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Impatience Doesn't Help



It has been ten years since Vladimir Putin upset the participants at the Munich Security Conference with his confrontational speech, the kind of undiplomatic rhetoric that really did not fit the image of the partner in stability which at the time was still fondly held of the Kremlin boss. The spontaneous stir, however, was soon dissipated. The Cassandra voices were stilled, which suggested that maybe we should in fact stop and consider just how stable and secure the situation really is on the NATO eastern flank, and whether the stance adopted by the Alliance really is as appropriate as it seemed. The Russian intervention in Georgia a year later did not cause any long-lasting fluttering, either. It took the crisis in the Ukraine to bring about a real rethink. But Putin's speech was not the only missed opportunity for a critical look at our own assessment of the situation. Another chance came in June 2011. The outgoing US Minister of Defence Robert Gates paid a leave-taking visit to NATO Headquarters in Brussels, in order, in a manner of speaking, to present high-ranking representatives of the Member States with the outcome of his term of office. His speech was no less disturbing than Putin's appearance in Munich, albeit for other reasons – and it remained equally devoid of result. Instead of what might have been expected, taking his leave with some friendly remarks about transatlantic solidarity, he tore a strip off the Europeans, and painted a gloomy picture of the future of the Alliance. The Libyan war had shown how the military capabilities of the European allies really needed to be put in order. Some of them, even after the unanimous decision for intervention, had not even been in a position to field any troops, and those who were prepared had not been able to sustain the effort for more than three weeks even against this vastly inferior opponent. NATO, in his view, has become a two-class alliance, in which some would have the will and ability to act militarily, and the others would be fit only for discussions and peacekeeping. If this trend were not stopped, if the Europeans are not at last ready to invest more in their military capabilities, then it should come as no surprise if a new generation of American politicians, whose views are not longer shaped by experiences of the Cold War, were to lose interest in NATO.

True, Donald Trump is not a representative of this "new generation", but the uneasi-

ness about the NATO of today, which can be heard in some of his (albeit not infrequently contradictory) remarks, and even the sharpness with which he expresses his views, does not fall outside the framework of what has repeatedly been heard over the past few years on the other side of the Atlantic with regard to the state of the Alliance. What is particularly regrettable about this criticism is that there is very little that can be argued against it. If the Europeans are honest about themselves, they can only concur that over the decades they have indeed grown accustomed to the peace dividends, and have been able to force through economies because they have been able to tag along with a sense of collective security by relying on the Americans. In fairness, however, it should not be forgotten that the long years of focussing on peacekeeping and stabilisation operations was a matter of transatlantic consensus within NATO – and it needed fewer resources to be available than for the defence of the Alliance.

And it should also not be forgotten that as early as 2011 Barack Obama had irritated the Europeans by announcing that the USA would thenceforth be giving preference to Asia with regard to its strategic interests. There was no longer much trace of this by the end of his term of office. However, what exactly lies in the interests of superpower USA is only partially left to the power of definition of its President. The motives which for a century have directed the commitment of the Americans towards our continent have not lost their relevance. A stable Europe, bound to the USA in partnership, is not in contradiction with the concept of "America First".

The call by the Americans for the Europeans to invest more in their defence is to be taken seriously, but their impatience does not help matters. A few days ago NATO Secretary General Jens Stoltenberg was able to redress the balance somewhat by pointing out that in 2016 the Alliance partners increased their outlay on defence by 3.8 percent against the previous year. This development looks set to continue. The planned upswing of capabilities will take time, however, and not just money. The frequently invoked "Two Percent" of gross national product may therefore perhaps point the way. But, when it comes down to it, it is nothing more than a benchmark in accountancy.

Peter Bossdorf

The Croatian Armed Forces



(Photo: Tomislav Brandić/Hrvatski vojniki)

Tasks, capabilities, organisation, contribution to NATO- and EU-led operations and modernisation programmes. **Page 34**

Meeting the Future Threats



(Photo: Eurofighter)

TYPHOON avionics and weaponry continue to evolve, thus extending the aircraft's capability spectrum. **Page 56**

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Ground Based Radars



(Photo: Finnish Defence Forces)

Technology advancement faster than ever before paves the way for new sophisticated and versatile solutions.

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■ Monitoring Systems by Boger Electronics

(df) At IDEX Boger Electronics presented its portfolio of communication solutions for border control and border surveillance applications. Boger Electronics is designing, manufacturing and integrating the systems according to current requirements. The systems cover all relevant communication frequency ranges, from HF up to V/UHF, and communication networks – always customised according to current requirements and end-user needs. Furthermore, Boger COMINT / SIGINT systems provide a seamless overview of the RF spectrum, enabling the end-user to detect unauthorised emitters or targets (for example unauthorised border crossing). Systems can comprise single receivers up to powerful remote-controlled solutions consisting of antenna systems, signal-distributors, decoders, receivers, workstations and more.

■ Military Vehicles from BMC at IDEX

(df) BMC's products range from multi-purpose armoured and tactical wheeled vehicles to logistic trucks and mine-resistant ambush-protected vehicles. At IDEX several multi-purpose vehicles were of special interest. One of these was the AMAZON 4x4 armoured tactical vehicle, that has a high level of protection against mine and IED threat (STANAG 4569 certified, ballistic protection, mine protection, IED protection) together with high mobility (maximum speed 110 km/h, range 600 km) with its powerful 268kW engine and drive-



Photo: Dorothee Frank

line components at combat weight (kerb weight is 11,300 kg). The integration of different mission equipment is available. Another highlight was the BMC 245 4x4 tactical wheeled vehicle. The engine is a Cummins ISL 9E3 375 Euro-3 with 6 cylinders, a capacity of 8.9 litres and maximum power of 275 kW at 2,100 rpm. Maximum speed is 105 km/h and the range is about 800 km. A characteristic of this vehicle is the availability of different types of superstructure, to meet the needs of any operation. The vehicle offers high mobility with

a fording capability of 1,000 mm, ground clearance of 400 mm and the possibility to climb a gradient of 60% or traverse a side slope of 30%.

■ Diehl at IDEX

(df) One of the highlights of IDEX was at the Diehl Defence display of the IRIS-T SLM air defence system. A special feature of this highly-sophisticated system is the flexible software architecture that allows any national device to be added to the system. For example, Sweden will use the system with national radars. This flexibility is rare



Photo: Dorothee Frank

in other systems and will allow future technologies to be added or any incremental updates to be realised with low risk and effort. Another outstanding feature is the packaging of system elements in standard containers that might be added to any suitable national vehicle; the vehicles may be changed during the system's lifetime, too. Other features include vertical launch which enables comprehensive 360° protection against attacks from the air by aircraft, drones, helicopters, cruise missiles, guided weapons and rockets. The seeker is locked onto the target during missile flight (lock-on after launch). Target data are updated during the flight via a data link. This air defence system enables simultaneous engagement of several targets, even at very short range and with extremely short reaction times. The guided missiles are fired from eight launch canisters, using thrust vector control for superior manoeuvrability. Due to the system's high degree of automation it is ideally-suited for continuous operation with minimal staff requirements.

■ Weapon Sights from Dynamit Nobel Defence

(jh) Dynamit Nobel Defence (DND) had on display at IDEX its range of sights for shoulder-launched weapons. THERCAM 25/75 is a standalone TI system based on the latest uncooled micro-bolometric technology, providing the best possible image quality with large pixel matrix at low pitch. The sight offers night vision capability as



Photo: Dorothee Frank

well as daytime reconnaissance and tracking. THERCAM 25/75 fits the RGW 90 family of shoulder-launched weapons and is compatible with assault rifles. MNV-50 is a monocular night vision scope which can be used as a handheld observation sight as well as a weapon-mounted scope in conjunction with a day scope. MNV-90 has been primarily designed as a clip-on camera to the VIS optics of the DND shoulder-launched weapons, namely RGW 60, RGW 90 and PANZERFAUST 3. The camera can also be used for surveillance. DYNA-HAWK is a sighting device with integrated fire control system developed for the RGW 90 family. It is equipped with a laser range finder, ballistics computer, internal display and allows for the engagements of targets up to a distance of 1,200 metres. The system automatically identifies the ammunition and selects the appropriate operating menu when attached to the launcher.

■ Remote Controlled Weapon Station for the GUARANI

(gwh) The GUARANI armoured personnel carrier – manufactured in Brazil by Iveco – gets the REMAX remote-controlled weapon station by Ares Aeroespacial e Defesa S.A. (Ares). Ares, the Brazilian subsidiary of Elbit Systems, was awarded a framework contract, in a total value of approximately €93M, to supply 12.7/7.62mm remote controlled weapon stations (RCWS) to the Brazilian Army. The initial production order totals €7M. The REMAX stabilised weapon station has been specifically designed by Ares to meet Brazilian Army requirements as part of the VBTP programme and was successfully tested and fielded in Brazilian Army GUARANI 6X6 vehicles. It will be used in armoured vehicles and logistics ve-



Photo: Elbit

hicles used in combat for troop transport, border patrol and peace-keeping missions. The contract includes associated equipment and services. The REMAX will be supplied over a five-year period.

■ Supacat Unveils HMT 400 DESERT

(df) At IDEX Supacat unveiled their HMT 400 DESERT, a new variant of its JACKAL Special Operations Vehicle (SOV). HMT 400 DESERT has been adapted to enhance performance in the desert's harsh environment and climatic conditions. It has no armour and the lighter gross vehicle weight im-



Photo: Dorothee Frank

proves the power-to-weight ratio and increases mobility over deep desert sand. Further desert features include enhanced cooling, a central tyre inflation system and lightweight bead locks to enable the vehicle to be operated at the lowest tyre pressures. The HMT 400 series is already well-proven in the harsh terrain of the Afghanistan theatre of operations. An air suspension system allows selection of a variable ride height to match the terrain and also to enable loading within a CH-47 CHINOOK. Supplied with an optional mine blast and ballistic protection kit, the HMT 400 can be fitted with a variety of mission-specific packages – weapons, communications, ISTAR and force protection equipment – to suit a wide range of operational roles. The photo shows the HMT 400 DESERT configured to comply with the UAE Presidential Guard's requirements for a new special operations vehicle, specifically including tactical CH-47 internal loading, and has undergone successful tactical trials and testing by UAE forces.

