: IAR-316B, a licensed version of the ALOUETTE IIIB,

and IAR-330 PUMA, a licensed version of the Aerospatiale SA-330 transport helicopter. For the latter, Israel's ELBIT was chosen in 1995 to upgrade 24 helicopters with the SOCAT (Sistem Optronic de Cercetare şi Anti-Tanc).

Romania operates 68 of these two helicopters, most of which are more than 30 years old and need to be replaced. Moreover, Romania lacks a dedicated attack helicopter platform and has been using the armed SOCAT-PUMAs for the attack and close support role. Attack/anti-tank helicopters, thus are a priority, but in the past five years, Romania's need for SAR-helicopters for the internal security forces has been highlighted by a series of accidents and tragedies which required a faster intervention by first responders. Over the last three years, three international helicopter manufacturers have reportedly been in contact with the Romanian authorities regarding a possible rotary acquisition: Airbus, Bell and Sikorsky. But no public tender has been issued nor has the number of helicopters Romania wants to acquire been specified. Most likely, Romania will operate a mix of types.

Since there is a domestic industry, there will be a demand to produce locally, like at IAR Ghimbav. The government wants Romania to become a regional helicopter hub and provide helicopters for both its armed forces and its neighbours, if they are interested. IAR Ghimbav has ongoing negotiations with Bell-Textron Helicopters which is why the AH-1Z and the UH-1Y, selected by the Czech Republic, are likely to be considered. But Bucharest has also signalled that it will acquire an undisclosed number of helicopters from Airbus, also to be assembled locally. In December 2017, the MoD began talks with Airbus for an initial order of four H215M helicopters, for which there already is a line at IAR Ghimbav. ■

Bulgarian Procurement and Arms Exports

Eugene Kogan

When it comes to allocating funds to defence budget, Bulgaria's recent and current administrations have not been up to task.

Bulgaria's procurement programme is linked to the Ministry of Defence (MoD) budget allocations. Back in 2015, defence budget was US\$664M or about 1.16% of GDP. One year later, defence budget stood at US\$769M or 1.31% of GDP. However, in 2017 budget decreased to about US\$585M despite the notion

The Bulgarian government has neglected the country's defence budget, capabilities and procurement programmes over the past decade. Prime Minister Boyko Borisov's current government plans to change the negligence of recent years and implement procurement programmes cannot be taken for granted. After all, Borisov

sity but rather as a long-term target that should be accomplished in an unspecified future. As early as February 2017, Managing Prime Minister Borisov had disregarded the wish of former President Rosen Plevneliev to increase the country's defence budget to at least 2% of GDP by 2024. Since then Borisov has not changed his mind and it is not to be expected that there will be a gradual increase in defence funding in the coming years. Borisov's attitude towards increasing the defence budget has not changed since his first-elected government back in July 2009 despite the fact that back in 2014, Bulgaria committed itself at the NATO Summit in Wales to a defence spending target of 2% to be reached by 2024. In an interview on 17 November 2017, President Rumen Radev has reinforced the author's view by saying that "Bulgaria is still lagging behind in building military capabilities. What is more, Bulgaria is moving away from the requirement of Article 3 of the NATO Treaty to develop its own capabilities, as well as the Lisbon Treaty, obliging EU member states to improve their military capabilities."

Moreover, in 2015, 70% of the defence budget was already spent on personnel costs, including military pensions, and the situation did not improve in 2016 and 2017. As long as the majority of the budget is spent on personnel costs, the funds for procurement requirements are not sufficient. In order to break a vicious circle of perpetual scarcity of funds for procurement, the Ministry of Finance presented plans to privatise the large state-owned arms manufacturer VMZ Sopot in 2018 and the arms exporter Kintex in 2019. The idea was that the proceeds from the sale should be used for the acquisition of new fighter aircraft. In May 2017, however, Bulgaria stopped privatisation without giving any explanations.

Lack of coherence in the allocation of defence budgets in conjunction with divergent, if not contradictory, views on the



Photo: Scott Wagers / U.S. Air Force

A paratrooper from Bulgaria's 1st Special Forces Battalion with US soldiers during exercise "Thracian Spring" at Bezmer Air Base, Bulgaria

that more funds should be allocated. Therefore, the proposed plans of the Ministry of Finance that Bulgaria should spend BGN4.4Bn (€2.25Bn) on defence in 2018 should be taken with a grain of salt; such an increase is unlikely to happen despite the wishes of MoD officials.

Author

Eugene Kogan is a defence and security expert based in Tbilisi, Georgia.

has led several Bulgarian governments since July 2009, and today we see the results of the governments led by Borisov, which can be described as failure. As far as Bulgaria's arms exports are concerned, we can see different results: Arms exports increased significantly between 2014 and 2016. The official figure for 2017 will be published in summer 2018. Therefore it remains to be seen whether there is a further increase in arms exports.

Bulgarian government officials do not see the NATO-required benchmark of 2% GDP for the defence budget as a neces-

restoration of the country's defence capabilities and a lack of pressure from NATO members therefore lead to repeated delays in the procurement issues discussed below.

In addition, the Borisov government does not see the changing strategic environment around the Black Sea region as a threat to Bulgaria in particular; as early as February 2017, a spokesperson for the Bulgarian Ministry of Defence said: "Bulgaria has not committed itself to participate in a permanent Black Sea navy," led by its NATO ally Romania. The spokesperson added that, "in 2017 the country is not planning any major international naval exercises such as Black Sea Breeze, which took place in July 2016."

As a result, a *laissez-faire* foreign policy is pursued by the government, which does not regard the NATO benchmark as one that should be pursued steadfastly. Borisov also sees Russia as a partner rather than an opponent, and Bulgaria's economic considerations are more important to Borisov and his government than the common position of NATO and the EU towards Russia. Bulgaria's procurement plans are being delayed so as not to irritate Russia and to maintain friendly and trusting relations with Russia. That is why it can be said that

although Bulgaria is a NATO member state, it has chosen Russia as its defence partner. The government officials will probably reject the author's statements outright, but this is to be expected.

Procurement Plans versus Sobering Reality

Back in April 2016, then Minister of Defence Nikolay Nenchev said that, "A project to acquire two multi-purpose patrol ships with modular design to replace the obsolete Soviet-era built patrol ships for the Bulgarian Navy is to cost BGN820M (€419M)." The project was and still is part of a €1.24Bn defence procurement package for the Bulgarian Air Force and Navy approved by the government in late March 2016 and approved by parliament in June 2016. However, the initial acquisition programme has a maximum tax-free value aforementioned. With the changes to tax legislation in 2017, under which the potential contractor was legally obliged to repay 20% of the approved amount of tax, this budget declined significantly. Even though Bulgaria has held preliminary talks with the EU and NATO member states about the potential acquisition of ships and a visit of French President

Emmanuel Macron to Bulgaria in August 2017 to discuss the participation of French companies, no final decision has been made so far; the recent naval tender follows a competition that Bulgaria launched 10 years ago and then cancelled due to fiscal strains. It is therefore a senseless business to speculate if and when a final decision is likely to be made.

The same holds true for Bulgaria's fighter modernisation and procurement efforts with which the country intends to upgrade its Soviet-era fleet of 15 MiG-29s and 14 Su-25s since it joined NATO in 2004. A final decision has not yet been made, although the long-term procurement programme and the interest of international manufacturers in the sale of combat aircraft has been made public. The repeated statements by Bulgarian government officials that the Swedish Saab GRIPEN won the competition are not true, and the Swedish manufacturer admitted this fact in September 2017.

Krasimir Karakachanov, Minister of Defence, told the Bulgarian Parliament on 10 November 2017 that, "By the end of July 2018 tendering and awarding procedure for the new fighter aircraft must be completed." However, the budget law 2018 adopted by parliament in Decem-

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ber 2017 did not provide any funds for procurement. That is why Karakachanov's statement should be treated with a grain of salt, despite the minister's optimism.

As the entire tendering process took a long time, in August 2017, Karakachanov had already requested funds to maintain the airworthiness of the current fighter and strike aircraft of the Bulgarian Air Force. At the time Karakachanov said that: "only eight of MiG-29s and four of Su-25s were in a serviceable condition. [As a result], the minister has held talks with representatives of RAC MIG about the options for maintaining the MiG-29 fleet," but no word was said about maintenance of the Su-25s. The Bulgarian MoD has asked RAC MIG to overhaul and maintain 15 MiG-29s in a four-year deal worth about BGN81.3M (US\$49M) on 11 December 2017, but no agreement was signed yet. Whether or not RAC MIG will ultimately go ahead with the business remains to be seen.

Although Bulgaria, as a member of NATO, is obliged to keep at least one squadron of 12 fighters in good flying condition, the reality is different. Therefore, in June 2017, the Bulgarian Parliament authorised NATO to contribute to the protection of the country's airspace.

Karakachanov's report on the planned acquisitions submitted to the government in September 2017 also mentioned procurement of 198 armoured fighting vehicles (AFVs) at a cost of BGN1.22Bn, with repayments of BGN100M annually up until 2029. The implementation of the project would allow employment in all areas of ground operations, even at night and under extreme climatic conditions. In June 2016, the Bulgarian parliament already refused the green light for the acquisition of AFVs. Therefore, as with the above-mentioned procurement plans for combat aircraft and patrol ships, there are currently more questions than answers and doubts about the government's sincerity in implementing the plans.

Arms Exports on the Rise

Borisov's *laissez-faire* domestic procurement policy has led to constant delays, accompanied by the indecisiveness of the government and blaming others, such as President Radev, for the government's mistakes. On the other hand, Bulgaria has substantially increased its arms exports between 2014 and 2016. According to a report by the Bulgarian Government's Inter-ministerial Commission for Export Control and Non-Proliferation of Weap-

ons of Mass Destruction, Bulgaria has exported arms worth more than €1Bn in 2016, compared with €642M in 2015 and €402M in 2014.

Major customers of Bulgarian arms were and still are Iraq and Saudi Arabia, followed by the United States, Afghanistan, Croatia, Azerbaijan, India, Egypt and Russia. July 2016 data on 2015 arms exports show that Bulgaria exported arms and ammunition to Iraq for €159.6M, while Saudi Arabia bought arms worth €92.4M. According to the report, in 2016 Bulgaria exported arms and ammunition worth €259.2M to Iraq, while Saudi Arabia bought arms worth €238.9M, the US bought arms worth €97.8M and Afghanistan bought arms worth €55M. Bulgarian arms exports to NATO and EU members were about €200M.

The Bulgarian arms company VMZ Sopot increased its revenues to about BGN501.3M (US\$277.7M) in 2016, a 400% increase compared with 2015. The Bulgarian arms manufacturer Kintex has tripled its net sales in the first half of 2017 from about BGN50M (€25.5M) to BGN152.3M (€77.8M) compared to the same period last year.

With the escalation of conflicts in the Middle East, Bulgaria's defence sector has steadily increased its turnover. As long as the conflicts in the Middle East continue, Bulgarian arms exports could continue.

Finally, the frequent changes of governments and the government's differing views on the best weapons system, combined with the government's indecisiveness, make the procurement of weapons systems difficult, if not impossible.

Another aspect that must not be forgotten is that Prime Minister Borisov is not keen to spend any money on the purchase of, for example, fighter aircraft and patrol boats. So far, the delaying tactics

for purchasing the abovementioned goods have worked quite well and there has been no real pressure on Borisov to



Boyko Borisov, Prime Minister of the Republic of Bulgaria, at a troop visit

Photo: U.S. Army

change his tactics and increase the appropriations for the defence budget. Bulgarian officials may not agree with the author's claim regarding procurement, but the way in which the procurement process for combat aircraft and patrol ships has been going on for more than 14 and 11 years respectively supports the author's position; the Bulgarian government is unwilling to tackle accumulated problems seriously. It was therefore not surprising that in September 2017, Karakachanov presented the government with a report on the planned acquisition of combat aircraft, naval patrol ships and AFVs, which provided for deferred payments until 2029 to mitigate the effects on the state budget. Unless there is pressure from NATO headquarters, Borisov's government sees no urgency to increase the defence budget and implement its procurement policy.

With regard to the steady increase in arms exports, Bulgaria has managed to sell goods that had been in stock for some time and are now finally finding their way to customers in the Middle East. However, let us remain cautious when it comes to forecasting an increase in arms exports from Bulgaria. ■

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New Danish Defence Agreement

Jørgen Bo Leimand

Responding to emerging threats, Denmark's Government issued a new Agreement for the Danish Defence 2018 - 2023 which will substantially increase defence spending.

Photo: USMC



Soldiers of the Danish Home Guard receiving a briefing prior to conducting urban warfare training at Camp Grayling, Michigan. The troops joined the 24th Marine Regiment for an international exercise designed to improve urban patrolling, stability operations and counterinsurgency tactics.

Threat Assessment

"Global threats are more serious than at any other time since the fall of the Berlin Wall. Threats can occur anywhere in the world, both far from Denmark and in our region. Danish Defence enforces the sovereignty of the Kingdom of Denmark and ensures the continued existence, integrity and security of the nation. A robust Danish Defence and preparedness is the prerequisite for a safe society." This is the baseline for the new Defence Agreement. You could also say that the government by this agreement responds to the requirement from President Trump to the NATO Nations to live up to the promises made at the Wales Summit 2014. In addition, you can also claim that this agreement is a response to the threat coming from Russia which has forced NATO to deploy forces to the Baltic States including Danish troops. Finally, you can claim that this is a response to the migration and terrorist problem. By studying the agreement, you will find that all three issues are covered. Basically, it is the first time since the fall of the Berlin Wall and the dissolution of the Warsaw Pact that there is an increase in the Danish

Defence budget. Some of the equipment that is needed now was scrapped and sold or donated 20 years ago.

Elements

With the new six-years Defence Agreement from 2018 to 2023 the Parties behind the agreement agree to substantially increase defence spending. By 2023 the annual budget increase will reach DKK4.8Bn. There will be more operational units and troops and a more agile, less top-heavy organisational structure – meaning fewer generals and more foot soldiers. The national emergency preparedness will be significantly strengthened with more people and more equipment, and cyber security will be heavily enhanced. The substantial increase will strengthen the Danish Defence in the areas described below.

NATO

Denmark's contributions to NATO's collective deterrence and defence will be increased with investments in new capacities, for example a brigade for deployment, air

defence missiles for our frigates, a 50% increase in special operations patrol units and a capacity for anti-submarine warfare. Together with NATO, the Danish Armed Forces must have sufficient potency and robustness to deter others from attacking our allies and ourselves. The new Defence Agreement will secure a considerable increased Danish contribution to NATO Response Force (NRF). The newly held Defence Ministers meeting in the NATO HQ in Brussels showed that the new Danish Defence agreement is well in line with the new NATO capacities approved by this meeting.

A New Deployable Brigade

Based on the Danish Army's current operational capabilities, the Danish Armed Forces will establish a deployable brigade, which in the framework of NATO can help to deter a more equal opponent and be part of the collective defence. The brigade will strengthen the Danish Armed Forces' overall fighting power and the mobility of the defence, and it will strengthen the ability to operate in a NATO context. The elements in the brigade can be deployed in smaller units when they are not part of the brigade structure. This strengthens the ability to participate in international missions at different scales and thereby tailor the contribution to the actual scenario. This deployable brigade could be used in a Baltic context should it be necessary. This new initiative shows that the Danish Armed Forces are now foreseen to be used primarily for a territorial defence and as an element in NRF and not as an expeditionary corps as in the last 25 years.

This new brigade will have in its inventory both new and enhanced capabilities and the shopping list might look like this:

- More operative battle tanks to establish a third battle tank squadron.
- Ground-based air defence units including multi mission radars.
- Anti-tank missile systems to protect the combat battalions.
- A third artillery unit.
- An additional light recce squadron.
- Additional ISR equipment.
- A drone capacity.
- More than 100 new lorries for logistics support and brigade HQs support,
- Engineering equipment, medical units, etc.




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With the investment in 2018-2023, the Armed Forces will in 2024 have a deployable brigade of approximately 4,000 soldiers which will meet the NATO force requirements for a medium brigade.

Contribution to National Security

The Danish Armed Forces shall contribute more to the safety and security of the Danes. The overall resources of the society are utilised to the utmost if the Danish Armed Forces' ability to support the police is significantly strengthened in the following areas:

- The armed forces will continue to assist police forces, including border control and surveillance tasks, if the police need this type of support. In this context, the defence may, in whole or in part, carry out the operational support for border control, including the support from the Home Guard. However, the command and control rests at the police HQs.
- The armed forces will deploy on a permanent basis a FENNEC helicopter to the Copenhagen area on a very high readiness alert to be used by the police in anti-terror operations.
- The Royal Life Guard will set up an additional rifle company of conscripts which can be made available to the police within a few minutes.
- Funds are allocated for the armed forces to provide high-readiness units to the police in the event of terror, etc.
- The armed forces take over the operational responsibility for personal protection in high-risk areas. You will see soldiers on patrol and on guard in some areas of Copenhagen.
- The armed forces will establish additional special operations force patrols, which will be able to support the police if needed.

A Light Infantry Battalion

A light infantry battalion (up to approx. 500 soldiers) will be established. The battalion can be deployed by air or sea and can be part of the collective defence, certain international operations or national tasks, including support to the police. The light infantry battalion consists of a staff, a staff company and three standing light infantry companies and are equipped with mortars, air mobile vehicles and anti-tank missiles. This should be seen as tool to assist other NATO forces in case that Danish territory is needed as a staging area before the NATO troops are deployed to the conflict area which could be the Baltic area. The battalion might be responsible for

Host Nation Support according to NATO rules. Every year during the cold war period the AMF (Allied Forces Central Europe Mobile Force) held the so-called "Express Exercises" somewhere in NATO. In 1981 the last "Express Exercise – Amber Express" took place on Zealand; the Danish Armed Forces might have to dig up some of the experiences gained from those exercises and some of the old plans might still be valid.

A Royal Life Guard Company

The armed forces' contribution to Denmark's security is, as shown above, strengthened with the increased support to the police, for example with protection and guard units and with personnel on high readiness who can support in case of terrorist attacks etc. The national military service and mobilisation system will be strengthened so that more troops can be mobilised in case of a crisis or war. The best example of this is the additional rifle company established by the Royal Life Guard in the barracks at Gothersgade next to Norreport Station in

- The Special Operations Command is reorganised to strengthen the operational capacity. In addition, more personnel will be added to the Ranger Corps and the Frogman Corps. During the agreement period 2018-2023, the number of special operations force patrols is increased by more than 50%.
- The Special Operations Command is reinforced with equipment for a deployable Special Operations Force Headquarters (Composite Special Operations Component Command). Here Denmark cooperates with The Netherlands and Belgium.

Conclusion

While the Danish Armed Forces are working hard on implementing this new agreement there are still current operations to handle. Those are FRONTEX – Sicily, Baltic Air Policing – Lithuania, Enhanced Forward Presence – Estonia, Operation Inherent Resolve – Iraq, Standing NATO Mari-



Photo: NATO

The Danish Contingent during a flag-lowering ceremony aboard Camp Leatherneck in Afghanistan on 21 July 2014. The ceremony marked the end of the DANCON mission for the Denmark Army with Regional Command (Southwest).

Copenhagen. In case of a terrorist attack at Norreport Station the rifle company from the barracks at Gothersgade can be at the scene within 5 minutes and can secure the area while the police initiates investigations. This level of support has never existed in peacetime and it shows how seriously politicians take Denmark's current threat level.

The Special Operations Forces

The Danish Special Operations Forces are reinforced by a number of initiatives:

time Group 1 – the Baltic Sea, Resolute Support – Afghanistan, and UN Missions (UNTSO, MINUSMA, UNMISS, UNCMAC). In addition to this, Denmark will again in 2018 deploy F-16 to Iceland to take part in the Iceland Peacetime Preparedness Needs. This is just to show that Denmark is a loyal partner to NATO and UN. I think that if some politicians are focusing on a 2% contribution to NATO, in addition to that figure you should perhaps look at the value of the armed forces, or as Plato said; "Wise men speak because they have something to say; fools because they have to say something."

Protective Eyewear for the Picky Operator

For more than 30 years Wiley X has been a global leader in the protective eyewear market, supplying military forces and law enforcement personnel with top-of-the-line ballistic eyewear. But what is the secret behind the ongoing success?

Wiley X insists that all its tactical premium eyewear products meet the ANSI Z87.1 safety standard for high velocity/high mass impact as well as being EN.166 certified. Furthermore, it is no secret that many models also meet various MIL-SPEC ballistic military standards for spectacles. In short, you will not find better eye protection out there than in a pair of Wiley X glasses.

"Our secret of having a successful global brand is quite simple," says Mr. Lars Rounborg Rasmussen, Director, Tactical and Law Enforcement at Wiley X EMEA LLC. "Our main focus is that our co-operators are successful. The only way to accomplish that is with customers being successful when wearing Wiley X. If these two important players had not been successful, our brand would never have become what it is today. Secondly, we never compromise on the quality. More than 10 years ago I put on my first pair of Wiley X while serving and the exact same pair is in my office today, still having a bit of camo paint on them," he smiles. As Lars says: "We must be willing to fail to become genius. Only by pushing the limits we are able to do better and succeed in bringing innovative new products to the customer's table."

Many of the key members of the Wiley X organisation have a professional military background, which the functionality and performance in the products clearly show. In 2018 Wiley X presents unique products focusing on the level of durability, comfort and flexibility that one wishes to take advantage of when using tactical eyewear.

WX Dual Lens System

The WX Spear Dual takes anti-fog to an extreme new level. The WX Dual Lens System consists of a two-layer lens that separates the temperature differences between the outside and inside lens by making a thermal bridge, which makes it nearly impossible to fog in any extreme situation.

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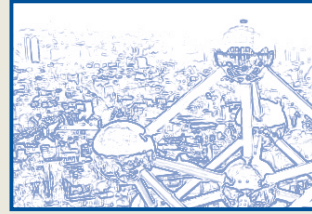
WX Comm Temple System

"In our line of spectacles, we have focused on a very thin temple system. We wanted to make a system not compromising the protection level of the eyewear or the ear protection when using ear muffs. We came up with the WX Comm Temple System," explains Lars. The new and very thin Comm Temple System offers the user a comfortable solid fit when worn together with ear protection and communication devices. The thin and flexible design provides noticeable comfort at any time and still provides the user with the protection required when moving fast and quickly in close-combat situations without compromising on safety. The WX Comm Temple System is available in model WX Rogue Comm and will be adapted to more Wiley X models in the future as a part of the Wiley X DNA.



Photo/Grafiks: Wiley

"When buying a pair of Wiley X eyewear and thereby becoming a Wiley X family member, we thank our customers for providing us with constructive feedback to facilitate our development in the future. We need our family members to help us remain as the brand putting the 'the cool factor' into every eyewear and pushing the limit line further. We have been a brand of the people for more than 30 years and we will continue being so for the next 30," concludes Lars.



NATO's Resolute Support Mission in Afghanistan: an Interim Review

Joris Verbeurgt

Following the 9/11 attack on the US, President George W. Bush launched Operation Enduring Freedom against the Taliban regime in Afghanistan, together with the UK. The Taliban had been ruling Afghanistan since 1996 and were accused of supporting Al Qaida and providing shelter to its leader Osama Bin Laden, the mastermind behind the 9/11 attack. The US and the UK were later joined by other forces, including the Northern Alliance, which had been fighting the Taliban for years. In December 2001, the United Nations Security Council (UNSC) established the International Security Assistance Force (ISAF) with the initial aim of supporting the Afghan (interim) administration in Kabul. In 2003, the UNSC authorised the expansion of the ISAF mission throughout Afghanistan. NATO took command over ISAF and provided the majority of the troops to stamp out the insurgency that was launched that same year by Taliban leader Mullah Omar. As from 2006, the Taliban, the Haqqani Network, Hezb-e-Islami Gulbuddin and other groups were successful in conducting guerrilla raids and ambushes in the countryside and suicide attacks against urban targets. When the Taliban began to make significant gains, the US and ISAF responded to this asymmetric war tactic with counterinsurgency operations. From 2007 the violence escalated and the war spread to neighbouring northwest Pakistan. US and NATO troop numbers gradually increased and peaked in 2011 when 140.000 foreign soldiers were deployed in the Afghan theatre. On 1 May 2011, Osama bin Laden was killed in Pakistan by US Navy SEALs. A year later, NATO leaders expressed the desire to withdraw their forces. The UN facilitated peace talks between the Afghan Government and the Taliban and an exit strategy was put forward. On 28 December 2014, NATO formally ended ISAF combat operations in Afghanistan and officially transferred



Photo: Justin T. Updegraff / U.S. Marine Corps

An Afghan National Police officer distributing tires on three tons of confiscated opium and heroin to be burned at Bost Airfield, Afghanistan, in November 2017

full security responsibility to the Afghan Government. Operation Resolute Support was formed the same day as a NATO led successor to ISAF. Parallel to this NATO change of operation, the US replaced Operation Enduring Freedom with Operation Freedom's Sentinel. As of May 2017, over 13.000 foreign troops have remained in Afghanistan without any formal plans to withdraw.

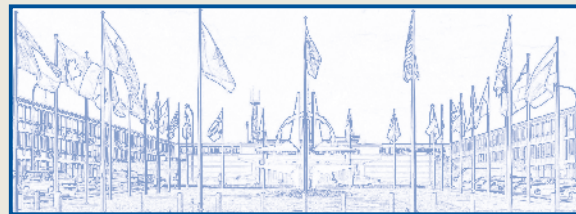
The Mission

The purpose of Resolute Support is to help the Afghan National Defence and Security Forces (ANDSF) and the Afghan institutions in building the capacities needed to defend Afghanistan and to protect its citizens sustainably. Around 13.000 personnel from 39 NATO allies and partners are available for this task. The activities include training, advice and support in the security-relevant ministries and in the higher ranks of the Army and Police. Operations are conducted from one "hub" (Kabul/Bagram) and four "spokes" (Mazar-e-Sharif in the north, Herat in the west, Kandahar in the south, and Laghman in the east). Support is offered in the fields

of operational planning, budgetary development, force generation processes, management and development of personnel, logistical sustainment and civilian oversight (guaranteeing the rule of law and good governance practices). At the NATO Summit in Warsaw in July 2016 and at the meeting of NATO Leaders in Brussels on 25 May 2017, the allies agreed to sustain the Resolute Support Mission and to keep it under review. The United States' new South Asia strategy led to an increase in the US troop contribution, and 27 other nations have also committed themselves to increasing the number of troops in the coming months. NATO Secretary General Jens Stoltenberg announced that the size of Resolute Support Mission will increase from around 13.000 to around 16.000 troops in the course of 2018.

Good News?

In 2017, the U.S. military dropped more than 3.500 bombs or three times the amount of ordnance it used in 2016. A new offensive targeting Taliban drug labs was led by the Afghan Air Force. It resulted in the deaths



of key Taliban leaders and the destruction of US\$80M in narcotics, an important source of income for the Taliban. General John Nicholson, Resolute Support commander, stated that "In 2017 the Taliban failed to take any provincial capitals and the ANDSF were on the offensive in up to six corps areas at a time." This winter season – traditionally a time when both Afghan and insurgent forces regroup and prepare for renewed fighting in the spring and summer – no rest was given to the insurgents: attacks on Taliban strongholds continued and offensives were launched in all six corps zones, even in January. Narcotics and weapon storage facilities are continuously targeted by the US and Afghan air forces or raided by the Afghan Special Security Forces. They also execute raids on Taliban prisons, liberating numerous captives. Afghan air power is spectacularly increasing with the gradual arrival of 160 UH-60 BLACK HAWK helicopters for the Afghan Air Force. Resolute Support is advising and assisting, but the Afghans are leading the fight. Pressure on Taliban and anti-government entities is increasing. According to General Nicholson, security in Afghanistan is improving and there is hope for the future.

The Current Security Situation in Afghanistan

But is that really the case? Or are the spectacular attacks and raids mere window dressing? 4 January 2018: At least 20 people were killed in a suicide bombing that targeted a mobile police checkpoint in Kabul. As many as 30 others were injured in the incident. 20-21 January 2018: Gunmen of the Haqqani Network launched an attack on the Intercontinental Hotel in Kabul, killing 40 people and injuring at least 22. 27 January 2018: At least 103 people were killed and 235 others injured when a Taliban suicide bomber exploded an ambulance laden with explosives near government offices in central Kabul. 10 February 2018: In the province of Helmand, a Taliban infiltrator turned his gun on men who he had worked with for months in a pro-government militia force, killing 16 of its members. 19 February 2018: At least 24 policemen were killed in western Farah province during coordinated attacks by the Taliban. 23-24 February 2018: 25 Afghan army members died after Tali-

ban militants attacked their checkpoint in western Farah province. 27 February 2018: A group of fighters wearing army uniforms kidnapped 30 people, including 19 policemen, after stopping a bus at the border of the provinces of Kandahar and Uruzgan. In another incident, a police checkpoint in Kandahar province came under attack by the Taliban fighters leaving six policemen dead and wounding five others. 9 March 2018: At least 24 members of the Afghan security forces were killed and several others injured in a Taliban attack in Farah province. 21 March 2018: A suicide bombing near a Shiite shrine in Kabul killed at least 33 people and injured 65 others while they were celebrating the Persian New Year. 23 March 2018: At least 13 people were killed and dozens more injured in a suicide car bomb attack at the Ghazi Muhammad Ayub Khan stadium in Lashkar Gah during a wrestling match. These are just a handful of examples of kidnappings, shootings, ambushes and (suicide) bombings on Afghan soldiers, policemen, government officials, and civilians that happened since the beginning of this year. As the number and the intensity of the attacks is going crescendo, 2018 promises to be another very bloody year for Afghanistan. After seventeen years of fighting, thousands of American and allied lives lost, and US1,007Bn dollars spend on the war, anti-government forces are still controlling large parts of the Afghan territory and are capable of planning and executing attacks in the centre of Afghanistan's capital. Narcotics production is at an all-time high – Afghanistan is the world's largest producer of opium and heroin - and recently, IS-Khorasan, the Afghan branch of IS, gained a foothold in Afghanistan. The "War on Terror" is therefore far from over. Although the Afghan armed forces achieved some highly mediatised successes on the battlefield, we cannot see even a beginning of a turning point on the military level. The political, economic and social prospects are equally gloomy: the Afghan government

and institutions are of the most corrupt in the world and fully rely on the massive support of western powers for their survival. However, the US and its NATO allies cannot accept, nor admit, that Afghanistan was (another) military adventure that turned into a failure, if not a disaster, taking into account all the money and resources spent and the unimaginable toll in human lives and suffering that resulted from it. The examples of Vietnam, Iraq, Libya, and Syria have shown that conventional armies, however modern and well-equipped, can never achieve a decisive victory at the battlefield over an enemy who refuses to stick to the rules of modern warfare. Especially when that enemy has the support of large parts of the population and of neighbouring countries who sympathise

Photo: Robert Cloys / U.S. Air Force



A Train Advise Assist Command-Air (TAAC-Air) advisor of the US Air Force advising an Afghan Air Force member during a 100-hour inspection on a Mi-17 at Kandahar Airfield, Afghanistan, in March 2016. TAAC-Air assists Afghan partners to develop a professional air force.

with their cause, or use it to conduct proxy-operations against powers they do not like in the region, like Pakistan or Iran. The conflict in Afghanistan extends beyond the Afghan borders and therefore, a sustainable solution can only come from diplomacy and bargaining between all stakeholders. Resolute Support, initially designed as a step towards an honourable exit, is just another phase in a conflict that seems to have no ending.

“We experience a new wave of tension under the sea.”

Photo: US Navy



Interview with Admiral James G. Foggo III, Commander of the US Naval Forces Europe-Africa

to the Black Sea, two of which are already operating in the Mediterranean. It is an impressive demonstration of capabilities. We are watching them carefully and we need to know where they go at all times. In addition, Russia demonstrated its ability to launch KALIBR missiles from the Mediterranean and did so effectively. It is a concern for me, although I have confidence in the deterrent capacity of our forces. We do not seek to fight but to dissuade.

ESD: In addition to the permanent US Naval Force in Europe, aircraft carriers of the US Navy operate in the Mediterranean. For example, last year there were two strike groups for the operation “Inherent Resolve” (Iraq), which later also operated from the Persian Gulf. Is the transit of an aircraft carrier expected this year?

Admiral Foggo: We will see another aircraft carrier and new amphibious landing ships arrive inspring

ESD: We also have the instability in Africa...

Admiral Foggo: That is, not only the presence of the Russian Navy increased. Violent extremist organisations that come from places in the Middle East or the African continent threaten Europe. With great sadness, we think of the attacks that occurred last August in Barcelona, Spain. Such a situation is terrible for any country. There is Boko Haram in Nigeria, Al Shabab at the Horn of Africa, Al Qaida on the African continent or Daesh in the Middle East or places in Libya where we fought and carried out different operations last year.