■ New Generation of Combat-Proven Microdrones

(df) FLIR, for the first time, had the Prox Dynamics HORNET UAS on display at IDEX. These microdrones are the next iteration of those the British Armed Forces had in use in Afghanistan. Due to their small size the BLACK HORNET 2 nano-sensors are inherently safe and pose virtually no risk to other air vehicles or personnel, allowing the system to be operated almost anywhere at any time without prior airspace coordination. The BLACK HORNET's small size and electric motors make it virtually inaudible

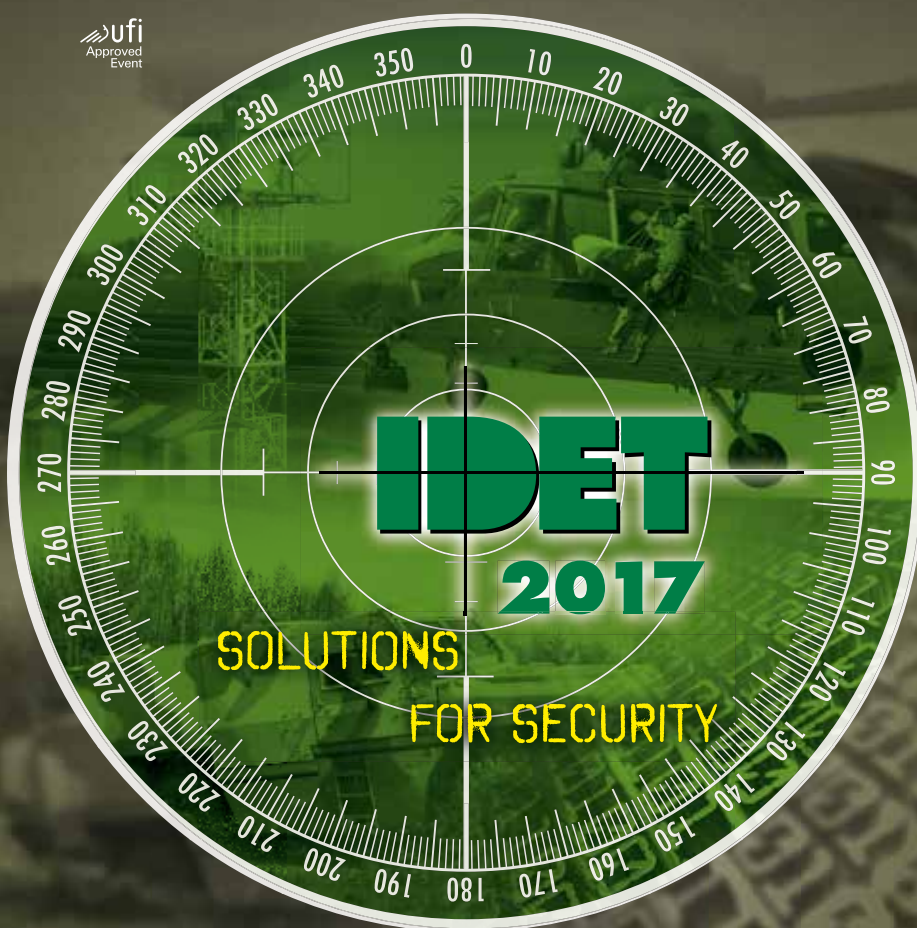


Photo: Dorothee Frank

and invisible beyond short distances. Also, using the systems is quite easy, with training only lasting two to three days. The main features of the BLACK HORNET 2 are a rotor span of only 120mm, a mass of 18g in-

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cluding cameras, maximum speed of 5 m/s, endurance up to 25 minutes, digital data link beyond 1,600m line-of-sight, GPS navigation or visual navigation through video, autopilot with autonomous and directed modes, hover & stare mode, preplanned routes, steerable EO cameras (pan/yaw and tilt) and live video and snapshot images. Even though the company offers its own small computer to go with the system, integration into several other soldier systems, like the German GLADIUS, has already been achieved, so that the soldier does not need to carry any more additional equipment than necessary.

■ ARC-FIRE – Making Your Artillery Smarter

(jh) Hirtenberger Defence Systems' Integrated Artillery Fire System (IAFS) provides superior computing technology for the rapid and accurate engagement of targets by artillery assets. As an element of new systems or an upgrade or modernisation measure for systems in ser-

Photo: Jürgen Hensel



vice, ARC-FIRE seamlessly integrates with third-party command and control, target acquisition, communication and support systems. Hardware elements include a laptop computer for the commander and several handheld devices for use with, for example, the forward observer and other troops. ARC-FIRE offers an intuitive user interface and provides data on weapon position, fire mission, weapon aiming, integrated mapping and a satellite view. Based on a similar system layout, a second version of ARC-FIRE is offered in support of infantry mortar platoons. ARC-FIRE has already been ordered by a Middle-Eastern customer in the scope of a major artillery procurement, and several other potential

users in Northern Europe, Southwest and Southeast Asia have indicated a serious interest in the system.

■ SKYGUARDIAN

(df) General Atomics Aeronautical Systems, Inc. (GA ASI) has launched a "Type-Certifiable" (STANAG 4671) version of its PREDATOR B product line, called SKYGUARDIAN.

Photo: GA-ASI



The launch was held before an audience of international dignitaries from nine nations comprising the United Kingdom, Italy, France, Australia, Belgium, The Netherlands, Denmark, Norway, and the United States. The SKYGUARDIAN is the result of a five-year company-funded effort to deliver a Unmanned Aerial System (UAS) that can operate under the stringent airworthiness requirements of non-military airspace. The aircraft leverages the legacy of the multi-mission PREDATOR B fleet, which has amassed nearly two million flights hours. SKYGUARDIAN can fly in excess of 35 hours with airspeeds up to 210 knots, and reach altitudes of more than 14,000 metres. SKYGUARDIAN will be fully-compliant with NATO's UAV System Airworthiness Requirements (defined in STANAG 4671) and UK DEFSTAN 00-970. GA-ASI also collaborated with the LufABw (German Military Aviation Authority) to define airworthiness requirements for German Airspace. To facilitate qualification testing, GA-ASI is building three company-owned aircraft, along with two airframes designed specifically for full-scale fatigue and static testing to satisfy type-certification requirements. The company plans to deliver the first production aircraft in 2018.

■ VBTP 6x6 Amphibious Armoured Vehicle

(df) At IDEX Iveco showed the new VBTP, a family of 19.6 tonne 6x6 armoured, amphibious vehicles. Fitted with an Iveco-FPT 9-litre, 281 kW (383 HP) bi-fuel common-rail engine, coupled to an automatic gearbox, it can carry 11 personnel. VBTP is 7.0 metres long, 2.7 metres wide and 2.3 metres in height and can be transported by C-130 HERCULES and KC-390 aircraft. It can be equipped with manned and unmanned turrets carrying armaments from



Photo: Dorothee Frank

5.56 to 30 mm. Development of this new family of armoured vehicles started in 2009 as a joint enterprise between Iveco and the Brazilian Army Department of Science and Technology. The vehicles are being produced in a purpose-built facility in Sete Lagoas (Brazil). The Brazilian Army nomenclature for the VBTP vehicle is "GUARANI". The GUARANI is designed to provide the basis for a family of vehicles capable of fulfilling a multitude of roles. The adoption of a modular approach provides numerous advantages, including the development of product variants without unnecessary re-engineering, so reducing timescales and costs. This approach also facilitates an optimum combination of power, protection, payload and flexibility in operation, and support through improved maintainability and ease of upgrade. With different configurations to fulfil roles including personnel carrier, command post, recovery and ambulance, the GUARANI family will meet a whole range of operational needs, extending the Army's operational capability in scenarios which are particularly suited to this type of vehicle.

■ Sensor for GMA Land Navigator

(jh) GMA Land Navigator has selected Sensor STIM210 as its inertial engine. The STIM210 provides high accuracy inertial data for the AXD-LNS Land Navigator Solution. Sensor is currently in serial deliveries supporting the Land Navigator which went into regular production in late 2016, following five years of development. STIM210 is a small, lightweight, low power, ITAR-free high-performance tactical grade gyro module with 3 gyros, currently deployed in



Photo: Sensoron

applications such as UAVs, satellites, portable target-acquisition systems, land navigation systems, turret stabilisation, missile stability and navigation, and mortar aiming systems. The GMA AXD-LNS is a high performance navigation system intended for a wide range of applications, such as advanced navigation displays and advanced Navigation Control Systems in armoured vehicle programmes. Due to its High Stability MEMS sensor-based architecture, the AXD-LNS is easily configured for platform stabilisation applications. In a GPS-denied environment, the system exploits the velocity and high-accuracy inertial data in order to provide continuous navigation solutions.

■ New Offer for Poland's Wisla Programme

(df) MEADS International has presented an updated offer for Poland's medium-range air defence (Wisla) programme to the Polish Ministry of National Defence. "We're extremely pleased to have been given the opportunity to present a detailed offer to the Ministry of National Defence," said Tom Oles, vice president for MEADS at Lockheed Martin Missiles and Fire Control. "MEADS represents the most affordable and the quickest path to the capabilities



Photo: MEADS International

Poland requires, and if MEADS is selected for Wisla, Polish Industry will benefit from technology implementation and future sales of MEADS in partnership with global leaders in defence." Jointly developed by Germany, Italy and the United States to replace PATRIOT, the 360-degree MEADS system addresses deficiencies in currently-fielded systems. It defeats challenging new air and missile threats from any direction, arrives and moves with deployed troops, and is interoperable with other NATO forces. All of these functions have been tested and evaluated in several tests and exercises, like Joint Project Optic Windmill. Germany has chosen MEADS as basis of its new tactical air defence system TLVS. This offer to Poland contains a Technology Transfer Plan, that will help Polish industry to become a world-class air and missile defence system integrator, MEADS International stated. "The presentation follows a year of active discussion with the Polish govern-

ment regarding the security and industrial benefits of the Medium Extended Air Defense System (MEADS). Advanced capabilities, partnership and a proven technology transfer methodology remain key characteristics of the MEADS industrial offer." The estimated budget of the Wisla programme is about €5Bn.

■ NIMR Rapid Intervention Vehicle RIV

(df) NIMR made the debut of their Rapid Intervention Vehicle – the NIMR RIV – at IDEX, with many different potential customers showing interest in the vehicle. The NIMR RIV is a light 4x4 vehicle, offering high-speed response to tactical situations in remote sites, either by fast ground transit or helicopter insertion, underslung or inside a CH-47. The maximum speed of the NIMR RIV is 160 km/h, the cruising range 1,000 km at 120 km/h. The vehicle has the ability to climb 300mm vertical obstacles and to mount a gradient of 60%. Gross weight is 4,000 kg with a payload capability of 1,500kg. The NIMR RIV has under-body blast protection as standard and modular applique armour packs for ballistic protection. Optional equipment includes an add-on ballistic armour kit, underslung structure, central tyre inflation system, runflat inserts, various weapon systems, tactical communications, self-recovery winch, 6 seater option



Photo: Dorothee Frank

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and payload growth potential. With all these features a typical mission is conceived using speed and mobility as the critical advantage, enabling the crew of four to traverse diverse terrain at high speed, both on and off-road, armed, for example, with up to a 12.7mm machine gun.

■ AMRAAM Refreshment Programme

(df) The US Air Force and Raytheon are jointly developing a new signal processor for the Advanced Medium Range Air-to-



Photo: US Navy

Air Missile (AMRAAM) under the Form Fit Function Refresh (F3R) programme. With this upgrade AMRAAM production shall be ensured well into the 2020s. AMRAAM, which first version entered service in 1991, is currently flying worldwide in 37 nations on the F-16, F-15, F/A-18, F-22, TYPHOON, GRIPEN, TORNADO and HARRIER. The AIM-120C5 and AIM-120C7 variants were fully integrated on the F-35 in 2015, in support of US Marine Corps' initial operational capability for F-35B, and AMRAAM is the only air-to-air missile qualified on the F-35 at the moment. Moreover, the AIM-120D variant, fielded in 2015, is the newest air-to-air weapon in the US arsenal and includes significant capability improvements, including increased range, GPS-aided navigation, two-way data link and improved weapons effectiveness.

The Arctic as an International Security Problem

Stephen Blank

During the last decade climate change has made the Arctic simultaneously a problem of global governance and of international security. Moreover, climate change is apparently accelerating to a point where scientists now report the ocean surface is warming twice as fast as previously thought and Arctic temperatures are spiking.

Since climate change threatens the entire world with massive ecological disasters, 195 countries have signed the legally binding Paris treaty and the Arctic

because the Arctic has also become a geopolitical security problem. Although climate change is the natural phenomenon driving change in the Arctic

precaution is driving other states like Norway and potentially the US and Canada to take greater interest in developing their Arctic military presence than has heretofore been the case. Thus we see, if not the actuality then at least the preconditions for, a regional arms race occurring here as well as a simultaneous race between negotiation and militarisation. The Arctic is not strictly a European security issue, even though Arctic defence inevitably connects to defence of key NATO members and the North Atlantic. Indeed, Russia's Deputy Prime Minister Dmitry Rogozin stated the following as one reason that the Arctic had become so prominent in Russia's 2015 Maritime Doctrine:

"As for the Arctic, several events motivate our decision. One is the growing importance of the North Sea Route. Mr. President, I reported to you that we have begun work on building a new fleet of atomic-powered icebreakers. Three new atomic icebreakers will be ready for work accompanying ships along the northern route in 2017, 2019, and 2020. Furthermore, the Arctic also assures us free and unhindered access to the Atlantic and Pacific oceans. Then there are the riches of the continental shelf, the development of which calls for an attentive approach." As observed in 2013, the most under-reported aspect of the Arctic's growing importance is its impact upon Asia's international relations. Not only has the Arctic's future disposition entered into the agenda of Asian international relations, the problems posed by opening the Arctic due to climate change, and the expectations of expanded commercial exploitation of its waters and of an eventual energy bonanza create interesting parallels to other energy issues in Asia, particularly those connected with the South China Sea. This is especially important for the delimitation of maritime EEZs (economic exclusion zones) under UN-



Photo KE Adventure

The Arctic remains challenging terrain, proven again by the ORTELUS, which followed the route of Ernest Shackleton's endurance expedition.