ESD: NATO already inaugurated the Strategic Direction South Hub in Naples. What is the objective of this centre?

Admiral Foggo: The NSD-S Hub will serve to challenge the current and evolving security issues that the Alliance and

partners face. We will collaborate to locate the threats in North Africa and regions of the Middle East. We will share information not only in NATO, but with other organisations like the United Nations. We need to tackle the networks of illicit narcotics trafficking or illegal immigrants in North Africa, which are facilitated by terrorist organisations that obtain financing from them to attack Europe or my own country. We must create a safer environment with our partner countries in those regions to end illegal immigration.

ESD: What is the strategic importance of the Naval Station Rota (Southwest of Spain) for the US Navy?

Admiral Foggo: It is a strategic crossing for the transit of our ships from the US to Europe. The location allows us to act from Rota in the Mediterranean and then in the Black Sea; also towards the North Atlantic and the Baltic or towards the West African coast. The Naval Station Rota allows us to reduce our costs and the number of ships we need to deploy in Europe. Rota is a crucial gateway to the Mediterranean for us.

ESD: What kind of missions did AEGIS destroyers carry out from Rota?

Admiral Foggo: The four destroyers (DONALD COOK, ROSS, PORTER and CARNEY) are equipped with the AEGIS ballistic missile defence systems. Precisely, the defence of Europe against this type of missile is one of its functions; the missile defence is a mission in which Spain is very interested. In addition, the destroyers carry out submarine warfare missions in this new wave of tensions that we experience and they protect the sea lanes necessary to trade between West Africa, Europe and North America.

The interview was conducted by Esteban Villarejo.

Since October 2017, Admiral James G. Foggo III (Virginia, 1959) has been the commander of the US Naval Forces Europe-Africa and the leader of the NATO Allied Joint Force Command Naples.

He is in charge of the Sixth Fleet, based in the same Italian city, which deploys at this moment 3,950 sailors and three warships. The four AEGIS destroyers of Rota (Spain) and their accredited personnel (3,400) also depend on him. In addition, a naval detachment at the Greek base of Soudha Bay (Crete) and another air base at Sigonella (Italy) are under his leadership.

He commanded the attack submarine USS OKLAHOMA CITY (SSN 723) in 1998. Foggo's awards include the Distinguished Service Medal, Defence Superior Service Medal, Legion of Merit and NATO Meritorious Service Medal. Recently, he visited Madrid where he met the Spanish MoD and Navy authorities.

“Proud submariner”, Adm. Foggo warns ESD about the “new wave of tension that we experience under the sea.”

ESD: What is your perception of security in the Mediterranean with a Russian hyperactivity from the naval point of view?

Admiral Foggo: The situation is very complicated. Everything changed considerably after the crisis in Ukraine. The Russian Navy plans to send six KILo Class submarines

NATO Keeps up its ASW Guard

Guy Toremans

The undersea warfare exercise DYNAMIC MANTA 2018 is an opportunity for NATO's naval forces to strengthen their anti-submarine and anti-surface warfare capabilities.

NATO's annual anti-submarine warfare live exercise DYNAMIC MANTA 2018 (DYMA 2018), led by the COMSUBNATO - RADM Andrew "Andy" Lennon (COMSUBNATO) and hosted by the Italian Navy, took place in the Ionian Sea to the Southeast of Sicily between 3 and 16 March 2018.

DYMA 2018 brought together ten NATO countries contributing a force of six submarines, nine surface combatants, and 19 aircraft including eight maritime patrol aircraft (MPAs). The submarines - HMCS WINDSOR (Canada), HS MATROZOS (Greece), ITS ROMERO ROMEI (Italy), SPS MISTRAL (Spain), TCG PREVEZE (Tur-

A Multi-Threat Environment

In order to create a realistic multi-threat environment, ten Maritime Patrol Aircraft (MPA) and eight helicopters from Canada, France, Germany, Italy, Spain, Turkey, United Kingdom and the United States operated from Sigonella Air Base under the control of personnel from NATO's Maritime Air Command (MARAIRNATO). The host navy provided support from its Augusta Naval Base and the Sigonella Air Base, the latter serving as hub for all fixed- and rotary-winged aircraft.

A media programme, organised by the MARCOM Hq. in Northwood, included

HMCS WINDSOR. "The participation of our submarines in exercises such as these enhances our ability to operate with our NATO Allies and contributes to solutions in an evolving and challenging global security environment," said Captain Christopher Robinson, Commander Canadian Submarine Force.

To Hunt and be Hunted

Conducted in a continuum-free play, the exercise serials incorporated intense ASW and anti-surface warfare, MPA-submarines coordination, shore-based helicopter operations, submarines stalk-



Photos: Guy Toremans

DYNAMIC MANTA 2018 took place in the Ionian Sea in March 2018.

key) and USS JOHN WARNER (US) - were joined by the frigates BSN LOUSE MARIE (Belgium), FS LANGUEDOC (France), HS ELLI (Greece), ITS CARABINIERI (Italy), SPS CRISTOBAL COLON and SPS VICTORIA (Spain), TCG GAZIANTEP (Turkey) and the destroyers HMS DUNCAN (UK) and USS LABOON (US).

Author

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visits to the submarines and the maritime patrol aircraft, as well as a "day-at-sea" on board SNMG2 flagship, the RN's Type 45 destroyer HMS DUNCAN.

Described as NATO's premiere ASW exercise, DYMA 2018 offered the crews the opportunity to evaluate and sharpen their ASW skills in the high-end warfare capabilities in preparation for future collective operations, emphasising the new roles of a submarine away from their exclusive mission to sink ships. For the first time in the DYMA series was the participation of a Canadian submarine, the

ing surface units and surface vessels practicing the detection and tracking of submarines, while the submarines in turn practiced both defensive and offensive tactics - to hunt and be hunted, as well as escorting high value units (HVUs) and protecting them from submarine threats. The exercise was supported by an In-Stride Debriefing Team (IDT), composed of ASW experts and personnel of NATO's CIS Agency, working side-by-side with MPAs and the MARAIRNATO staff which reconstructed and analysed all the ASW events, bringing together opera-

tional data from all participants and then sent the results to ships, submarines and aircrew within 24 hours. This rapid turnaround allowed participants to optimise their performance while events were still fresh in mind.

CDR Santiago Vila Barron, commanding officer of the Spanish frigate SPS CRISTÓBAL COLÓN, told ESD that "DYMA 18 demonstrates that ASW remains vital within NATO's portfolio, especially in a geopolitical scenario characterised by increasing instability, in particular in the Mediterranean, a crucial region that has seen a sharp increase in risks and challenges which go beyond the maritime security domain. DYMA 2018 is our first major exercise since our return from the Australia "around the world" deployment and started our new operational cycle in January this year. Among other duties, SPS CRISTÓBAL COLÓN will act as sector anti-air warfare commander (AAWC), as Force Marshaller for surface task groups and acting as officer conducting the serials/anti-surface warfare commander (OCS/ASWC). DYMA 2018 is one of our main training opportunities to prepare our operational certification that will take place at the Spanish Navy Combat Evaluation Centre CEVACO in Rota; an organisation very similar to the British FOST. Finishing in mid-June we will then take part in electronic warfare and deploy with SNMG2 from September to December 2018."

Having been engaged in recent years in so-called "reassurance missions" and spending much time supporting maritime embargo enforcement, counter-piracy and counter-terrorism operations in the Mediterranean and the East of Suez, NATO's sub-hunting skills lay largely dormant.

A Vital Theatre

Hence the importance to buttress the ASW experience again, e.g. finding, classifying and tracking other military units, submarines in particular. And with the Mediterranean being a melting pot of challenges and a vital geostrategic theatre (such as maritime migration, instability along the Southern coasts, choke points for access into the Atlantic and Indian oceans, the conflict in Syria and Russia's permanent "at-sea" presence in the region) the chosen exercise area is well-suited to conduct real-world maritime situational awareness activities. Complex exercises such as the DYMA and the Dynamic Mongoose series remain an excellent opportunity for NATO's naval

forces to strengthen interoperability and increase their combined anti-submarine and anti-surface warfare capabilities. Technology developments above, on, and below the surface gave the participating platforms the opportunity to test new tactics. Exercising with submarines such as the Italian ITS ROMEO ROMEO and the Greek HS MATROZOS are a big challenge. They are very silent boats, fea-

submarines. The Alliance estimates that these auxiliary submarines may be able to manipulate objects on the seabed, such as the underwater cables scattered across the oceans and carrying about 95% of all telecommunications and Internet connections. Blocking it could disrupt the Internet, while intercepting it could give a valuable picture of the data flowing inside.



Highly realistic exercises like DYNAMIC MANTA 2018 emphasise high-end warfighting skills and provide training and practice.

turing a high technology level such as an improved combat system and sonar capabilities such as the Kongsberg MSI-90U Mk 2 weapon control system and the STN ATLAS CSU 90-138 integrated sonar system, and the ability to detect, track, and classify contacts at very long distance. On the other hand, frigates such as the French FS LANGUEDOC and the Italian ITS CARABINIERI are more effective in hunting a sub-surface target close to a task force.

These exercises reassure NATO nations that the alliance's maritime units stay vigilant in light of Russia's increased naval activities, ranging from the High North, the Baltic Sea and Black Sea, to the Eastern Mediterranean; Russian submarines' deployments are at the highest level since the Cold War. Among Russia's capabilities are deep-sea research vessels and converted ballistic submarines - motherships - that carry smaller "auxiliary"

Due to this increasing Russian presence, the North Atlantic and the Mediterranean are becoming areas of concern for the alliance. State-on-state rivalry is again a significant security issue, particularly at sea. It is against this backdrop that NATO uses the DYMA exercise series to enhance its forces' capabilities to meet the alliance's collective defence and co-operative security commitments. NATO is taking already a forward-looking approach to ensure that its naval assets can maintain their edge. Several NATO submarine forces show a commitment to modernise their assets in order to ensure their forces are able to meet the challenges that future maritime operations will require. New submarine builds are in progress in Turkey, Greece, Italy, Spain, France, and Germany, while new builds are in the planning stages in The Netherlands, Norway, Poland and Sweden.

“Our biggest concern is certainly the capability of our forces.”

Photo: USAF



Interview with General Tod D. Wolters, Commander US Air Forces in Europe – Air Forces Africa (USAFE-AFAFRICA)

and beyond Europe and Africa is formed on the foundation of our agreements and partnerships. We greatly value these relationships and work hard and seek to develop them further.

ESD: Please share some of the recent developments and deployments for USAFE.

General Wolters: USAFE's day-to-day mission is to deliver air power capabilities to meet the requirements of geographic combatant commanders and the NATO Alliance. One of these critical air power missions is securing the sovereign skies of our NATO allies in the Baltics. This past January airmen from the 48th Fighter Wing at RAF Lakenheath concluded the United States' fifth rotation of Baltic Air Policing. During this four-month deployment, four USAFE F-15Cs completed roughly 3,000 alert hours, over 170 sorties, and 300 flying hours performing this NATO mission. The jets were scrambled almost 60 times in response to unusual or questionable air activity. Our support for the NATO Air Policing mission is just one of the many ways USAFE employs rotational forces to support our allies.

Earlier this year four B-52 STRATOFORTRESS aircraft from Minot Air Force Base, North Dakota, supported theatre integration and conducted joint and allied training to improve bomber interoperability.

Also in January, 12 F-16s from the Ohio Air National Guard were deployed to Estonia as part of the theatre security package deployments in support of Operation Atlantic Resolve.

Additionally, rotations of C-130 aircraft from Dobbins Air Force Reserve Base, Georgia, and from the Illinois Air National Guard were deployed to Portugal in support of Exercise Real Thaw 2018, and to Poland for joint readiness training. These rotational deployments create responsive air power capabilities and interoperability while strengthening relationships with our allies and partners.

Also, in accordance with the longstanding bilateral agreements, USAFE – under US European Command – participated with the Israeli Defense Forces in a combined missile defence exercise, Juniper Cobra '18. Activities and preparations associated with this exercise began in late January. Juniper Cobra '18 is part of a routine training cycle designed to improve the interoperability of US and Israeli Defense Forces, and it represents another step in the strategic relationship between the US and Israel, and contributes greatly to regional stability.

Another recent exercise is Iniochos '18, a Hellenic Air Force led, multinational flying exercise. Fourteen F-15Es and about 300 support personnel from the 48th Fighter Wing were in Greece to strengthen our relationship and maintain joint readiness and interoperability with our allies and partners.

ESD: Please share your key areas of focus in your AFAFRICA area of responsibility.

General Wolters: We are engaged in all quadrants of the continent. We certainly pay close attention to what is taking place on the eastern side with respect to the activity

ESD: General Wolters, thank you for taking the time to speak with ESD magazine. The United States has outlined a new defence strategy. Can you please speak to that.

General Wolters: Sure. To meet the national security concerns, the NDS (National Defense Strategy) directs three specific lines of effort. The first, build a more lethal force. The second, strengthen alliances and attract new partners. The third, reform the department for greater performance and affordability. Its clear intent is to develop a more lethal, resilient and rapidly innovating joint force which combined with the robust constellation of allies and partners will safeguard international order.

In perfect alignment with the NDS is our recently published USAFE-AFAFRICA Command Strategy which helps shape our efforts on the preservation and improvement of military readiness and our critical warfighting posture. Our strategy centres on advancing the core elements – our forces, our footprint, and our agreements and partnerships.

First and foremost are our forces. The airmen, equipment, units, and organisations assigned or rotationally deployed to USAFE/AFAFRICA that we can bring to bear to address security challenges across all domains and levels of conflict. Second, our footprint. The vital network of installations, infrastructure, prepositioned equipment, and combat support capabilities required to project air power throughout Europe and Africa. And lastly, our agreements and partnerships. Everything the Command does to posture and operate in

Four US Air Force F-16C FIGHTING FALCONS and four Swedish Air Force JAS 39 GRIPENS flying in formation together behind a US Air Force KC-135 Stratotanker during aerial refueling training in Swedish airspace in February 2018. The air refueling training is in conjunction with a rotational deployment of F-16Cs to Amari Air Base, Estonia, as part of a Theater Security Package.

Photo: US Air Force / Luke Milano



in the vicinity of Somalia. We are certainly focused on the activities in the north, the north, the northeastern side with respect to what is taking place in Libya. And certainly, if you extend all the way to the far western side, with the potential catastrophes that can occur as a result of the influence of Boko Haram; we are certainly paying attention there. And in that environment, as AFAFRICA service and support, we are

General Wolters: Our biggest concern is certainly the capability of our forces. When folks want to talk about the A2AD environment, I am quick to steer them in a discussion about gaining access to what is typically referred to as a higher threat environment. What we do to counter that is exercise and train against those specific threats, and ensure that we have a competitive edge against those threats, and that

General Wolters: With respect to US observations of Russian aviation, what we saw in '15, what we have seen in '16, what we have seen in '17, and now what we have seen in '18 shows a steady pace of Russian aviation. Nothing with a dramatic increase, nothing with a dramatic drop-off. Each and every one of the air policing encounters that we have with Russian aviation we document and we track and we characterise. In well over 95% of those incidents where we have air activity, we have observed safe behaviour on behalf of the Russian aviation force.

ESD: What is your assessment of the stability situation in Turkey as it pertains to USAF-AFAFRICA operations and the bases you use there?

General Wolters: We are fielding of the same number of bases that we have had over time, and the relationship that is ongoing from a military-to-military perspective, and certainly in the air domain with us and Turkey remains very, very strong. A strong NATO partner, our aviation relationship is incredibly powerful, and, at the end of day, I would characterise all the activities that are ongoing in the air domain between us and Turkey to remain incredibly strong.

ESD: Do you anticipate increasing your presence in eastern European countries like Romania?

General Wolters: USAF's support of Baltic Air Policing and the employment of theatre security packages are a direct application of the Air Force's portion of the European Deterrence Initiative funding which is projected to reach more than US-D1Bn in 2018. Along with these missions, the 2018 EDI budget continues to support the prepositioning of Air Force equipment and airfield infrastructure improvements in at least six different countries.

I can tell you that our rotational presence with our US Air Force assets will continue to increase in Romania just like they have over the course of the last several years, and I anticipate more exchanges with our rotational forces there over time.

ESD: General, thank you for your time. Do you have any closing thoughts?

General Wolters: Thank you. Let me say America's airmen in Europe and Africa are resourced and trained to fight as a part of our larger military team. Our unrelenting focus is on maintaining and improving our readiness to perform the critical national security missions we have been assigned.

The interview was conducted by Joetey Attariwala.

Photo: US Air Force / Eli Chevalier



Participants of African Partnership Flight Senegal prepare to board a C-130H HERCULES at Captains Andalla Cissé Air Base, Senegal, on 22 March 2018. The APF programme is US Air Forces Africa's premier security cooperation programme with African partner nations to improve professional military aviation knowledge and skills.

focused on, with each passing day, improving our ability to conduct intelligence, surveillance and reconnaissance activities and certainly enhancing our ability to improve logistics and lastly, making sure that we do everything we can, from a command and control perspective to be as responsive as we can possibly be. So the entire continent is certainly of concern to us in AFAFRICA.

In January, we hosted the first-ever Partnership Flight Symposium combining our African and European partner nations with a focus on aeromedical operations. This symposium united 50 representatives from 12 nations with the common goal of exchanging ideas and increasing medical support capacity, and most importantly, to save lives. We also took part in the African Partnership Flight Mission in Senegal with approximately 70 African participants. The African Partnership Flight Mission is a multilateral military-to-military event designed to improve professional air knowledge and skills, build relationships, and help resolve security and stability issues.

ESD: How are you preparing USAF-AFAFRICA forces for the increasing prevalence of anti-access / area denial environments?

is what we will continue to do. The more ready we are, the better the capability we will have, and the better edge that we will maintain. And that will remain our focus in USAF-AFAFRICA.

ESD: Can you please speak to NATO spending and how that relates to your command?

General Wolters: Europe and Canada have increased defence spending over the past three years, and as we sit right now in 2018, eight countries will meet the two percent with 15 nations on pace to reach or exceed two percent by 2024. We are very focused on ensuring that from a bang-for-the-buck perspective, we look at cost, capability and capacity. And given those facts at this very moment, we feel that the trajectory of spending is improving, and I'm firmly convinced that given this trajectory we're on the right glide path for future success.

ESD: There have been many instances of intercepts of Russian aircraft, just as you have mentioned. What is your assessment of the intercepts, some of which have been dangerously close and potentially unsafe to US and allied aircraft?



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Aspects of Water Management in the Field

Tim Guest

Managing land-based water resources is of paramount importance in any theatre of operations. From purification to delivering potable resources to waste water management, the requirements for handling water supplies for larger units and forces are necessarily complex and involved.

Managing water in the field at individual, squad and smaller unit level is typically an all arms task for which standard procedures and basic water management systems and equipment are employed. Water management for larger units, when quantities make it a bulk commodity requiring major logistic efforts, falls mainly on the shoulders of engineer units and corps in most armed forces. While each defence organisation or military has its own approach and written policies on water management with which all units must be familiar, should it fall upon them in an operational scenario to have some responsibility for water supply management, similar approaches, equipment and systems are standard, particularly among allied nations, such as those of NATO. Land-based water management support involves everything from water selection, pumping and purification, to storage, distribution, cooling (if necessary in hot climates), together with all aspects of consumption, re-use and waste water management.

Unfamiliar Terrain to Familiar Bottles

If using unfamiliar sources to feed bulk water needs in unfamiliar geographies, water source intelligence will also be the focus of troops involved with water management in the field to ensure the source is safe from enemy contamination, as well as other contaminants.

In recent years, in well-known operational deployments, water supplies have often relied on shipping vast quantities of bottled water in several arid scenarios; such shipments require specialist materials handling



The Camel II Unit Water Pod System consists of an 800-gallon water tank mounted securely on a government furnished M1095 trailer.

equipment and involve an extensive supply chain. The product, however, delivers less water by volume in comparison with bulk supplies and this is where the advantages/disadvantages of packaged versus bulk water need to be weighed carefully before any deployment and with the context of the specific operational scenario/geography/past experience fully understood. Only then can command elements be sure that the right source/supply has been selected. If a bulk water option, such as rivers, reservoirs, etc., is chosen in a tactical scenario, then crucial water source management and activities, such as purification procedures, storage and bulk distribution, ideally need to be planned to take place as close to any selected local source of water as possible. One supplier of mobile water bottling plants is Conteno, which supplies its systems to certain NATO members as well as Abu Dhabi in the UAE. The mobile plants are typically capable of supplying anywhere between 36,000 litres and 120,000 litres per day; the six systems supplied in

the UAE deliver 472,000 litres of potable water 365 days/year, running 20 hours each day. The aim of the systems is to replace expensive daily supplies of purchased water bottles in more permanent mobile/temporary base locations. UV-treatment of water, bottles, caps and tear-off pouches, eliminates contamination risks and filling and capping takes place in a sterile positive air pressurised cabinet. In local water source scenarios Conteno systems will link up with a range of container-based local water purification systems (ultra filtration, reverse osmosis, etc).

Planning

Planning for all aspects of water management in the field must include water supply advisories and guidance, based on operational and theatre experience: What water supply is being used? Is it safe? Levels of evaporation? Accordingly, those responsible for planning any aspect of field water management need to ensure that forces

Author

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under their remit have adequate resources for water purification, storage and distribution and that the quantities available suit the force size being deployed and meet the appropriate rate of deployment so that a 'higher-demand-than-supply' situation is avoided.

If local water resources are to be used, surveillance of such supplies is crucial to keeping them secure and safe. Environmental health issues can arise not simply through enemy action or sabotage, but also by simple contamination by waste water, if not managed carefully.

When it comes to consumption, calculations and allocations are made based on unit and force size, as well as the region in which those forces have been deployed. In temperate, tropical and arctic theatres good sources of water are widespread although some may require purification treatment to make them potable; in such scenarios both non-potable and potable water are typically included in consumption calculations; where water is much more scarce in arid regions, bulk supplies will need to be moved to forward troops. According to the US DoA/DoN/USMC Joint Bulk Petroleum and Water Doctrine 2016, in early phases of tactical ops, experience with joint forces in the Middle East have determined it best to use potable water to meet both potable and non-potable requirements. This avoids the impractical need for separate storage and distribution systems when ops are still in progress and more permanent operating bases and camps have yet to be established. This does, however, increase the volume of potable water needed in such regions.



Photo: TerraGroup Corporation

A TerraGroup LWPS (Lightweight Water Purification System) at Camp Leatherneck in Helmand Province, Afghanistan

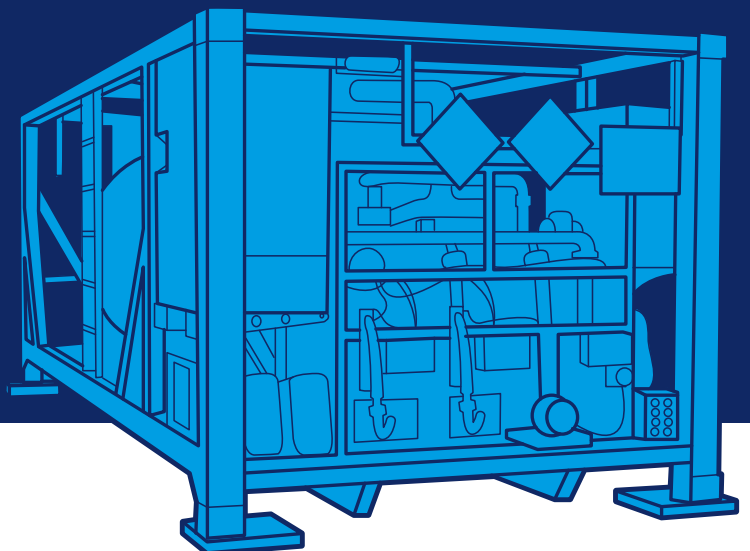
The doctrine goes on to explain that once more permanent bases and routines are established, separate potable and non-potable SOPs will enter the frame with storage assets, such as the USMC 50,000-gallon storage asset, deployed for both. Disciplined methods of conservation and re-use will also be laid down at this stage, because one unavoidable factor to be taken into account in any deployment, anywhere, is that some 10% of a force's water resource will be lost. Estimates by the US DoD show evaporation accounts for around 4% of this loss and spillage and waste, 6%; the latter waste includes a volume of water that cannot be purified in reverse osmosis (RO)

processes and has to be discarded. With the determination of the total water requirements of any force requiring careful calculation, this wastage has to be factored into overall calculations. Such calculations involve taking into account the number of personnel and multiplying this number by a factor laid down in most armed force's water management regulations. This provides a daily requirement figure. This figure then needs to be divided by daily production capabilities of a single purification plant in situations where bulk water purification has to be undertaken to meet the daily needs of a force on the ground.

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Distribution

The weakest link in the whole water management ecosystem is the distribution of the final product to troops on the ground. If weather or the operational situation deteriorates, the movement of water from storage sites can often be badly affected, or interrupted. Even at the best of times,

those which resupply ammunition to the artillery. WEW, a Thielman company, produces several mobile 'drop-and-go' solutions, in use with many defence forces in NATO and around the world. Fully integrated solutions incorporating pumping, filtration and preservation systems include a variant capable of providing potable water from any source, including CBRN contami-

into the Camel II Unit Water Pod System for the US Army. The system includes the 800-US-gal Camel tank integrated into a frame and mounted on M1095 trailers. The extremely low-profile system is a key element of the US Army's primary water distribution system for platoon level and below. The thin-skinned water tank is insulated and jacketed and equipped with a specially designed internal baffle system to prevent water surge during rugged operations over rough terrain. The highly-engineered tank, which incorporates no less than five patents, has freeze protection. Other variants equipped with generator sets can be integrated with a chiller system to provide temperature controlled water, as well as compact water-treatment for saline and contaminated water sources. The tank itself is capable of sustaining positive pressure and partial vacuum to compensate for diverse operating conditions including during airlift, commensurate with modern multi-modal military logistics operational requirements. An original tranche of 327 Camel tank units were delivered to Choctaw Defense in the 2013/2014 timeframe as part of the US Army's Camel II Unit Water Pod programme and has since been fully tested at Aberdeen Proving Ground and elsewhere.

Photo: TerraGroup Corporation



Portable water purification systems are designed for rapid response, remote locations and expeditionary teams.

moving bulk water is a hugely manpower-intensive operation requiring a wide variety of equipment-handling systems. In use with many NATO members are the likes of water trailers from companies like WEW, capable of carrying around 2m³ of water, water pod systems carrying around 3m³ pods, or heavy vehicle modular water systems that carry around 13m³ tanks – these are DROPS-type vehicles (dismountable rack offloading pallet systems) similar to

nated sources. The company's solutions can be carried on a wide range of vehicles from small patrol vehicles right through to 10X10s. As an added advantage for convoy duties and operation in exposed areas, WEW has developed a range of ballistic protection options for its water modules. At the end of 2017, WEW announced it was delivering 167 additional Camel low-profile water tank modules to prime contractor Choctaw Defense for integration

Purification

Water purification to deliver a potable product is the first step of tactical water support operation once a bulk source has been selected. Purification is normally undertaken using a reverse osmosis water purification unit with tests to verify its purity, normally the remit of medical supervising staff.

A ROWPU, or reverse osmosis water purification unit, is typically a self-contained, portable water purification and water treatment plant and widely used by NATO forces. This process is crucial to eliminate the risk of contracting water-borne diseases such as cholera, dysentery and typhoid. A ROWPU also ensures water quality aspects such as taste, odour and clarity, as well as hardness, which is very important if the end product is to be used in boilers, chillers or other military plant where corrosion must be avoided. Ampac USA manufactures a variety of ROWPUs for the US DoD, as well as many of its allies and can handle water from any sources such as: brackish water, boreholes and wells, ice holes, lakes, lagoons, rivers, seawater and surface water. The company's ROWPU use either pure water extraction methods integrating single-pass reverse osmosis (using one membrane

Photo: TerraGroup Corporation



Modern water purification systems are portable, scalable and modular.

bank), or double-pass reverse osmosis (using two membrane banks) depending on the type of water being purified.

Another leading manufacturer of tactical lightweight water purification systems is TerraGroup Corporation which makes portable water purification and filtration systems as well as water storage and distribution equipment for military field applications, potable water for disasters, emergency water supply and NBC decontamination. The company's TECWAR RO water purification systems are portable, scalable, modular systems designed for rapid response, remote locations and expeditionary teams. Its LWPS (Lightweight Water Purification System) is a modular, lightweight and highly mobile tactical RO water treatment and purification system designed for the U.S. Marine Corps and the U.S. Navy. It is "all source capable", meaning that it is suitable for producing potable, safe drinking water from a wide range of sources, i.e., ponds, lakes, streams, rivers, oceans, and even water contaminated with nuclear, biological and chemical agents. It provides absolute water purification for any field condition and can be transported in a variety of military vehicles and aircraft.

The Berkefeld M Range of mobile drinking water purification systems from Veolia water technologies in Germany, are designed for military operations. The compact plants are said to be extremely robust and able to purify water from almost any water source delivering an end product at a rate of 15 m³/h that meets both WHO and German TVO drinking water regulations. They each combine advanced filtration steps including: pre-treatment, inline floccula-

Water Treatment and Distribution

The production and filling of drinking water on site offers many advantages in terms of reliability, continuity and costs.

The WTC family of water treatment systems from Kärcher Futuretech is the right choice if it is unclear before use whether fresh, salty or chemically unclean natural water should be treated. Based on reverse osmosis, invisible chemical impurities, including salts dissolved in the water, are also removed. If the raw water source is located in difficult terrain, the personnel can

carry the unit to the site with carrying handles. The components that come into contact with drinking water have been selected in accordance with internationally recognised regulations and enable the production of drinking water that complies with the regulations of the WHO (World Health Organization) and other institutions. The WTC systems have a capacity of 550 to 8,000 litres of drinking water per hour (13.2 to 350 m³ per day) and are transported on trailers or in containers. The capacity allows 70 to 1,750 people to be supplied with water of the desired quality.

Kärcher offers the fully automatic WBP 1300 filling machine, which produces 1,300 bottles from plastic preforms and fills them with chlorine-free drinking water. These small bottles are given to individuals as a personal water supply. (gwh)

Photo: Kärcher Futuretech



tion, pre-filtration, ceramic ultra-filtration, reverse osmosis, UV and disinfection systems. Certification approval for M Range systems to be transported either inside or as an external load under a range of helicopters is currently in progress.

Another player in the RO sphere is Tecimer whose compact, mobile, RO water purification systems comply with both US EPA and WHO standards and can pu-

rify different water qualities, from brackish water to seawater, including rivers, creeks, lakes and wells. Transportable by air, land or sea, the units have a control panel that can be operated by one person; the systems can be deployed and made ready to start producing water in just 30 minutes to provide between 2,400 - 150,000 litres of clean drinking water per hour from any water source. In addition, the company has been supplying potable water trailers for military and peacekeeping forces in Afghanistan, Iraq, Sierra Leone, Chad, Honduras and Haiti for many years based around a 2,000 litre tank made from AISI 304 quality material. Four of Tecimer's potable water trailer units can be loaded into one 40DC container.

Photo: GOfA



A GOfA 20ft Water ISO container optimised for transportation throughout the Intermodal supply chain – by road, rail and sea – including hookarm systems. The unit is designed to fit pumps, hoses and generators as required. An example of this unit will be on display at Eurosa-tory 2018 in the German outdoor area.

From Potable to Sewage

Military camps and bases, no matter how remote or urbanised, will normally operate their own sewage and wastewater systems and UK company WPL provides standalone sewage treatment solutions designed specifically for military bases and also embassies. Security stipulations will invariably mean in each of these scenarios that mains drainage, if available, cannot be used for obvious reasons. WPL's wastewater treatment systems are tailored to individual military op-

erational requirements, take local climatic conditions into account and can be transported, deployed and installed easily underground. WPL's HiPAF modular waste water treatment system to handle waste from up to up to 2,000 people, consists of a separate primary settlement, a HiPAF SAF (submerged aerated filter) for biological treatment and final settlement modules.

Another player in the water management space, including the provision of camp wastewater pumping stations, is Eimco Water Technologies. The company's submersible pumping stations with grinder pumps can be supplied to interconnect as part of a larger system to feed a treatment plant. All of their pumping stations are provided with local control panels, gate and non-return valves. Eimco also supplies interconnecting pipe-work to connect camp facilities and pumping stations with the treatment plant, as well as high quality balance tanks to even out any hydraulic surge from the pumping stations and ensure that the wastewater treatment system is not overloaded.