Council (AC) has obtained a new lease on life. But even though the AC has become more active and even expanded its list of observers to include Italy and key Asian countries like China, India, South Korea, Japan, and Singapore, this extension of the scope and remit of global governance by major international actors in the Arctic through a process of consultation and negotiation is in danger of being eclipsed

tic, Russia's response to that change has driven and continues to drive the Arctic into becoming an international security problem. Since the evolving security dynamics of that international security problem take place within the context of the parallel efforts to bring about a multilateral governing regime for the use of the Arctic through the AC, a race is occurring between the efforts to achieve a satisfying form of global governance of the Arctic and the largely Russian-driven efforts to militarize the Arctic. Indeed, Russia's aggressive behavior and concurrent drive to militarize the Arctic beyond any semblance of reasonable threat or

Author

Dr Stephen Blank, Senior Fellow
American Foreign Policy Council.



Photo: US Department of State

The Arctic Council in September 2016

CLOS (UN Commission on the Law of the Sea). For example, should China successfully defy its neighbours, the US and the International Court of Justice in The Hague regarding the South China Sea, Russia could then follow suit and invoke China's behavior as a precedent. Alternatively, if Russia could defy the UN, AC and its Arctic neighbours and consolidate its control over an extended claim of Arctic waters, that could become a precedent for China in those disputed Asian seas.

Underdeveloped Military Potentials in the Arctic

This Asian dimension of the Arctic issues expands the scope of the threat posed by the militarization of the Arctic. Moreover this militarization occurs not so much because of military threat potentials in the Arctic which, apart from Russia, remain quite underdeveloped. Rather it is because the Arctic, as a military theatre, has historically been an adjunct or accompanying theatre to key European battlegrounds during World War II and the Cold War. Accordingly the Russian buildup becomes dangerous not just because of its Arctic potential but because of the threat this militarization poses to the security of Nordic states, especially Norway, and the North Atlantic and because of the negative precedent this militarization could have for Asia. The numerous warnings of the threat posed by Russian submarines to Western sea lines of communication and actual physical communication links attests to this concern in Europe.

So while the Stockholm International Peace Research Institute (SIPRI) recently published a book arguing that the AC's multilateral efforts to establish an acceptable Arctic

regime were likely to succeed despite the crisis in European security, today's reality is not only that Russia is arming but also Norway is quickly building up its defences while America's calls for greater interest in Arctic military presence are growing in number and volume. Even before Moscow first made large and disputed claims to Arctic territory to the UN in 2007, its military saw the Arctic as a zone of threat and not just because climate change made hitherto inaccessible areas accessible to greater prospects for year-round navigation, a trend that invariably raised concerns for search and rescue and aerial as well as maritime monitoring and defence of Arctic energy platforms. Kristian Atland and Torbjorn Pedersen concluded several years ago in their article "The Svalbard Archipelago in Russian Security Policy: overcoming the

Legacy of Fear – Or Reproducing It?", published in *European Security* June-September, regarding the Svalbard Archipelago (Spitzbergen) that, "there seems to be a high degree of continuity between Cold War and post-Cold War Russian interpretations of space-related activities on the Svalbard archipelago. The current pattern of securitization is in reality not very different from the Cold War pattern and it seems fair to assume that the historic baggage of Soviet/Russian mistrust and suspicion still serves as a 'facilitating condition' for securitization."

Moreover, the authors stated: "Besides, the 'audiences' that the 'securitizing actors' were playing up to, such as the Russian Security council, the Foreign Ministry, and the Defence Ministry shared many of their concerns. These 'audiences' were generally receptive to the calls for extraordinary measures around the archipelago at the time."

Acquisitive Frenzy on Russian Energy Resources

Indeed, Russian policy originates in the belief that everyone covets its energy resources. Pace Carl Schmitt, Russian security policy begins from the generalized presupposition of threat and this outlook is apparent in every Russian official doctrinal and official statement of the last decade. Russia's 2013 Foreign Policy Concept openly states that as competition grows around the sources of raw materials, their exchanges, and their markets, this source of competition could become a trigger for future conflicts. And official documents since then have reinforced and expanded this threat assessment. Consequently, Russia's ensu-

Photo: MoD Russia

**The northernmost military base, Arctic Trefoil, in Alexandra Land, Franz Josef Land archipelago**

ing military buildup of the Arctic evidently intends to go beyond any idea of defending what really is (except for the Northern Fleet's SSBNs) a rather secondary theater. Instead Russia apparently plans to engage the Arctic fully in defence planning for myriad threats going beyond risks to energy platforms and weather related mishaps or dangers to commercial shipping to include full-blown military scenarios that comprise Europe, as was the case during the Cold War. Certainly, its deployments listed below indicate that Russia views the Arctic as a potential theatre in a bigger European or even Trans-Atlantic war. These threats evidently comprise a NATO or US aerospace attack with missiles, air and naval strikes and even potential amphibious landings in the Arctic to seize energy installations.

Recent accounts indicate the magnitude of Russia's conversion of the Arctic into an international security problem. Moreover, Russia has already announced plans for continuing military expansion in the Arctic

NATO aerospace attack (its biggest fear) is likely to come. As a result, "interviews with officials and military analysts and reviews of government documents show Russia's build-up is the biggest since the 1991 Soviet fall and will, in some areas, give Moscow more military capabilities than the Soviet Union once had," Reuters stated in the article "Putin's Russia In Biggest Arctic Military Push Since Soviet Fall" in January 2017. These investments confirm the priority status of the Arctic in Russian military planning. As a leading Norwegian scholar, Katarzyna Zysk recently observed in her paper "Russia's Strategic Underbelly: Military Strategy, Capabilities and Operations In the Arctic" from May 2016: "The Russian authorities have further underlined the importance of the Arctic in numerous policy documents, including the 2015 Maritime Doctrine, in which the Arctic and the Atlantic have been given priority. At a meeting of top-ranking officials of the Defence Ministry in December 2015, Minister Shoigu promised that

Rooting in Soviet Precedents

These deployments take their point of departure from a long-standing threat assessment whose roots derive from Soviet precedents as noted above. Russian authorities, as well as intelligence and expert circles alike, have since the early 2000s argued that the expected growing global demand for energy, with simultaneously declining production worldwide, could trigger rivalry and a potential future competition with international corporations as well as state actors, for declining energy reserves in particular in the Middle East, the Caspian Sea, Central Asia, in Barents Sea and the Arctic. In the assessment of Presidents Putin, Medvedev, and the General Staff, such competition may eventually lead to a conflict. Russia, with its enormous share of global natural resources, may in the future become an object of a large-scale expansion. According to the Russian General Staff, it will be one of the most important challeng-



Photo: Royal Canadian Navy

Arctic patrol ship of the Royal Canadian Navy

in 2017. Russia's Ministry of Defence has announced that it is building over 100 facilities in the Arctic on its bases in the Franz Josef Land and Novaya Zemlya archipelagos, Sredny Island, Cape Schmidt, and Wrangel and Koteln Islands.

US figures (Gramer) show that in recent years Russia "unveiled a new Arctic command, four new Arctic brigade combat teams, 14 new operational airfields, 16 deep-water ports, and 40 icebreakers with an additional 11 in development." Russia is also building up new Arctic coastal forces and new state of the art over the horizon radars that indicate its belief that the Arctic is likely to be the route through which a

reinforcement of the military units in the Arctic would be among the priority tasks in 2016, and a complete Arctic force group is to be fully established by 2018."

Zysk also observes the Soviet roots of Russia's current strategy: "The foundation for Russian military strategy in the region remains the traditional mission to form a 'bastion' in case of conflict, i.e. maritime areas around the naval bases closed to penetration by enemy naval forces, where Russia would deploy strategic submarines and maintain control, while in the areas further south, where Russia would be unlikely to hold control, it would seek to deny control to potential adversaries."

es of Euro-Atlantic security. General Valerii Gerasimov, the Chief of the General Staff, assessed that the likelihood of the threat may increase by 2030. In addition, as Keir Giles and Mark Smith wrote in 2007: "Russia views the Arctic in very different terms from all other littoral and nearby states, and takes any 'foreign' interest in those areas as an indication of hostile intent which may require a securitized response."

So while the Arctic remains peaceful today, the military buildup depicted by Zysk and others, along with everything else that is happening cannot but inflame allied suspicions. Those anxieties were already visible in the author's conversations with Norwe-

gian officials in 2014 and are more readily discernible in the movement of 300 US Marines to Norway, increased Norwegian defence spending and a new defence agreement with the UK. Since the centerpiece of Russian defence forces here remains the Northern Fleet, which is one of the nuclear fleets holding SSBNs, and their bases, should conflict move to the Arctic from Europe or another theatre, we must take into account the real nuclear escalation potential here. And because Russia's current threat assessment is so extravagantly out of alignment with the reality of other Arctic states' capabilities we cannot simply count on the Arctic remaining a zone of peace.

Warming but Still Threatening Cold

Yet despite this militarization, it is not clear that Russia is investing sufficient resources at home to counter the expected threats that climate change could present to its territories. The Siberian Times reported that there is a real threat of the actual collapse of buildings in Siberia's permafrost territories by 2050. Moreover, as long as energy prices stay in the \$50-60 range, as appears to be the case, the expected Arctic energy bonanza will not materialize. Russia will then be starved of opportunities to fund a revival of its civilian and commercial infrastructure, thus further negating prospects for exploiting the Arctic for such purposes. Indeed, cooperative ventures have stalled due to the collapse of energy prices that makes multilateral cooperation over energy prices impractical given the inherently high prices of Arctic oil and gas. Also, the imposition of sanctions, particularly on Russian efforts to obtain financing and technology for Arctic projects, has further driven the potential for cooperation in the Arctic off the contemporary agenda.

In 2015-2016 despite the accelerating warming of global and Arctic temperatures, commercial exploitation of the Northern Sea Route (NSR) actually declined. Less than 40,000 tons of cargo was shipped across the NSR in 2015, down from over a million in 2014. This figure clearly re-

flected declining oil prices that negate the point of Arctic energy explorations, sanctions on Russia and major global recessions in Europe, Russia, and the Far East. And 75% of that shipping was Chinese, another sign of Russia's decline in Eurasia relative to China. Given low energy prices and sanctions upon Russia, pressures to curtail energy and mineral exploration in the Arctic have also grown. Symptomatic of this trend is the example of President Obama's executive order of December 2016, restricting offshore drilling in most parts of US Arctic waters, which also reflects the current inutility of drilling in the

Arctic given low energy prices as well as strong environmental concerns as to what any Arctic drilling might lead to. All this occurs even as Western elites complain that such militarization undercuts not only the Arctic Council but also any hope for peaceful Arctic political-economic cooperation. Since the Council does not deal with hard security issues, this militarization raises the distinct possibility that despite advances in international governance regimes for exploiting the Arctic and dealing with the consequences thereof, the region may descend into armed rivalry if not actual conflict. ■



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Belgian Security and Defence Policy

Nicholas Fiorenza

The future of Belgium's security and defence policy is laid out in the Strategic Vision for Defence published in June 2016 and agreed by the Belgian government last December. The new defence and security strategy sets out the tasks and shape of the Belgian armed forces, which will be reduced from 32,000 to 25,000 soldiers and civilians.