Combat Water Supply System

KBR is a service provider for government customers with 34,000 employees worldwide. Among other things, KBR provides field logistics for the defence sector. The British Ministry of Defence (MoD) recently commissioned KBR to design, manufacture and supply a Combat Water Supply System (CWSS). Under the terms of the contract, KBR will put into operation a water treatment, storage and distribution system to supply potable and palatable water to the UK armed forces. Once operational, KBR will provide fully integrated Contractor Logistics Support (CLS) through to 2025 with responsibility for the design, manufacture and supply of each of the variants of the CWSS. "The Combat Water Supply System will ensure the availability of quality water around the world, reducing our dependence on bottled water, saving money and reducing environmental impact," said Major General Colin McClean, Director Land Equipment for Defence Equipment and Support, the UK MoD's procurement organisation. With the CWSS programme, the UK MoD wants to provide an end-to-end solution that includes the provision of water from source to point of use. In particular, CWSS is needed to purify water, test and ensure water quality, store, distribute and dispense water in prescribed quantities. KBR will be responsible for maintaining the UK MoD's CWSS capability.

Water is Precious

Managing water in the field is highly involved and aspects of the in-theatre water supply ecosystem have barely been touched on here. Storage systems, threats from natural contaminants and enemy sabotage, as

well as the numerous individual and squad-level procedures and systems available to ensure every man and woman in the field has their correct, sustaining ration of water when and where they need it, could fill a book and will, at some stage, be the subject of a future article. ■

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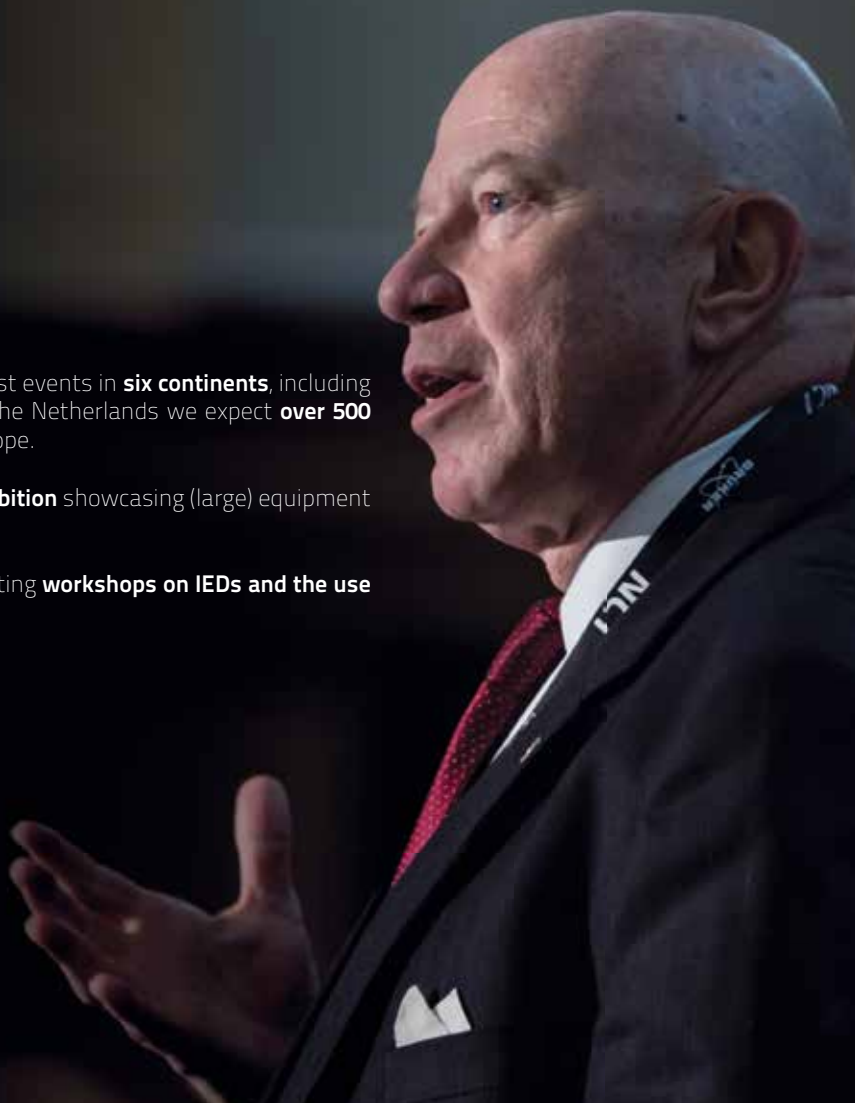
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The Technology Revolution that Drives the Drone Evolution

Tamir Eshel

Unmanned systems and technologies are making a big change throughout the world. The use of Unmanned Aerial Systems (UAS) for commercial, civilian and scientific applications is growing rapidly, along with changes in regulations that gradually induct those systems into civilian airspace.

Various autonomous systems are developed, bringing about exciting, new services, including flying cameras, to new transportation paradigms such as autonomous delivery services and driverless cars. Conceived by a fusion of advanced technologies of new sensors, micro-electronics and controls, artificial intelligence and machine vision, efficient energy storage and material sciences, the unmanned commercial revolution also opens new opportunities for military uses of unmanned systems.

UAS were traditionally used in two distinct applications – as sensor carrying platforms, drones replaced manned aircraft in intelligence, surveillance and reconnaissance, target acquisition (ISTAR) and fire direction for artillery and rocket attacks. Armed drones also assumed manned air attack missions, in environments that require long persistence and rapid response, prosecuting targets with short life cycle, something close-air-support and combat patrols could not perform efficiently over time.

These missions are assumed by several classes of UAS (drones), serving different military users – mini and small UAS, tactical drones, extended range and long endurance platforms and even those designed for operations at very high altitude; those different classes provide different services to different users. Avionics, propulsion, navigation, flight controls, communications and payloads are tailored to meet the capabilities and limitations of each category and match its operating parameters. But the introduction of commercial technologies is blurring the boundaries defining those

Photo: Northrop Grumman



First Generation HALE: Global Hawk

categories, as developers and users embrace commercial electronic systems to introduce smaller, smarter and autonomous applications that could not be obtained with past military systems.

Take, for example, the long missions of High Altitude Long Endurance (HALE) drones. Current platforms require very large and complex jet-powered platforms, such as the American GLOBAL HAWK or the Chinese SOAR DRAGON, designed to climb to a cruising altitude of up to 60,000 ft, well above commercial air traffic, to cover very large areas. While those platforms are capable of very long range, their missions are limited to 24-32 hours. Harnessing modern, commercial photovoltaic cell technology, energy recycling, electronic miniaturisation and ultra-light aerostructures, HALE drones

of the future could use different shapes, materials and sensors to perform the same missions in different ways. For example, by employing distributed optical and electronic sensors, small, low power sensors can replace large and heavy ones required for high resolution, wide area surveillance from high altitude. Heavy, gas guzzling jet turbines can be replaced by many electrical motors driving large propellers designed to operate in the thin air. Photovoltaic cells coupled with efficient energy storage can sustain such platforms in the air over days and nights, enabling the platform to operate for weeks, months and even years. Commercial platforms of this type are being developed to perform as "pseudo satellites" and could also be used for military missions, including signal intelligence, missile

Author

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launch detection, wide area surveillance and communication relays, naming only a few possible missions.

The Medium Altitude Long Endurance (MALE) is the most widely used drone application currently in use. Utilising relatively large platforms designed to carry payloads from 250 kg to 1.7 tonnes, platforms such as the American MQ-9 REAPER, Chinese WING LOONG 2, and Israeli HERON TP differentiate from smaller drones in their ability to carry multiple payloads – a combination of sensors of different types, disposable stores like weapons, sensors, leaflets and other stores, wideband datalinks that can download multiple data streams at high speed, and flight safety devices, such as de-icing systems, enabling the unmanned aircraft to fly at degraded weather conditions. As those platforms are more tolerant to payload weight, power and size, technological enhancements implemented in systems of this category focus on the certification of those platforms to enable their integration in civilian airspace, introducing sensors and control functions to implement autonomous sense and avoid behaviour to improve flight safety. Other fields of improvement associated with autonomous control are cyber hardening of airborne systems protecting the entire drone systems, including its communications and controls, from exploitation by cyber attack. Additional enhancements

Photo: Airbus



New propulsion and energy storage concepts will enable new drones such as ZEPHYR to loiter for weeks, months and even years.

focus on the image and data processing, automatic sensor fusion and handling of huge volumes of information storage, turning the airborne platform into a flying database, thereby enabling multiple user access to that information in real time, on demand. Other improvements address the remote operations of unmanned aircraft from forward basing. Although MALE drones can fly on missions spanning over 32-48 hours,

they are relatively slow and often operate from forward operating bases close to theatre. While the platform itself is unmanned, ground operations require significant ground support that often requires the deployment of dozens of support personnel, with significant infrastructure of multiple transport planes to deploy to each operating base. An evolving remote operation capability is changing these operations, enabling MALE drone operators to operate from temporary bases and runways much closer to their theatre of operation, spending more time on target and less on transit.

With the new capability, IAI's HERON and HERON TP can automatically land on remote runways located thousands of kilometres away where they are serviced by a small crew and basic fuelling infrastructure before taking off for another mission. This capability utilises the drone's satellite communication, combined with precise automated taxiing, take-off and landing, to recover and launch the drone in the remote operation concept, offering utmost operational flexibility.

A similar capability was demonstrated by General Atomics with the MQ-9B GUARDIAN, implementing the platforms satellite link with latest Automatic Take-off and Landing Capability (ATLC). While the MA-9 is designed for remote operation via SATCOM, launch and recovery in theatre are supported by forward operators. SATCOM ATLC enables taxi, launch and recovery operations from anywhere in the world and will reduce required aircrew manpower and Launch-Recovery



Photo: via author

Multirotor drones introduce revolutionary capabilities for warfare - in this example, a four-wheeled IRIS robot is thrown from a 6-rotor drone, designed to carry the land robot to rooftops and other tough to reach locations.

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Element (LRE) footprints. According to GA-ASI information, with trained RPA aircrew only required at the mission control element GCS location, the overall operating cost of the RPA will be reduced. It also enables rapid self-deployment of aircraft to any global runway with a Global Positioning System (GPS) surveyed file.

Another trend is the miniaturisation of electronic systems, enabling platform and payload manufacturers to pack more functions into smaller platforms. This trend is becoming more evident with the integration of few distinctive

20 hours, and provide enough power to drive multiple sensors, communications channels and other mission systems, such as electronic support and jammers. They are small enough to operate below cloud base, providing reliable, high resolution imagery or cover wide areas with synthetic aperture radar imaging, communication interception and relays. Such payloads are now matured to fit the space, size and power characteristics of SUAS. Even smaller unmanned platforms are designed for operation by the tactical user (battalion and below). Mini-drones like the

In recent years, military users embraced the new category of multirotor drones, combining vertical take-off and landing and the innovative multirotor control scheme that enables such platforms of superior manoeuvrability, including hovering, perch and stare, obstacle avoidance, damage tolerance, self-recovery and other functions of autonomous flight. While some multirotors are being developed specifically for military uses, most users rely on systems derived from the commercial world. The open standards enable integrators to employ smart, mission specific drone-based applications using specialised sensors and functions at very short development cycles. Typical uses include functions supporting target acquisition, and security to weaponised drones that carry stabilised gun platforms, missiles or even drones rigged into "flying IEDs". Such weapons are not limited to military operators – drug cartels; terrorist and insurgents are utilising such systems for criminal and terror activities, and this trend is expected to increase as commercial drone technology becomes more ubiquitous.

Some multirotor drones and other ultra-small VTOL sensor systems are now designed as flying cameras, operated by the warfighter. Weighing a few hundred grammes and packed into compact pouches, such nano drones are robust, endure weather and field operations, and are designed for simple, intuitive operation in all environments. Current systems are limited to the outdoors, but soon such systems will be augmented with obstacle avoidance and communications facilities to enable indoor surveillance. Some of the approaches using such systems indoors involve combined operation of autonomous air and ground systems, as well as the short deployment of ground systems by aerial delivery platforms, enabling operational agility, particularly in urban terrain.

Such capabilities are being developed today, using advanced sensors and processors developed for autonomous vehicles and commercial drones. The military applications of such systems will also enhance the drones' military capabilities, featuring automatic target detection and tracking, situational assessment and decision support. When coupled with weaponisation, such capabilities would turn the drones into highly capable loitering smart weapons. Packed together, they will form lethal and effective swarms that deserve special coverage. ■



Photo: via author

A SKYLARK C drone is launched from a boat. The system can also be used from an unmanned platform at sea.

categories into the Small Unmanned Aerial Systems (SUAS) category. Tactical UAS that had endurance of 10-15 hours and carried about 50 kg of payloads, are now replaced by small tactical UAS that weigh much less, endure missions of 7 – 24 hours (running on electrical or internal combustion engines) and carry smaller but much more capable payloads (15-20 kg of weight). Many of the mini-drones associated with this category are flying wings - FURY, ORBITER and BIRD-EYE 650. All utilise compact and mobile launchers and utilise parachute and airbag systems for retrieval, enabling the drones to run independently and closely support ground and special operation forces. Unlike mini UAVs, the majority of these SUAS utilise internal combustion engines to sustain missions of 15-

SKYLARK, PUMA AE, RAVEN and WASP, that are launched by hand, using simple bungee or catapults, are simple and robust to support the warfighter anywhere and anytime. In the past, those systems were challenged by limited endurance, communications, image quality and payload stabilisation. Today, using much more powerful batteries, stabilised, miniature, multi-sensor payloads and robust, secure, digital datalinks, those mini-UAVs deliver excellent imagery that has become critical to field operations. Evolutionary improvements in this category focus on payloads and user controls becoming more reliable, intuitive and responsive. Some of the payloads tailored for those platforms combine multiple sensors or are dedicated for specific applications such as 3D mapping that required dedicated surveying platforms in the past.

New UAV Turbine Engines from PBS

PBS, established in 1814, is a registered NATO supplier of turbojet engines that have proven themselves in hundreds of aerial targets, UAV and UCAV systems and piloted micro jets in France, Germany, China, Russia, Spain, the UAE, the USA and many other countries.

PBS jet engines stand out among competing engines due to excellent power-to-weight ratios, compact design, reliable operation, low fuel and oil consumption and high speed, together with reliable starting at high altitudes.

With its in-house expertise in design, development, production and testing, PBS continually works on new engine development in order to meet missile and UAV market requirements. This year, the company is finalising development of a new turbojet engine, the PBS TJ150.

Weighing just 19.6 kg and with a diameter of 272 mm, this powerplant offers 1,500 N (337 lb.ft) of thrust. It features an integrated starter-generator with 600 W electrical power output and it is controlled through a full-authority digital system (FADEC). The engine can operate at a speed of up to 0.9 M, in ambient temperatures of -50 °C to +45 °C and at altitudes of up to 9,000 m. It offers both ground and in-flight restarts at up to 4,000 m, with maximum speed of 0.6 M. Based on PBS's most commercially

successful model, the 1,300 N thrust PBS TJ100 turbojet, the new PBS TJ150 is a single-shaft engine comprising a starter generator integrated in the radial compressor impeller, one axial turbine, an autonomous oil system and a digital control system. To date almost 800 units have been delivered to customers.

PBS also manufactures turboprop and turboshaft engines designed for MALE UAVs, unmanned helicopters and small experimental aircraft. The PBS TP100 and TS100 develop up to 180 kW. Low

weight, small installation dimensions, extended time between overhauls (TBO) and high efficiency at high altitudes are among the competitive advantages of PBS turbine engines. These models are able to achieve flight altitudes of 9,000 m with a maximum starting elevation of 6,000 m.

Auxiliary Power Units (APU) are used all around the world, both in defence and civil aircraft and helicopters, and are another main product line of PBS. They operate as air generators for starting systems and as emergency power and hydraulic

sources. Their main advantages are simultaneous supply of electrical power and compressed air, offering continuous operation for up to 6 hours, long service life and the ability to start and operate at altitudes of up to 6,000 m.

PBS Turboprop Engine TP100



PBS Turbojet Engine TJ150

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Combat Drones Become a Mainstay in European Armed Forces

Peter Austermann

Today, more than ten nations worldwide operate combat drones. Also known as Unmanned Combat Aircraft Systems (UCAS), these platforms are capable of shadowing, tracking over a long period of time and, if necessary, destroying potential targets with high precision.

The battlefield and operational concepts have changed dramatically over the last two decades. Asymmetric warfare and the fight against terrorism require weapon systems that can be used in many areas of the theatre in order to fight targets flexibly and promptly. Combat drones meet these criteria effectively and efficiently.

Historical Background

The first UCAS entered service in the USA in October 2007. The initial contingent of MQ-1 Predator drones has grown over time to more than 90 aircraft. The inventory includes the updated MQ-1C GRAY EAGLE and MQ-9 PREDATOR B. These systems are manufactured by General Atomics and serve in the roles of Reconnaissance, Close Air Support (CAS), and Battlefield Air Interdiction (BAI). Additionally, they are employed against high value targets in the fight against terrorism. The systems have an endurance of 27 hours, a range of up to 1,100 miles, and a flight ceiling of 45,000 feet.

During operations the UCAS are deployed in theatre. On location a US crew performs take-off and landing; the actual mission however is controlled and conducted from a base in the US. The US Air Force employs PREDATOR B armed with laser-guided precision munitions like the AGM-114 HELLFIRE, GBU-12 PAVEWAY II, or GBU-38 Joint Direct Attack Munition (JDAM). In the future, the HELLFIRE missile will be replaced by the Joint-Air-To-Ground Missile (JAGM). Further armament options are available. For example, in 2014, the Dual Mode BRIMSTONE was tested successfully off a Predator B.

Author

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Another member in the UCAS portfolio is Northrop Grumman's MQ-8 FIRE SCOUT, an unmanned helicopter, which operates predominantly from guided-missile frigates and Littoral Combat Ships (LCS). The HELLFIRE missile is its standard armament, but it can be substituted by GBU-44/B VIPER STRIKE (Northrop Grumman/MB-

Great Britain's Combat Drone Aspirations

The first combat drone, MQ-9 PREDATOR B, also known as the REAPER, was delivered to Royal Air Force (RAF) units stationed in Afghanistan. The procurement specified an unarmed version of the system. After six months of operation, it became clear that



Photo: U.S. Army

An MQ-1C combat drone of the US Army

DA), a laser-GPS-guided glide bomb, and the Advanced Precision Kill Weapon System (APKWS), a guided missile with a range of 5 kilometres, manufactured by BAE Systems. Equipped with a suite of payloads and a range of up to 250 km, FIRE SCOUT gives ship commanders a rapid response capability to address maritime threats. The ability to engage targets at extended ranges results in a higher degree of naval protection.

In general, the US Armed Forces consider the use of combat drones to be very positive. In theatres such as Afghanistan and Iraq, these weapons systems have performed their tasks very satisfactorily. In the coming years, a large part of the US defence budget for unmanned aerial vehicle systems will be allocated for new acquisitions and modifications to existing UCASs.

the platform had to be able to hit fleeting targets. Furthermore, an increased requirement for CAS was noted.

The decision to weaponise these drones was a contentious issue. The CIA's use of combat drones in Yemen and Pakistan was quickly described as "targeted killing." Extensive reporting led to a broad discussion among the population and in the British Parliament as the legality, morality, and utility of was questioned. Finally, it was decided to arm the platform under the following conditions: An armed British REAPER cannot fly in British airspace; the system cannot be autonomous; it requires human command and control; decisions to release weapons cannot be autonomous.

In order to meet these requirements, RAF deployed one squadron to Creech Air Force Base (AFB) in Nevada, USA. Training for pilots is conducted at Holloman Air Force

Base in New Mexico, USA. 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 from 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 on other, manned aircraft in service.

In 2016, the British Ministry of Defence decided to double their fleet of armed combat drones and contracted General Atomics to deliver the Certifiable PREDATOR B (CPB) between 2018 and 2023. The contract stipulates the delivery of 26 combat drones for the amount of €850M. Based on the REAPER, the new drones will fly at an altitude of 13,000 metres and have an endurance of more than 40 hours. In addition to the aforementioned standard armament, UK MBDA has started to qualify its own BRIMSTONE missile (range up to 12 km) on the CPB. The drone's name upon entering the service will likely be PROTECTOR.

In a memorandum of understanding between BAE Systems, Dassault Aviation, Rolls-Royce, and Safran in 2016, the parties announced to start Phase 0 on the Fu-



Photo: Leslie Pratt/ US Air Force

An MQ-9 REAPER, armed with GBU-12 PAVEWAY laser guided munitions and AGM HELLFIRE missiles, deployed in a combat mission over southern Afghanistan.

ture Combat Air System (FCAS). A study group was commissioned to evaluate potential technologies, design concepts and the work share of industrial partners over the next 12 months. The delivery of two prototypes (one English and one French) was planned for 2025 but according to the latest developments, an airworthy aircraft is not to be expected by this time; the published minutes of a bilateral summit in January 2018 raise questions about the initial time line of the project. Both governments are still looking to establish suitable guidelines before committing to start Phase 1. The British company SteelRock presented its domestically manufactured combat drone VELVET WASP at the Dubai Air Show 2017; VELVET WASP is an unmanned helicopter with a weight of 17 kg and a range of 100 km. The platform has a weapon station and was presented

in Dubai with Textron's Fury, a precision rocket. No information is available as to whether the British Army will introduce this system.

The French Role in the European Combat Drone Project

The French Armed Forces have been operating unarmed drones for over 50 years. Between 2013 and 2015, this arsenal was expanded by three MQ-9 PREDATOR B systems (two aircraft per system). Five of the six drones are stationed in Niamey in the Sahel region in support of "Operation Barkhane." One system is still in Cognac north of Bordeaux for training purposes as well as for surveillance flights at major events.

The platform also supports military exercises in French airspace. A contract with

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Photo: U.S. Air Force



The German Bundeswehr has used Israeli HERON 1 systems as reconnaissance drones in Afghanistan and Mali.

General Atomics provides for the delivery of three additional systems by 2019. The new systems are Block 5 modifications (so far only Block 1 systems are in use); the entire fleet is expected to be brought up to the latest state of the art. In addition to standard armament, BRIMSTONE missiles (MBDA/UK) and a variant of the missile MMP (Missile Moyenne Portée) are also being tested.

On 6 September 2017, the French Defence Minister announced her government's decision to arm drones. As in the UK, this decision was a contested one, and certain operational rules had to be established. For example, French combat drones cannot be used outside armed conflicts. The decision was supported by a change in public perception: Increased awareness of a growing terrorist threat led to surprising opinion polls: 74% of the adults surveyed welcomed the use of combat drones.

The French government also expects that the future European Battle Drone Project (European MALE) will be armed. A consortium of Dassault Aviation, Airbus and Leonardo has been commissioned to develop this UCAV. The first flight is planned for 2025. Recent statements by the French Minister of Defence raise doubts that the timetable of the project, which does not provide for British participation, can be met.

In addition to arming drones, all future French drone systems will be connected to a cloud. This ensures the connection to the manned weapons system and enables joint operations under one command.

Germany's Path towards Combat Drones

The Bundeswehr has been using Israeli HERON 1 systems as reconnaissance drones since 2010; these systems support MINUSMA

and "Resolute Support" in Mali and Afghanistan, respectively. The platform and its payloads can perform Image Intelligence (IMINT) and Surveillance/Reconnaissance missions. Due to its long endurance and range, the drone is an important force multiplier in the theatre. The data collected serves to verify the results of reconnaissance by other means and systems. The drones are leased by Israeli Aerospace Industries (IAI) and maintained by an Airbus subsidiary. In general, the operators assess the experience with HERON 1 positively. However, changing operational concepts requires skills that are missing in this system.

Minister of Defence von der Leyen announced in 2016, that the German government will start negotiations with Israel in order to lease HERON TP, a drone, which can also carry weapons. The fact that the collaboration between Airbus, IAI, and the German Armed Forces has been very successful underpinned this decision. Contrary to other providers, this "well oiled team" will shorten the time to operational capability. It was also assumed that, due to previous experiences with HERON 1, the training efforts for operators will be significantly less.

One of the providers, General Atomics (GA), protested against the procurement decision and used legal means to reverse the decision. The Federal Arbitration Office rejected the protest and the wish to resume the programme. As a last resort, GA sued without success before the Düsseldorf Higher Regional Court.

However, in the last legislative period, the programme did not receive Parliament's approval. The Social Democratic Party, a member of the previous coalition, rejected the proposed funding of €25M. The new government intends to return to this issue as soon as possible.

Two systems will be delivered two years after contract signing; the remaining three systems will follow in three-month intervals. Germany decided to station these drones on the Israeli air field Tel Nof, also known as Air Force Base 8. German Armed Forces personnel will conduct the missions, Airbus employees will perform maintenance tasks, and German suppliers will provide satellite connections and data links as well as the associated encryption. As with HERON 1, the operational command remains with the Tactical Air Force Wing 51 "Immelmann" (TaktLwG 51) located in Kropp-Jagel in Schleswig-Holstein. Over the last years, the wing has become a drone base with an on-site HERON 1 simulator. Initially the mission, data collection, and evaluation will be conducted with ground stations in Israel or at other deployment bases.

Earlier this year, the members of the newly elected government expressed in their coalition agreement that drones are to be leased, which is an important step towards arming future unmanned aircraft systems. However, the selection of possible weaponry is not discussed. A government publication mentioned that a "high-precision, scalable and timely effect" on stationary and moving targets is desirable. This translates into an air-to-ground missile, which the controller can defuse or divert on its way to the target if desired. The warhead must be scalable to adjust the effect at the target.

Unconfirmed sources from the Ministry of Defence state that a missile developed by Israeli Military Industries (IMI) - WHIP SHOT - could be an option. WHIP SHOT is a low-cost weapon and currently in use on Israel's HERON drones. The missile has a weight of 15 kg, which includes a warhead of 6 kg. It is plausible that WHIP SHOT or other, similar missiles manufactured in Germany will find entry into the user's arsenal.

HERON TP is projected to be leased for nine years. At that time, the European Combat Drone should enter service in Germany.

More Than a Prophecy

Combat drones have entered the service of the European armed forces. Their significance as force multipliers will continue to grow in the future at a speed that surpasses the prophecies made just a few years ago. When it comes to military technology, European nations strive to gain and maintain sovereignty, and UCAS are no exception. The European combat drones project is another step in this direction. ■

A New Case for CAS

Tamir Eshel

Since the beginning of the air battle, air platforms have supported the ground forces with essential services - observation, provision of firepower, communication, supply and evacuation of the injured.

Surveillance, observation and air strikes have been the main purposes of air support since the beginning of the air force, although these services often led the attacker to confront the enemy air force from the ground and in the air in order to control the combat area and protect his own air force from enemy attacks.

Air attack missions are defined as close air support missions (CAS missions) that are closely coordinated with the armed forces on the ground and support and reinforce them with scalable effects, from the mere "show of force" to intimidating hostiles to direct attacks with overwhelming firepower, the defeat of enemy forces in direct contact and proximity to friendly forces. As an extended arm of the ground force, CAS should be accessible to the supported ground force, communicate clearly and effectively, share situational awareness and rapidly translate fires requests into effects.

CAS Operational Environment

In the past and also today this is easier said than done, because the pilots of the fast jets assume that CAS missions cannot communicate directly with the troops who support them, like the crews of combat helicopters do. On the other hand, the guns currently available for CAS missions have evolved by adding precision fire to the powerful cannons and unguided missiles they carry. Modern weapons are laser-guided missiles, rockets and EO/IR guided weapons that enable CAS-oriented platforms to increase their utilisation with ever more efficient weapons and thus achieve more effects with fewer aircraft.

But despite the quantum leap in precision, speed and electronics, the use of CAS has not changed so much compared to the practices invented decades ago. They rely on maps, voice communication and grid



Photos: via author

F-35 vs. F-16 – The current approach vs. future approach to CAS using multirole fighter planes in A2AD

coordinates to find their targets and avoid risks to friendly forces. Because ground and air communications are not easy to integrate, the digital transformation that has invaded the air forces in recent years has not completely changed CAS and made many processes slow and vulnerable.

But the most critical gap is the changing battle space - the introduction of state-of-the-art anti-aircraft missiles like Man Portable Air Defence Missiles (MANPADS), which work effectively from the ground to high altitudes and are virtually immune to flares and deception, mobile radar devices and infrared sensors capable of detecting aircraft at low altitudes, which significantly increases the effectiveness of air defence artillery (AAA). These weapons are likely to reach insurgents, at least in asymmetric battle zones where the enemy forces enjoy state support (Yemen, Syria, Ukraine, Mali, etc.).

During high-intensity operations, forces may encounter even more demanding opponents - in the form of sophisticated air and coastal defence systems that form anti-access - area denial (A2AD) battle

zones and challenge air force activity at all altitudes and distances. In such circumstances, contingency forces find it difficult to rely on the availability of CAS, airspace surveillance, communication relays and MEDEVAC. Under these circumstances, the psychological effects of fast jets attacking the enemy can be quickly turned upside down, as the ground troops that urgently need this support see their rescuers being shot down one by one by the enemy.

Precision of Close Support

To meet the challenges and gain the upper hand, the CAS of the future must be equipped and deployed with a high-end opponent in mind.

Traditional CAS can no longer be valid in the future. Aircraft flying missions at low altitudes are now at high risk from MANPADS and AAA. These weapons have severely affected even the most protected attack helicopters (the Russians lost several highly protected attack and attack helicopters in Syria), equipped with state-

Author

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of-the-art infrared countermeasures - DIRCM; NATO air forces, Israel, Saudi Arabia, Turkey and Egypt lost several helicopters in battle, including AH-64 APACHE, Mi-28 and Mi-35 and T-129, which are heavily protected and built to fight guerrillas. A-10C and Su-25B, which are operated by American, Russian, Syrian and Iraqi forces and also fly at low altitudes, suffer disproportionately high losses.

This vulnerability drove the air forces involved in these missions to prefer operations at higher altitudes, out of range of existing MANPADS and AAA. Operation at higher altitudes, however, requires the use of special sensors to maintain situational awareness and detect targets with high precision.

Fortunately, ground forces have access to laser markers and compact target des-

ignation equipment, thus sharing own position and target locations with the attackers. Operation at higher altitude also enable the attack aircraft to maintain continuous communication with mission command to offload some of the burden of attack planning and target clearing which helps to minimise the risk of fratricide and collateral damage.

Less threatened contingents allow the armed forces to use cheaper yet more versatile platforms that enable the air forces to effectively conduct CAS missions in a "permissive environment" - i.e. where the opposing forces lack effective air defence. In most scenarios, this requirement becomes rarer.

The platforms for these missions are various types of turboprop trainers, crop dusters and other aircraft designed

specifically for low-cost operation on unpaved runways. The most popular is the Brazilian SUPER TUCANO A-29 from Embraer, which is now in service with seven air forces worldwide. The A-29 was modified by the US-based Sierra Nevada Corporation for close combat with the Afghan Air Force. It is one of two candidates to be evaluated by the US Air Force Combat Command for the OA-X light CAS mission.

The US Air Force has tested the A-29 against the Beechcraft AT-6 produced in the USA; both are equipped with modern avionics and EO/IR sensor payload, air-to-ground communication packages and weapon systems that control several underwing hardpoints. These aircraft are certified for carrying and launching precision weapons such as GPS-guided bombs, laser-guided missiles and unguided guns, but without the massive 30mm cannon of the A-10C WARTHOG.

Both A-29, AT-6 and AT-802A have a relatively high speed and operating limit and are quite manoeuvrable, which increases the survivability from low-level small arms threats. However, such aircraft cannot be confronted with more significant air defence unless they are deployed from a distance, far from the assisted force, so that the above-mentioned psychological effect of air power is missing. New in this category are the SCORPION from Textron Airland and BRONCO II, based on the Advanced High Performance Reconnaissance Light Aircraft, or AHRALAC designed by the South African Paramount Group, sponsored in the USA by Bronco Combat Systems (BCS).

Larger platforms, mainly intended for night warfare, include tactical transport aircraft converted into flying gunships - including the AC-130J GHOSTRIDER, AC-235 and AC-27 SPARTAN, which are mainly used to support special missions. These aircraft are equipped with medium-/high-calibre guns (30, 40 or 105 mm), missiles and guided weapons to establish an airborne fire support base. While the firepower these aircraft can deliver is massive, they are large, slow targets in daylight that would be very vulnerable during the ingress and egress phases. Therefore, their use is limited to night time.

Drones are also used in the air support role, often operated from medium to high altitude. While manned aircraft rely on the pilot's ability to verify and confirm the target, unmanned aircraft require simultaneous confirmation from multiple sensors in different locations to verify the target validity. To support that they carry multiple, high performance sensor pay-



A F-35B testing the 25mm multibarrel cannon mounted on the belly pod

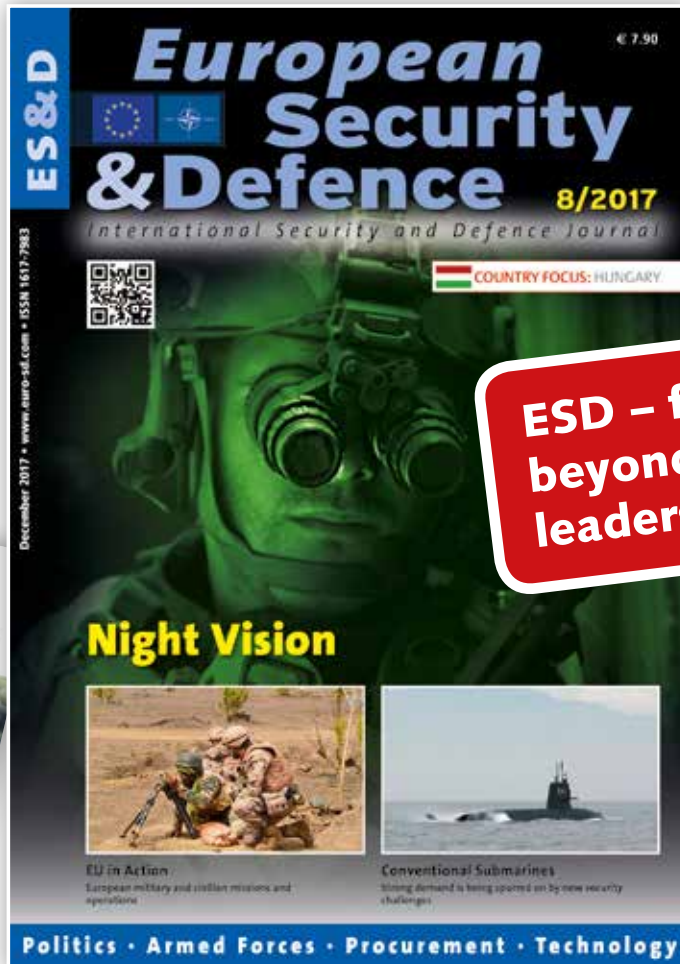


A-10C - dedicated CAS platform with an awesome multibarrel 30mm cannon

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loads that often include EO/IR (operating in different bands), COMINT and radar to verify and prosecute targets in permissive combat environment.

A New Generation

All these solutions partially address the need for air support in uncontested or lightly contested airspace, where operators favour operability, low maintenance and affordability, and would rely on weapon delivery methods more relaxed than the procedures pursued by western air forces.

However, such platforms should avoid operations in contested airspace, as the cost in lives of pilots and supported troops could surpass the benefits they gain. Air support in contested airspace requires completely new CAS capabilities that would rely on technological advancements offered by 5th generation fighter jets, precision standoff weapons, or totally new concepts that provide support from the air by unmanned systems, distributed fires, loitering, ballistic or cruise missiles and other innovations.

Unlike the CAS aircraft currently used or being considered, 5th generation fighters (such as the F-35 Joint Strike Fighter, JSF) were designed to operate in contested airspace. The combination of stealth, sensor fusion and information sharing enables the aircraft to deliver the effects without being detected or threatened by the enemy. It enables 5th generation fighters to operate at relatively high altitude, well above the MANPADS and AAA ranges and avoid being targeted by enemy Integrated Air Defence Systems (IADS). With their advanced capabilities such aircraft can support friendly forces even in contested airspace, avoiding the loss rate that would be experienced with conventional aircraft.

Unlike the CAS-dedicated aircraft that can be loaded with weapons, the F-35 carries fewer weapons in its internal weapons bay, to maintain its immunity to enemy radar and SAM. However, using smaller guided weapons, such as Raytheon's GBU-53B SDB-II or MBDA SPEAR will enable those planes to carry out multiple strikes on each sortie. JSF pilots also maintain excellent situational awareness using the aircraft integral sensors - Distributed Aperture System (DAS) and EO Targeting System (EOTS), and share their pilots' situational picture among the flight and with other elements, thus enabling tighter and faster communication between air and ground units. The US Defense Advanced Projects Agency (DARPA) has evaluated

some of these advanced capabilities under the Precision CAS programme that integrated various mission specific functions used by the Joint Tactical Air Controller (JTAC) and the fighter pilot, to integrate, accelerate and render the CAS mission in a less vulnerable and predictable way.



Modern short range air defence systems like this Russian PANTSIR S1 are turning the battlespace into a highly dangerous zone for aircraft, helicopters and drones.

Despite the great potential of 5th generation fighters, the future of CAS may not be with manned aviation at all, but with unmanned platforms, specifically as part of the integration of manned and unmanned assets currently being evaluated in testing. Several concepts are pursued – including the integration of combat helicopters and drones (the US Army has tested such concepts combining operations of AH-64 attack helicopters and MQ-1C GRAY WOLF attack drones). Other tests involved using fast jet-powered target drones employed “loyal wingmen” with conventional fighter aircraft, enabling fighter pilots to manoeuvre their unmanned “wingmen” to assist and carry out certain parts of the combat missions. Such wingmen could assume the most dangerous missions or act as “bait”, luring the enemy to a kill zone. Equipped with advanced levels of autonomy, such weapon carrying stealthy wingmen could become “strikers”, and even depart from their manned leader, to carry out independent strikes, including such missions that involve close support in contested airspace. Drones are increasingly employed in these roles operating in permissive airspace, including the MQ-1C and MQ-9.

When CAS is employed from a distance and fighters no longer swoop above, ground troops could turn to other means

for support, less visible but much more effective and ready to act, that also “come from the air”, but are controlled directly by the supported forces.

Some of these solutions, such as loitering weapons, are already available, utilising standard or specially designed drones as

persistent weapons, loitering over the combat zones for hours, acting as airborne surveillance elements that can turn into attackers by a flip of a button. When deployed in masses, loitering munitions can also coordinate their surveillance and attacks acting as a swarm, to overwhelm and saturate key enemy elements such as missile sites, radar or air defences.

Another form of “independent fires” are ballistic rockets that employ trajectory correction to achieve hit accuracy of less than 10 metres. Such rockets are operated by the ground forces, to support with the launch platforms located tens of kilometres behind the supported forces, enjoying unlimited ammunition supply and relative security from enemy attack. Their effective operation depends on the network that would expediently bring the right weapon to the target. These fires are not limited by weather or enemy countermeasures, thus providing more reliable and dependable support to the troops.

Assisted by rockets and loitering munitions and other guided missiles launched from the ground, the fighting unit that relies on that support can reduce the numbers and types of weapons carried by the troops, enabling the unit to be leaner, lighter and more effective. ■

GLOBALEYE – the Endgame for Stealth?

Georg Mader

This is at least the slogan with which innovation-driven SAAB describes its latest brainchild, the Swing-Role Surveillance System (SRSS) GLOBALEYE. ESD was invited to attend the roll-out at Linköping in late February, a multi-media event staged not for the Flygvapnet (Swedish Air Force) but for the United Arab Emirates (UAE-AF).

Based on top of one of today's premium business jets, the platform provides a new level of quality for the simultaneous monitoring and tracking of air, sea and land targets. In addition, there is much praise from all commanders who feel terrorised by too little time when faced with stealth opponents.

At first glance, however, there is not much difference on the outside. The so-called ERIEYE radar by ERICSSON from Gothenburg (part of the SAAB Group since 2006) with its transmitter/receiver modules (TRM) in a fixed "ski-box" antenna braced atop the hull (contrary to the rotating antenna of the earlier AWACS aircraft) has been around since the mid-1990s. Operators with long and/or vulnerable borders or coast lines have been using the system for years. Brazil, Greece, Mexico, Pakistan, Saudi-Arabia, Sweden, Thailand, the UAE and of course the manufacturer have already gained substantial operational experience with the platforms SAAB-340, SAAB-2000 and EMBRAER-145. Now follows another step, this time based on the Canadian Bombardier GLOBAL-6000 executive jet.

And for this development, the "ever-researching explorer and pusher of technological boundaries" (as SAAB's event narrator calls the company) - the author adds here the Swedish enthusiasm for new business fields - has investigated and tested how a performance limited by the given antenna body can be significantly increased. Before we go into detail, one limitation needs to be mentioned: Due to the design of the sideways "looking" ski box, only a 300° and no 360° all-round view is possible, which means that a sector of 30° to the front and back is not permanently covered.

Author

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Photo: Georg Mader

GLOBALEYE, SAAB's latest radar innovation



Photo: SAAB

GLOBALEYE offers a 70% increase in detection performance.

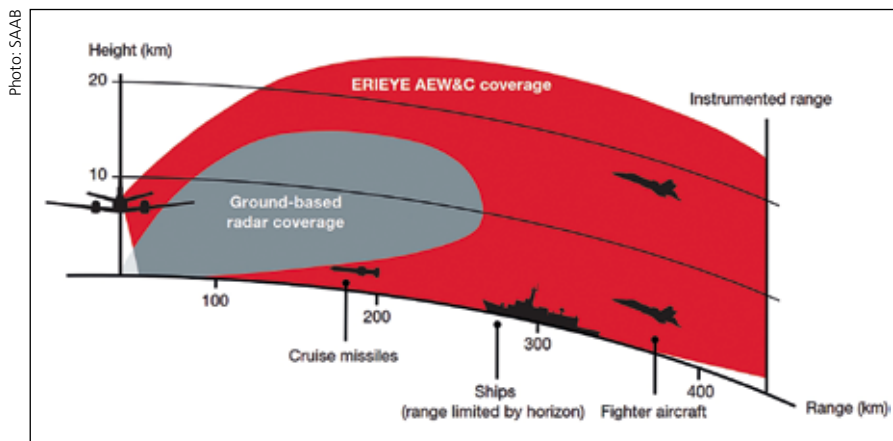
According to SAAB's radar programme director Lars Tossman, the new 2-4 GHz S-band radar ERIEYE-ER (Extended Range) would more than compensate for this with a significantly increased detection and tracking performance compared to the previous system.

A Brief Excursion into "Waffles"

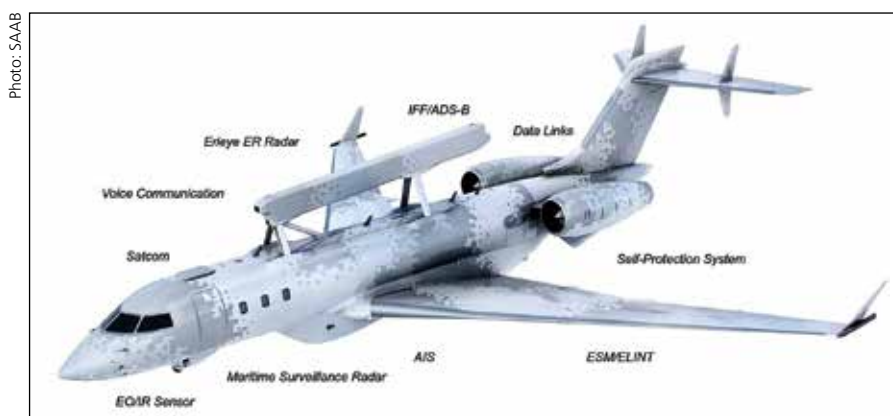
According to Tossman, the enormous increase in performance was only possible because gallium nitride (GaN) was used for the core TRM elements instead of gallium arsenide (GaAs), which did the "job" in the last 20 years.

GaN initiated a fundamental change and restructuring in semiconductor technology for HF (high frequency) applications. GaN-based effector/transistors with an operating voltage of up to 600V have been tested in power switches since 2012, allowing significantly higher switching frequencies. The material is well suited for high-power HF amplifiers as it provides four to six times the power density (in W/mm) of the GaAs technology. In addition, it is heat and radiation resistant, which - in addition to applications in the mobile communications world - is of strategic importance for defence and space applications.

However, a major problem in the production of GaN-based components is the diffi-



GLOBAL EYE is the improved successor of SAAB's ERIEYE radar.



By combining several sensors and radars, SAAB's latest innovation can do the jobs of AWACS (AEW&C), MPA and JOINT STAR simultaneously.

culty of producing large GaN single crystals to produce "waffles". In microelectronic and microsystems technology, these are disks about 1 mm thick that serve as a base plate for microelectronic components in highly integrated circuits. Several such "waffles" are mounted directly one behind the other in a TRM module. About how many "waffles" there are in the "ski box" and how much electricity they consume, individually or in total - Mr. Tossman just smiles knowingly.

More Time for Decision-Making

As it has been tested while overlooking air and sea space at SAAB's facility in Gothenburg, SAAB is convinced that the new radar offers a 70% increase in detection and tracking performance of conventional air targets thanks to the new TRM technology. Or - and this would be a breakthrough that would make headlines - has the same performance as its predecessor or similar systems, but also against targets with only one tenth of the radar cross section (RCS)! Of course, SAAB admits that "true" stealth fighters like F-22, F-35, Su-57 or J-20 - with considerable gradual differences between

them - will continue to be harder or much later to locate than a TYPHOON, RAFÁLE, GRIPEN or Su-30, especially from a frontal perspective. But the Swedes now claim that GLOBAL EYE would give back a "decent" period of time to take measures to the local battlefield commander.

When confronting stealth or low-observable aircraft there are only a few minutes left for a reaction or warning if detected in time. But the new radar would extend the time and airspace between the detection and decision lines. Usually GLOBAL EYE has a field of view of about 650 km, but since parts of the antenna can be focused on a specific sector, much more performance can be provided. In any case, using GLOBAL EYE would reduce or eliminate constant CAPs (combat air patrols) with your own combat aircraft; you could leave them on the ground in QRA (quick reaction alert) status - and thus save resources.

While SAAB does not forget to mention what all this means against UCAVs or sea-skimming supersonic cruise missiles, they do not paint such hot scenarios for all potential users, where at all times a great air war is looming along their borders. On the contrary, SAAB's narrators chose a completely different performance presentation:

It was pointed out that a long-standing problem for airborne radars would now have been solved thanks to ERIEYE ER: the hovering helicopter.

Other Roles to Prioritise

The SAAB spokesman emphasised that for the first time there will be no multi-roll capacity but swing roll capacity in up to 13 hours of airspace surveillance: a Leonardo SEASPRAY 7500E 360° surface contact radar based on AESA with approx. 400 km horizon and a retractable Star SAFIRE 380-HD electro-optical/infrared (EO/IR) sensor gimbal. The former radar could, it was claimed, detect the periscopes or masts of submarines or even jet skis over almost 70 km away and later be an indicator of moving ground targets (GMTI). This would unite the jobs of AWACS (AEW&C), MPA and JOINT STAR.

Of course, such a critical force multiplier would be hated by potential opponents in a hot scenario which is why SAAB considered ESD's question of protection to be justified: There is extensive self-protection equipment with various detectors, approach alarms and counter-measures integrated, and it was also explained that no one would operate such a valuable platform alone in enemy airspace. Thanks to the excellent detection performance of GLOBAL EYE an "escort" can be requested at any time.

An "Eye in the Sky" for NATO?

The launch customer UAE, who is militarily active from Yemen to Libya, is said to have paid over US\$1Bn for the first two platforms ordered in 2015. This includes training, support and a SAAB security concept for the base. One year later, a third aircraft was ordered for approx. US\$230M. Since the colourful roll-out, the first aircraft has been successfully flown for 106 minutes at noon on 14 March. The UAE AF markings are now removed and a temporary Swedish SE-RMY registration is used.

Due to the contractual obligation towards the customer, it is not possible to say when the delivery will be made to the Gulf. But although this will probably not happen before 2019, there is still a lot of time left to mature for another "job". SAAB sees the replacement of NATO's E-3A in about 10 years. "While our sensors could do their job easily and much more, we are certainly much cheaper than Boeing 707 aircraft with TF-33 engines," Tossmann emphasises. ■

Army Helicopter Requirements

Sidney E. Dean

Army helicopters have traditionally been grouped according to their primary mission as well as by distinct attributes, usually size or payload. The simplest division is into transport and multi-mission/utility aircraft on the one hand, and reconnaissance and attack helicopters on the other.

Technological developments, as well as changing threat assessments and operational doctrines, are defining new demands for the design of future helicopter generations, and are requiring modification of some currently operational systems.

Three major trends can be identified:

Versatility: While the era of mission-specific designs is not over, rising procurement costs and rapidly changing operational environments have increased the demand for military systems - including helicopters - that are adaptable. Multi-mission rotorcraft will be expected to reconfigure quickly between missions in order to transition between general transport and more specialised tasks such as Search and Rescue (S&R) or Medical Evacuation (MedEvac). Even specialised aircraft such as attack helicopters are expected to be modular to allow regular upgrading with newly developed components and to ease maintenance.

Performance: A variety of factors – recent experience in challenging geographic environments, improving counter-air technology, and the requirement for smaller forces to conduct full-scale missions at a high operational tempo – have led to demands for higher performance helicopters. This relates to physical performance (airspeed, range, flight ceiling, payload capacity) as well as to improved avionics and sensors. Modern helicopters will be expected to fly and land under degraded conditions (e.g. “brownout” and “whiteout” caused by sand- or snowstorms) and to engage targets at longer range.

Unmanned Operations: As autonomous technology advances, more helicopters will be designed for optional manned or unmanned operations. Equally

Photo: US Army



A UH-60 BLACK HAWK helicopter over Afghanistan: The BLACK HAWKS are one of the most versatile medium-lift utility helicopters produced by Sikorsky since 1979. Some 3,000 remain in service in 25 nations, with the US Army being the primary operator.

important is the ability for tandem operations between manned and unmanned aircraft. This will be especially useful for manned attack helicopters which can use data links to deploy UAVs as advanced scouts or even as armed platforms for intruding into highly-defended airspace. The concept enhances situational awareness, lethality and survivability, while incurring lower operating costs when compared to deployment of manned scout helicopters. The United States Army has advanced the farthest here with its MUM-T (Manned-Unmanned Teaming) programme which allows the crew of an AH-64E APACHE helicopter to control up to three MQ-1C GRAY EAGLE UAVs (Level 4 Teaming). While implementation is still in a very early stage, this technology allows the AH-64E to engage targets from beyond line of sight.

Transport/Utility Helicopters

The most recent transport helicopter to enter service is the Chinese Army's Z-18A, with a reported IOC in 2017. China Central Television released footage in January showing the Z-18A partaking in air assault exercises. This medium-lift helicopter produced by Changhe Aircraft Industries Corporation (CAIC) is powered by three turboshaft engines and can carry 27 combat-equipped soldiers or 14 stretchers internally or a 5,000 kg load externally. A stern ramp permits offloading small tactical vehicles. Composites and titanium are used extensively to reduce weight. The reported service ceiling of 9,000 metres permits operations at the highest altitude of the Himalayas. Maximum speed is 336 kph. The unarmed helicopter is equipped with terrain-following radar, a nose-mounted weather

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Photo: Caracal / Wikipedia CC



The Airbus H225M incorporates the modular philosophy which increasingly dominates helicopter design.

radar and a digital or “glass” cockpit. One of the most versatile medium-lift utility helicopters is the UH-60 BLACK HAWK family produced by Sikorsky since 1979. Some 3,000 remain in service in 25 nations, with the US Army being the primary operator (circa 2,200 units). Continual upgrades have kept the UH-60 and its export-variant S-70A relevant. Older versions of the US Army’s baseline utility helicopter are being upgraded to

Additional upgrades are expected, as the Army plans to operate the UH-60 well into the 2030s. The baseline utility variant can be configured for air assault missions (11 combat troops), cargo transport up to 4,100 kg, MedEvac, and gunship missions. The optional standard weapon load consists of two door-mounted machine guns or GATLING guns. Specialised UH-60 versions have been configured for electronic

ture. In 2017 Sikorsky completed work on a new weapon suite for the S-70M and S-70i models. By temporarily mounting two stub wings outfitted with hard points, this enables the baseline utility helicopter to be configured as an attack helicopter deploying 70mm HYDRA rockets, HELLFIRE air-to-ground or STINGER air-to-air missiles, or 12.7mm GATLING guns. The weapon suite integrates with the on-board avionics and targeting system and the pilots’ helmet mounted display.

The Airbus H225M, previously known as the EC725 or SUPER COUGAR, was introduced by the French army in 2005. Since then it has been acquired by eight other nations (including air force and naval variants). The SUPER COUGAR incorporates the modular philosophy which increasingly dominates helicopter design. It can be configured for various missions including assault transport, special operations, gunship and S&R. For tactical transport missions it can seat up to 28 soldiers. Slings loads up to five tonnes are possible. The MedEvac configuration fits 11 stretchers plus four medics. For special operations and combat S&R missions, weapons options include 7.62 and 20mm guns on deck as well as external gun and rocket pods.

The medium-lift multi-mission helicopter embodies many features typical of state-of-the-art utility helicopters. These include a fully digital cockpit with an advanced avionics and automatic flight control system integrating flight, navigational and tactical data; redundant flight systems; a defensive EW system controlling chaff and flare dispensers; crashworthy passenger seats; removable armour plating against small arms up to 12.7mm; a modular-built, comparatively light alloy and composite fuselage; a reinforced frame providing improved crash safety. The two turboshaft engines are independent and feature a reduced infrared signature. The five blade composite rotor reduces vibration. A rotor de-icing system, engine-intake sand and ice filters, and an aerial refuelling probe are optional. French forces have used the H225M extensively in Afghanistan and other non-European theatres, reporting excellent results including a 95 percent availability rate.

In terms of capacity, the CH-47 CHINOOK is one of the heaviest helicopters used by Western armies. It carries 33 combat-equipped soldiers or 55 passengers without gear; 24 stretchers and three medics; 10,900 kg intern cargo; or a sling load of 11,800 kg. The latest iteration, the CH-47F, entered service with the US Army in 2007. Seven additional nations also operate the “F” variant. It features new

Photo: US Department of Defense



A US Army CH-47 CHINOOK: In terms of capacity, the CH-47 CHINOOK is one of the heaviest helicopters used by Western armed forces.

the UH-60M configuration which entered service in 2009. The upgrade includes: a digital cockpit; improved gearbox, engines and rotor blades; and an integrated vehicle health management computer. Performance parameters include: a combat radius of 600 km, maximum speed of 300 kph, and a service ceiling of 5,800 metres.

combat, dedicated MedEvac deployment, and special operations transport and gunship missions. After the 2011 raid on Osama bin Laden’s compound in Abbottabad, it was revealed that at least two MH-60 special operations helicopters had been retroactively outfitted with stealth technology to reduce radar and noise signa-

engines, avionics, communications, and a modernised airframe designed to enhance stability and survivability. The stronger engines increase most performance parameters – speed, climb-rate, service ceiling, operational radius – when compared to the previous “D” variant. The most valuable enhancements are found in the digital cockpit. These include the Digital Automatic Flight Control System (DAFCS) which helps the pilot to hover or land under poor visual conditions (fog, smoke, snow, “brown out”); and the Common Avionics Architecture System (CAAS) which integrates multiple communications, navigation and mission subsystems. The cockpit features an open systems architecture design, allowing for easy upgrade of hardware and software. A special operations variant known as the MH-47G is also available. Both the “F” and “G” variants are expected to stay in service well into the 2030s. There has been discussion of a potential CH-47H variant to be developed in the coming decade. Featuring new engines and a new rotor design, it would have an increased payload capacity and would serve until 2060. At the other end of the capacity spectrum are smaller multi-mission aircraft such as

the Hindustan Aeronautics Limited (HAL) Light Utility Helicopter (LUH). The aircraft weighs three tonnes and fits up to six passengers or one tonne of cargo. Top speed is given as 250 km/h, with a mission range of 250 km and a service ceiling of 6,500 metres. The Indian army is procuring 187 LUH. Deliveries are expected to begin this year. A Light Observation Helicopter variant is also under development.

Reconnaissance and Light Attack Helicopters

Pure reconnaissance and observation helicopters are uncommon in today’s multi-tasking world. Some light multi-purpose rotorcraft include reconnaissance in their portfolio, but increasingly effective MANPADS and other mobile air defence systems make it advisable for recon helicopters to have the capacity for self-defence and to strike mobile targets of opportunity. This blurs the line between armed reconnaissance and light attack helicopters. Boeing, for example, applies both designators to the AH-6 LITTLE BIRD and its export variant, the AH-6i – arguably the world’s lightest manned attack helicopters. The designated mission profile includes light at-

tack, precision attack, anti-armour, reconnaissance, armed escort, troop insertion/extraction and combat S&R. Itself a variant of the MH-6 operated by the US Army Special Operations Command, the AH-6 has a fully integrated cockpit and an advanced mission computer designed to enhance situational awareness and reduce pilot workload. Targeting is accomplished via the AN/ZSQ-3 FLIR and the L-3 WESCAM MX-15Di EO/IR targeting sensor system.

The mission-enhanced LITTLE BIRD programme completed in 2015, bringing all aircraft up to the AH-6M standard, adding: a six-bladed main rotor and four-bladed tail rotor; an improved tail boom and tail rotor system; a strengthened frame to accommodate an increased weapons payload; larger doors; improved engine inlets and filters; and improved landing struts. The crashworthy fuel tanks are armoured against small arms fire up to 12.7mm. Armament includes TOW, Hellfire and Stinger missiles as well as various gun pods. The small helicopter features an unsurpassed power-to-weight and payload-to-weight ratio.

Korean Aerospace Industries and Airbus are developing a Light Armed Helicopter (LAH) designed primarily to act as a re-



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Photo: USMC Air Station Yuma



The AH-6 LITTLE BIRD is arguably the world's lightest attack helicopter.

connaissance and attack helicopter, while retaining a medium-lift transport capability. Based on the Airbus H155 DAUPHIN, the 2.6 tonne LAH will have two 1,650 horsepower turboshaft engines and a five-bladed main rotor enabling a speed of 325 km/h and a 549 metre per minute climb rate. Armament is expected to consist of a 20mm automatic cannon in a chin turret, augmented by rocket and gun pods carried on two winglets. Delivery of the first operational aircraft is expected in 2022.

rotorcraft was specifically designed for attack helicopter operations at high altitude, filling a known capabilities gap. To this end French engine manufacturer Turbomeca designed an engine optimised for high altitudes. The operational ceiling is estimated between 6,000 and 6,500 metres. While based on HAL's Dhruv light utility helicopter which entered service in 2002, India has leveraged considerable foreign cooperation to optimise the LCH. The weapons load includes a French GI-AT-Nexter 20mm turret gun, Belgian anti-

customise new aircraft to optimally meet their unique operational requirements. In addition to outfitting its own armed forces, India hopes to export the LCH.

Attack Helicopters

The difference between "light" and "full-fledged" attack helicopters is based on the latter's stronger armour protection, heavier payload capacity and mission focus on offensive combat operations. Attack helicopters remain highly nimble aircraft, relying on speed and mobility to ensure survival and mission success.

The seven tonne Z-10, built by CAIC, entered service with the Chinese Army in 2012. While some French and Israeli hardware is reportedly used on the Z-10, all mission software is reportedly indigenous. The digital cockpit features HUD, multi-function displays, night-vision goggle compatibility, fully-integrated navigation systems and a fly-by-wire control system. Later aircraft are equipped with terrain-avoidance and terrain following radar.

As is common on full-fledged attack helicopters, the two-person crew sits in tandem with the pilot above and behind the gunner. The fuselage is tapered toward the rear to reduce the radar cross section. The cockpit and other vital areas are armoured; bulletproof cockpit windows can withstand 7.62mm rounds. The nose-mounted sensors include FLIR, a low-light camera, and a laser rangefinder and target designator. The EW suite includes radar and laser-warning indicators, as well as countermeasures (infrared jammer, chaff and flare decoys). A nose turret houses a 30mm cannon, while winglets can carry up to 1,500 kg of ordnance. This payload can consist of up to sixteen HJ-10 anti-tank missiles, but more typically would include eight HJ-10 plus additional air-to-ground and air-to-air ordnance.

At 3,300 kg, the Airbus EC655 TIGER is one of the most nimble full-fledged attack helicopters. Nearly 80% of the hull is made from lightweight Kevlar and carbon laminates, with panels being honey-combed both for weight reduction and to enhance crew survival during a crash. Entering service in 2005, the TIGER remains one of the world's most modern attack helicopters. A total of four variants are offered, including the UHT (multi-role fire support), HAP (escort and multipurpose combatant), and ARH (armed reconnaissance).

The HAD (support and destruction) variant also known as TIGER Mk2 displays the greatest combat power and is the "heaviest" attack helicopter of the TIGER family.



Photo: US Army

The AH-64 APACHE attack helicopter is among the world's most potent attack helicopter. The newest APACHE variant is the AH-64E APACHE GUARDIAN introduced in 2013.

India's HAL commenced production of the indigenous Light Combat Helicopter (LCH) in 2017. IOC with the Indian Army, which has ordered 114 LCH, is expected this year. Missions include combating tanks, other armoured vehicles, slow-moving aircraft and ships, as well as reconnaissance, battlefield surveillance and S&R. The new

tank missiles and MDBA's MISTRAL-2 air-to-air missile. The electronic warfare suite comes from SAAB South Africa while the sensor suite and networking systems were developed jointly with Israel. While extensive, this sort of mix-and-match is a common phenomenon in today's globalised weapons market, and enables nations to

The mission profile includes destruction of armoured or hardened mobile and stationary targets, ground fire support, aerial or ground escort, reconnaissance, and air-to-air combat. The loadout includes eight HELLFIRE II or SPIKE ES air-to-ground/anti-armour missiles, plus four MISTRAL air-to-air missiles, optionally augmented by 68mm or 70mm unguided rockets. The 30mm gun in the chin turret can provide effective fire support at a distance of 2,000 metres. Despite using 77% composite materials in the hull, the HAD is also heavier than the other variants; features more powerful engines; has better ballistic armour; is better suited to operations in hot climate zones; and includes an Uplink/Downlink satellite antenna for data exchange with a ground station. A rooftop mounted sight (RMS) located atop the cockpit can directly feed to the pilot's helmet-mounted sight display (HMSD); both RMS and HMSD can be slaved to the 30mm gun for fast engagement of targets of opportunity. Extensive experience operating in austere environments in Afghanistan and Africa have proven the TIGER to be easy to maintain.

An upgraded TIGER Mk3 featuring improved avionics and weapons is to be procured by France, Germany and Spain in the mid-2020s. A decision on the precise configuration is expected no later than 2019. The roots of Boeing's AH-64 APACHE attack helicopter currently used by 15 nations go back to the 1970s. However, Boeing and the US Army as prime operator have consistently upgraded the APACHE, retaining its position as the world's most potent attack helicopter. The LONGBOW Fire Control Radar and Radar Frequency Inferometer (RFI) adopted beginning with the "D" variant allow target acquisition outside the line of sight. The technology permits acquisition of 128 targets and simultaneous targeting of 16. The newest APACHE variant, the AH-64E APACHE GUARDIAN introduced in 2013, features more powerful engines, a new transmission and improved composite rotor blades; this provides enhanced performance (cruise speed, climb rate, payload capacity, reaction and loiter time, and range) compared to the "D" variant. The "E" variant can control offboard UAVs (MUM-T) and engage maritime targets. Link 16 permits sharing situational awareness with friendly forces, while a new ground-fire acquisition system automatically locates the source of enemy fire and directs the APACHE's 30mm turret gun to suppress those targets. With a base weight of 5,200 kilos, the APACHE is cleared to carry a 3,000 kilo payload including 16 HELLFIRE



Photo: David Alvarez Lopez

Entering service in 2005, the TIGER remains one of the world's most modern attack helicopters.



Image: Korean Aerospace Industries

Korean Aerospace Industries and Airbus are developing the Light Armed Helicopter (LAH).

missiles. While the weight of the extra payload and the LONGBOW radome had made the APACHE less agile than many rivals, the "E" variants performance enhancements have levelled the field again, while the APACHE's larger payload provides it with greater combat power than most competitors. The US Army intends to continue purchasing the AH-64E until production ends in 2026, and will fly the APACHE until circa 2050.