Belgium aims to increase defence spending from the current 0.9 percent of gross domestic product to 1.3 percent in 2030, not including pensions. If pensions are included, Belgium plans to reach the two percent of gross domestic product called for by NATO in 2024.

To stop the slide in defence spending, the current government plans to invest €200M in major equipment before the 2019 federal elections. A further €9.2Bn will be invested between 2020 and 2030. The money will be invested in the land, air and naval components, which are now referred to as "dimensions", as well as in cyber intelligence.

The plan aims to achieve a balance between personnel costs with the intention of reducing them to half of the defence budget, with operating costs accounting for 23.5 percent and defence investment for around 17 percent. In 2016, Belgium spent nearly 78 percent of its defence budget on personnel and only around five percent on defence investment, with operating costs accounting for 17 percent. The operations budget will be increased from €607M in 2016 to €1.155Bn in 2030. Spending on research and technology will be increased from the current €5M to €140M in 2030 to reach two percent of the defence budget, as called for by the European Defence Agency.

The main aims of Belgian security and defence policy are to contribute to collective defence in the face of a more aggressive Russia on NATO's eastern flank and to collective security to manage crises such as refugees, terrorism, criminality and human trafficking emanating from Europe's southern flank. Another key mission is protecting Belgian citizens all over the world. Other missions are to support the police in homeland defence, national



Photo: NATO

Belgian F-16 aircraft have frequently participated in NATO's Baltic air-policing mission since its beginning in March 2004.

and international humanitarian missions, defence diplomacy, and the implementation of arms control treaties, weapons inspections, non-proliferation, and disarmament.

Air Force and Navy: Spearheads for Collective Defence

The Belgian Air Force and Navy are seen by the Strategic Vision as "spearheads" for collective defence which can also contribute to collective security. The F-16 is the current spearhead for Belgium's contribu-

tion to NATO collective defence, regularly rotating to the Baltic states to police their airspace.

Belgium has the ambition to have two combat aircraft available in 15 minutes for national air defence and for air policing and six expeditionary combat aircraft available within three days for an unlimited period. Since 1 January 2017, two Belgian F-16s have been on 15-minute quick reaction alert (QRA) not only to police the airspace of Belgium and Luxembourg, but also of The Netherlands under a joint air policing agreement agreed by the three Benelux countries in March 2015. Belgium and The



Photo: MoD Belgium

The Dutch minister of defence Jeanine Hennis-Plasschaert and her Belgian colleague Steven Vandeput signed a letter of intent on 30 November 2016 on the joint procurement of new ships to replace their M-Frigates and mine hunters.

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Netherlands will take turns policing each others' airspace, making them the first countries in world to do so. The Belgian fighters will be on QRA for the first four months of 2017, after which two Royal Netherlands Air Force (RNLAf) F-16s will take over.

The Belgian air force and RNLAf also take turns deploying F-16s to Jordan to participate in air operations against the so-called Islamic State in Iraq and Syria. The country not providing aircraft provides security for the base in Jordan.

The Belgian air force plans to acquire 34 new combat aircraft to replace its 54 F-16s. Under consideration are the RAFALE, Eurofighter TYPHOON, Gripen E, F-35, and F/A-18 SUPER HORNET. Belgium is ready to publish the request for proposals and the contract for whichever combat aircraft is selected will be signed by 2019 for deliveries beginning in 2023. The question of whether the combat aircraft will continue to have a nuclear mission remains open.

The second spearhead consists of six minehunters to help keep European ports and waterways free of mines and two M-Frigates acquired from The Netherlands to contribute to the protection of the sea lines of communication essential for the Belgian and European economy. Belgium's level of ambition is to have a multi-purpose frigate with a helicopter on board available for 36 months, followed by a period of two years with an availability of six months per year. Its ambition also includes having two mine countermeasures vessels and a coastal patrol vessel available for an unlimited period of time, plus the capability to counter mines in ports and deep waters.

Belgium and The Netherlands signed a letter of intent on 30 November 2016 on the joint procurement of new ships to replace their M-Frigates and mine hunters. The strategic plan foresees the Belgian navy continuing to have two frigates and six mine hunters. The new frigates will have an improved anti-submarine capability, along with Belgium's four NH90 NATO Frigate Helicopters, and a ballistic missile defence capability.

Belgium will take the lead on the procurement of the new mine hunters and The Netherlands will take the lead on the procurement of the new frigates, reflecting each country's area of naval expertise. Currently, the Belgian and Royal Netherlands navies operate the M-Frigates jointly and the two navies can reinforce their frigate and mine hunter crews with each others' personnel, although this usually occurs for joint training. It still has to be determined how the new ships will be operated. One possibility being considered is for the new

frigates to be operated by The Netherlands and the new mine hunters by Belgium.

The two countries are ready to begin preliminary studies on replacing the ships, with Belgium planning to do so by 2030. The new generation of mine hunters will have the additional requirement of taking over the tasks of the Belgian logistics support ship GODETIA, which will not be replaced. Belgium is also studying the possibility of joining Germany in contributing to the Royal Netherlands Navy's joint logistic support ship Zr. Ms. KAREL DOORMAN. This would involve Belgium providing the Dutch ship with a helicopter detachment and medical unit.



Photo: MoD Belgium

A Belgian logistics company supports the German-led NATO battalion deployed to Rukla, Lithuania.

For both collective defence and security, the Strategic Vision foresees the reinforcement of military cyber capabilities, with a quadrupling in personnel to 199, the improvement of defensive capabilities and the addition of offensive capabilities, supported by cyber reconnaissance.

Army: Spearhead for Collective Security

The army is seen by the Strategic Vision as the "spearhead" for collective security. The focus of the motorised forces will be the southern flank of NATO but they will continue to contribute to collective defence of the eastern flank. To continue to fulfil these tasks, these forces will receive new combat and support vehicles and individual soldier equipment and be digitised. Soldiers will receive personal weapons, Belgian Soldier Transformation (BEST) vests, night and thermal vision equipment, heavy machine guns and light mortars. Their communications equipment and interconnectivity will be modernised along with those of international partners with multi-role radios, satellite communications, and battlefield management system tablets.

The army's motorised capability consists of the Medium Brigade with five manoeuvre battalions, supported by engineers, indirect fire, intelligence, surveillance, target acquisition and surveillance (ISTAR), logistics, and communication and information systems. This will require investments in mobile bridge layers and improvised explosive device (IED) route clearance for the engineers, long range mobile artillery, short range fire location radar, drones for indirect fire support, and containers and armoured trucks for logistics.

Belgium has the ambition to provide a force headquarters for six months and an 800-1,200-strong battlegroup for crisis

management operations for an unlimited period. In addition, its ambition is to provide a second battlegroup for the EU or the NATO Response Force or two joint companies numbering 250 troops each for separate deployments. Belgium currently commands the EU Training Mission in Mali, is participating in the German-led battlegroup in Lithuania with a 90-strong logistics company, and has 270 troops on standby for an EU battle group during the first six months of the year.

Under the Strategic Vision, Belgian ground forces will be optimised for special operations with the transformation of the Light Brigade into a Special Operations Command consisting mainly of para-commandos. In addition to increasing the size of the Special Forces Group to 225, the two para-commando units – 2 Commando Battalion and 3 Parachute Battalion – will be transformed into ranger battalions which can be employed as a Special Forces Support Group. The new ranger battalions will be capable of deploying by parachute, air-mobile, amphibious assault or ground infiltration with little support, in addition to the non-combatant evacuation of Belgian civilians from conflict areas. Air mobility

will be provided by Belgium's four NH90 multi-role transport helicopters, which will receive special operations forces kits and medical evacuation kits. The Royal Netherlands Marines will train two Belgian para-commando companies to acquire an amphibious capability so the two forces can conduct joint landings, while the Belgians will help the Dutch marines develop paradrop capabilities.

Support for Internal Security

Defence is the last rampart for internal security, according to the Strategic Vision. The armed forces' support for internal security goes beyond air policing. The navy supports internal security with coastal patrols, a maritime information centre, and search and rescue by NATO Frigate Helicopters, although naval missions take precedence. The Service d'Enlèvement et de Destruction d'Engins Explosifs (Explosive Removal and Destruction Service, SEDEE) provides a na-

deployed to reinforce the police. Their strength rose to 1,000 after the terrorist attacks on Paris on 13 November 2015 and to 1,600 after the attacks on Brussels on 22 March 2016. Operation Vigilant Guardian was optimised in October-November 2016 with patrols replacing static guard duty and the number of soldiers deployed reduced to 1,100. The Belgian military leadership is concerned about the reduction in training resulting from the heavy workload of Operation Vigilant Guardian. For example, the Bevrijding/5 Linie (Liberation/5 Line) Battalion had to cancel eight out of 11 weeks of training planned for 2016, leaving only two weeks of field training in Germany and a one-week computer-assisted exercise.

European Capability Anchor

Increasing European defence cooperation is essential for Belgium's defence and security policy, which is anchored in European

medium-altitude, long-endurance (MALE) unmanned aerial systems.

The Strategic Vision aims for Belgium to have the capability to conduct its key missions, with a balance of credible and sustainable combat capabilities across the four dimensions: land, air, sea and cyber. The emphasis will be on strategic enablers for national support and to fill European capability gaps and non-kinetic and civil-military capabilities for conflict prevention and post-conflict stabilisation. This will require a wide national capability portfolio integrated into European capabilities with the ability to adapt to changes in the security environment and the maximisation of the possibilities for European cooperation. The Strategic Vision foresees an increase in human intelligence and unmanned aerial and space-based reconnaissance. The military intelligence service will receive more personnel and funding and be adapted to new threats such as terrorism and hybrid warfare. The Belgian army's reconnaissance vehicles, tactical unmanned vehicles (UAVs), mini UAVs and all their multi-sensors will be modernised. In addition, Belgium plans to procure two MALE unmanned aerial systems in the short term and four more European systems in the long term. Currently, there are no plans to arm them but the option to do so in the future is open. Belgium is also participating in NATO's Alliance Ground Surveillance programme and plans to do the same in France's Spatiale Optique (CSO) optical space component satellite programme.

Ends and Means

The major defence spending increases foreseen by the Strategic Vision will not be made until after the 2019 federal elections. In addition to cutting the armed forces to 25,000 soldiers and civilians in 2030, the average age will be reduced from the current 40 to 34.

Belgium's military leadership is concerned about the effects of the reduction in training and of past defence budget cuts on the capabilities of the nation's armed forces. It is also concerned that the continuing loss of expertise and personnel is adversely affecting capabilities, especially those of the army.

Recruitment is being gradually stepped up from 900 in 2016 to 2,100 a year in 2021-2030. Military pay will become more flexible to attract specialists and more will be invested in training trainers. At the same time, individual military pensions are being reduced but the overall pension budget will nevertheless grow from the current nearly €1.37Bn to €1.65Bn in 2030. ■



Belgium deployed troops on the streets to reinforce the police after terrorist attacks.

tional explosive ordnance and counter-IED response capability and disposes of thousands of munitions per year left over from the two world wars. Under the Strategic Vision, the SEDEE and military hospital infrastructure available for disaster response will be rationalised and an air information centre will be created.

Belgian soldiers have been on the streets of Brussels, Antwerp, Liege and other cities for over two years since 17 January 2015 to deter terrorist attacks under Operation Vigilant Guardian. Following the arrest on 15 January of suspected Islamic radical terrorists planning to attack the police and the seizure of weapons caches, police uniforms and cash, 300 soldiers were

capacity development via a bottom-up European defence, according to the Strategic Vision. Belgium plans to fill capability gaps through European programmes. For air-to-air refuelling, Belgium plans to pay for and operate an aircraft of the joint European A330 Multi-Role Tanker Transport fleet and to acquire two refuelling kits for its A400Ms. Belgium is procuring seven A400Ms, with deliveries scheduled to begin in 2019, and will contribute to the Belgian-Luxembourg A400M training centre. The national ambition is to have four transport aircraft, including one or two in the aerial refuelling role, available for an unlimited period of time. Belgium will also participate in the development of European

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Azerbaijan's Relations with Russia: Beware of the Bear

Eugene Kogan

The geographic location of the three South Caucasian countries Armenia, Azerbaijan and Georgia is a curse. For centuries these countries have been divided and ruled by the dominating Persian, Russian and Ottoman empires. The empires have collapsed and faded away, but their successor states Iran, Turkey and the Soviet Union (present-day Russia) continue to dominate the region.

The collapse of the Soviet Union has given Azerbaijan a breathing space to build a new independent state. Yet the curse of geography still lingers. An independent and sovereign state for 25 years, Azerbaijan is still surrounded by Russia and Iran. And this time around President Vladimir Putin will not give President Ilham Aliyev's regime a second chance to get closer to the West and Turkey.

Azerbaijan's Vulnerabilities

First of all, it is important to elaborate on Azerbaijan's current domestic situation and its implications for relations with Turkey, its strategic partner, as well as Azerbaijan's relations with the EU and the US, because it explains why Azerbaijan eventually chose to co-operate with Russia. Over the past two to three years, Azerbaijan's manoeuvring space has shrunk – due to the domestic economic downturn, falling oil and gas prices and subsequent depreciation of the local currency, and cooling relations with the EU and the US (hereafter called the West) and Turkey. In the end, Azerbaijan is left with the only viable option of co-operating with Iran and Russia, the two countries that Azerbaijan has to be very careful with.

On the one hand, for the last 20 years Azerbaijan pursued a multilateral policy and kept Russia at a safe distance. Azerbaijan did not allow Russia to drag it into Russian-led organisations like the Collective Security Treaty Organisation (CSTO) and the Eurasian Economic Union (Eurasian Economic Union). Furthermore, Azerbaijan has strenuously objected to the deployment of Russian peacekeeping forces along the Line of Contact (LoC) in Nagorno-Karabakh. Azerbaijan learned from the experience of

neighbouring Georgia that deployed Russian troops would stay put, which would make Armenia and Azerbaijan even more dependent on Russia and the international community even more impotent. After all,

recently the two countries have grown apart. In the end, Azerbaijan decided that co-operating with Russia by advancing Azerbaijan's interests is preferable to antagonising Russia. Some might describe Azerbaijan's policy

(Photo: Picture Alliance)



A general view of a destroyed Talish village situated near the Karabakh-Azerbaijani contact line. Many historical Armenian and early Christian monuments were destroyed in the village during the 1994 war and April 2016 "four-day war" when the Azerbaijani army took control of the village on 2 April 2016.

the international community has no leverage to make Moscow withdraw its troops, and international appeals to Russia to withdraw its troops from the occupied territories has fallen on deaf ears in Moscow.

On the other hand, the government of Azerbaijan realised that in comparison with Russia the West is weak and indecisive when it comes to the South Caucasus, and Turkey is preoccupied with domestic and foreign crises and distracted from Azerbaijan. As a result, Azerbaijan has to cope alone with its neighbourhood including Iran's ambiguous policy. Although Azerbaijan and Turkey have been on the same page for many years, re-

towards Russia as Finlandisation, akin to the Finnish pursuit of neutrality after the end of the Second World War in the face of a hostile Soviet Union. With that explanation kept in mind I turn to Azerbaijan's relations with Russia.

Closer relations with Russia mean a radical shift in Azerbaijani strategic vision and foreign policy pursuit based on the past co-operation with the West and Turkey. There is no doubt that the shift was accompanied by a strengthening of Ilham Aliyev's regime at home. Aliyev feared a domestic destabilisation – a kind of Rose or Orange Revolution or what the Russians call "colour revolutions"

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– and he accused the EU and the US of applying double standards to Azerbaijan. Particularly the Western critique of the Aliyev regime cooled relations between Azerbaijan and the West. In other words, Aliyev's greed for power and alienation from the West made the regime in Azerbaijan a natural partner of Putin's Russia as Russia has no real allies. Czar Alexander III who ruled Russia in the late 19th century believed that Russia only had two allies – her army and navy. Not much has changed since then, but the two Russian allies have been compounded with Russia's strategic rocket forces and nuclear weapons.

Russia's Reward for Loyalty

Unlike the West, Russia does not ask Azerbaijan to maintain an unblemished human rights record and uphold democratic standards. Russia wants the regime in Azerbaijan to remain stable, predictable and loyal to Russia. The latter point is important since Russia rewards loyalty. For instance, in May 2015 Russia signed an agreement on gas imports to buy 2 billion cubic metres (bcm). Rovnag Abdullayev, President of the State Oil Company of Azerbaijan Republic (SOCAR), said that "negotiations have been opened with Gazprom about the purchase of between 3 bcm and 5 bcm annually on 12 May." Negotiations regarding the price of supplies are pending. In addition, Russia continues to reward Azerbaijan by supplying it with advanced arms to the detriment of Russia's strategic partner Armenia. Back in April 2014 Zakir Hasanov, Azerbaijan's Minister of Defence, said: "Today Azerbaijan's Armed Forces receive modern weapons from Russia. That helps to boost our country's defence capability."

Additionally, Russia is the second largest trade partner of Azerbaijan (excluding oil exports) after Italy. According to the data of the Azerbaijan State Customs Committee (SCC) the trade volume between Azerbaijan and Russia totalled US\$743M between January and June 2016 while Russian imports from Azerbaijan accounted for US\$191M for the same period. Last but not least there is the issue of Azerbaijan migrant workers in Russia. According to Anatoly Fomenko, Deputy Director of the Russian Federal Migration Office, "about 10.5 million migrants resided in Russia back in April 2013" (the latest official data available). "Of this number about six hundred thousand were Azerbaijanis." Russia can use them to exert pressure on Azerbaijan to bow to Moscow's demands. Russian officials dismiss this point out of hand.

To improve relations between Russia, Azerbaijan and Iran as a new partner, the three

presidents met in Baku on 8 August 2016. In addition to international and regional politics and talks on energy and transportation co-operation, the presidents discussed the North-South Transport Corridor. The corridor would connect Northern Europe with Southeast Asia and might serve as a link connecting the railways, roads and shipping infrastructure stretching from Iran to Russia through Azerbaijan. According to Theodore Karasik, a political analyst and a senior Gulf State Analytics Advisor in Washington, "the

or not Azerbaijan would agree to join the union is another matter. As time goes by, Azerbaijan's manoeuvring space vis-à-vis Russia continues to shrink, while the West and Turkey are preoccupied with their own problems.

Finally, the frozen conflict over Nagorno-Karabakh is a trump card in relations between Azerbaijan and Russia. The conflict allows Russia to keep Armenia and Azerbaijan, to various degrees, in its sphere of influence. Russia has little interest in resolv-



Photo: Azerbaijan Army

Azerbaijan showing its military assets during a parade in Baku

project will significantly reduce the costs and time of transportation. The heads of the three countries discussed in Baku customs, transit costs, as well as other important issues."

Under Control

In spite of its steady arms purchases and in spite of growing economic co-operation, Azerbaijan views Russia's strengthening position in the post-Soviet space and beyond (i.e., in Syria) as the greatest threat to its independence and sovereignty since Russia is a predator state. Russia will not hesitate to use ethnic minorities (i.e., the Talysh or Lezgian people) in northern Azerbaijan and bordering Dagestan or the Azerbaijani diaspora in Moscow to undermine the current regime, while at the same time keeping Azerbaijan under its control. Seemingly, at the moment Russia is not interested in bringing Azerbaijan into the EEU since the union is going through serious economic challenges. However, in the future Russia may ask Azerbaijan to join the union despite potential objections from Armenia. If Russia sold arms to Armenia and Azerbaijan despite objections from Armenia, then Russia indeed has persuasive power to bring Azerbaijan into the EEU despite objections from Armenia. Whether

ing the conflict, a point that Russian officials deny outright. Although the four-day war in Nagorno-Karabakh in April 2016 clearly exposed the limits of the Russian involvement in conflict resolution, Russia was the only one that was actively engaged in the diplomatic negotiations, while the rest of the OSCE Minsk Group delegated that mission to Moscow.

In conclusion, Azerbaijan understands perfectly well that good neighbourly relations with Russia are the foundation for prosperity for the country. Azerbaijan's stability and prosperity depend on Russia and not vice versa. Therefore, "beware of the bear" means that Azerbaijan needs to tread carefully and act accordingly in its relations with Russia, since Russia can exert pressure on Azerbaijan. Azerbaijan's cooling relations with the West and Turkey has put it in a tight spot, and Russia may not give Aliyev's regime a second chance to get closer to the West and Turkey. After all, strong Putin is not weak Yeltsin and US interests in Azerbaijan in 2017 are no longer the same as they used to be in the early 1990s. In addition, Turkey is distracted by terrorist acts, military involvement in Syria and the continued cleansing of the Fethullah Gulen supporters, while Russia is waiting patiently for the right moment to bring Azerbaijan back into its orbit. ■



Viewpoint from Berlin



Germany's Reassessment of Transatlantic Security Relations

Wolfgang Labuhn

All smiles and friendly handshakes at the latest summit of NATO Defence Ministers at Brussels in February and at the 53rd Munich Security Conference when the new US Secretary of Defense James Mattis reaffirmed "our strong transatlantic bond", and the "full US commitment to NATO" which President Donald Trump had previously called "obsolete". However, as Mattis as well as Vice President Mike Pence also reiterated, Trump's message of "fair burden sharing" puts the Berlin government in a quandary. For at the Brussels meeting Mattis expressed optimism in that "the Alliance will adopt a plan this year, including milestone dates to make steady progress toward meeting defence commitments in light of the increased threats that we all agree that we face". In an election year, the German government is thus expected to spell out in detail how to meet the agreed NATO target to spend at least 2% of the respective GDP on defence by 2024 at the latest. The annual German defence budget currently stands at around €37Bn equalling roughly 1.2 % of the German GDP. 2% would bring the budget to well over €60 billion, a financial effort that the German electorate would not accept at the present time.

Not surprisingly, the Berlin coalition of Christian Democrats and Social Democrats is split on the issue. Foreign Minister and Social Democrat Sigmar Gabriel agreed to a larger German contribution to European defence efforts. But in his view creating the impression that Germany would add €30Bn to its current defence budget within eight years would be "totally unrealistic". On the other hand, at the Munich Security Conference Chancellor Angela Merkel reaffirmed Germany's acceptance of burden sharing including spending more on defence: "We will make every effort – we remain committed to this goal". Merkel also indicated how her government hopes to raise defence spending to 2% of the GDP as spending on development cooperation and crisis prevention should be included in the calculation. Meanwhile, Defence Minister and fellow Christian Democrat Ursula von der Leyen never ceases to point out Germany's contribution to international operations to fight terrorism, and to NATO's enhanced forward presence in Eastern Europe.

Meanwhile, Germany is spending a considerable amount of money on new military hardware. 100 mothballed LEOPARD 2 main battle tanks are to be bought back from the manufacturers and to be modernised to the latest standard. The German Navy will get five additional K130 frigates. Defence Minister von der Leyen has also decided to order six – rather than four – MKS 180 multi-purpose frigates. In addition, the recently established German-Norwegian partnership to jointly purchase identical new submarines involves two more vessels for the Germany Navy by 2030. The German-Norwegian strategic partnership includes further development of Kongsberg's "Naval Strike Missile" (NSM) designed to be the main weapon system for all future frigates of both countries. Furthermore, Germany plans to purchase up to six HERCULES C-130J transport aircraft to be used jointly with France in response to air transport shortcomings until the delivery of all new Airbus A400M airlifters. Also, Germany is to join Europe's future Multinational MRTT Fleet (MMF) of up to eight Airbus A330 Multi-Role Transport Tanker (MRTT) aircraft. All these projects will require additional billions of euros.