Future Vertical Lift

During the 2030s the Army expects to begin introducing new rotorcraft under the Future Vertical Lift (FVL) programme. Ultimately all current classes of helicopter flown by US armed forces are to be replaced under this programme, but this process is expected to span at least two decades. FVL is intended to develop new rotorcraft using revolutionary rather than evolutionary, traditional design concepts. These will rely on advanced technology

developments, but the new configurations will in turn, dictate new operational concepts to take advantage of future aircraft's attributes and capabilities. Major aspects of the FVL family of rotorcraft as defined by the Army will include "integrated situation awareness, supervised autonomy, advanced manned/unmanned teaming and scalable and tailorable lethal/non-lethal fires and effects. Future Vertical Lift will maintain an early and continuous focus on reliability and maintainability to create maintenance free operating periods and reduce forward logistics burdens, while also establishing an affordable life cycle of sustainment." While FVL is primarily intended to develop manned aircraft, all models must be designed for unmanned flight when operationally necessary. Modular systems and open architecture designs should enable the continual upgrading of aircraft systems to keep pace with technological advances and/or new operational requirements. ■

Sharp Teeth for Attack Helicopters

Doug Richardson

For people outside of the military helicopter community, the concept of an armed helicopter will involve memories of the 1979 movie 'Apocalypse Now' and the sequence in which a US air cavalry unit uses its helicopters to attack a Viet Cong-held village while playing Wagner's "Ride of the Valkyries".

The attack scene showed aircraft armed with unguided rockets, plus forward-firing and door-mounted machine guns, a weapon fit that was typical of those used during the Vietnam conflict. By the late 1950s, the US Army could see the potential usefulness of the helicopter as an anti-tank weapon. It had already adopted the French SS.10 wire-guided anti-tank missile system as an interim ground-launched weapon, so mounting an S.11 version in the UH-1 was an obvious next step. Known as the M22 armament subsystem, this was operational in Vietnam by September 1965 and made its first combat launches in October of the following year. The M22 was always seen as an interim weapon, and an Improved COBRA Armament Program begun in March 1972 armed the UH-1B Huey with the Hughes BGM-71 TOW anti-tank missile. This used semi-automatic command to line of sight (SACLOS) guidance, rather than the more difficult-to-master command guidance of the SS.11. Rushed to Vietnam later in 1972, and proven in battle later that year, this added the guided missile to the basic family of helicopter armaments.

In an article of limited size, we cannot document the full range of weapons that are currently available, but will use developments and deployments reported in the last few years to illustrate the current trends.

While the first generation of wire-guided missiles such as the TOW, Euromissile (now MBDA) HOT and Norinco HJ-8 had required the gunner to manually steer the missile onto the target, SACLOS reduced the gunner's workload by reducing his task to that of keeping the weapon sight aligned with the target while an automatic tracking system kept the missile positioned on the line-of-sight.

Author

Following an earlier career in engineering, **Doug Richardson** is a defence journalist specialising in topics such as aircraft, missiles, and military electronics.



Photo: Raytheon

The shape of helicopter armament to come? In the summer of 2017, Raytheon revealed that it had tested a pod-mounted high-energy laser system mounted on an AH-64 APACHE.

Photo: Roketsan



Roketsan has successfully developed the MIZRAK-U long range antitank missile (top) and CIRIT guided rocket (below).

KBM's 9M114 SHTURM-V (AT-6 SPIRAL) is a relatively simple radio-command SACLOS weapon of 8 km range that armed the Mi-24V and -24P 'Hind' helicopters. The follow-on 9M120 ATAKA-V (AT-9 SPIRAL-2) is similar, but has a maximum range of 8km. It arms upgraded Mi-24 HIND helicopters and the Mi-28 and Mi-35 series. Russia has

used its Mi-28N and Ka-52 attack helicopters during recent combat operations in Syria. The Ka-52 is reported to have used the anti-tank (9M120) and anti-personnel (9M120F) versions of the ATAKA, as well as 80mm S-80FP unguided rockets. At the MAKS-2017 air show in Moscow, Russia, JSC Russian Helicopters showed its

new Mi-171SH-HV transport helicopter. This is equipped with six external hardpoints that can carry guns such as 12.7mm-calibre KORD machine guns or the UPK-23-250 pod-mounted GSh-23 cannon, launchers for S-8 rockets, OFAB-250 high-explosive fragmentation incendiary bombs, and up to eight ATAKA missiles. The upgraded Mi-28NM Night Hunter helicopter gunship is being cleared to carry and deliver updated versions of the ATAKA missile. Fired by an improved version of the aircraft's onboard fire control system, these will have a longer range than current

The next logical step was to equip the missile with a seeker that allowed it to automatically home onto the laser energy reflected from a target illuminated by a laser designator. Known as semi-active laser (SAL) homing, this technique is used by most versions of the AGM-114 HELLFIRE missile which was developed to arm the AH-64 APACHE.

China's Z-10 attack helicopter can carry the HJ-10 SAL-guided missile. Also known as the AKD-10, this has a range of up to 8 km. IAI's NIMROD SAL-guided missile has a maximum range of 25 km, but its 98 kg launch weight has restricted its use to the IDF's CH-58 assault helicopters. The company's SkyBow (LAHAT) is a 12.5 kg SAL-guided weapon with a maximum range of 13 km and is compatible with helicopters in the class of the AH-1 COBRA, Mi-17, and MD-530.

South Africa's Kentron (now Denel) developed the ZT35 INGWE missile in the late 1990s. It uses laser beam-riding guidance, and has a maximum range of 5 km. It has been qualified for use on the Denel Rooivalk helicopter, and marketed as an upgrade for the Mi-24. The follow-on ZT6 Mokopa has a range of 10 km. It uses SAL guidance, but proposed IIR and millimetric-wave variants have not materialised. Algeria is reported to have ordered MOKOPA to arm the LYNX helicopters carried by its MEKO A-200 frigates.

Originally known as LR-TRIGAT, the PARSYS PARS-3 LR is a 49 kg weapon with a maximum range of 6 km. It homes onto its target by using a nose-mounted IIR seeker. Development was protracted, so the sole user became Germany. A prolonged development programme has also plagued India's Bharat NAG IIR-guided anti-tank missile and its air-launched HELINA derivative. Rafael's SPIKE-ER (originally known NT-D or DANDY) has a maximum range of 10 km, and uses a combination of inertial and a combined TV and IIR seeker. A lock-on-before launch mode allows 'fire-and-forget' attacks, while a fibre-optic link to the launch helicopter can be used by the gun-



Photo: MBDA

The first test launch of MBDA's SEA VENOM/ANL was conducted from a DAUPHIN helicopter in June 2017.

ner to select a target using his video display. MIZRAK-U (previously known as UMTAS) was developed by Roketsan to be a long range antitank missile for the locally developed T-129 ATAK attack helicopter. A two-way RF datalink provides communications with the launch platform, and terminal homing is by means of an IIR seeker that allows lock-on before launch and lock-on after launch attack modes. A SAL-guided L-UMTAS version is also available.

An AGM-114L LONGBOW HELLFIRE was developed for use on the AH-64D APACHE LONGBOW. This version is guided by a millimetric-wave active radar seeker. Based on the HELLFIRE, MBDA's BRIMSTONE missile originally used an active MMW seeker of

British design, but was designed for use from fixed-wing aircraft. In 2008, the UK fielded a dual-mode variant whose seeker had an alternative SAL mode. MBDA went on to develop the dual-mode BRIMSTONE 2 missile and is currently promoting this for helicopter use.

Late last year, Airbus Helicopters delivered the first TIGER helicopter retrofitted into the HAD (Hélicoptère d'Appui Destruction) standard to the French Army Aviation following the formal acceptance of the new standard by the French Defence Procurement Agency (DGA). A new STRIX roof-mounted sighting system incorporating a laser designator allows the HELLFIRE II air-to-ground missile to be fired.



Photo: BAE Systems

BAE System's APKWS guided rocket is unique in that it is guided by four laser-energy sensors mounted on the leading edge of the canard control surfaces. This allows the weapon to use the full range of existing war-heads.

France is now working with Germany and Spain to define the specification for a proposed Mk3 variant of the TIGER. Currently, the French aircraft carry the HELLFIRE, German examples are armed with the PARSYS TRIGAT, while Spain uses the Rafael SPIKE-ER. For the Mk3, it is hoped that all three users will adopt a common missile.

Missiles such as HELLFIRE carry warheads in the 8 – 12 kg class, so may be overkill when fired against many types of target that need to be engaged during counter-insurgency operations. By the late 1990s, the US services could see the need for smaller and less destructive weapons that would reduce the risk of collateral damage. The obvious solution was to develop guided versions of standard air-to-ground rockets. BAE Systems' Advanced Precision Kill Weapon System (APKWS) uses existing

unguided rocket. By the end of 2011, TALON had completed an operational demonstration in the UAE, using AH-64D helicopters from the UAE Air Force, while the certification process for use on the AH-64D/E attack helicopter was completed in 2014.

The US Navy's Low Cost Guided Imaging Rocket (LOGIR) is based on passive IR guidance using an imaging seeker teamed with the hardware of the 70mm HYDRA rocket. Although it has been test-fired from helicopters, its only application so far has been in South Korea's surface-launched K-LOGIR coastal defence system.

Elbit Systems offers its guided Smart Tactical Advanced Rocket (STAR) upgrade for 80mm rockets and teamed with ATK to develop the GATR (Guided Advanced Tactical Rocket). The latter also forms the basis of the Diehl Defence GILA (Guided Intelligent Light Ar-

Developed by Harbin Jiancheng, China's SKY ARROW Arrow 90 is a guided version of the Type 90-1 90mm unguided rocket. Several types of guidance have been promoted, including laser beam-riding, but the version adopted for service is understood to have a SAL seeker. Ukraine's State Kyiv Design Bureau 'Luch' has used the 80mm rocket as the basis of its AR-8L SAL-guided rocket. Laser-guided rockets developed by Thales subsidiary TDA Armaments could form part of the armament of the Mk2 version of the TIGER now being developed by France.

Although helicopters have been used to deliver high-explosive bombs, they lack the manoeuvrability and performance needed to deliver such weapons effectively. Heavy and often-improvised blast weapons are more practical. During the Vietnam War, the US made limited use of barrel bombs to attack Viet Cong guerrillas operating under forest cover, while Syrian use of similar weapons against opposition forces has become notorious in recent years, with an estimated total of more than 5,000 Syrian barrel bombs being used by mid-2014. Some of the Syrian munitions have been filled with chlorine gas, and the Office of the United Nations High Commissioner for Human Rights (OHCHR) released a report in 2014 detailing how these improvised chemical weapons had been used by Syrian government forces against several towns. Chile and Saudi Arabia operate SUPER PUMA helicopters configured to carry the EXOCET antiship missile. The concept has been brought up to date by the H-XBR programme under which Airbus Helicopters rolled out the first of five Operario MB H225M helicopters for the Brazilian Navy in October 2016. These aircraft are equipped with a Telephonics APS-143 surface-search radar (which supplements the FLIR Systems Star SAFIRE III electro-optical/infrared (EO/IR) sensor turret used on Brazil's other H225M helicopters), and are armed with one or two AM39 Block 2 Mod 2 EXOCET missiles.

Jointly ordered in 2014, the MBDA Sea Venom/ANL has been developed by the UK and France. A DAUPHIN test bed helicopter owned by the DGA conducted the first test firing of MBDA's SEA VENOM/ANL missile in June 2017. Performed at the Île du Levant test range in France, the flight was configured to test the weapon's full-range performance. It was due to be followed by tests intended to exercise the systems' operator-in-the-loop capabilities. Weighing around 100 kg and based on IIR seeker guidance coupled with a two-way datalink, the new missile will arm the UK's AW159 WILDCAT helicopter and France's new Hélicoptère Interarmées Léger (HIL). It is designed to replace existing and legacy systems such

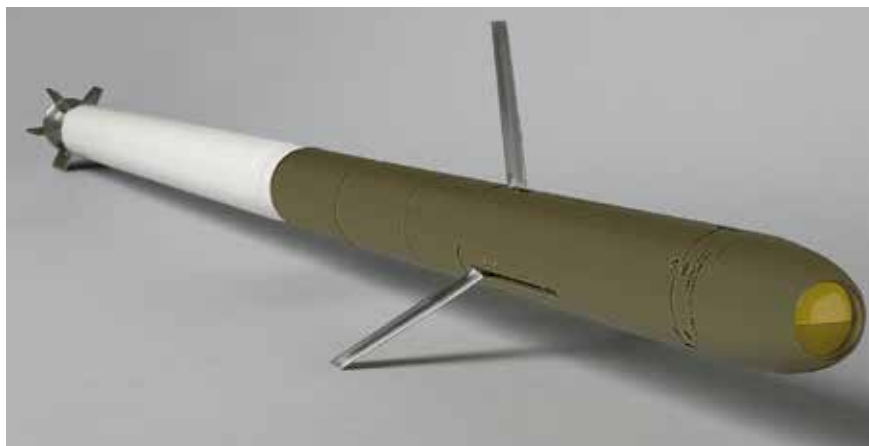


Photo: Raytheon

Raytheon's TALON guided rocket uses a nose-mounted SAL seeker.

HYDRA 70 components such as launchers, rocket motors, warheads and fuzes, but adds a new WGU-59/B control section located between the warhead and the motor. Laser seekers located in the leading edge of each of the four pop-out control surfaces operate in unison, as if they were a single seeker. This configuration leaves the nose section free to contain a current warhead and fuze, and since the laser seekers are stored within the control section until the rocket is fired, their optics are protected from the motor efflux from rockets fired earlier in the mission. APKWS can be fired from any helicopter that has been cleared to launch 2.75-inch rockets. Initial operating capability on USMC AH-1W SUPER COBRA attack and UH-1Y VENOM (or Super Huey) utility helicopters operating in Afghanistan was announced in 2012.

Developed in collaboration between Raytheon and the UAE company Emirates Advanced Investments (EAI), the TALON laser-guided rocket (LGR) mounts a nose-mounted digital semi-active laser (SAL) guidance and control kit on the 2.75-inch HYDRA-70

armament) 70mm calibre guided rocket proposed by the German company in 2010 as a smaller weapon able to supplement the PARS 3LR air-to-ground missile used on German TIGER helicopters. For users of 68mm and 70mm rockets, Elbit Systems has created another SAL add-on kit – the Guided Advanced Tactical Rocket (GATR).

Roketsan's CIRIT 2.75-inch laser-guided missile is not an add-on kit, but a custom-designed weapon intended to allow armed helicopters to attack light armoured or unarmoured targets. It is fired from a smart launcher that is compatible with MIL-STD-8591, MIL-STD-1553 and MIL-STD-1760. Turkey has used CIRIT to arm existing AH-1W COBRA helicopters and the locally developed T-129 attack helicopter. In 2013, the UAE and Roketsan announced that CIRIT had been ordered to meet an urgent operational requirement from the UAE armed forces. In May 2014, Roketsan and MBDA Deutschland signed a memorandum of understanding covering a 70mm guided rocket seen as a potential solution for an anticipated German Army requirement for the UH TIGER.

as the UK-developed SEA SKUA and the French-developed AS15TT anti-ship missiles. Air carriage trials have already been conducted to demonstrate its compatibility with existing LYNX helicopters.

The UK's next-generation AW159 WILD-CAT naval helicopter will also carry the Thales Lightweight Multi-role Missile (LMM). Developed to meet the Royal Navy's Future Anti-Surface Guided Weapon – Light (FASGW-L) requirement, this 13 kg weapon uses laser beam riding guidance and has a maximum range of 8 km.

Naval helicopters can be used in the anti-submarine role. The normal armament consists of air-droppable depth charges or homing torpedoes. Although the Cold War era saw the carriage of nuclear depth bombs aboard US, UK, French, Soviet, and Chinese ASW helicopters, no weapons of this type are thought to be currently in service.

Russia's 120 kg ZAGON-2 anti-submarine weapon was designed for use from the Ka-28 HELIX naval helicopter, as well as Il-38 and Tu-142M fixed-wing ASW aircraft. It could be used to arm the Mi-14 HAZE helicopter, whose ASW variant is thought to have been withdrawn from service during the 1990s, but is reported to be returning to operational status. After being delivered to the sea surface by parachute, the ZAGON-2 sinks, and then uses a built-in active sonar system to detect a submarine target, then home towards it.

Short-range air-to-air missiles typically weigh around 80 to 90 kg and are too heavy for use on a helicopter. The normal method of providing an attack helicopter with air-to-air capability is to adapt an existing man-portable surface-to-air missile such as the Raytheon FIM-2 STINGER or the MBDA MISTRAL.

Air-to-Air STINGER (ATAS) entered development in 1984. Although the weapon has been cleared for a wide range of helicopters, its only operational applications are the OH-58C and -58D(I), MH-60, and AH-64. The most recent firing trials to be reported were conducted late last year by South Korean Army AH-64E attack helicopters. These used STINGER air-to-air missiles to shoot down unmanned aerial vehicle targets during a live-fire exercise

(probably known as the PL-90 in Chinese service) seems to be the only purpose-built air-to-air missile for helicopter use. It is similar in size and weight to the MISTRAL.

High-energy lasers could become a future weapon for attack helicopters. In June 2017 Raytheon announced that it had completed the successful flight test of a high-energy laser system carried by an APACHE AH-64. Conducted at White



Photo: Doug Richardson

Unguided 68mm and 70mm rockets can be converted to Guided Advanced Tactical Rockets (GATR) by use of an Elbit Systems add-on kit.

at an artillery range in Boryeong, South Chungcheong Province. The missile has a maximum range of 6 km, but these targets were engaged at a range of 2.5 km. MBDA's MISTRAL is carried by Spanish TIGER helicopters, and the Indian Army plans to use this weapon on its RUDRA Mk IV combat helicopter (an armed version of the Advanced Light Helicopter) and Light Combat Helicopter (LCH).

China's Luoyang Optoelectro Technology Development Centre (LOEC) TY-90

Sands Missile Range, New Mexico in conjunction with the US Army Apache Program Management Office and the US Special Operations Command, the test coupled a laser with a version of the Multi-Spectral Targeting System (an advanced electro-optical infrared sensor). This was the first time that a fully integrated laser system mounted on a helicopter had successfully tracked on a number of targets, and engaged these with directed energy. ■

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William Carter

Helicopters are difficult to fly. You have about ten times the chance of dying in a helicopter crash than in a fixed-wing aircraft. Therefore, good training is needed to reduce the high helicopter accident rate.

In the run-up to last month's Heli-Expo 2018 in Las Vegas there was a report on the recently opened CAE Brunei Multi-Purpose Training Centre (MPTC). Amongst other training equipment, this has a CAE 3000 Series Full Flight Simulator for the Sikorski S-70i BLACK HAWK helicopter. This simulator has 220 x 80 degree visual including "chin" windows for extra cues at the hover, and 6-axis motion. Head of Standards and Evaluation Lt Col Johar Mohammed has over 3000 helicopter hours, and commented that the simulator visual system graphics are "awesome" and that motion is correct and well co-ordinated with visual references. Cues of real motion in a helicopter simulator are particularly important during take-off, hover, low-level manoeuvre, descents, emergencies, and landing. The CAE TROPOS-6000 visual has detailed Brunei topography including modelling of Bandar Seri Begawan (Brunei's capital), countryside, military training areas, offshore oil rigs, Brunei Navy ships, plus night scenes with car headlights, realistically-positioned stars and moon, and Night Vision Goggle (NVG) imagery. Johar says that apart from converting new pilots and ongoing military training, the S-70i simulator is also used for search and rescue, firefighting, formation flight, winching and stretcher lift, mountain flying, shipboard and oil rig operations, and special missions. Overall, he concluded, it is difficult to tell whether it is real flight or the simulator. Finally, it is considerably less costly to train in the simulator compared to the aircraft itself, which can be preserved for operational missions.

Difficult to Tell Whether it is Real Flight or a Simulator

Although this is only one example, it sums up the current state-of-the-art in helicopter training. It is fortunate that such progress has been made, because having flown both fixed- and rotary-wing aircraft, I can confirm that helicopters have less natural stability, are more difficult to fly, and have a more critical safe flight envelope beyond which is loss-of-control or worse. They have more accidents than fixed-wing aircraft, and a 2002 NASA



A CAE-built AW101 full flight simulator at Leonardo's Norway Training Centre at Stavanger Airport



A Thales full flight mission simulator for the AS532 SUPER PUMA of the Swiss Air Force

analysis showed a helicopter accident rate of about ten times that of fixed-wing aircraft. In terms of deaths, another NASA analysis concluded that on a worldwide 10-year rolling average, you have about ten times more chance of dying in a helicopter crash than in a fixed-wing aircraft. Really good training is therefore "of the essence" to reduce the high helicopter accident rate.

A Higher Mortality Rate

The need for high fidelity Outside-World (OTW) visual cues is obvious, and because of closer proximity to the ground compared to fixed-wing aircraft, particularly at the hover, highly detailed cues are needed. These include blades of grass or crops that bend and

wave under the influence of rotor wash, outgoing ripples when hovering over a water surface, the detail of trees and their leaves when landing in a clearing between trees, and so forth. As well as wide-angle simulator visuals for the main cockpit windows above and to the side of the main instrument panels, helicopters have transparencies below and to the side, the "chin" windows mentioned above. These give vital cues for control at the hover, also for slow flight at very low level, so called "nap-of-the-earth" (NOE) operations. Imagery for helicopter simulator chin windows can either be from a wide vertical field-of-view main visual system, or from dedicated chin window displays using TV monitors. The main visual system is projected, sometimes directly on a screen a few metres in front of

Photo: via author

Photo: via author

the main cockpit windows, sometimes on a curved mirror of large horizontal and vertical extent. The mirror surface is on a flexible substance such as mylar sheet, which is kept in its precise curvature by a pump when the simulator is in operation. The mirror reflects images projected above the simulator screen and its vertical curvature allows a "distant focus" to be perceived by the simulator crew. This is the so-called Cross Cockpit Collimated Display (CCCD or C3D) first patented and marketed in 1982 by the Rediffusion simulation company in the UK. Since then, CCCD displays have become widely available from all major simulator companies. However, curved mirror systems have a physical limit of about 60 degrees in vertical field-of-view. For helicopter simulators this can be preserved for above-the-horizon view by using extra TV monitors for the "chin" windows, and such monitors can also use collimated optics so that the distant-focus of the display can be preserved. If larger vertical view is required, a dome-based visual can be used with multi-channel projection on the inside of the dome surface.

Cues of Real Motion

The need for cues of real motion in a simulator is less obvious. However, these are needed if handling fidelity is a training requirement, for instance in critical situations such as manoeuvre and low flying, particularly in helicopters at the hover and at NOE altitudes. The reason is because the way cues of motion and visual are received and processed by the human brain. Aviation medical experts have told us for many years that the brain processes cues of motion more



Photo: Sikorsky

A FSI Sikorsky S-76B helicopter simulator with night vision goggle training



quickly than it processes cues of a changing visual scene. This fact is critical to the way that a motion-based simulator works, in which cues of pitch, roll, yaw, heave, sway and surge, the 6 motion axes, must be sensed before their accompanying visual cues. A simulator motion system must act quickly, and in no circumstances must the visual system display such changes **before** the motion platform has moved, or disorientation will result. Motion cues are particularly strong in conditions of critical control actions, reduced visibility, night scenes, or in pure instrument flying when in cloud. I remember flying a helicopter simulator with an impressive big visual, but when the motion was switched off, I started oscillating on the controls, particularly on the collective lever when at the hover - an accurate landing was simply not possible, all you could do was put it roughly on the ground and "hope for the best." Once the 6-axis motion was switched on again, the symptoms of over-control disappeared and the simulator flew

like the real aircraft. This summarises the need for simulator motion if the simulator is to handle like the aircraft, and a helicopter at the hover is one of the more critical cases. There are also special helicopter characteristics such as the "vortex wing" state, analogous to a fixed-wing stall that can lead to fatal crashes, and needs to be trained so that it can be avoided.

In simulators without motion, to avoid overcontrol the control responses need to be changed from those of the aircraft, made less responsive and more stable, therefore no longer being "as aircraft" and not able to train realistically for critical handling situations. As well as rates of motion in the 6 axes, vibration has to be considered. Unlike fixed-wing aircraft, helicopters have particular vibration modes at certain speeds and rotor RPM. Although these can be simulated through the motion platform, it is less fatiguing on the platform jacks to have separate vibration devices fitted under the pilots' seats or under the simulator cabin floor. This is easy to do, for instance by fitting a box in which an eccentric weight is programmed to rotate at appropriate parts of the flight envelope.

As well as helicopters with their big main rotors, other types of aircraft can hover and many of the remarks above also apply. These include fighters such as the HARRIER and the B variant of the F-35 that has rotating nozzles for VTOL operation, although hovering very close to the ground is not desirable due to hot gas re-ingestion, and vertical landings follow a steady descent to a firm landing. There is also the Bell Boeing V-22 OSPREY with rotors at the end of its wings and helicopter characteristics at or near the hover, rather like a CHINOOK helicopter but with the two rotors separated laterally rather than longitudinally.

Recent Projects

Finally, some recent projects in helicopter simulation and training in 11 nations are summarised below:



Photo: via author

Cockpit view of a Russian Ka-50 helicopter simulator



Photo: via author

Night vision goggle training with a Flight Safety simulator

Canada: Bluedrop Training and Simulation Inc. of Halifax, Nova Scotia, is to deliver a simulator for the Bell 206 helicopter to the Canadian Forces Contract Flying Training and Support (CFTS) Programme in Southport, Manitoba. It will have 220 degree visual, motion and vibration systems.

Germany: CAE Elektronik GmbH of Stolberg has upgraded the German Navy's SEA KING Mk41 simulator to Full Mission Simulator (FMS) standard at Nordholz Naval Airbase. This has CAE's MEDALLION 6000 image generator, Common Database (CDB) architecture, upgraded avionics, a new vibration system and improved instructor and debrief stations.

Kuwait: Thales is to provide Kuwait forces with training for CARACAL H225M helicopters, developed from the Eurocopter COUGAR. Thales will supply a Reality H full flight mission simulator (FFMS) and two other trainers, which can be networked for collective training.

Malaysia: Thales delivered a FNPT II Flight and Navigation Procedures Trainer for the H120 helicopter to Gading Kasturi. The company provides flight training at the Royal Malaysian Air Force College in Alor Setar.

Norway: Leonardo Helicopter Division has opened its Norway Training Centre at Stavanger Sola Airport. This has a CAE-built AW101 full flight simulator and a Norwegian Air Force AW101 rear crew trainer that can be linked to the FFS. The Sola facility is administered by the Leonardo Helicopter Training Academy in Yeovil, UK.

Peru: Russian Helicopters Holding, headquartered in Moscow, has built a helicopter simulator centre in Lima for the Peruvian military. This is to train for the 24 Mi-171Sh helicopters that are operated by Peruvian Ground Forces.

Switzerland: Thales UK has upgraded simulators for the AS532 SUPER PUMA of the Swiss Air Force. Work on the Full Flight Mission Simulator includes avionics, radio, digital map, forward-looking infra red (FLIR), and helmet-mounted display (HMD). Improvements have also been

made to other simulators, in particular to the instructor station.

Turkey: Quantum3D of San Francisco is to provide their INDEPENDENCE IDX 8000 image generator to Turkish simulator manufacturer Havelsan. This is a simulator for the T-625 helicopter that is replacing the Bell UH-1H HUEYs of the Turkish Army.

UAE: CAE, headquartered in Montreal, Canada, is to provide the United Arab Emirates Joint Aviation Command (JAC) with a fixed-base flight training device (FTD) for the NORTHSTAR Aviation 407 multi-role helicopter (407MRH). This will have a 240 x 95 degree 21 ft diameter dome display by 3D Perception of Norway with projectors that are automatically aligned and calibrated through sensors embedded in the screen. The 407MRH is a variant of the Bell 407GX.

UK: Virtualis Ltd of Sale, SW of Manchester is to supply two H135 helicopter simulators to the UK Military Flying Training System (UKMFTS). This is under a contract with Lockheed Martin, a partner of the Ascent Joint Venture which is the prime contractor

Photo: via author



A CAE flight simulator for Airbus Helicopters H135 and H145 for the UK Military Flying Training System (UK MFTS)

for UKMFTS. The simulators will have the Virtualis VR Helicopter Crew Reality System (HCR) and will be operational at RAF Shawbury in 2018.

UK - Helicopter Modelling: J2 Aircraft Dynamics Ltd of Daresbury, UK, has introduced j2Rotary for helicopter simulation models, part of the company's j2 Universal Tool Kit. It integrates j2 modelling, analysis and flight data functions with the Blade Element Rotor Model (BERM), tail rotor and gearbox components of the HeliSIM system from Presagis of Montreal, Canada. It includes helicopter features such as autorotation, ground effect and translational lift due to horizontal flow of air across the rotor. This enables the rotor model and airframe effects to be tuned independently of each other using automated techniques already used for fixed wing models.

US Army: CAE USA of Tampa, Florida, is providing rotary-wing flight training and other services for the US Army Aviation Centre of Excellence (USAACE) at Fort Rucker, Alabama. This includes classroom, simulator, live flying and support services, and employs about 300 CAE personnel. The project has a total value of US\$450M. The US Army Initial Entry Rotary-Wing (IERW) programme trains about 900 Army and Air Force students per year with classroom instruction, simulator, and live flying on TH-67 CREEK and UH-72 LAKOTA helicopters. After IERW, pilots either convert to front-line helicopters (AH-64 APACHE, CH-47 CHINOOK, UH-60 BLACK HAWK) or transition to the Army and Air Force fixed-wing flight training programme at CAE's Dothan centre, close to Fort Rucker.

Conclusion

For the most effective training it is worthwhile spending money on a high quality full flight simulator with good visual and, particularly for helicopters, well-synchronised motion. This is not only to improve operational performance in the real aircraft but increase safety by simulating the areas of critical handling. Helicopter accident rates are greater than those for fixed-wing aircraft and because of the nature of helicopter design and the versatile way they operate, always will be. This increases the need for really good training aids such as full flight simulators, so that lack of training does not contribute to accidents. For the more complex helicopters and aircraft capable of hovering such as the HARRIER, F-35B and OSPREY, such simulators cost much less than the real aircraft and can be funded by using money liberated by relatively small reductions in training flying. ■

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Air Force Simulation: An Update

William Carter

It is 30 times less costly to train on a modern state-of-the-art full flight simulator compared to training on the aircraft itself.

At the 2017 European International Training Equipment Conference (ITEC) in Rotterdam, NATO Chief Scientist Dr. Tom Killion said that simulation is now a core part of almost all that NATO does. It is embedded in many NATO activities, from basic training up to Mission Rehearsal in a Synthetic Theatre of War (STOW) environment. Today, he said, "Synthetic reality is reality." A critical area is how to model enemy action, for which realistic behaviour must be used including looking at different enemy tactics, the cyber area, and different responses to these situations. This is not easy for real vehicles such as "red air" in live exercises, but straightforward when simulation is used, through which a number of different enemy actions and responses can be generated.

Later in the Conference there was a symposium on training for the F-35 LIGHTNING II Joint Strike Fighter (JSF). Air Commodore Robert Adang of the Royal Netherlands Air Force said that today, Air Superiority requires Information Superiority, and the F-35 can be regarded as an "Information Dominance Fighter." This leads to a problem in matching F-35 operations with other fighters. Looking at the future inventory of fighters in NATO Europe, there will be about 18% "fifth generation" F-35 and 82% others, mainly fourth generation aircraft. It is essential that these can operate together, not only between aircraft in the air but also between their simulators for realistic collective training, and when simulators are connected in a network as "the majority of training can be done in the simulator."

At the end of 2017 at the Inter-Service & Industry Training, Simulation and Education Conference in Orlando (I/ITSEC), Major General Scott Smith, US Air Force Director of Training and Readiness said "live Red Flag training exercises flown in Nevada are as realistic as we can make them, but we need simulation as well because it can train for scenarios not possible in live training." There is the cost factor, and in aircraft like the F-35, "lots of training flying will break the bank, therefore more simulation is needed." However, he concluded, simula-

tors must be current with the aircraft modification state and be able to be connected to simulators at different bases for combined training.

The Cost Ratio

More training now takes place on military flight simulators and less in the aircraft itself. Looking first at large military aircraft, one of many examples is the use of the Full Flight Simulator (FFS) design that is also used by Airlines worldwide. An example of its military use is that it has halved the number of aircraft training flights needed to qualify new pilots on the Multi Role Tanker Transport (MRTT) aircraft that is based on the Airbus A330.

After training on the simulator, new MRTT pilots fly only two sorties on the aircraft before taking their qualification test. This closely parallels the US Air Force conversion programme for pilots of the C-17 GLOBEMASTER III strategic transport, which has been in place for over 10 years and has some 20 simulator sorties, followed by two training sorties in the aircraft and then the qualification test. The savings in air-time and cost by using simulator training in this way are enormous. At a conference of the

Flight Simulation Group of the Royal Aeronautical Society, the cost ratios between aircraft, and simulator training were calculated. For heavy multi-engine military aircraft these were estimated at about 30 to one, increasing to 40 to one for large airliners because of loss of revenue if an aircraft is taken off line for training. That means, it is 30-40 times less costly to train on a modern state-of-the-art Full Flight Simulator compared to using the aircraft itself. For fighter aircraft and military helicopters the cost ratio is between 10 and 20 to one, depending on the type of aircraft and the level of simulator used. Another benefit of simulator training is that less flying hours also mean less aircraft fatigue and a longer airframe and engine life.