However, after 25 years of constantly reducing the size of its armed forces the most important German contribution to burden sharing will probably be a significant increase in the number of troops. Medium term planning now aims at 198,000 German troops by 2024, compared to the maximum strength of 185,000 troops as planned in 2011 for a "readjusted" Bundeswehr.

Thus President Trump's ominous remarks on the future of the NATO Alliance have already led to a fundamental German reassessment of transatlantic security relations. While for the foreseeable future the US will remain indispensable for Europe's security, the present Berlin government has accepted the necessity to considerably improve Germany's defence capabilities. But increased spending on personnel and equipment combined with extended cooperation projects with its European NATO partners will still not meet the objective of spending 2% of its GDP by 2024. Whether Angela Merkel's preemptive defence accounting to include development aid and crisis prevention spending will convince the new US administration of Germany's commitment to burden sharing within NATO remains to be seen.

Bosnia-Herzegovina – a Failed State or a Prospective EU Candidate?

Igor Tabak

Looking at Bosnia and Herzegovina throughout the years, it is often difficult to bring together the disparate narratives related to the country.

On one hand, it is a dysfunctional post-war construct with a makeup and constitution determined through pressure from international actors (during 20 days of negotiations in Dayton, Ohio, in autumn 1995). Although there were three

to EU accession, and also close to negotiating NATO membership, and a place that saw a constant drop in the number and activity of locally deployed international peacekeepers. This dichotomy is glaring – spawning discussions about a new

joint government sessions – while periodically threatening secession from B&H and unification with its wartime sponsor. With respect to EU and NATO membership, the Republika Srpska entity acts somewhat similarly to Serbia proper; that is, it conducts EU negotiations while dodging NATO integration. The entity Republika Srpska actively enforces the EU prerequisite reforms, but just up to the level where those reforms strengthen its own power – while at the same time blocking all the EU reforms that would benefit the overall country. While Republika Srpska is unable to proclaim military neutrality on its own (like the Republic of Serbia did in December 2007), it was still able to stop the approach of the overall B&H to NATO through stalling some changes that were prerequisite to negotiation.

The other B&H entity, named “Federacija Bosne i Hercegovine”, was constructed during the war, in 1994. It was made up of Bosnian Muslim and Croat territories in order to form a stronger negotiation partner, able to meet the politically strong Bosnian Serbs on a more equal footing. Today it is organised in ten cantons (five with Muslim majority, three with Croat majority and two mixed), that are grossly inefficient and just vaguely based on former historical divisions. While most of the joint bodies in overall B&H are still constructed to reflect the interests of all three major ethnic groups of the land, the Bosnian Croats ended up in a joint entity with the overall Bosnian Muslims majority. Furthermore, a large part of the Croat population ended either in Muslim majority cantons or in the ones that are mixed. The Muslim majority opts for hard-line unitarist views in contrast to the more federalist views of the Croat minority of the “Federacija Bosne i Hercegovine” entity. As a result, the Croat representatives keep calling on a reform of the Dayton structure of B&H, aiming for either the formation of a third, Croat entity, or at least restructuring of the existing “Federation” entity, in order to better resist the pressure of political assimilation and to curb emigration. While



Photo: NATO

Signing of the full and formal Dayton Agreement in Paris, France, on 14 December 1995

sides in the conflict that negotiated in the US, still this unwieldy country was stitched together from just two main entities – one of the major political problems in the country. Many political and cultural differences remained, with power composed of three ethnical political hierarchies that remained stable (if not stagnant) since the war. On the other hand, Bosnia and Herzegovina is a country broadly on the path

war, while international attention to and awareness of Bosnia and Herzegovina's situation is decreasing.

The Structure as the Source of Problems

The two main entities of Bosnia and Herzegovina are very different. On one side there is the Republika Srpska – a direct successor of the statelet that the Bosnian Serbs conquered and ethnically cleansed during the conflict. Today it encompasses around 49 percent of the overall country and is organised in a centralised way. By way of calling upon the Special and Parallel Relations agreement, Republika Srpska cooperates actively with the neighbouring Republic of Serbia, going so far as to hold

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Photo: Federal government Bosnia and Herzegovina



The building of the Parliamentary Assembly of the Federation of Bosnia and Herzegovina in Sarajevo

effective assimilation is not common, this internal conflict often makes the Croats of Bosnia enter into operational alliances with the political forces in Republika Srpska, even though the overall interests of Croats and Serbs in Bosnia differ significantly. On the other hand, emigration of Bosnian Croats has been made easy by

political scene in overall Bosnia and Herzegovina remains strongly divided, with big ethnical and religious blocs pretty stable and represented by national parties with little change in views or personnel. Amidst this muddled political scenery, the international community is still on the spot in B&H – primarily represented by

representative was changed frequently, since March 2009 that post has been held by the Austrian diplomat Valentin Inzko. Apart from this “freeze”, it gradually became very obvious that the High Representative was extremely reluctant to use the “Bonn powers” – a range of somewhat controversial measures intended in

Photo: Bundesheer



EUFOR ALTHEA is now mainly focusing on capacity building and training of the Armed Forces of Bosnia and Herzegovina.

the neighbouring Republic of Croatia that is not able to establish a political relationship with the Croat minority comparable to that between Serbia and the Republika Srpska, but liberally allows dual citizenship rights to Bosnian Croats (especially tempting since the accession of Croatia to the EU in summer 2013). This unstable political situation is made worse by the fact that the national po-

the High Representative in B&H (including his dedicated Office of the High Representative and the international Peace Implementation Council) and the EU (with the combined Office of the EU Special Representative and the EU Delegation in B&H as well as the EUFOR ALTHEA operation with around 600 troops deployed). Unlike in the first days of the post-war period, when the personnel of the High

Photo: OHR



The Austrian diplomat Valentin Inzko has been the High Representative for Bosnia and Herzegovina since 26 March 2009.

1997 to help break the bureaucratic or political impasses, as well as to incapacitate local incumbents working against the spirit of Dayton accords. This general inactivity contributed significantly to the administrative and political impasse in today's B&H. Also, the role of the US has to be mentioned, not just because the

peace was established through its efforts in 1995, but also because the local US Embassy remained a strong player working on furthering the stability of this complicated post-war national structure.

The Recent Political Tremors

Even though the growth of domestic radical Islamism and the threat posed by Wahhabi fighters residing in the country periodically draws the attention of foreign observers, the main problems for Bosnia and Herzegovina remain more structural. Some of the instabilities that shook the political scene of B&H during the last six months had to do with elections, international and local, while others were centred on power-games between the Bosnian Serbs in the Republika Srpska entity and the rest of B&H.

On one hand, the US presidential elections in late 2016 presented the chance that relations between the USA and Russian Federation were to change – emboldening the Republika Srpska entity to join the efforts of the Republic of Serbia in getting politically closer to Moscow. On the other hand, the municipal elections in overall Bosnia and Herzegovina held on 2 October 2016 only confirmed the strength of traditional ethnically based leaders and parties – the Serb Milorad Dodik and his SNSD (Alliance of Independent Social Democrats), the Muslim Bakir Izetbegović and his SDA (Party of Democratic Action), and Dragan Čović heading HDZ BiH (the Croatian Democratic Union of Bosnia and Herzegovina). The municipal elections in B&H also refocused attention on some existing individual flashpoints – Eastern Herzegovina where the Muslims and Croats clashed (in Mostar and Stolac), and Srebrenica where the Serbian parties won over the local Muslims, symbolically deepening the local genocidal trauma.

The efforts of the Republika Srpska entity to gain more independence by constantly keeping alive the threat of secession (and then joining the neighbouring Serbia) were the other major source of instability. This kind of situation was visible in September, with a referendum held in Republika Srpska against the wishes of the other half of the country, the joint government structures and the international community (apart from Russia, which sided vocally with the Bosnian Serbs). In this referendum held on 25 September 2016 Milorad Dodik, president of Republika Srpska, tried to ensure that 9 January was to be celebrated as the “Day of RS” in the future – commemorating the day in pre-war 1992, when the Serbs in the Parliament of B&H

stopped joint participation, proclaimed their Republic of the Serbian people in B&H and started the war. As the referendum succeeded in gaining a slim majority of the overall number of voters registered in Republika Srpska (thus making it legal) it was no surprise to see 9 January ceremonies thereby reconfirmed contrary to the decisions of the Constitutional Court of B&H that outlawed the commemoration and declared that it discriminated against the Croat and Muslim population. Unlike Dodik, who on various occasions cited this referendum as a stepping stone to further referenda, Mladen Ivanić (Serbian member

appearance gave the local celebration a visible regional note, making it also part of the upcoming competition for the presidency of the Republic of Serbia (which is to be decided in April 2017) where a lot of attention is centred on gaining the support of the hard-line nationalist part of the Serbian political scene.

The Role of EU Membership in Today's B&H

As is clearly visible from the last annual report on the state of preparation of Bosnia and Herzegovina for EU membership pub-

Photo: RS government



The central celebration of the “Day of Republika Srpska” was held in Banja Luka on 9 January 2017. Milorad Dodik (left), president of Republika Srpska, and (to the right of Milorad Dodik) Tomislav Nikolić, president of Serbia, were amongst the guests.

of the three-ethnicity Presidency of Bosnia and Herzegovina) just supported the September referendum with reservations on the rest of the secessionist agenda.

As expected, 9 January 2017 automatically became another date of inter-entity confrontation. The central celebration was held in Banja Luka, and is remembered for the controversial appearance of a unit of the joint Armed Forces of B&H that got approved by the aforementioned Mladen Ivanić as the presiding member of the Presidency (counter to the decision of the responsible joint Ministry of Defence and the opinion of the NATO HQ in B&H) – as well as for the presence of Tomislav Nikolić (president of Serbia), and Ivica Dačić (the Serbian minister of foreign affairs), in this way reaffirming the support of the Republic of Serbia for the Bosnian Serb entity, apart from the joint B&H. This

lished in November 2016, the country is not nearly ready for immediate accession. B&H is a country without a functioning market economy, just beginning the reforms and changes in most fields that were studied. Still, as can be vividly observed from the recent period when the EU accession was blocked, without an international effort the local situation cannot improve itself, because the country is gridlocked by local political differences. So, the renewed EU efforts defined also by the resolution on the progress of reforms in B&H passed by the European Parliament on 15 February are among the few remedies with proven ability to enact reform. Consequently, even the struggle to enact basic EU accession procedures already makes sure that this Balkans country doesn't end as a failed country on the immediate borders of the European Union. ■

The Brazilian Air Force – Amazonian Roller Coaster

Georg Mader

A few years ago, the future of the Brazilian Air Force (Força Aérea Brasileira or FAB) and of Brazil as the pre-eminent nation in Latin America was bleak. With the GRIPEN-E/F fighter aircraft and the Embraer KC-390 tanker/transport aircraft, the FAB has two major procurement projects up and running. Unexpected cuts in the 2016 defence budget, however, have prompted a sizeable staff reduction and the closing of regional air commands. This is in addition to an ambitious restructuring plan launched in December 2016. In the meantime, platforms like F-5EM/EFs and A-1A/B (AMX) are being modernised to cover the transition period. For 2017, the budget allocates an increase of 12.2% for defence.

Planning...

Brazilian budget planning often resembles a roller coaster ride. However, high-ranking FAB officers such as FAB commander Lieutenant Brigadier Nivaldo Luiz Rossato assured the author in 2016 that key acquisition programmes are not in danger. But they also confirmed that the 2016 budget cut of 6.4% will necessitate a reduction of 25% in the FAB's officer corps over the next 20 years. This staff cut comes in addi-

ing mobility, flexibility, force projection, and command and control (C2) capabilities. Currently, the FAB has more than 600 airframes and some 70,000 personnel, the latter of which needs to shrink by 17,000 (about 25%).

...and Budgets

The reduced defence budget apportioned the FAB a share of 26.2% or US\$6Bn – slightly less than the Navy's share. Just like

terms, this figure is far lower than allocations made to the air force in 2008-2010; the largest share went to the acquisition of the SAAB GRIPEN-E/F multirole fighter whereas the next large project, the EM-BRAER KC-390, will consume 17% of the budget.

It is here where the roller coaster ride takes yet another turn. Unexpectedly, Brazil's 2017 budget stipulated a real-term rise of 12.2% compared with the previous year. Brazil's total budget of BRL3.5 trillion will allocate BRL94.8Bn (US\$29.7Bn) or 2.7% to defence. This figure strongly contrasts with the drastic 6.4% cut of 2016, even when considering the country's high inflation rate. In real and nominal terms the rise is the largest in Brazilian defence spending in over a decade. Moreover, it is expected to reach US\$20.5Bn in 2021, tracing an annual growth rate of some 4.0%, at least according to a report by Strategic Defence Intelligence (SDI).

These figures and structural plans provide the framework for FAB's programmes:

GRIPEN-NG

In December 2013, Brazil announced its intention to procure 36 Saab GRIPEN E/Fs (28 single-seaters and 8 twin-seaters) to fulfil its so-called F-X2 requirement. A contract with a value of approximately US\$5Bn was awarded in October 2014. Several observers – the author is one of them – have been asking themselves why the FAB chose the smallest of the contenders with the "shortest legs" for Brazil's giant airspace of 22 million square miles. The FAB, however, has no such doubts. When evaluating the three contenders – F/A-18 E/F and RAFALE were competing against Saab – all of them fulfilled the requirements of taking off in two configurations from an FAB base to

Photo: via author



F-5EMs of the Brazilian Air Force during exercise Red Flag 2008

tion to a major restructuring programme developed over several years which will shut down some air force bases. The programme, called "Força Aérea 100", is to be completed by 2041; it aims at increas-

other air forces, the FAB suffers from high personnel costs. Lt. Brig. Rossato wants the air force to invest in intelligent technologies in order to reduce personnel costs. Currently, 68% of FAB's budget goes towards personnel costs. Reportedly, this number, however staggering, is still lower than in both the Navy and the Army. Nonetheless, the FAB needs to switch to hiring skilled temporary personnel for administration, construction and similar jobs. Air force procurement funds are BRL2.5Bn (US\$775M) or 11.4% of the FAB's total budget. In real

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complete a given mission and return to base. All three aircraft completed the mission on their own without tanker support but the GRIPEN with its new GE414 engine did not burn as much fuel as the heavier twin-engine aircraft.

Brazilians call the aircraft the GRIPEN-NG which stands for "New Generation"; it has nothing to do with Saab's 'NG'-demonstrator or 39-7. Deliveries of the airplane are expected in 2019-24, and Saab is already heavily investing in Brazil to live up to the contract's local content provisions. Brazil has the world's third or fourth largest aerospace industry. Brazilian companies like Embraer, AKAER Engineering, AEL and INBRA are also involved in the "GRIPEN-NG design group". Officials are confident that GRIPEN-NG will become the backbone of FAB fighter aviation in the medium- and long-term. Considered by many to be one of the most advanced warplanes, the SUPER GRIPEN is seen as a watershed platform for the FAB. It will be a major factor in deterring any threats to Brazil's sovereign airspace; it will fly air defence and QRA missions but also conduct precision air strikes and aerial reconnaissance. In contrast to Sweden's Flygvapnet, which is not implementing it, the twin-seater 'F-model' is crucial to Brazil and will largely be designed and built in Brazil in a customised version. South Africa will cooperate with the project just as it does with other Brazilian military projects. The SAAF also operates the D-GRIPEN – not only for OCU/training but in a C2/battlemaster role as well.

According to FAB Brig. José A. Crepaldi, Director of Brazilian Department of Defence Products during F-X2, the programme is a strategic one for Brazil regardless of the government in office. He said it is a programme for the nation and not for a particular government. This is why the GRIPEN investment is not riding the budget roller coaster and Brazil might one fine day end up with 108 GRIPENs. This number is taken from a 2007 feasibility study that explored how many aircraft are needed to fulfil all future missions. The study found that Brazil is in need of three batches of 36 new fighter aircraft. Although there might be some shuffling around when it comes to the different scenarios, it is the FAB's declared goal to develop a single-type air force. Whether three batches will amount to 100 or 80 fighter aircraft is still up in the air.

EMBRAER KC-390 and Other Transports

The twinjet high-wing and T-tail KC-390 was carefully designed to serve the Bra-

Photo: via author



The GRIPEN-NG will become the backbone of FAB fighter aviation in the medium- and long-term.

zilian nation as specified in the National Defence Strategy. It represented a great leap forward for FAB's capacity for air transport and force multiplication. It is the largest aircraft ever developed and manufactured in Brazil. An initial agreement was signed in 2009, and the production and delivery contract for 28 aircraft was signed in 2014. Two prototypes are up and flying and it has made transatlantic flights. Hose-drogue refuelling tests and paratrooper tests have been completed and first deliveries to FAB are expected next year. Although Brazil's 2017 budget draft foresees a rise from BRL625M (2016) to BRL717M for the aircraft's development and procurement, this remains far lower than the BRL1.2B spent on the project in 2015. Lt. Brig. Rossato said that the high personnel costs mentioned above had been responsible for delays and that

funding for the KC-390 would increase in the future. In any case, the aircraft will enhance the mission array of the GRIPEN. Most likely, the KC-390 will replace the FAB's fleet of Lockheed Martin C-130 HERCULES which have been in service since 1965. The FAB currently operates a fleet of 22 C-130s – five C-130Es, 15 C-130Hs and two KC-130H tankers. Until 2000, the Italian Air Force operated 10 of the C-130Hs. When Italy acquired 22 new C-130Js and longer-fuselage C-130J-30s it sold the C-130H back to Lockheed Martin, which in turn sold them to Brazil. The sale to Brazil also included spare engines and parts for both the airframe and the avionics systems. Two years ago, one of the C-130s crashed at an FAB outpost in Antarctica; last summer the wreckage and the remains were transported to Brazil.

Photo: via author



The first flight of the Embraer KC-390 took place on 3 February 2015.



Photo: via author

The SUPER TUCANO from Embraer has become an export bestseller.

When it comes to the lower transport segment, FAB will receive one search-and-rescue (SAR) aircraft Airbus D&S C295 fewer than originally planned. The aircraft – designated as SC-105 AMANAS – performs SAR missions over the country's vast maritime and jungle areas. It is operated by the Squadron "Pelicano" based at Campo Grande Air Base. In Brazil, maritime air patrol is an air force task, which is why the FAB acquired 12 SAR aircraft under its earlier CL-X2 programme, and in April 2014 it contracted another three SAR aircraft for €191M. Only recently, Brazil cancelled the procurement of one of the three aircraft, the earlier financial squeeze being the reason.

The 2016 budget cuts suspended Brazil's project to procure two second-hand Boeing 767-300ER commercial aircraft – one converted by Israel Aerospace Industries' (IAI's) BEDEK Aviation Group to its B767 Multi-Mission Tanker Transport (MMTT) configuration and the other one by TAP M&E in Brazil. The project intended to replace the KC-137 (Boeing 707 airframe), which was retired in 2013. It remains unclear whether this suspension is for good.

Last July, FAB fielded a C-767 (locally designated as B767-330ER) personnel and cargo transport aircraft, leased from COLT Aviation. Squadron "Corsário" operates this aircraft out of Galeão Air Base in Rio de Janeiro.

Embraer-314 (A-29 SUPER TUCANO)

The Brazilian company Embraer developed the perfect design for flying light attack with 'cheap' turboprop airplanes in areas or scenarios of little or no resistance in the air: the SUPER TUCANO and its predecessor TUCANO. The FAB and other Latin American air forces like the Colombian Air Force repeatedly used the TUCANO for intelligence, surveillance and reconnaissance missions (ISR) with guided and unguided ordnance and achieved great results against drug cartel infrastructures. The SUPER TUCANO or '314', introduced in 2003, has become an export bestseller. In 2015 Embraer's Vice President Geraldo Gomes told the author that more than 200 SUPER TUCANOs have been delivered to or ordered by more than 10

countries. Since then, SUPER TUCANOs have been delivered to Lebanon, Mali, Ghana, Mauritania and Afghanistan (via US-based Sierra Nevada Corporation). Since June 2012, the FAB has operated 99 SUPER TUCANOs, manufactured under a contract of approximately US\$214.1M. Of these, 66 SUPER TUCANOs are two-seater versions (designated A-29B) and 33 aircraft are the single-seat A-29 ALX. The first SUPER TUCANO was delivered to the FAB in December 2003 and the last in June 2012. With the SUPER TUCANO, WWII-era wing-mounted .50 calibre (12.7mm) heavy machine-guns made a comeback in military aviation. Additionally, the SUPER TUCANO can carry a load of up to 1,550 kg (3,300 pounds).

Legacy Fleet Modernisation

Budget cuts ended the operation of 12 second-hand MIRAGE 2000C fighters leased from France by Christmas 2013. The FAB's current frontline combat fleet comprises modernised Northrop Grumman F-5EM/FMs, TIGER IIs and a mix of legacy and upgraded AMX-International A-1A/B/M fighters. Both aircraft have exceeded their life span and are earmarked for retirement although they are to see an upgrade to a sophisticated avionics and NAVAID-level and cockpit environment. Some upgrades have been completed. The fleet of 49 modernised F-5EM/EFs (43 single-seaters and six twin-seaters) was meant to be complemented by 11 modernised F-5E/Fs (eight single-seaters and three twin-seaters) before they entered FAB service under an April 2011 contract, but in the end only the three twin-seaters were authorised for modernisation by Embraer, with the first modernisation being completed in October 2014 and remaining two in November 2016.

Embraer also received a modernisation contract for the 43 A-1A/B aircraft (33 single-seaters and 10 twin-seaters) to A-1AM and -BM aircraft for BRL843M. But,



Photo: via author

Brazil ordered 50 H225Ms in June 2008, 18 of which were designated for the FAB.

reportedly, the FAB has received fewer aircraft than anticipated. Last year an FAB official explained to the author that Brazil might need to slow down or postpone the modernisation of A-1s and F-5s while the first GRIPENs are being delivered. The new type, therefore, would have to take over missions sooner than the A-1.

Trainers

In November 2016 the FAB officially announced its interest in acquiring advanced trainers. Lt. Brig. Rossato confirmed this to ESD. Potentially, the FAB might purchase some 50 aircraft in a tender open to international bidders. As of yet no decision has been made regarding when to issue the tender but studies are well under way for establishing the effort. An FAB official stated that designs developed for the USAF's ambitious T-X trainer programme could compete in Brazil as well. Disregarding the actual status of the T-X programme, this would theoretically apply to systems like the Lockheed Martin/KAI T-50 GOLDEN EAGLE, Leonardo's M-346, Textron's SCORPION, the BAE Systems HAWK AJT, Irkut's YAK-130 or the Czech Aero Vodochody L-39NG. Besides being a trainer, the FAB also wants such an aircraft to perform close air support (CAS). For now the FAB has one squadron for each training purpose, teaching future fighter skills, helicopter skills and multi-engine skills. They are equipped with EMB-314, AIRBUS (Eurocopter) AS350 and EMB 110 BANDEIRANTE.