Real Flight or Simulator?

Then there is flight simulator design. Breakthroughs came in the 1980s with two significant developments. First, the US Federal Aviation Administration (FAA) decided that check rides involving critical emergencies, such as engine failure after takeoff (EFATO), could be flown in a high quality Full Flight Simulator (FFS) rather than in the aircraft itself. An outboard engine failure in a 4-en-

Photo: via Author



A CAE full flight simulator with replaceable cockpits at Dothan Airbase, USA

gined aircraft such as a B707 has to be handled with care, and when real airliners were used, there were a series of fatal crashes in the 1970s with over 50 fatalities including the deaths of several FAA inspectors. The FAA ruling was followed by other authorities, FFS design improved further and production rates increased, with spin-off for simulators for large military aircraft. The second development was from the Rediffusion company in the UK, who introduced their mirror-based Wide-angle Infinity Display Equipment (WIDE), the first Cross-Cockpit Collimated Display system with a distant focus. This has a large, continuous, horizontal field-of-view with imagery that is seen by the pilots in a large mirror that also has vertical curvature. The vertical curvature enables both pilots to see the same scene at a distant focus rather than on a projection screen a few feet away. Also in the 1980s, the quality of computer graphics improved so that realistic Outside World (OTW) scenes could be produced that include "texture" as well as smooth surfaces, and polygon count increased so that more detailed images could be produced. Simulator motion platforms became lighter, and changed from hydraulic to electric actuators with quicker response times. Then, another spin-off from civil to military, as a result of several airliner fatal loss-of-control accidents such as AF447 over the Atlantic, the use of Full Flight Simulator (FFS) for so-called "upset" recovery training for airline pilots has led to even better motion cueing than before, and the edge of the flight envelope must now be modelled as well as the middle. Continuous development has resulted in FFS characteristics that are difficult to distinguish from those of the aircraft itself. In the military, this allows conversions to complex aircraft like the C-17 and MRTT mentioned above, to be made more safely and much more economically than in the past. After initial conversion, regular simulator checks maintain flying standards throughout a pilot's career. In terms of simulator design, the civil FFS design is well suited to multi-engined military aircraft, also to military helicopters, the latter being covered in another article in this edition in which Lt Col Johar Mohammed says, "it is difficult to tell whether it's real flight or the simulator."

Training Aids

Turning now to military fighters, training aids have always been different to those for bombers, transporters, tankers, maritime patrol aircraft and helicopters. The need for extreme manoeuvre and very large field-of-view makes military variants of the civil FFS

design unsuitable, although a large dome can be mounted on a motion platform and multi-channel imagery projected on the inside of the dome, as in some helicopter simulators. The need for very large fields-of-view for fighter aircraft has led to visual



A centrifuge to simulate high-G effects, produced by AMST

system designs that are not compatible with motion platform mounting. These use projectors that are outboard of the display surfaces, which can be a series of separate semi-transparent screens that are wrapped around the pilot's cockpit, such as L-3 Link's SimuSphere system. In the Rockwell Collins design for the F-35 Joint Strike Fighter (JSF) mission simulators, their small GRIFFIN rear-projected dome is used with an array of projectors outside to give essentially a 360 degree view. GRIFFIN has recently been used for the F-16 as well. This is a small dome suitable only for single seat aircraft, and the pilot straps in outside the dome and is then motored into position on his seat. The reason for its small size is that the original requirement for F-35 simulators was that they had to fit in a type of building already in use by the USAF for simulators with more limited visual systems.

High-G Effects

Looking at high-G effects, these cannot be simulated directly unless a centrifuge is used. However, in a fighter simulator, effects of G can be produced by inflating

the pilot's own G suit when computed G exceeds a threshold figure of 4 or 5, and high-G effects such as tunnel-vision, grey-out and black-out can be simulated by adjusting the visual display when computed G approaches 8 or 9. In addition, major Air Forces have centrifuges that can sub-

Photo: via Author



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ject trainee fighter pilots to real G up to about 9, above which it is difficult to retain consciousness even when employing "G-straining" muscle tension, and wearing an anti-G suit that applies pressure to the legs and abdomen. There are two current manufacturers of man-carrying training centrifuges, Austria Metall System Technik (AMST) of Ranshofen, Austria, and Environmental Tectonics (ETC) of Philadelphia, USA. Finally, in terms of high-G effects, a pressure-breathing-under-G system is fit-

Canada: CAE, headquartered in Montreal, Canada, has a contract for the C295W Fixed-Wing Search and Rescue (FWSAR) training programme for the Royal Canadian Air Force. CAE will provide upgrades for training devices, courseware, and other support.

Colombia: Elbit Systems, headquartered in Haifa, Israel, has built a Fighter Mission Training Centre (FMTC) for the Colombian Air Force. This provides training for up to 24 pilots at a time using a variety

Israel - Cloud Networking: Elbit has networked aircraft simulators at different locations using a secure cloud-based Synthetic Natural Environment (SNE). This is now being expanded to a number of current platforms at the Israeli Air Force SKYBREAKER Mission Training Centre.

Sweden: 3D Perception (3DP) of Norway has delivered a NORTHSTAR display system to the GRIPEN fighter simulator facility at Malmslätt near Stockholm. This has a dome with twelve projectors and 3DP's latest dis-

Photo: via Author



A full flight simulator for the C-17 GLOBEMASTER



Photo: William Carter

A head-mounted display (HMD) developed by Inzpire Ltd.

ted to some fighter aircraft such as the Eurofighter to help a pilot resist adverse high G effects, and this feature can be used in a simulator as an extra cue of high G.

Recent Projects

Some recent projects in Air Force simulation and training in 11 countries are summarised below, and helicopter projects are covered in another article in this edition:

Australia - Air Refuelling: CAE Australia manages the training centre at the RAAF station at Amberley near Brisbane. Use of the CAE-built Full Flight Simulator (FFS) for the KC-30A Multi Role Tanker Transport (MRTT) has more than halved aircraft training flights needed to qualify new pilots. The FFS can be connected to other trainers such as the one for the Air Refuelling Officer (ARO) who controls the air refuelling boom used for centre-line refuelling. Wing-mounted pods have hoses with drogues for probe-mounted aircraft. The MRTT is based on the Airbus A330 and has a fuel capacity of 111,000 kg.

Australia - Maritime Surveillance: Boeing Military is to deliver a training system for the P-8A maritime surveillance aircraft to the Royal Australian Air Force.

of aircraft systems and mission scenarios, with computer generated forces (CGF) for friends and enemy. This is similar to the Elbit SKYBREAKER MTC design already in use.

Germany, Spain: Indra Sistemas of Spain is to produce a new type of simulator for the Eurofighter TYPHOON for the German and Spanish Air Forces. Indra is also developing two Eurofighter Part Task Trainers (PTTs) for Spain, for delivery in December 2018 to airbases at Albacete and Morón.

Germany, Japan, USA: Lockheed Martin has contracts worth US\$198.4M for C-130 full flight simulators for Air Force Special Operations Command (AFSOC). Five new C-130J weapon system trainers (WST) will include large-view mirror displays and full motion, and will be delivered to bases in Germany, Japan and the USA.

Germany, USA: Lockheed Martin is to deliver new visual systems to flight simulators at Rammstein Air Force Base, Germany, and Dyess Air Force Base, Texas.

Israel: Elbit Systems has a US\$74M contract from the Israeli Ministry of Defence to provide and operate flight simulators for C-130H and C-130J transport aircraft. Elbit recently upgraded the C-130H with a new digital cockpit, head-up display (HUD) and radar system.

play processor.

UK - Network Links: QinetiQ Group, headquartered in Farnborough, has a £9.5M contract to provide network links from RAF Stations Lossiemouth and Coningsby to the Air Battlespace Training Centre (ABTC) at RAF Waddington, south of Lincoln. This is for simulator training for RAF Eurofighter TYPHOON pilots.

UK - New T&S Facility: BAE Systems has opened a £2.3M Training and Simulation Integration Facility (TSIF) at their site at Warton Airfield. This includes simulations of the BAEs HAWK, TYPHOON and future aircraft. This is part of a wider programme in which the company is to invest over £10M in simulation facilities at Warton. A new Mission Systems Integration Facility co-located with TSIF is to open later in 2018 for evaluation of future aircraft designs.

USA - Arkansas: Lockheed Martin is building a new C130 HERCULES training centre at Little Rock Air Force Base, Arkansas, to open in Q2 2018 with a C-130J/LM-100J full mission simulator (FMS). Lockheed Martin is also to upgrade two existing C-130J trainers.

USA - AWACS: Quantum3D is to supply training equipment for the US Air Force Airborne Warning and Control System air-

craft (AWACS). Quantum will deliver their MANTIS Image Generation Software, GeoScapeSE Synthetic Environment, CatalystSE digital content creation system, and other systems.

USA - C-130: CAE of Tampa, Florida, is to supply six C-130J Weapon Systems Trainers (WSTs) to the United States Air Force and Air National Guard. The C-130J WSTs are full motion, full mission simulators and are for delivery to various air bases up to 2021.

USA - EW Training: Lockheed Martin Training and Simulation has a US\$104M contract for up to 20 truck-mounted emitter systems to train aircrew in SAM threats. These will simulate current and future surface-to-air systems and will include an Advanced Radar Threat System Variant 2 (ARTS-V2) for medium-range SAM.

USA- F16 Domes: Rockwell Collins Simulation & Training Solutions (STS) is to provide display systems to Lockheed Martin for two F-16 simulators. This includes the Rockwell Collins GRIFFIN dome and SpectraView display, as used in F-35 Full Mission Simulators. Field of view is 300 degrees horizontally and 120 vertically.

USA - Fuselage Trainer: CAE USA has a contract for an HC/MC-130J enhanced fuselage trainer (eFuT) for the USAF Special

Operations Command at Kirkland Air Force Base in Albuquerque, New Mexico.

USA - Mission Operations: General Dynamics Information Technology has a US\$47M contract from the US Air Force for systems for the Mission Operations Center at Kirkland Air Force Base. This is for simulation software and hardware for a Live, Virtual and Constructive (LVC) combat environment.

Unmanned Air Systems (UAS)

UAE: CAE of Montreal, Canada, has a CAN\$56M contract for training UAE Air Force remotely piloted aircraft (RPA) operators. UAE-based CAE Maritime Middle East LLC will deliver classroom instruction, desktop and sensor operator trainers, UAS mission trainers, and training sorties on real RPA. CAE will also supply an RPA Pilot Fundamentals training course to the Khalifa Bin Zayed Air College in Abu Dhabi.

UK: Inzpire Ltd is to supply training systems for the RAF Protector Remotely Piloted Air System.

USA: Serious Simulations LLC and Aeronyde Corporation are to produce a wireless augmented reality (AR) head mounted display (HMD) for control of unmanned aerial vehicles (UAVs).

Summary

Flight simulation technology is mature and offers a range of options to suit the aircraft type and the flight envelope to be simulated. High fidelity visuals give near real-world resolution and for simulators with motion platforms, feedback from the civil area due to accidents like AF447 have improved cueing to a point that, to the pilot in the cockpit, aircraft handling is almost indistinguishable from that of the real aircraft. For fighter simulators with very wide visuals and no motion, less realism of aircraft handling is possible, but the visual plus other simulator facilities such as anti-G-suit inflation and visual effects at high computed G, can lead to effective training. When simulators are coupled and realistic training scenarios presented together with a variety of enemy and friendly actions, they can achieve more than the aircraft itself. Modern military training requires a balance between the use of simulation and the aircraft itself in a training mode. The balance today is leaning towards simulation, and this trend will increase in the future, preserving the aircraft for operations and combat rather than constant use on training missions. ■

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Maintainer Training

William Carter

It seems obvious that maintenance personnel should train on the equipment itself. This may seem to be a realistic training environment but has major disadvantages. One is that the equipment may be in operational use and simply not available for training. Another is that in training, mistakes may be made, and these are not acceptable if they damage the operational equipment. In addition, excessive use of the real equipment for training may reduce its in-service life.

To avoid these disadvantages, a Training Rig can be produced that replicates the real equipment. Maintenance personnel can then be checked out on the Rig before being allowed to service or repair the real equipment. Different rigs can be used for specialist maintenance tasks, and their design can be optimised for training rather than operations, such as by being made more robust than the main equipment in areas that will be subject to repetitive wear in use. In the past, rigs were made from failed components during build, or from components damaged in service that could be reverted to a training role. We can do better today and rigs specific for training are now used. Some rigs are large, for instance the undercarriage maintenance trainer for the C-17 GLOBEMASTER III military transport aircraft. This is the same size as the real thing but is stronger in places to allow for repetitive cycles of operation, frequent changes of wheels, and so forth. Major projects now have training aids for maintainers in the overall programme from the start. In the case of the C-17, Cubic Defense Systems produced a suite of 12 maintenance training aids including the undercarriage rig.

Turning now to fighter aircraft, Boeing produced eight maintainer training rigs for the F-22 RAPTOR air dominance fighter. These are, in alphabetical order, an Aft Fuselage Trainer (AFT), an Armament Trainer (AT), Cockpit and Forward Fuselage Trainer (CFFT), Egress Procedure Trainer (EPT), Fuel Systems Trainer (FST), Landing Gear Trainer (LGT), On-Equipment Systems Trainer (OST) and a Seat and Canopy Trainer (SCT). This gives a good idea of the range of training rigs for maintainer training. In addition to rigs, Computer-Based Training (CBT) can be used on PCs, and there is also the use of pure simulators.

Looking at the F-35 LIGHTNING II, now in full production for service in up to 11 nations, an Aircraft Systems Maintenance

Photo: USAF



The Aircraft Systems Maintenance Trainer (ASMT) is used to train maintainers at the F-35 Academic Training Center at Eglin AFB, Florida.

Trainer (ASMT) is used to train maintainers at the F-35 Academic Training Center at Eglin AFB in the Florida panhandle. Students can train on more than 100 modules for maintenance tasks on airframe, avionics and engines. The Eglin F-35 schoolhouse also has a Weapons Loading Trainer, Ejection System Maintenance Trainer, Integrated Power Package Maintenance Trainer and a Landing Gear Maintenance Trainer. Up to mid-2017, over 4,300 F-35 maintenance engineers have graduated at Eglin. F-35 maintenance students will also train at the 82nd Training Wing at Sheppard AFB, Texas, and the US Marine Corps is using a similar model for F-35 maintenance training at its F-35 bases.

In sum, the range of training aids for maintainers include exact replicas of the part

concerned, some have partial realism, and some are based on working models of systems such as electrics, hydraulics, controls, weapons and so forth, either as physical 3D models but sometimes as computer imagery that shows the working of the system concerned.

Another variant of a training rig is for engineering development and is sometimes called an "Iron Bird". Here, the real system is installed rather than simulated or modelled. Such rigs are used by the equipment manufacturer for development of systems such as hydraulics, electrics and controls before the main equipment design is finalised. These rigs have real components and are often configured and laid out in the same way as the real vehicle. After "design fix" of the main equipment, such engineer-

ing development rigs can be used either for in-service maintainer training, for further development of the equipment, or as an aid in investigating incidents and accidents.

Photo: USAF

Simulation Technology

Simulation technology can also be used for maintenance training without the use of physical rigs or models. Such a simulator can be regarded as an “electronic training rig”, similar to a physical rig but with more versatility because simulation technology can be used to optimise training. The power of modern Computer-Based Training can be harnessed to the full. This particularly applies to electronic systems and displays in the real equipment, which the maintenance engineer needs to understand in some detail.

Much maintenance consists of replacing whole Line Replaceable Units (LRU) rather than repairing faults inside units. Even so, the engineer needs to know the correct LRU and how to replace it quickly and safely. The removed unit needs testing to see if it can be repaired, then there is the repair itself. All of this needs detailed knowledge of systems in the units. A computer display can first show the constituent parts and then, in stages, the full system, which is a good way for engineers to prepare before taking crucial decisions. This is similar to the understanding that operators should also have, and, in many cases, a simulator or training rig can be used to train both maintainers and operators. This also applies to the “digital classroom” where screens and instructional software are available at each desk. The engineer’s own laptop can be used for self-paced training and then later on-the-job to provide system data while maintenance is taking place. There are also Head-Mounted Displays (HMD) through which imagery such as system diagrams and checklists can be called up in real servicing situations, avoiding reference to books, servicing manuals, or the engineer’s own PC while the servicing takes place.

Computer-Based Training (CBT)

A modern classroom will have one or more screens at each student’s desk. The instructor will have copies of the student’s screens plus a large screen for making presentations to the class. The traditional teacher’s desk has transformed into an instructor’s control station. PowerPoint presentations with moving models and video footage have replaced “chalk and talk”, slides and vufouls. In terminology, Computer Aided Instruction (CAI) is classroom-based and



Preflight inspection in a C-130J fuselage trainer at the US Air Force C-130 Aircrew Training System schoolhouse at Little Rock AFB, Arkansas.

instructor-led, whereas Computer-Based Training (CBT) is a more general term and, with well-designed instructional material, can be self-paced by the student with no instructor input. CBT is not confined to the classroom and can be carried out at the workplace, at home, or anywhere. Instructional material can be in computer memory, on DVD, memory sticks or the web, and be viewed on PCs, tablets, or even smartphones. So-called “e-learning” uses web links for the source data. In terms of imagery, maintainer training does not need the real-world geographic scenes that are so effective in simulators for operators of the equipment. What it needs is diagrams of systems, components, how they fit together and how they can be removed and taken apart. Visual imaging and display techniques used in the gaming industry can be applied to visual presentations and can make learning more interesting.

Simulators Common to Operators and Maintainers

Training in the working of systems and components is common to both operating crew and maintainers because both disciplines need to understand the basics of how electric, hydraulic, controls, avionics, weapons and other systems work. Therefore, in the progression of training aids that should be specified for a complex vehicle or weapon system, many will be useful to both operators and maintainers. In the planning of a training programme and its training aids, the needs of all personnel

associated with the equipment should be taken into account. A full mission simulator (FMS) may be designed for operators rather than maintainers, but almost any other simulator or training aid below the FMS level will be useful for both operator and maintainer training and should be designed as such.

Recent Projects

Some recent maintainer training projects follow, in alphabetical order of the nation of location:

Australia

Boeing Defence Australia (BDA), headquartered in Sydney (www.boeing.com.au), has provided maintenance training devices for the Royal Australian Air Force P-8 POSEIDON maritime patrol aircraft. These devices are similar to those used by the US Navy, and training will start in early 2018. The devices provide interactive simulation and use mission systems software. Hardware-based trainers are included and also full-scale replicas of aircraft components.

Canada – C-130

CAE, headquartered in Montreal (www.cae.com), has a five-year contract with Lockheed Martin to continue support for Canadian Air Force CC-130J technician training. CAE supports fuselage training devices, a cockpit systems trainer, and virtual maintenance trainers. CAE also provides instructors, training device upgrades, and courseware updates.

Canada – Helicopter Maintenance

Flightline Training Services of Brampton, Toronto (www.flightlinetraining.com), has Transport Canada (TC) approval for helicopter maintenance training. This adds to earlier TC approvals, and a course for the Bell 407 has taken place.

Germany – Eurofighter

Airbus Defence and Space, headquartered in Munich has delivered a Eurofighter Maintenance Simulator Trainer to the German Air Force. It can train for engine runs, fault detection, maintenance, radar and system

cow for training B747 maintainers. This is in addition to three Volga-Dnepr sites in Moscow and facilities in Krasnoyarsk and Krasnodar for servicing A320 and B737NG, 737CL and B747.

UK – A320

Aerosim Technologies, Inc of Burnsville, Minnesota, USA (www.aerosim.com), has installed an A320 virtual maintenance trainer (VMT) at the Prospects College of Advanced Technology in Basildon, East of London (www.procat.ac.uk). The A320 VMT is a simulation-based training tool

(3) Avionics and Electrical, and (4) Egress and Life Support. The courseware will be developed through TRU's Learning Content Management System and have 3D graphics and simulation of aircraft systems.

US Air Force

Kratos Defense & Security Solutions, Inc., of San Diego, California (www.kratosdefense.com), is to supply \$20M of maintenance training systems for the Boeing KC-46 PEGASUS air refuelling and transport aircraft, in a contract with Boeing. This will include Interactive Multimedia Instruction (IMI) and networked full mission simulation (FMS). This is part of a \$78M seven year training programme for the KC-46.

US Army – Lakota

Distributed Simulation Technology, Inc (DiSTI) Corporation of Orlando, Florida (www.dist.com) is to provide Interim Contractor Support (ICS) to the US Army for the UH-72A Lakota Virtual Maintenance Trainer (VMT). This includes 12 interactive student workstations, an instructor station, a "hangar" workstation, hardware-based trainer, and training on hand-held mobile devices. The trainer is at the Western Army National Guard Aviation Training Site (WAATS) in Marana, Arizona.

US Army – Phalanx

The Distributed Simulation Technology, Inc (DiSTI) Corporation of Orlando, Florida (www.dist.com) has a US\$2.8M contract for an Operator/Maintenance Trainer (OMT) for the US Army Counter-Rocket, Artillery, Mortar (C-RAM) Land-based Phalanx Weapon System (LPWS). LPWS is designed to intercept rockets, artillery shells, and mortar rounds. Training systems will be delivered to Fort Sill, Oklahoma, Fort Campbell, Kentucky, and Fort Lee, Virginia by April 2018. The OMT will use DiSTI's VE Studio development toolkit.

Summary

Training for maintenance engineers has come a long way from the apprentices who trained in the craft Guilds of the Middle Ages. Maintainer training can use the real equipment but it may not be available because it is in operational use, and in any case the real equipment should not be damaged by use in training. Specially designed training rigs and the use of modern simulation technology can avoid these problems. Simulators can be used in the classroom, on an engineer's laptop PC, and on the job itself using either a PC or Head-Mounted system to call up data as required. ■

Photo: US Navy



Full mock-up of the POSEIDON's landing gear in the P-8A Maintenance Training Facility at the Center for Naval Aviation Technical Training in Jacksonville, Florida

tests, repair, and troubleshooting. Some 400 fault scenarios can be simulated. The MST can be operated in the workplace and in a classroom. At each workstation, a Tranche 2 Eurofighter TYPHOON is simulated including a cockpit replica with flight controls.

Germany – NH90

Reiser Simulation and Training GmbH of Berg-Höhenrain, SW of Munich (www.reiser-st.org) is producing a Maintenance Training Rig for the NH90 NTH SEA LION helicopter. The contract is from the NATO Helicopter Management Agency (NAHEMA). The rig can replicate over 1000 maintenance tasks, such as removal, repair and installation of parts, and a cockpit model will be used for maintenance of avionics, electrics and flight control systems.

Russia

Volga-Dnepr Technics Moscow (www.vd-technics.com/en/mro/moscow) has established an aviation training centre in Mos-

cow that includes basic flight deck layout, the installation of ground locks and other safety devices, application of ground services, and aircraft malfunctions.

UK – T-6

TRU Simulation + Training Inc, headquartered at Charleston, South Carolina, USA (www.trusimulation.com) is to provide maintenance training courseware for the UK T-6C TEXAN II aircraft under a programme managed by Affinity Flying Training Services. Affinity is a joint venture between KBR Inc, headquartered in Houston, Texas, and Elbit Systems of Israel, and is the Fixed Wing Aircraft Service Provider (ASP) for the UK Military Flying Training System (UKMFTS) programme for UK Army, Navy and Air Force aircrew. The T-6C TEXAN II is made by Beechcraft Defense, part of Textron. The courseware will train Affinity technicians and is to meet EASA regulatory standards. It will include four courses (1) Engineering Familiarization, (2) Airframe, Powerplant and General (APG),

Hybrid Forces for Close Quarter Battle (CQB)

John Antal

Urban warfare will be the common setting for future wars. Armed forces must be optimised to conduct warfare in the megacities of the future.

Warfare is changing as demographics, the battlespace, and technology change. Most of the people of the world live in cities and megacities — cities with a population over ten million that possess a complex structural and infrastructure system. There are over 31 megacities in the world today and the UN predicts that there will be 41 by 2030. Urban warfare will be the common setting for future wars and land battles in open areas will be exceptions to this rule. Cities tend to consume military units and few armies have the manpower or expertise to sustain a prolonged CQB fight in a megacity. Recently, General Mark A. Milley, Chief of Staff US Army, recognised this fact and challenged his leaders to review the requirements for CQB in megacities. He believes that warfare will experience a fundamental shift in the next decade, and to win, forces must be optimised for urban warfare. Doing so requires an effort to maximise CQB training for the human force and leverage emerging unmanned technologies to create a hybrid human-machine force.

Maximising CQB Training

To win in the megacity battlespace requires excellence in CQB tactics, techniques and procedures (TTP). In the past 17 years of counterinsurgency operations, US and NATO forces gained experience in CQB in places like Fallujah,



Photo: Timothy Valero / U.S.M.C.

A Marine fires his weapon while advancing toward his target during close-quarter tactics rifle qualification at Camp Pendleton, CA, in February 2017.

Ramadi, Basra, and Baghdad, but none of these were battles in megacities. Fighting in a megacity that is composed of a forest of 65-story steel and concrete high-rise buildings is deadly work. In order to generate overmatch and reduce friendly and non-combatant casualties, the training for CQB should immerse individuals and units in the exacting conditions of urban combat with greater realism and definition than ever before. Many military forces have urban warfare training facilities, but most of these resemble villages or towns, not cities. The US Army does not have a megacity training area, but the premier CQB training course is conducted at Range 37 at Fort Bragg, North Carolina. "Our mission is to give the operators that come here a world-class range to train on," said Maj. Pete Kranenburg, Range 37 commander. Range 37 is a live-fire, 360°, 130 acre shoothouse, specifically designed to train CQB skills. Feedback from units in the field is used to upgrade the range to meet the needs of the warfighters. "Just as an example, we had an operator who

died on a certain type of stairwell during combat," Kranenburg said. "I told them to send me a picture of the staircase and in two weeks my engineers had built an exact replica that soldiers could train on. This range is constantly being enhanced and improved." Clearly, the facility at Fort Bragg is extremely beneficial, but modern urban warfare training centres that are realistic, modular, expandable and customisable are needed to prepare forces for a future CQB fight.

New technologies are key to enhancing the realism and effectiveness of CQB training. Robotic targets can fulfil a vital need by allowing soldiers to engage active, moving and thinking targets. The best of these robotic targets have an Artificial Intelligence (AI) programme that causes them to react, advance, retreat, group or scatter. One of the leaders in this field is an Australian company, Marathon Targets. These targets have many representations, but the standard model is an interactive man-sized figure mounted on a two or four-wheeled robot that moves across the terrain at the speed of a

Author

John Antal is an expert on military affairs. He has published 14 books on military and leadership subjects and over 500 articles in military professional journals. He served 30 years as a soldier in the US Army, retiring as a Colonel, having commanded combat arms units from platoon to brigade.

Masthead

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walking or running human. According to Marathon: "Robotic targets allow for the creation of tactical live fire scenarios capable of simulating realistic combat environments. Documented tests and evaluations carried out by the US Marine Corps determined that soldiers developed a 104% increase in combat accuracy within a 24 hour period through use of our robotic targets. In addition, the US Army's Research Institute measured a 3.7 times increase in range throughput compared to traditional training methods." Marathon targets form a Robotic Opposing Force (ROPFOR) that military personnel can use to hone their CQB skills like never before. These robots can be configured to be enemies, friendlies or non-combatants, training soldiers to discern friend from foe in what British Army General Sir Rupert Smith termed "war amongst the people."

Creating the Hybrid Human-Machine Force

New technologies are enhancing the warfighter's ability to observe, survive and win in the urban battlespace. Finding the enemy first is a key element of CQB tactics and small, hand-held robots that crawl, roll or fly can provide the ability to observe the enemy before conducting a dangerous breach. One micro UAV, the BLACK HORNET NANO developed by Prox Dynamics of Norway now part of Flir Systems, is already in use by the military forces of 19 NATO countries. The BLACK HORNET provides troops on the ground with local situational awareness, allowing them to see over a building or fly the micro-UAV inside a building or tunnel. The BLACK HORNET is equipped with a camera that provides streaming, full-motion video and is small enough to fit in the palm of your hand. With batteries, it weighs only 16 grammes.

Modern combat requires each soldier to carry a heavy load of equipment, weapons, and supplies. This heavy load can drain strength and cause injury. Any means to reduce the soldier's load can produce an advantage in a fight. Exoskeletons have long offered promise in this area, but have failed to deliver due to power requirements. One passive exoskeleton system developed by Canada-based Muwashi is an intermediate approach to exoskeleton design that enhances the human operator's power to move and lift without an external power source. The Muwashi UPRISE Tactical Exoskeleton is an ultralight "mechanical system for redirecting the load carried by the soldier. Muwashi's passive exoskeleton technology represents a major breakthrough in the field of soldier systems and cargo transport." According to Muwashi, the exoskeleton is made of lightweight titanium that is adapted to the human body to provide a transfer of 50% to 80% of the load carried by the shoulders of the fighter towards the ground. A 50% load improvement would allow the warfighter to decrease fatigue and wear more effective body armour to substantially increase survivability in a CQB fight. The UPRISE Exoskeleton is presently in user trials with several NATO nations.

Supporting the CQB warfighter with robotic support vehicles is another attempt to move toward a human-machine hybrid force. The US Marines are testing several robotic mechanised weapons platforms, which look like small tanks, to support CQB operations. The Marines are training with MAARS robot weapon platforms built by Britain's QinetiQ North America/Foster-Miller. The tele-operated MAARS can carry a wide assortment of systems, including a M240B 7.62mm machine gun, a 40mm rocket launcher, or a grenade launcher. The Marines are also testing a Multi-Utility Tactical Transport (MUTT) developed by General Dynamics Land Systems. The MUTT is amphibious, can use tracks or low-pressure

wheels to traverse terrain, weighs about 750-pounds, and can be carried by an MV-22 OSPREY. Another test vehicle is the Robotic Vehicle Modular/Combat Area Robotic Targeting (RV(M))/ (CART). The RV-M is made by Polaris Defense/TORC Robotics, weighs about 800-pounds and can be configured to carry an M134 minigun that has a rate of fire from 2,000 to 6,000 rounds per minute. Other configurations include a .50 calibre machine gun or JAVELIN anti-tank missiles. The Marines are testing these robotic combat systems and forty other technologies to develop the tactics and techniques of manned-unmanned teaming (MUM-T) and integrate robotic autonomous systems (RAS) with manned platforms and Marines.

One company in the US, Howe and Howe Technologies, famous for the development of the RIPSAN extreme vehicle series tank platforms, has joined forces with the US Army Armament Research, Development and Engineering Centre (ARDEC) to develop new robotic combat systems. According to Howe and Howe, their Robotic Weapon Station SCORPION RS2 "represents the next evolution of ground combat. As one of the first effective mid-sized UGVs (Unmanned Ground Vehicles) to be developed, the RS2 SCORPION allows the warfighter safe, accurate stand-off and effectiveness while still engaging the enemy with lethal and/or 'less-than-lethal' force." The RS2 is currently a tele-operated unmanned weapons station that is controlled by a soldier on the battlefield or in a safe area (sanctuary). If the right Artificial Intelligence (AI) software were added, the RS2 and other robotic weapons systems could be modified for autonomous weapons system (AWS) operation.

Developing the All-Robotic Force of 2030

With the rapid acceleration of technology, especially in power, computing power and miniaturisation, the trend will be to replace human fighters with robots. Making these robots semi-autonomous, or fully autonomous, provides a significant military advantage. In the Autumn of 2016, John Bassett, a former intelligence officer for the UK's Government Communications Headquarters (GCHQ), predicted that US military units will consist of more robots than human soldiers by 2025. Many other nations are working on robotic ground forces to fight CQB. China is working on advanced robotic systems and may have taken the lead in the development of autonomous systems AI.



Photo: Howe and Howe

Howe and Howe designed the RS-1 GREMLIN modular platform for the US military. With a remotely controlled platform, the GREMLIN may be ideal for sniper applications, riot control, or for use as a hostage resolution tool.



Photo: British MOD

The BLACK HORNET NANO is one of the world's smallest UAVs providing unparalleled situational awareness for the CQB warfighters.

A recent report by the US-China Economic and Security Review Commission (October 2016) stated: "China is poised to enter a 'golden age' for AI development based on government support for this research, growing public and commercial entity participation, and global partnerships that leverage the expertise of US companies...China's AI research receives support at the highest levels of Chinese leadership." The Russians understand this as well: Vladimir Putin said in September 2017 that whoever is the leader in Artificial Intelligence "will become the ruler of the world." Lieutenant-General Andrey Grigoriev, head of Russia's Advanced Research Foundation (ARF), sees semi-autonomous robots replacing soldiers: "I see a greater robotisation. In fact, future warfare will involve operators and machines, not soldiers shooting at each other on the battlefield...The soldier will gradually turn into an operator and be removed from the battlefield."

Today, we are witnessing the commercial development of self-driving cars and AI powered smartphones and devices that are based on cloud robotics — the idea that the robot could be lighter weight, lower cost and smarter as its "brain" is located in the cloud. These advances are also fuelling the testing, development and

eventual deployment of human-machine combat teams to fight CQB. In this hybrid force, human soldiers and robots will work together to increase the effectiveness of CQB ground forces and allow robots to go into danger instead of humans. AI is developing at a rate whereby autonomous systems will become feasible and will represent another revolution in warfare. The US Third Offset strategy is designed to pursue next-generation technologies to outmanoeuvre competitors by investing in fields such as in robotics, 3D printing, miniaturization, big data, and autonomous systems. "From an operational perspective, the journey we're on has the potential to vastly increase the effectiveness of our conventional forces but we have to ask the right questions," said Vice Chairman of the Joint Chiefs of Staff Air Force Gen. Paul J. Selva about the Pentagon's third offset strategy at the Center for Strategic and International Studies. "We have to experiment with the right tactics, techniques and procedures. We have to disseminate those in doctrine to our fielded forces, to our partners, our allies and our friends." By 2030, more nations will seek to field hybrid human-robotic forces that will place more bots, not boots, on the ground. ■

European Shipyards: How to Remain Competitive?

Giulia Tilenni

So far, European shipbuilding companies have been able to maintain a leading role in the global market. However, Asian competitors could curb it in the years to come.

Integration is sometimes seen as a viable strategy for maintaining competitiveness, but such a move is unnatural because of structural differences amongst stakeholders, as the STX-Fincantieri example demonstrates. The global market of vessels is slowly recovering from the 2009 financial crisis. The military segment, which accounts for US\$30-40Bn per year, is developing at a fast pace.

So far, EU-based shipbuilding companies have been able to keep up competitiveness for at least two reasons.

First, the most important shipyards have both civil and military production lines. This was a key factor in times of economic crisis and has had a positive impact on the supply chain as well.

Second, EU-produced vessels - especially the most complex (for example multi-purpose frigates, aircraft carriers, etc.) - are known for their high qualitative standards and cutting-edge technology. Furthermore, European shipyards have solid expertise in the military sector. This means that shipbuilding companies are able to develop the entire programme lifecycle - from design to maintenance - autonomously.

For what concerns military capacities, European project capacities for complex ships were crucial for European shipbuilders as they helped to achieve and maintain a leading position on a global scale. Thanks to cutting-edge technology, European shipyards have been able to export about 40% of their production. This is a remarkable result if we consider that open competition is not the norm in the military market, which is worth being called a monopsony (states as sole customers for multiple competing companies).

However, European shipbuilding compa-



Photos: Alessio Sbarbaro

A CMHI Shipyard in Shenzhen. Asian investments in shipyards are putting pressure on Europe's shipyards.

nies' leading position is eroding. Military navies' role is growing all over the world, giving new impetus to investments. Although in the EU, several countries are either renovating their ageing fleets or advancing a slight build-up, Asian countries are more heavily investing in military vessels' procurement, due to growing maritime ambitions. The demand stimulated by Asian procurement programmes can either provide European shipyards with further orders or put at stake their leading position. As far as Asian production only concentrated on quantity, European companies were able to focus on quality instead. Recently, however, the wealth of investment that Asian countries have pledged to their shipyards has significantly reduced the qualitative gap; China, Japan and South Korea are increasing the sophistication of their maritime products. The more Asian countries expand their technical capacities, the less they have to procure abroad, which has a negative impact on European shipyards' exports. As Asian navies' developments are by far more ambitious than European countries

modernisation programmes (for example, the Chinese fleet will become the biggest in the world by 2030), Europe-based shipbuilding companies might not be able to win enough bids to remain in the leading group of significant producers in the military naval sector.

How to Maintain the International Relevance of European Shipyards?

The protection of the technological lead remains of the utmost importance in order to maintain the competitiveness of European shipbuilders vis-à-vis the emerging players. Consistent investment in R&D is essential to prevent European shipyards' marginalisation in the global market.

Moreover, superior technical capacity in itself may not be sufficient to keep pace with Asia's enormous shipyards and production capacities, while maintaining adequate quality and economies of scale. The European shipbuilding sector is rather fragmented; there are many small

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companies (in comparison to Asian colossuses) and little room for economies of scale, with high labour costs further reducing the competitive edge. In sum, it is highly unlikely that technology advancements will be sufficient to defend primacy.

Aggregation is also seen as a viable option for reversing the trend in other sectors such as the aerospace industry. The hypothesis of creating a European champion in the naval sector (a kind of naval Airbus, as some would say) could create competitive advantages and contribute to securing the European shipyards.

To this end, viable integration pathways are:

- The establishment of bigger shipbuilding companies through acquisitions;
- Mergers.

To pursue integration through M&A operations would mirror what China has done with its biggest shipyards. However, European dynamics in the military sector (for example golden shares and the consequent need to match political and industrial objectives) make these processes particularly difficult to trigger.

Obstacles to Integrating European Shipyards

Although European integration might look viable and reasonable, it would be much harder than in China for several reasons:

Geopolitics and Military Ambitions

Geopolitics and military ambition greatly concur to influence states' military planning and operational requirements. As both elements hardly overlap from one country to another, military navies require custom-tailored features for their vessels, especially those with long traditions and solid expertise in building military vessels. For example, an exclusive focus on Mediterranean operations will result in different operational requirements from navies in need of deploying in the Atlantic Ocean. In addition, countries like France

or Great Britain, the navies of which are expected to enforce presence and surveillance missions in remote areas will have a different approach to power projection than smaller or less far reaching countries. Are common requirements possible in these cases? What would be the ratio to rationalise requirements? Which geopolitical challenges would be considered top priorities if European countries decided on harmonisation? These questions remain unanswered, but are the most influential driving force for systemic reasoning.

The Corporate Structure

Public vs. private – EU shipyards do not share the same corporate structure. Some are entirely private ventures (for example Damen), others are state-owned (for example Navantia), and there is a number of mixed cases. The corporate structure has a crucial impact on defining strategies and desired end states. Naturally, private companies' define their industrial objectives according to profit. Instead, when states are shareholders, political objectives become part of the industrial strategy. As a result, the state share in a company can:

- Affect competition at the expenses of liberal trade dynamics. For example, preserving jobs or key national know-how are often considered priorities regardless of the economic record.
- Guarantee preference for national procurement, as companies' production is supposed to better respond to national operational requirements and/or because of strategic independence considerations.

International Reach

EU shipyards also differ in their international activities. In order to maximise profits and to provide customers with comprehensive support (e.g. MRO), a number of EU shipyards operate in non-European countries as well. International activities could consist of installing docks abroad, concluding M&A operations, cre-

ating joint ventures (for example Fincantieri) or holdings (for example Damen).

To sum up, differences in corporate structure and international footprint limit spontaneous opportunities of cohesive EU-level integration. In a few postulates:

- Private ventures have little interest to make political objectives part of their corporate strategy unless they bring tangible economic advantages.
- European countries are far from harmonising operational requirements, so even product-based approaches tend to fail. For example, today's FREMM frigates in service in the French Marine Nationale and in the Italian Marina Militare are two diverse vessels, despite of the attempt of building on the same project.
- The emergence of dual-use technologies makes it difficult to choose what to share and what not to share with international partners, through a common methodology. For example, Fincantieri owns the Marinette production site for the military sector, and collaborates with China's CSSC in the civil sector, while the Lebanon-based holding Privinvest has a prominent role in German naval procurement. This makes it difficult to measure how COTS components for military products should be regulated on a European-wide basis. This might reduce the viability of integration attempts.

This notwithstanding, the most important EU shipbuilder, the Italian company Fincantieri, has recently concluded negotiations with France for purchasing the Saint Nazaire shipyard, previously under STX Europe control. The STX-Fincantieri case gives an example of how difficult it is to merge productions from different backgrounds, alliances, and practices.

The STX-Fincantieri Example

The French Agence des Participations de l'Etat (APE) and Fincantieri Europe (a branch of Fincantieri) signed the share

Company	Corporate structure	International Dimension
Damen, The Netherlands	private, holding structure	50 companies worldwide (23 in The Netherlands)
Fincantieri, Italy	state-controlled, via Fintecna S.p.A (71.64%)	operates in 13 countries and four continents through different subsidiaries and joint ventures
Naval Group, France	state-controlled, via Agence des Participations de l'Etat (62.49%)	operates in 18 countries
Navantia, Spain	public, via Sociedad Estatal de Participaciones Industriales (SEPI)	Modest international presence (e.g. Australia, Chile)

Corporate structure and international dimension of selected European shipbuilders

purchase agreement for STX France in February 2018. This agreement marks the last step of a year-long acquisition dispute about the Saint Nazaire shipyard in France. In 2016, when STX France (part of STX Europe, a European subsidiary of the South Korean STX Offshore & Shipbuilding) was offered for sale after STX bankruptcy, Fincantieri was selected as preferred bidder by the competent South Korean court. According to the preliminary agreement, the Italian group was expected to purchase a 66.6% share of STX France for €79.5M. However, France (a 33.3% shareholder of STX France with pre-emption rights on the remaining shares) opposed the agree-

operates in Asia (including China) and in the US (Fincantieri Marine Group), could potentially harm French interest. Thus, France offered Fincantieri a minority share of STX France. When the Italian company refused, Paris decided to purchase the remaining STX France shares, thus becoming the 100% shareholder. After several months of negotiations, stakeholders finally agreed on STX France shares distribution thanks to an out-of-the-box solution: Fincantieri will hold 51% (the desired share), but 1% will be loaned by APE. The French agency will hold a 34.34% share, of which 1% is loaned to Fincantieri. For twelve years, APE could decide to terminate the

share (depending on employees and local companies shares) should go to Naval Group, one of Fincantieri's competitors. The two companies have worked together on the HORIZON and FREMM frigate programmes. As FREMMs have become different due to customisation, the two companies have often been competitors in international bids – except the recent Canadian frigate bid. A roadmap for integration in the military domain is expected by June 2018. The agreement could include an exchange of shares (10%), some joint R&D activities, joint participation to foreign bids, and joint acquisitions. Naval Group and Fincantieri CEOs hope for integration,

Shipyard	Turnover (2016)	Backlog (2016)	Defence and security products
China Shipbuilding Industry Corporation (CSIC)	€6.7Bn	n.a.	Auxiliary vessels, surface vessels (e.g. destroyers, aircraft carriers) and submarines (conventional and nuclear)
China State Shipbuilding Corporation (CSSC)	€2.7Bn	n.a.	n.a.
Constructions Mécaniques Normandie, CMN (Prinvest)	€800M	n.a.	Surface vessels (patrollers, Fast Attack Craft Missile)
Damen	€1.7Bn	€2.75Bn	Combatants, crossover, auxiliaries, Patrol vessels, Amphibious vessels
Fincantieri	€6Bn	€18.2Bn	Surface ships (Aircraft carriers, destroyers, frigates, corvettes, patrol vessels, small combatants, amphibious ships, replenishment ships) and conventional submarines
German Naval Yards Kiel (Prinvest)	n.a.	n.a.	Surface vessels (offshore patrol vessels, corvettes, frigates)
Hyundai Heavy Industries	€11Bn	€19.25Bn	Auxiliary vessels, surface vessels (destroyers, multipurpose frigates, corvettes, FAC) and conventional submarines
Mitsubishi Heavy Industries	n.a.	n.a.	Surface vessels (destroyers) and conventional submarines
Naval Group	€3.2Bn	€11.6Bn	Surface ships (multi-mission vessels, corvettes, 4.000-tonne frigates, multi-mission frigates, projection and command ships, aircraft carriers, tankers) and submarines (conventional and nuclear)
Navantia	€710M	€2Bn	Surface vessels (destroyers, frigates, corvettes, FAC, patrollers, amphibious/aircraft carriers, mine hunters) and conventional submarines
Saab Kockums	€12M	€876M	Corvettes and conventional submarines
TKMS (ThyssenKrupp Marine Systems)	€1.6Bn	n.a.	Surface vessels (frigates, corvettes, auxiliaries) and conventional submarines

Financial results and products of selected international shipbuilders

ment for a number of reasons, including preserving jobs, maintaining production in France, and avoiding technology brain-drain. This latest issue is crucial for Saint Nazaire's military vessels production, as the shipyard is one of the two EU-based shipyards to produce 300 m+ long vessels, a key strategic asset for aircraft carriers. France was afraid that Fincantieri might take strategic decisions that, taking into account that Fincantieri

loan if Fincantieri does not respect contractual terms – a good solution to reassure Paris. To sum up, at the beginning Fincantieri was expected to become bigger by acquiring about the 67% of STX France, but the final agreement looks more like a joint venture. However, part of STX shares has to be sold yet, and the missing shares are the ones concerning Saint Nazaire military activities. In particular, a 10% to 15.66%

as it could enhance competitiveness in non-EU bids – especially against Thyssenkrupp and Damen, the main competitors in the frigate segment. Meanwhile, additional concerns have already been raised, namely the choice of the systems provider within common offers. As Thales (the main French naval systems provider) is a Naval Group shareholder (35%), it will take part in the ongoing discussions. Instead, the

Italian firm Leonardo (usually in couple with Fincantieri on the Italian markets and for Fincantieri's autonomous offers abroad) wants to be included in the agreement, too. Hence, Leonardo and Thales are direct competitors in the naval segment (while they work together in the space sector via Thales Alenia Space). To date, Leonardo fears that it would lose its role in favour of Thales, which would be automatically included in the agreement as Naval Group shareholder. To date, the Italian government has declared that Leonardo will be included in the working groups, but nothing has been disclosed about its eventual role in the agreement.



Photo: Alessio Sbarbaro

Fincantieri's shipyard in Sestri Ponente

Conclusion

Integration could be a sensible step towards maintaining competitiveness in Europe, particularly in the military field, but complex obstacles could complicate integration and thus reduce its likelihood. Ultimately, Fincantieri and STX are not so dissimilar in their corporate structure and industrial strategies, especially in terms of government involvement and political interests (strategic capabilities, jobs, etc.). But the integration led to tough negotiations and an out-of-the-box so-

lution for the most demanding concerns. Worse still, both the EU and the member states have not tackled the problem across the continent, making it difficult to have a comprehensive overview of who is doing what today and what the strategic planning of European countries could need tomorrow. However, as Asian shipbuilding groups are becoming increasingly important, it may be time to draw the EU's attention to this issue - as with other issues related to the EDTIB (European Defence and Technology Industrial Base) project. ■

Disclaimer: Direct comparisons amongst shipbuilding companies are unusual due to indicators' complexity and missing information. International stakeholders (as the OECD) are still debating on which indicators better describe the shipbuilding market. Yet, the table above is an attempt of providing an idea of magnitudes at play.

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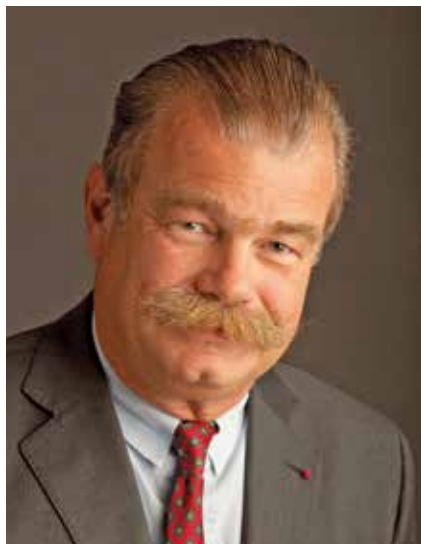

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“Eurosatory is the uncontested leader in its domain.”

Photos: COGES Event



On the eve of this year's Eurosatory exhibition as the largest international showcase of equipment for land forces in Europe, ESD took advantage of the opportunity to speak with the organiser, Patrick Colas des Francs, Director of COGES Event.

Besides, there will be the “Eurosatory Lab” as a first, an all-new area highlighting defence & security start-ups.

ESD: Within the environment of international defence exhibitions at a global scale, what is the position of EUROSATORY and why?

Colas des Francs: Eurosatory, as an exhibition dedicated to land and air-land defence and security, is the uncontested leader in its domain. It is the most complete exhibition offering international solutions to all sectors of the domain. A wide variety of international defence and security players are part of the exhibition. The number of international attendees increases every year, both in terms of exhibitors and visitors, and media. The presence of 212 delegations shows the high professional level of the show. More than 700 journalists representing almost 430 media from all five continents come to Eurosatory. It is a unique exhibition at an international level that provides its participants the opportunity to join the international land and air-land defence and security market.

ESD: To what extent can you count on the support of the French Government?

Colas des Francs: Eurosatory is supported and inaugurated by the French Ministry of Defence.

The Homeland Security Ministry has participated in the exhibition since 2012 and is represented by authorities.

Both the Ministry of Defence and the Homeland Security Ministry are largely represented at the exhibition with stands displaying operational equipment and services. Both ministries organise institutional business meetings with official delegations. The French Government provides its support on administrative procedures for import of foreign products and materials displayed at Eurosatory.

ESD: What will be the highlights of this year's EUROSATORY, both in terms of (dynamic) displays and presentations at the conferences and workshops?

Colas des Francs: A new “Intelligence” technology cluster will be opened in 2018. It will showcase new products and services from the intelligence field and cover topics

ESD: Can you elaborate on the history of Eurosatory? When and how did it start, how has the exhibition developed until the present day?

Colas des Francs: The name “Eurosatory” has derived from the earlier trade fairs called Satory which had been organised by the French military procurement agency since 1967. In 1992, the scope of the exhibition was extended to include Europe-wide participation, and its name changed to Eurosatory. Then in 1996, with participation of the USA and the Russian Federation, the show became truly international.

Eurosatory always followed the evolution of the domain. In 2000, Eurosatory became the “Land and Air-Land Defence International Exhibition”. Upon request of the exhibitors and due to the technology continuum between defence and security industries, Eurosatory became the “Land and Air-Land Defence and Security International Exhibition” in 2008.

Eurosatory has continuously developed its knowhow and confirmed its leading position. In 2016, Eurosatory was designated as “the Land and Air-Land Solution” and hosted 1,571 exhibitors from 57 countries. The exhibition had 57,024 professional visitors from 140 countries.

Today, Eurosatory is the number 1 international land and air-land defence & security exhibition. In 2018, the 26th edition of Eurosatory offers an exceptional conference programme as a forum for the discussion of new trends and to meet leading experts.



In 2016 Eurosatory attracted more than 57,000 visitors.

Photos: COGES Event

like surveillance systems, cyber security, geospatial analysis, reconnaissance systems... Eurosatory has always put forward creativity and innovative technology of its exhibitors. In this context, the Eurosatory Lab has been created for the 2018 edition. It is an all-new start-up 1,000 square metres area dedicated to international start-ups of the defence & security domain. Eurosatory will select up to 100 most ground-breaking start-up companies to exhibit alongside 1,500 other firms. The Eurosatory Lab will facilitate defence and security start-ups to introduce and market their technologies to potential collaborators and key investors. There will also be start-up battle conferences and pitch presentations, a chance for start-ups to showcase their products and innovations to more than 57,000 defence & security professionals. It is also an opportunity for established companies to identify new technologies that they can take advantage of.

Eurosatory 2018 will present a new international thematic event dedicated to CBRN issues and organised with the participation of French and foreign ops officers, exhibitors, state representatives, experts and VIPs. This CBRN event completes already existing technology clusters and live demonstrations.

In 2018, Eurosatory offers to participants a multitude of services in order to help them to develop their commercial opportunities.

ESD: How many exhibitors from how many countries do you expect this year?

Colas des Francs: In 2016, 1,571 exhibitors from 57 countries presented their products and services. For the 26th edition of Eurosatory we expect about 1600 exhibitors from all countries with a defence and security industrial base. Several national pavilions will be opened for the first time. Australian, Bosnian and Azeri pavilions have already registered for participation. Some pavilions have enlarged their exhibition space in 2018, such as Germany, Serbia, South Korea and Turkey. Negotiations for pavilions are underway with Lithuania and Colombia.

ESD: How many official delegations do you expect, and from where? What should the exhibitors do to make sure they can meet with the delegations that they want to meet with?

Colas des Francs: In 2016, Eurosatory hosted 212 official delegations from 94 countries comprising 821 VIP delegates total. More than 200 global official delegations are expected for 2018. Eurosatory hosts many official delegations



An extensive conference schedule will be part of Eurosatory's communication concept this year.



The exhibition premises offer dedicated areas for live demonstrations.

headed by ministers, vice-ministers, secretaries of state, chiefs of staff, national armament directors, general directors of police, gendarmerie, civil defence and custom. To ensure the best possible visiting programme for the exhibition and to facilitate the organisation, the organiser provides delegations with 3-day visiting schedules adapted to their interest and supported by an escort officer. However, it is the chief of the delegations' decision to fix the final visiting programme.

We advise exhibitors to announce their participation in Eurosatory as early as possible, to prepare it well and to make their presence at the exhibition known through networking and communication.

One of the first priorities of Eurosatory for the 2018 session remains to highlight multiple services such as visitors-exhibitors connection service or exhibitor conferences. These services allow exhibitors to maximise their visibility and optimise their presence at the exhibition.

ESD: Are there any plans to change or amend the concept of EUROSATORY in the future?

Colas des Francs: Eurosatory constantly follows the evolution and trends of the defence and security domain. The security sector has

been largely represented at the exhibition at the last four editions. In 2016, 580 companies - 37% of exhibitors - were dedicated to security. 300 of them presented solutions for civil security and disaster relief. In 2018, we also expect exhibitors with products dedicated exclusively to private security. Another Eurosatory trend is intensifying the conference's programme. Eurosatory 2018 offers a large panel of conferences. International and rather short (less than two hours), they attract a high-level panel of speakers including operational staff, manufacturers, media, experts, think tanks and senior officials.

Moreover, we can emphasise that all the requirements of the land and air-land defence and security domain are covered by Eurosatory: exhibitors representing each line of the product list are presented. The entire industry is represented, from prime contractors to suppliers.

Eurosatory is definitely a key step in industry's commercial development on an international scale. I would like to use this opportunity to invite you to attend the next and 26th edition of Eurosatory that will be held in Villepinte Paris Nord Centre on 11 - 15 June 2018.

The interview was conducted by Jürgen Hensel

Modernisation of Heckler & Koch's Production Facilities

Waldemar Geiger

Heckler & Koch's order books are full. They have been able to win several national and international calls for tenders by armed forces and police authorities in the recent months. The German State of Bavaria's police recently decided to award the company a contract for 40,000 new service pistols. However, the positive business results include significant delivery commitments that Heckler & Koch had to enter into.

Against the background of Heckler & Koch's recent voluminous order intake, the question was asked to what extent the production capacity in the town of Oberndorf can be considered sufficient. In fact, the company has embarked on optimising all of its production processes in order to meet the high demand. These measures lead to an increase in productivity by 25%.

Flow Production According to a Production System

Even today, the majority of military small arms production facilities are laid out for workshop production. Individual assembly units are manufactured and assembled in different work areas and in a multitude of process steps before they are forward-

ed to the next production stage. This method comprises many transport and storage cycles, which in turn prevent optimal utilisation of production capacities. Also, the transparency required for business management optimisation is negatively affected: Quite frequently it is hard to understand why individual weapons can only be completed and delivered at a certain point of time.

Heckler & Koch is among the few small arms manufacturers with all production cycles executed in-house, and the company claims that it has a unique insight into the current production capabilities of this industrial sector.

In the last two years many measures have been taken to tap previously untapped production potential. Based on intensified employee training and an analysis

of the complete value-added processes, production (manufacture of individual components) as well as assembly (assembly of individual components and assembly units to a finished weapon), for instance, were converted to flow production according to the HK production system. For this purpose, dedicated optimised production lines had to be developed for each product. Through this measure throughput and assembly time are reduced and utilisation of production capacities is optimised. The transparency achieved with these measures allows for quick response to customer requirements and prioritisation of individual projects. Moreover, individual sub-processes can be synchronised, enabling the convergence of all components at the project milestones on time.

Optimisation of Assembly Lines

According to an example practised in the automotive industry for decades, Heckler & Koch, as a leading manufacturer of small arms, has now decided to clean up every process and, wherever possible, optimise output. "Material must flow," says Stefan Warnken, Head of Assembly, during the guided tour through the assembly halls at the Oberndorf site. Due to the good economic situation in Germany in general and in the State of Baden Württemberg in particular increased production needs cannot simply be compensated for by hiring new staff. Rather, increased production figures can often only be achieved through internal measures. Thanks to the new assembly lines that have been developed and optimised in cooperation with the staff, higher production volumes can be achieved with the same manpower, says Warnken. Ergonomics, organisation

(Photos: Heckler & Koch)



Investments in staff qualification programmes, new machines and optimised workflow processes have contributed to increase productivity by up to 25%.

A Further Insight:

Interview with Frank Kolzarek, Director, Operation, Heckler & Koch GmbH

ESD: What have been the challenges that the modernisation of your production capabilities has brought along in terms of delivery schedules? Have you been able to respond to these?

Kolzarek: We launched the reorganisation with a workshop introducing the qualification programme. Contents included:

- Value stream analysis (identification of redundancies),
- Spaghetti charts,
- Determination of dedicated production lines (e.g. barrel),
- Process step matrix (standardisation of production sequences).

All of these are tools of the production system. After the training programme the first sequence-optimised layouts were developed, following which the complete programme according to the flow production principle was implemented.

We have moved from working according to a workshop principle to a flow production scheme, with the objective of reducing the processing times by up to 70 % in order to improve the time to market for HK.

ESD: What are the medium- and long-term consequences of this innovation from a sales perspective?

Kolzarek: In the medium and long term we will improve the delivery performance by:

- Reducing processing and lead times, thus streamlining production cycles
- Increasing transparency and
- Optimising the conditions for visual inspection,
- Simplifying planning and controlling, as well as
- Standardising production processes.

This reorganisation creates the prerequisites for continuous improvement.

The questions were asked by Waldemar Geiger.

and quality considerations have played a decisive role in the design of the new lines. In particular, compared to the last visit, improvements in cleanliness and organisation immediately catch one's attention. Every production unit, material and tool has its place; when it is not in use or being processed, it is located at its designated place. As a result, redundant search times are avoided and deviations from the optimum state are immediately identified.

This kind of assembly line production offers the Head of Assembly, who's background is in the automotive sector, several advantages. Thanks to special software, the entire process is visualised for every staff member. Errors can thus be detected more quickly and eliminated immediately. Production targets can be tracked by everybody, which allows for the process to be immediately adapted in the event of a failure.

Also, the assembly lines were designed to be scalable right from the start. Consequently, production volumes can be easily adjusted by transferring additional personnel to the necessary assembly line.

New Capacities for Repair and Retrofit

In order not to burden the production lines with repair and retrofit activities, investments have been made to establish separate capacities for these tasks. In addition to different modernisation orders for the G36 (for example IdZ-ES), a retrofit measure for the British SA80 standard assault rifle to the version A3 is executed in this production area. The jobs and processes created particularly for these activities also enable a higher output volume here without the need to involve more manpower.

Comprehensive Personnel Qualification Measures

The company also points to considerable investments in comprehensive personnel training measures. Even though production will be ramped up significantly, quality leadership in small arms manufacturing remains the top priority. The company slogan "no compromises" is seen as a promise to soldiers and policemen in that they can, at any time, rely on their weapons.

The investments made in personnel, machinery and processes and the resulting increase in the production of handguns form a solid basis for adherence to the scheduled delivery times and quantities. ■



Due to assembly lines that have been developed and optimised in co-operation with the staff the company can take advantage of increased productivity without the need to invest in additional manpower.

“Dyneema®, the Next Generation Ballistic Material”

Photo: DSM Dyneema



Wilfrid Gambade has been President of DSM Dyneema since 15 January 2018

Interview with Wilfrid Gambade, President DSM Dyneema

hard armour inserts to protect against a wide range of ballistics threats. Personal armour made of Dyneema® materials reduces the burden of the officer; it helps safeguard those who protect us, such as dismounted soldiers and law enforcement officers. Body armour made of Dyneema® materials offers maximum protection with less weight, which increases comfort, mobility and efficiency.

properties. Combining anti-stab material with Dyneema® material already used in top-performing soft ballistic solutions enables our customers to create complete multi-threat protective vests which provide best-in-class stab resistance and handgun protection. The Dyneema® Anti Stab Technology platform provides vest manufacturers and end-users an extra choice to tailor solutions exactly to their needs.

ESD: What makes Dyneema® the “next generation ballistic material”?

Gambade: DSM has a track record to develop Dyneema® materials and technologies which are raising the protection benchmark in applications like protective vests, inserts and helmets. In order to better protect soldiers and police officers, it is necessary to have better, much lighter protection, and these materials and technologies can do just that. One proven example is the development of Dyneema® Force Multiplier Technology, which is a breakthrough, IP protected material technology. Compared to body armour made from traditional materials such as aramid, protective vests engineered with Dyneema® Force Multiplier Technology reduce weight by up to 30%, while enhancing comfort, agility and increased flexibility. These materials have outstanding ballistic properties, such as multiple hit performance and superior protection against angle and edge shots, as well as fragments from improvised explosive devices. We are able to develop these new technologies through our significant and continuous investments and belief in innovation to stay ahead of the curve.

ESD: In what types of law enforcement and military applications is Dyneema® material utilised?

Gambade: Dyneema® materials are used in protective helmets, vests, shields and

ESD: What are the key features of Dyneema® Anti Stab Technology and other Dyneema® materials? What level of protection can be achieved with a combination of these technologies and materials?

ESD: Your company serves a large number of different markets with dedicated solutions - civilian as well as military. What do these applications have in common? What kind of synergies do you generate?



German Police with Dyneema® protective vests.

Gambade: Until the launch of Dyneema® Anti Stab Technology, multi-threat vests were mostly based on laminated aramids, or steel rings called chainmail. DSM developed Dyneema® Anti Stab Technology, a fabric with very good anti-stab

Gambade: People in the frontline, whether law enforcement professionals or armed forces, need to be protected in the most optimal way to safeguard their lives and to do their job effectively. A general trend is to develop better, sig-

Photo: Land NRW

nificantly lighter weight protection and a large number of modernisation programmes are ongoing that require new technologies. Dyneema® material is a key ingredient in armour applications and enables body armour that is lighter and

ies are expanding their police forces and thus their budgets for new equipment. These developments require a broader range of life protection technologies as the threat to first responders increases in many geographic areas.

Photo: Dutch MoD



Synthetic link chain made of Dyneema® fibre in use with the Royal Netherlands Army'

Photo: DSM Dyneema



Dyneema® Force Multiplier technology

more comfortable. Reducing the burden on persons wearing body armour is a top priority, without compromising the level of protection.

There is a strong need in different markets to better protect people. While many countries such as the US, the UK, Brazil and India are implementing major modernisation programmes in the defence sector, there is also significant growth in law enforcement, as many cit-

In 2017, DSM launched a programme in the United States to raise awareness among first responders and among government leaders and citizens of the increased threats these professionals face on the job. The aim of this programme is education and training: to alert first responders to the possibilities of personal protection against increased threats such as handgun and rifle bullets, to inform them of new policies and procedures for

responding to dangerous situations and to train them in tactics and use of equipment to keep them safe and return them to their families. This programme will be extended to Europe and Asia in 2018.

ESD: Your business model is primarily based on B2B: How do you get to know the requirements of the "end consumer"?

Gambade: End users' insights are of very high value to us. Together with our industry partners we reach out to end-users to get to know their specific needs. Our team draws on experienced professionals from various end user backgrounds to provide technical and customer-facing insights straight from law enforcement agencies and armed services organisations around the world.

ESD: From the basic substances to the final product: What is your company's part in the production chain?

Gambade: Dyneema® material originated as a fibre, made from Ultra High Molecular Polyethylene (UHMwPE). Today there are various form factors such as fibres, unidirectional plates and fabrics. DSM is the only UHMwPE manufacturer backwards integrated in terms of UHMwPE polymer, the most important raw material for Dyneema® fibres, and with production facilities on three major continents. Unidirectional sheets (UD) are the most important form factor for life protection. Dyneema® UD is a composite unidirectional laminate that offers excellent energy absorption and enhanced protection. These materials are available for hard and soft ballistic protective applications.

ESD: At Milipol 2017 your company introduced "the world's strongest chain made of Dyneema® fibre". What markets do you focus on? Are military applications of this technology in sight?

Gambade: Synthetic link chains with Dyneema® material, certified worldwide by DNV-GL, are a massive leap forward in lashing and lifting operations. Soft, quiet, easy to handle, and safe - they are simply a better way to lash or lift delicate, heavy and oversized cargo. Synthetic chains made of Dyneema® fibre are already used for lashing and towing in outsized cargo transport, heavy shipping, heavy trucking/hauling, fishery, and aquaculture. And new uses involving lifting and towing are now entering the market, where we indeed also look into military use.

The questions were asked by Peter Bossdorf.

Modernisation and Protection of Armoured Vehicles

Gerhard Heiming

The International Armoured Vehicles Conference in London in late January 2018 focused on modernising armoured vehicles fleets and on technologies for crew protection. Experts from the armed forces and industry presented requirements, issues and innovations to the audience for discussion.

In addition to symmetrical threats, land warfare is confronted with asymmetrical threats in which traditional frontlines no longer exist; the "fourth generation war" has blurred boundaries between conflict and politics, combatants and civilians. "The armed forces must have the right mix of

"expeditional" or "local", according to the chief inspector of the Swedish Army, Major General Karl Engelbrektson. Rather, the equipment has to be balanced in such a way that as many "boots on the ground" as possible will always be achieved.

It is well known that the equipment of armed

by their modularity and multi-purpose capability, which must be integrated into the classic balance between mobility, firepower and protection in the "Iron Triangle".

The complex and urban environments of the future require modernising the C4ISR suites to ensure appropriate decisions and clear communication. Unmanned aerial vehicles (UAVs) supporting armoured vehicles and the ability to defeat UAV are some of the new technologies and changes in operational concepts discussed each year. As armoured vehicles remain in service for 20 to 30 years or more, it is important to maintain their operational capability in an affordable manner throughout their entire service life. Open architecture and modular solutions enable evolutionary development within the framework of a milestone plan for platform and fleet management throughout the entire lifecycle.

Wheeled Vehicles

The focus of current modernisation programmes is on medium-weight, protected wheeled vehicles which are quickly available and can be used for various applications with little logistical effort, such as the BUSHMASTER from Thales Australia and the BOXER from ARTEC, the Rheinmetall/KMW consortium, both of which were shown at the conference. The BUSHMASTER MR6, which made its debut in London, is the upgraded version of the 4x4 multi-purpose, protected 4x4 vehicle launched in 1997. The vehicle shown in the ambulance version is an applicant for the British Multi-Role Vehicle Protected (MRV-P), of which 80 to a maximum of 300 pieces are to be procured.

The BOXER armoured transport vehicle – exhibited in the Dutch engineer version (Geniegroep) – is an example of an internationally successful programme to replace obsolete vehicles and expand capabilities in Germany and The Netherlands. In Lithu-

capabilities for the future," said General Sir Adrian Bradshaw, chairman of the conference. Science and business are called upon to use their imagination to achieve the best possible results. The conference dealt with the question of how armoured vehicles contribute to the complex capabilities needed to overcome the challenges. It is not a question of "wheel" or "chain", "protected" or "unprotected",

forces is subject to financial and temporal restrictions. The rapidly changing security and threat situation leads to military capability requirements which guide the equipping of the armed forces. In addition to the purchase of new equipment and systems, modernisation and retrofitting are the methods of choice. If there is sufficient growth potential, new competencies can be integrated. This is why new vehicles are characterised

Photo: Bundeswehr Bähr



GTK BOXER at a Combat Exercise 2017 in UK. Recently the UK MOD has announced that they will re-join the BOXER programme.

ania – and perhaps soon in Slovenia – the BOXER is the basis for new armed forces structures. The BOXER is also competing in the UK for the Mechanised Infantry Vehicle (MIV) with a planned 400 units and in Australia for the Combat Reconnaissance Vehicle (CRV) with a planned 225 units. To date, the total order volume amounts to 716 vehicles with a perspective of up to 1,400 units. Eleven completely different versions have been realised for the three user nations, and versions will multiply with further orders. ARTEC CEO Stefan Haase and Andreas Zekorn, OCCAR's BOXER Programme Manager, introduced the BOXER as a European armaments programme. Procurement is carried out by the international armaments agency OCCAR on behalf of the nations, and OCCAR conducts negotiations with industry, concludes contracts and provides technical, commercial and legal assistance to the parties involved. By cooperating internationally, the procuring nations profit from economies of scale in production: they share the costs and optimise procurement and operation through a common information basis.

The nations have transferred tasks to the NATO Support and Procurement Agency (NSPA) within the framework of a weapons system partnership. The NSPA has deployed a team of experts who procure spare parts centrally at the expense of the nations and manage stocks as needed. In negotiations with industry, larger quantities allow for more favourable prices. Thanks to centralised management, stockpiling levels and thus tied-up capital remain low without compromising the quality of supply.

The In-Service Support Phase is usually the longest and costliest phase in the life cycle of an armaments programme and the only phase that offers the user true capabilities.

International programmes make it difficult to prepare for a common in-service support phase because they require all participating states to have a common approach. OCCAR's BOXER programme during the development and production phase and a usage phase with common elements managed by NSPA are a practical example of how this can work.

Tracked Vehicles

At IAV, tracked vehicles were in the background but the presentation of BAE Systems' new CV90 Mk IV combat vehicle was a highlight. The CV90 was presented only in the lecture and on paper, as was the PMMC G5 from Flensburg-based vehicle



Photo: Heiming

World premiere for the BUSHMASTER MR6, which applies for an ambulance car in the UK.



Photo: Rheinmetall

Active protection systems can also be configured for light wheeled vehicles, here the ADS system on a Light Modular Vehicle (LMV) from Iveco.



Photo: Heiming

The power manager NervCentre from Revision Military distributes electrical energy from any source to any consumer.

manufacturer FFG. With a battle weight of around 25 tonnes, both vehicles aim at an area where the competition to wheeled vehicles is high. Equipped with the rubber compound chain from Soucy the user benefits from reduced vibration, noise emission and – over longer service life – the logistical footprint. That melts down the advantages of wheeled vehicles.

The SCOUT SV armoured reconnaissance vehicle from the AJAX family which will go into production at GDELS any time soon, completed the small field of tracked vehicles at IAV. The first vehicles in the 40-tonne class have been delivered for Government Acceptance Testing. Once this has been completed, approval for series production is expected in the course of the year. 589 units are to be delivered to the British Army by 2024.

Mobility

Exhibitors with special tyres, for example for the BOXER (Michelin), with emergency running rims (Tyron), with chassis concepts (Timoney), with the rubber composite chain (Soucy) and engines (Caterpillar), put the spotlight on mobility. The lectures touched on the topic only marginally and always in connection with concrete projects.

Protection

In addition to passive protection through armour-plated steel and composite materials, ADS Gesellschaft für aktive Schutzsysteme and Rafael presented Active Protection Systems (APS) in lectures as well as in the exhibition. Although technically different, the concept of effect is similar:

After being assessed a threat, an incoming projectile is intercepted close to the object to be protected. High demands are placed on crew protection but also on minimum environmental hazards. ADS is currently having its system certified according to recognised safety standards. Both systems are in production. The Rafael system has already proven itself in use.

Electrical energy

Modern combat vehicles typically consume a lot of electrical energy to operate command, communication and reconnaissance equipment as well as medical equipment. Modern generators such as the integrated starter generator (ISG) from Jenoptik provide 20 kW to 500 kW. In retrofitted vehicles, generators in auxiliary power units (APUs) provide the necessary electrical power.

The growing demand for "Silent Watch" – observation mode with the main motor switched off – requires powerful accumulators. In addition to the standard lead gel batteries, numerous exhibitors at the IAV presented sophisticated lithium-ion batteries, which need only half as much space and weigh only a quarter (for example Bren-Tronics) with similar storage capacity. The manufacturers unanimously agree that the danger of fire and explosion of Li-Ion batteries has been averted. There is no battery type that can meet all requirements, such as extreme current peaks to start the engine, high continuous current over a medium period of time, low continuous current over a very long period of time. Combination equipment is therefore common.

Electric energy managers ensure that the accumulators deliver their energy reliably while protecting the storage facilities, as Eversys demonstrated, and modern accumulators give a warning signal when supply runs low and external energy supply is needed (usually by an internal combustion engine). With the help of energy managers, electrical energy can also be supplied to external consumers, to charge batteries from portable devices or to meet the immediate needs of deployable control cells.

Impulses

IAV showed important trends for armoured land vehicles. The conference, which has been held annually for 18 years, is used by the industry as a platform for new ideas. Lectures, discussions and the exhibition provide important impulses that stimulate the further development of skills and materials.

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“Propulsion units tailored to the customers' needs are the future of engine development for UAS.”

Interview with Karsten Schudt,
Managing Director of 3W-International

ESD: In 2009 you entered the professional UAS market with 3W-International. How has the market changed since then?

Schudt: At that time, the market was very clearly driven by military demand. The military recognised the utility of unmanned systems very early on and was also naturally a financier that invested in and advanced new developments — such as the Heavy Fuel engine. The situation has changed, because today many UAS are used for civil or commercial applications, which means that in addition to the state there are now also private investors who invest money in the development of non-military applications.

ESD: To what extent has this changed the business for engines?

Schudt: Back in 2009, our business consisted of selling 2-stroke engines. The customer was less interested in consultation, let alone in the engine's adaptation to his application area, so we were basically a simple engine supplier. That changed a bit when we were asked to apply our expertise to developing Heavy Fuel engines, but the sales activity barely changed little. However, in the past two to three years, it has been possible to detect a pronounced change in demand and in our customers' behaviour; that change goes hand in glove with civil and commercial applications. And now we've moved away from a purely sales business towards long-term project management, including pre-prototyping feasibility studies.

ESD: What are the reasons for these changes in the market?

Schudt: We are no longer purely an engine supplier; instead, we have developed ourselves into an expert partner for propulsion solutions based upon 2-stroke and Wankel-engine technology. Our customers

are increasingly focussed on efficiency: UAS have to achieve maximum range with maximum payload and minimum fuel consumption. That is a balancing act, of course, and compromises have to be made somewhere, but it is ultimately about the propulsion being tuned to the customer's needs. This means that we work very closely together with our clients, and become involved in the project early on so that we understand what our customers really want from us. So with our performance partner, Sky Power GmbH, we have developed an engine construction kit with which we can quickly visualise, engineer and combine the components to meet the customer's requirement.

ESD: Please tell us more about Sky Power.

Schudt: We have commissioned Sky Power to be our performance partner. Sky Power's function for us resembles that of a contract tuner for a car manufacturer — say, AMG to our Mercedes. Customer modifications, customisation, new developments and components, and the performance enhancement of 3W products are the goals of the partnership.

ESD: What role does Germany play as a site for such corporate developments?

Schudt: Germany is known for its engine technology, and “Made in Germany” is an important quality and sales factor. The quality of 3W engines stems from several factors, including technical expertise, long-term experience, tradition, and state-of-the-art production, and these contribute to one of the highest quality standards in the industry. From R&D and prototyping, to manufacturing and calibration, 3W guarantees constant and permanent quality control. Every manufacturing step is traceable, and employees are personally responsible for the fulfilment

of 3W quality standards. And our component suppliers and partners share these standards and guarantee these quality requirements. 3W is opposed to offshore manufacturing; we will stay true to Germany as a company location and the business will remain in German hands — making us the only combustion-engine manufacturer in Germany in the UAS arena that is not owned by China. We are planning a massive product and service expansion in coming years. To do so, we need engine expertise and experience that we can only find, first-hand, in Germany.

ESD: What of the immediate future?

Schudt: We introduced the first hybrid Wankel engine in 2017, and will expand our product range based on Wankel engine technology. Issues such as improving efficiency, reducing fuel consumption, and using hybrid 2-stroke engines are both current and future topics with which we are occupying ourselves. And of course we shall continue to work closely together with our customers: propulsion units tailored to the customers' needs are the future of engine development for UAS.

ESD: And looking further ahead?

Schudt: We very clearly want to expand our position as a leading supplier of engines, upholding the banner of German engine construction in the UAS area. Moreover, we see good opportunities for our Wankel engine technology to be used in remote UAS applications, for instance, as a range extender for electric mobility or purely as a small generator. But these are other markets that we'll be looking at in the near future.

The interview was conducted by Stephen Barnard.

3W-International is Expanding Sales Structures

(ck) With 35 years of experience in designing and manufacturing 2-stroke engines,



Photo: 3W International

3W-International GmbH has successfully developed and patented Heavy Fuel (HF) engines for the Unmanned Aerial System (UAS) industry. Increasing demand for

2-stroke engines has prompted 3W-International to expand its sales structure and engage George Bouvier as sales and project manager. Bouvier has the necessary technical background, and he has managed complex production projects in the international electronics industry. Bouvier will support the francophone market and selected international projects.

Exonaut Supports Viking 18

(ck) 4C Strategies, a company offering risk management solutions, will support the exercise VIKING 18 with its consultants and its EXONAUT software. VIKING 18 is the



Photo: David Paterson / 4C Strategies

world's biggest international exercise, with international military staffs and participants from the UN, EU, civil authorities, law enforcement agencies, humanitarian

organisations and international observers. The exercise will take place in Sweden from 16 to 26 April; some 50 countries, 35 organisations and 2,500 individuals will participate in the planning and execution. VIKING 18's goal is to prepare the participants for crisis response, natural disasters, and peace support operations around the world by training in a simulated scenario. The EXONAUT software will be used throughout the whole exercise; for planning, execution and evaluation across all levels. "EXONAUT is the only specialised software available," said Brigadier (ret.) David Paterson, Head of Group Military at 4C Strategies. "As a direct added value, VIKING 18 gives us insights into the user requirements for developing and running such complex exercises which can be inte-

grated into future releases of EXONAUT so offering the opportunity to better support exercise planners in designing and delivering cost effective, relevant, efficient and exploitable exercises".

More LAKOTAs for the US Army

(ck) Airbus Helicopters has received a contract for US\$116M to deliver 16 additional UH-72A LAKOTA helicopters to the US Army. The contract is the company's second this year; it includes the UH-72A aircraft, operator manuals and programme management in training configuration for the Initial Entry Rotary Wing Mission at Ft. Rucker. The UH-72A is a twin-engine utility helicopter used for various missions including troop and light cargo transport,



Photo: Airbus Helicopters

MEDEVAC, VIP transport, border security, and homeland defence. Airbus has delivered more than 423 UH-72A LAKOTA aircraft from its facilities in Columbus, Miss., since the award of the first contract in 2005. With additional aircraft in the fleet, LAKOTA operators have more capability to conduct disaster relief and counter-drug operations in support of civil agencies. Available in multiple configurations, the UH 72A LAKOTA is the lowest cost to buy, own and operate of any US military helicopter in production. The LAKOTA is a key component of the Army's Aviation Restructuring Initiative (ARI) and the primary rotary-wing trainer for the US Army Aviation Center at Fort Rucker, Alabama.

Alcon Appoints New Senior Defence Sales Executive

Alcon Components Ltd, a manufacturer of brakes and clutches for motorsports, has appointed Bill Waddell as its Military Business Development Manager. The ap-



Photo: Alcon

pointment is part of Alcon's £2M investment plan to service growing defence vehicle market demands. The appointment of Bill Waddell aims at boosting defence sales. Bill Waddell is well-known in the defence sector. Previously, he has worked with Ford, Pinzgauer, Rousch, Marshall and Supacat. Prior to joining Alcon, Bill Waddell was Head of Sales at Babcock/MacNeillie. The appointment comes off the back of some successes in the defence sector. Recently, Alcon sold Toyota LC200 armoured vehicle upgrade kits, and successfully launched the CIR55 heavy armoured vehicle caliper. The CIR55 caliper is a bespoke design that improves braking performance whilst reducing weight and cost when fitted to 8x8 type military vehicles. Alcon's brake kits improve performance and reduce weight; key requirements for any armoured defence vehicle.

Seats for the German Heavy Transport Helicopter (STH)

(ck) The German aviation company Autoflug and Sikorsky signed a letter of intent to collaborate more closely for the German heavy transport helicopter (STH) programme. The companies have held talks regarding the CH-53K, the new heavy-lift transport helicopter from Sikorsky, which is competing to be the successor to Sikorsky's CH-53 GS/GA currently in German military service. Autoflug aims at proposing its new seating solution for the German

Photo: Autoflug



STH programme. Autoflug is already developing safety seats for the current German CH-53 fleet to improve crash safety for its remaining service life. The seats have a low weight and are quick to fit and remove and durable with no maintenance, and providing the occupant with maximum freedom of movement. If the requirements remain similar for its potential successor, Autoflug could deliver a set-up of up to 48 troop seats for the CH-53K, with minimal development effort. Autoflug managers are convinced that German industry participation will be an important factor in the STH selection process.

New Sales Manager at Autoflug

The German aviation company Autoflug GmbH has appointed Alexander Bode (46) to head the company's Marketing & Sales division. In addition, Mr. Bode will be responsible for the Rescue & Safety as well as Service & Engineering divisions. Bode has



Photo: Alexander Bode / Autoflug

many years of experience in the aviation industry and will support Autoflug's expansion. Autoflug has turned its focus to the growing defence sector and is competing for the German STH programme. Bode's predecessor Martin Kroell will be in charge of the operational management of the company.

NIOSH Approved CBRN Protection

(ck) Avon Protection is a producer of Respiratory Protective Equipment (RPE) for air-, land- and sea-based personnel in the global military, law enforcement and first responder community. Just recently, Avon Protection's AVONAIR modular powered air range received NIOSH CBRN approval. The Avon devices EZAir, MP-PAPR and CS-PAPR are multipurpose and adaptable respiratory protection systems. The single



Photo: Avon Protection

filter Avon EZAir is the smallest and lightest CBRN powered respirator available with cost of ownership per use at nearly half that of PAPRs. The low profile MP-PAPR provides supreme user comfort through its unique flexible construction and hydration integration capability. The CS-PAPR is a highly flexible device for in-mission res-

piratory protection with rapidly changing threats. All three modular CBRN hardened systems provide high levels of protection. All AvonAir systems rely on a CBRN blower with flow control technology and an alarm system. Modularity extends to the mask and filters as well, with owners of Avon masks able to connect to their new powered air system and meet NIOSH CBRN requirements using the Avon CBRN canister. The patented design delivers operational flexibility; interchangeable modules allow for multiple protection level configurations that can be assembled to accommodate changing threats.

VBCI for Qatar

(ck) Barzan Holdings, a company 100% owned by the Ministry of Defence of Qatar, and Nexter have signed two Memoranda



Photo: Nexter

of Understanding (MoU) to accelerate Qatar's VBCI programme. The first MoU will allow for greater cooperation between Nexter and Barzan as both companies work together to finalise the Qatari VBCI programme. The two companies are also working to bring other common projects for the Qatari forces to fruition. The industrial cooperation between Barzan Holdings, Nexter and all other industrial partners has been finalised with the second MoU and formally launches the contractual process.

Energy Storage Aboard Ships

(ck) DNV GL, a global quality assurance and risk management company, has launched a Joint Development Project (JDP) to stimulate research on energy storage on board ships via lithium-ion batteries. More than a dozen partners from the entire value chain have joined the initiative, including flag states, research institutions, battery and propulsion suppliers, fire detection and extinguishing system providers, and ship owners, operators and yards. "Including batteries in ships, whether as a hybrid or fully electric system, offers the industry the opportunity to improve fuel economy, reliability and operational costs," said Geir Dugstad, Director of Ship Classification



Photo: DNV GL

and Technical Director in DNV GL. The JDP brings together stakeholders from across the maritime industry to create a pool of expertise for the use of batteries on ships. JDP aims at stimulating industry to push the development of batteries and associated systems, procedures, and approval processes. The JDP officially kicked off at the end of 2017, with tasks defined as follows: Safety Model Development and Assessment; Lithium-Ion Battery Risk Assessment; Battery Safety Testing Programmes and Battery Safety Simulation and Analysis Tools. Among the project partners are Damen, the Norwegian and Danish Maritime Authority, the Norwegian Defence Research Establishment, the maritime battery systems vendors Corvus Energy and Plan B (PBES), FIFI4MARINE (a lithium-ion fire extinguishing system provider), Nexceris (a developer of battery off-gas sensing technology), Rolls Royce Marine AS and ABB (both propulsion and system technology providers), and the ferry operators Stena and Scandlines.

Airport Surveillance Radars from HENSOLDT and Raytheon

(gwh) HENSOLDT and Raytheon plan to jointly develop and market air traffic control radars. The cooperation includes radar equipment for approach control at civil airports, air traffic control, airspace surveillance and aircraft identification according to the latest Mode S and Mode 5 standards, in order to offer fully integrated airspace surveillance radar equipment to

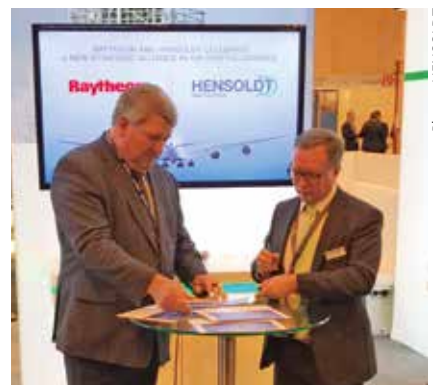


Photo: HENSOLDT

increase the safety and efficiency of air traffic. HENSOLDT's ASR primary radar and MSSR secondary radar are optimised to customer specifications and combined with Raytheon's Mode S secondary radar. With this combined solution, HENSOLDT and Raytheon complement each other from their respective air navigation services and sensor portfolios for the benefit of their customers.

Best Counter Terror IT Product

(ck) Founded in 1982, HGH Infrared Systems is a developer of electro-optical systems for industrial, defence and security applications. HGH's CYCLOPE automatic detection & tracking software was named "Best Counter Terror IT product" at the SCTX trade show's 2018 Award Ceremony, to recognise the software's intrusion detection & tracking success in the fight against terrorism. The software was recognised for its capabilities to detect, track, identify and recognise an unlimited number of threats, on land at sea and in the air. CYCLOPE is a 360° thermal sensor's (Spynel) integrated software based on detecting and tracking algorithms with ultra-low FAR (False Alarm Rate). Spynel sensors and CYCLOPE software are and have been used to prevent terrorist acts, thanks to the data accuracy they provide and their ability to detect and

Photo: HGH



track small objects in real time. "Our sensors and our Cyclope software keep on evolving to adapt to demand, and to our society's growing security needs," said Edouard Campana, HGH Infrared Systems' Sales Director.

Leonardo to Sign OCEAN2020 Grant Agreement

(ck) Leonardo has signed the grant agreement for OCEAN2020, the most important project to boost Europe's defence research under the European Defence Fund. The initiative is funded by the European Union and implemented by the European Defence Agency, the latter acting as contracting authority under the 'Preparatory Action on



Photo: Leonardo

Defence Research' programme. Leonardo will lead the project which is to be funded by a grant totalling €35M, and Leonardo will coordinate a consortium of 42 partners from 15 European countries. Within the scope of the same "Preparatory Action on Defense Research", Leonardo was selected as part of GOSSRA project, led by Rheinmetall. GOSSRA aims at standardising soldier equipment to improve interoperability during joint operations conducted by forces of European countries. Leonardo plays a significant role in European security and defence initiatives. The European Commission intends to provide the European Defence Fund with a budget of €1.5Bn per year from 2021 onwards. Of this amount, up to €1Bn per year will support the joint development of defence capabilities by EU member states. An amount of €500M is earmarked for research.

Suppliers for French BELHARRA Frigates Selected

(ck) As the system engineering leader and integrator Naval Group has started to select the suppliers and subcontractors for the five BELHARRA class frigates (FTI) for the French Ministry of Defence, the first of which will be delivered to the French Navy in 2023. To date, the main suppliers selected include Axima (for heating, ventilation and air conditioning (HVAC) systems); CNIM (for sonar hatches and torpedo hatches); Ixblue (for navigation units and their computers); Leonardo (for 76 mm medium calibre artillery systems); MBDA (for integration and services relating to missile-firing installations); MTU (one of the world's leading manufacturers of large diesel engines); Safran Electronics & Defense (for the optronic



Photo: Naval Group

identification system incorporating the very long range version of the PASEO XLR (eXtra Long Range) sight); and Thales (for the sonar suite, the electronic warfare suite and the communications system). With a displacement of 4,000 tonnes the French version of the BELHARRA frigates is intended for anti-submarine warfare and will have extended self-defence and special forces projection capabilities. It will integrate the new Thales SEA FIRE four flat antenna radar and firing installations for ASTER 30 and EXOCET missiles from MBDA.

NITEC 18 in Berlin

(ck) NATO operations are dependent on a secure, resilient IT infrastructure and an array of software applications which is why NATO invests in IT modernisation, the NATO communications infrastructure and the acquisition of thousands of applications - all accounting to billions of euros of investments. To foster NATO-industry collaboration, top officials from NATO and European and North American companies will meet in Berlin from 22-24 May to discuss NATO's technological and cyber needs, and to explain how companies can take part in NATO business. The conference "NITEC18 – NATO's Digital Endeavour: Expanding the Ecosystem" is a three-day event organised under the auspices of the German Ministry of Defence. Some 600 senior government, military and industry leaders, as well as defence and security experts will attend the conference. The annual event is a collaborative venture between the NATO Communications and Information Agency and AFCEA Europe. The participants will discuss new trends in digital transformation and upcoming business opportunities in NATO's IT modernisation, missile defence, Air Command and Control, cyber security, and intelligence.

Peli-Hardigg at ILA

(ck) Peli-Hardigg is a manufacturer of military approved, reusable cases that are lightweight, watertight, heat- and impact-resistant and virtually indestructible. For over half a century, Peli-Hardigg engineers have developed solutions for the transport and packaging needs of the defence sector. Phil Morrison, Peli-Hardigg's Technical Packaging Project Manager for EMEA, explains: "Peli offers an expanding global team of over 30 engineering experts in developing solutions for protection and transport of UAV, aircraft engines, satcom and weapon systems, regardless their size." Peli-Hardigg uses 3D engineering software to visualise

a container before production. The company will showcase the 3D engineering process and some of its transport solutions at the ILA Berlin Air Show (Hall 3 / Stand 113).

PROTECTOR Combined Test Team

(ck) A team of Royal Air Force personnel based in the US is preparing the way for the introduction into service of the UK's



Photo: General Atomics

new remotely piloted air system (RPAS), the MQ-9B PROTECTOR. The PROTECTOR Combined Test Team (CTT) comprises experienced pilots, sensor operators and engineers from the Royal Air Force, industry partners and the U.S. Air Force who are coordinating the testing of the PROTECTOR system, which will replace the MQ-9 REAPER in RAF service. "By complementing existing and future ISTAR and combat air capabilities such as the F-35 Lightning II, it will meet the needs of UK Defence worldwide for decades to come," said Wing Commander Iain Hutchinson, head of the test team. The UK is investing in an initial 16 PROTECTOR aircraft, manufactured by General Atomics Aeronautical Systems Inc. An important aspect of the work of the CTT will be to ensure that PROTECTOR complies with national and international airspace and safety regulations.

Renault and Thales to Cooperate

(ck) Renault Trucks Defense and Thales signed a Memorandum of Understanding (MoU) in The Hague for exports markets. With its native electronic network BATLENET INSIDE, Renault Trucks Defense developed a capability to integrate Thales' SOTAS IT system in Renault vehicles. Developed by Thales, SOTAS is a vehicle communication server based on an open and modular architecture to make it adaptive to different operational requirements. Upgrades can be performed without the need for reinstallation which translates into flexibility, which in turn delivers logistical advantages for a range of wheeled and tracked military vehicles. SOTAS systems are fielded in more than 30 countries. Renault Trucks Defense is a major supplier to the French land forces and special forces, responsible for the main-

tenance of more than 90% of all vehicles currently in service with the French Army. Renault Trucks Defense is also a major supplier for more than 60 countries.

UK to Rejoin the BOXER Programme

(ck) The UK has decided to return to the BOXER programme via the Organisation for Joint Armament Cooperation, or OCCAR. The British Army will require at least 500 mechanised infantry vehicles (MIV) from 2023. The UK will complete the evaluation of the BOXER next year. The volume of a possible contract is estimated at €2.7 billion. ARTEC, a joint venture between Rheinmetall (64%) and Krauss-Maffei Wegmann (36%), is under contract to deliver and support more than 600 BOXER vehicles to the German, Dutch and Lithuanian armed forces. Rheinmetall has already begun to set up an industrial consortium in the UK including BAE Systems, Thales UK, Raytheon, Rolls-Royce and Pearson Engineering in response to the national work share requirement of at least 60 percent. This approach will secure substantial jobs across the UK to manufacture, sustain and upgrade the UK BOXER



Photo: Rheinmetall

fleet through life. Armin Papperger, CEO of Rheinmetall AG, commented, "As a joint venture BOXER partner in via ARTEC GmbH, Rheinmetall warmly welcomes the announcement from the UK MOD. The BOXER vehicle offers exceptional levels of protection and mobility that have been proven in operations, and we look forward to welcoming the British Army into the group of armed forces already successfully operating BOXER vehicles."

RUAG Expands Approvals to Include Night Vision Systems

(gwh) RUAG Aviation has extended the scope of its EASA Part 21 J Design Organisation Approval (DOA) to include night vision systems. The specification allows the aerospace service provider to directly classify and approve modifications and repairs, design and develop supplementary type certifications (STC)

for aircraft with NVIS configurations and integrate new night vision systems into existing platforms. New helicopters are often equipped with night vision configurations by original equipment manufacturers. The night vision configuration on helicopters comprises a complex matrix involving both capabilities and personnel. It includes a mix of devices, such as night vision goggles (NVG), and authorised procedures as well as crew. Thus, the helicopter's maintenance organisation must be authorised within the scope of NVIS to effect any and all changes, as well as to uphold the overall status of the NVIS configuration.

CAMCOPTER Contracted by MDA

(ck) MDA, a Maxar Technologies company, has commissioned a fleet of Schiebel's CAMCOPTER S-100 Unmanned Air Systems (UAS) to fulfil a contract with an international customer. MDA chose



Photo: Schiebel

the CAMCOPTER S-100 UAS for its track record of providing support in sea- and land-based intelligence, surveillance and reconnaissance (ISR) missions. As a vertical takeoff and landing (VTOL) aircraft, the S-100 has a small logistical footprint, which allows for rapid deployment. By day and night, the UAS functions as a platform capable of carrying a range of payloads. With its history of conducting surveillance in hostile environments, MDA offers its services to an unnamed international customer. Such will include responsibility for the acquisition of the fleet and the required infrastructure, training, airworthiness, logistics, supply chain management, maintenance and all flight operations.

SEDEC Defence Conference in Ankara

(ck) For the first time, the Turkish State Secretariat for the Defence Industry (SSM) and the Association of Exporters of the Turkish Defence Industry (SSI) will jointly host the SEDEC Conference and Exhibition in Ankara from 3 to 5 July 2018, bringing together international

and national players from the fields of Homeland Security, Border Security, Interior Security and Defence Systems. It



Photo: SEDEC

is a platform that links the supply chains between major industrial producers and SMEs, as well as producers and users such as the Turkish State Secretariat for the Defence Industry, the Directorate General for Security, Land, Air, Marine and Gendarmerie. Many national and

international companies, procurement committees of national authorities and purchasing managers will participate in SEDEC. SEDEC also aims to bring foreign first and second level OEMs and suppliers together with Turkish defence SMEs and major industrial companies for bilateral business negotiations. In addition, the achievements of the Turkish defence industry are presented to foreign guests.

New Chairman at Sofradir

(ck) Sofradir Group shareholders Thales and Safran appointed Jean-François Delepau (53) as the group's new chairman. Previously managing director of ULIS, a Sofradir Group company, Mr. Delepau will oversee all operations of the three companies within the Group: Sofradir, ULIS and

US-based Sofradir-EC. Mr. Delepau joined ULIS as a deputy director in 2007. Previously he worked in different companies specialised in electronics & components in various positions (marketing, production). He also has eight years of experience as a technology consultant. Mr. Delepau graduated from Ecole Polytechnique in 1986. Sofradir is a producer of infrared and thermal imaging detectors and sensors, many of which are integrated in various military applications. Safran and Thales are equal shareholders in the Sofradir Group.



Photo: Jean-François Delepau / Sofradir Group

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