Helicopters

Currently the FAB uses the venerable Bell UH-1H IROQUOIS (23), the UH-60L/M BLACK HAWK (16) and the AS-332 SUPER PUMA as transport and utility helicopters. The FAB also has 11 AIRBUS (Eurocopter) EC725 CARACALS in the inventory to conduct maritime SAR roles. The FAB's mainstay for armed attack and patrol are 12 Russian Mi-35Ms, and the FAB uses AS350s (26) and AS355s (4) for rotary training, liaison and utility. With over 80 platforms, the Brazilian army operates more helicopters than the FAB.

The Future of the Air Force Bases

The plan "Força Aérea 100" intends to establish combined "air wings" at Anápolis, Brasília, Campo Grande, Canoas, Galeão, Manaus, and Natal air bases. While additional wings could be created, personnel at Afonsos, Florianópolis, Fortaleza, and Recife will be downsized to only about 200 over the next five years, thus maintaining a presence at those air bases while reducing costs. Anápolis in Goiás state will become the major FAB hub as the 1st Wing will host

two GRIPEN squadrons there. Internally, the GRIPEN will be named "F-39E". Another squadron will fly the KC-390 and the existing Embraer E-99/R-99 AEW and ISR platforms. The outdated AMX A-1A/B/M fighters will be stationed at Santa Maria in Rio Grande do Sul until their end of service life. Moreover, a Bombardier Aerospace R-35AM ELINT aircraft squadron will relocate from Recife to Anápolis. And a second KC-390 squadron will later be based at Galeão in Rio de Janeiro, where the 1st Troop-Transport Group's C-130 HERCULES aircraft are currently flying from. ■



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Protecting the Amazon

Tim Guest

Environmental issues are of huge importance to Brazil. Host of the Rio Earth Summit in 1992 and again in 2012, the country has striven to put in place measures to protect its vast environmental resources from some of the threats posed by the modern world. Today, the Brazilian Amazon is subject to protection from such agencies as the Brazilian Air Force conducting activities under the Amazon Protection System, or SIPAM.

With a wealth of news stories about rampant deforestation, persecution of indigenous peoples, illegal logging and drug-trade activities regularly running in the global media, many would think that the Amazon has been left to suffer and deal with such threats all on its own. This misconception is far from the truth in Brazil, home to the vast majority of the Amazon region, where the Brazilian Air Force (Força Aérea Brasileira, FAB) is among several government agencies operating together to protect the region.

Indeed, the FAB, with support from the army and federal police, has even undertaken bombing operations of illegal landing sites used by drug dealers to transport drugs and proceeds in and out of Brazil, as part of its activities in the Amazon. The FAB's AMX fighter-bomber has been the main aircraft used in some of these operations; upgrades to more than 50 AMX planes carried out by Embraer some years ago will see them operating until at least 2027.

SIPAM Background

Talking with ESD, unattributed Brazilian Government sources explained the origins and current objectives of the Amazon Protection System. Created in February 2002, SIPAM's objectives are the integration of information from across the region and generating updated knowledge for the articulation, planning and coordination of global government actions in the legally defined Brazilian Amazon, or "Amazônia Legal". The total area covered by SIPAM is some 510 million hectares – an area large enough to accommodate the whole of Western Europe. The ultimate aim of the system is to ensure the region's protection, social inclusion and sustainable development. The origin of SIPAM goes back to the Amazon Surveillance System (SIVAM) project, which was launched in 1990 and concluded in 2005. The original objective of SIVAM was to create a comprehensive network for the protection of the Amazon, involving the development and establishment

of technologies, intelligence analysis, and integration of federal, state and municipal bodies.

During its 15 years, the SIVAM project was divided into two components, one being a civilian and the other a military component. Today, both fall under SIPAM's umbrella with the military component linked to the Brazilian Air Force Ministry and its civilian component – SIPAM's Managing and Operational Centre (CENCIPAM) – directly linked to the Office of the President.

Some 40 other bodies contribute to the system, including the Brazilian Environment Institute (IBAMA), the National Water Agency (ANA), the Federal Police, the National Foundation for Indigenous Peoples (FUNAI), the Federal Revenue, the National Institute for Space Research, the National Institute for Research of the Amazon, the Civil Defence, as well as state and municipal environment bodies. For enforcement and control actions to tackle deforestation (and for this purpose alone), 3,000 police officers are mobilized every year.

The Brazilian Legal Amazon encompasses all of the northern region together with parts of the central-western and north-eastern regions. Legal Amazonia includes a total of seven states: Acre, Amapá, Amazonas, Pará, Rondônia, Roraima and Tocantins, as well as parts of two other states – Maranhão and a very small part of Goiás State. Although called Amazônia Legal, the region has three different biomes (i.e. large naturally occurring communities of flora and fauna occupying a major habitat, e.g. forest or tundra): 1) all of the Amazon rainforest biome within Brazil, 2) 37% of the Cerrado biome and 3) 40% of the Pantanal biome.

Because of the large number of challenges and opportunities posed by the characteristics of the region, a coordinated and differential approach is required. As a result, in addition to the activities of SIPAM, the Amazon Cooperation Treaty Organization (ACTO), to name but one, is another organisation actively involved in protecting



Photo: Google Maps

With a population of only two people per km², of which 4/5 live in the towns, the Amazonas region is one of the wildest, most natural and hardest to control regions in the world. Not only native tribes, but also drug producers and other criminals seek the shelter of the vast rainforest, often harming the environment by stealing its resources.

the region. ACTO is a social-environmental bloc formed by the nation states that share the whole Amazon territory: Brazil, Bolivia, Colombia, Ecuador, Guyana, Peru, Suriname and Venezuela.

The origins of ACTO date back to 1978, when, on Brazil's initiative, these eight Amazon countries signed the Amazon Cooperation Treaty (ACT) in Brasilia, with the objective of promoting harmonious development in the region and the well-being of every population therein; in addition, ACT aimed to strengthen the sovereignty of each country over its respective Amazon territory. Strengthening regional cooperation is the primary means to achieve these goals.

Technology and Data

SIPAM today uses data generated by a complex and sophisticated technological infrastructure and network of integrated subsystems comprising remote sensors, radar, meteorological stations and data platforms installed across the region. This network makes SIPAM capable of monitoring the whole region in near real time. Data are further obtained through five sensors carried by R99-B R95 and Learjet aircraft, which operate in microwave, visible and infrared ranges.

In addition, a further sensor data source – SIPAMSAR – has been provided to SIPAM by Censipam during 2016, which uses data from the 'Thematic Mapper' carried by the Landsat-5 satellite to monitor illegal cuts in the Amazonian area using data generated by the Italian satellite constellation, COSMO-SkyMed. These Synthetic Aperture Radar (SAR) data were acquired under Project Amazônia SAR, which was financed by Fundo Amazônia via BNDES and coordinated by Censipam.

SAR is a coherent, mostly airborne or space-borne, side-looking radar system using the flight-path of the platform to simulate an extremely large antenna, or aperture electronically, and that generates high-resolution remote sensing imagery. The Geoambiente company in partnership with e-GEOS, a joint venture between Telespazio and the Italian Space Agency for the commercialization of data delivered from the COSMO-SkyMed satellites, have provided more than 1,000 images in strip-map mode (40 km x 40 km), with a spatial resolution of three metres and covering two million square miles of land including the whole SIPAM area. According to Telespazio, "the use of these techniques on 'multi-temporal SAR data and multi-geometria' aims to detect and characterize land cover changes resulting from human



Photo: AC-Foto

Destruction of the rainforest for palm oil production: The field on the right is only visible to airborne sensors at close range.

activities in the Amazon, where clouds cover the area, but do not affect radar capabilities".

Data provided by SIPAM are of fundamental importance for Brazilian police and environmental intelligence and enforcement agencies. In the case of illegal logging, for example, information is provided on a daily basis to enforcement authorities distributed strategically close to the so-called illegal "deforestation hotspots". Once perpetrators have been caught, they are, according to the government source, "properly judged, administratively and criminally, as appropriate, under the requirements of due process of law".

Solving Many Challenges with Many Solutions

According to the Brazilian Government talking with ESD, illegal logging, land grabbing and drug trafficking are among the key environmental and social challenges that are being addressed by the government with SIPAM support. The Action Plan for Prevention and Control of Deforestation in the Amazon (PPCDAM is the Portuguese acronym), launched in 2004, continues today to reduce deforestation rates continuously and to bring about the conditions for a transition towards a sustainable development model in the region. The PPCDAM action plan has been structured to address the causes of deforestation with a "crosscutting", coordinated and intensive approach. It consists of three thematic axes to guide government actions. The first is land tenure and territorial planning; the second, environmental monitoring and control; and the third, fostering

sustainable production. A fourth thematic axis for PPCDAM, focused on the development of forestry economic instruments, was launched at the end of 2016.

PPCDAM's Environmental Monitoring and Control axis has hundreds of ongoing, integrated law enforcement operations, based on technical criteria and territorial priorities, as well as resulting from significant improvements in environmental monitoring systems.

The National Institute for Space Research (INPE) through the Amazonian Gross Deforestation Monitoring Project (PRODES), annually assesses gross deforestation in 'primary' forests in Legal Amazonia with a minimum mapping unit of 6.25 hectares. Additionally, a real-time Deforestation Detection System (DETER) was developed to serve as a guide for integrated enforcement operations. More recently, the DETEX (Selective Logging Detection System), the DEGRAD (Forest Degradation in the Brazilian Amazon Mapping System) and the TerraClass Project to assess land use and occupation dynamics of deforested areas have been further developed.

Success and Scope for Improvement

The Brazilian livestock sector is also another major organisation/sector now fully engaged with tackling deforestation in the Amazon, including through the new Working Group on Sustainable Livestock Production, of which main producers are part. Much of the cattle ranching that causes deforestation is actually undertaken for purposes of land grab-

Photo: XMobots



One of the drones in use is the ECHAR 20C.

bing, rather than for meat production. It is also important to highlight that PRODES serves as the “high-precision system” for statistically assessing and reporting deforestation rates. Other systems, in particular DETER, although publicly available, do not accurately reflect deforestation rates, but rather guide integrated enforcement operations. Many reports from the international media and international organizations often indicating dramatic increases in deforestation in the Amazon are misleading, as they are based on DETER, rather than PRODES. Between 2004 and 2015, the PPCDAm action plan and, in particular, monitoring and control activities supported by SIPAM, have actually achieved a dramatic reduction in the deforestation across the Amazon by about 78%.

That said, although already extremely successful, ESD’s Brazilian Government sources said that “SIPAM can always be further improved” and that recent bilateral initiatives with the European Union and Japan are doing just that. They’ve been able to increase the precision of satellite and radar images even more to counter the growing sophistication of illegal activities by increasingly sophisticated and tech-savvy perpetrators. The scope for improvement was actually highlighted in October last year, when it was reported by researchers from Brown University in the US that while efforts of the Brazilian Government as outlined above, particularly through the use of PRODES, have been very successful in reducing deforestation, more deforestation is happening in areas not covered by the sensors employed.

Comparisons of PRODES data with two independent satellite systems measuring untouched forest uncovered some 9,000 square kilometres of forestland that had not been included in PRODES monitoring. This whole area had been cleared between 2008 and 2012. The Brown team stated

that PRODES had been an incredible monitoring tool facilitating successful enforcement of policies, although it appeared that evidence showed landowners are finding ways to avoid monitoring and important swathes of forest continue to be destroyed.

Drones Fly in

Another dimension to the protection of the Amazon is the increased use of drones, which are now also being used by some Brazilian municipalities and private or state-run companies to map properties and monitor areas under their control. Whether it is to monitor that farmers and other property owners are maintaining the minimum forest cover required under Brazil’s Forest Code – farmers in the Amazon are required to preserve some 80% of the forest on their land, as well as protect springs and rivers, and any landowner/farmer having violated restrictions on deforestation previously is now required to reinstate and cultivate recovery of such lost areas – or water companies keeping

close watch on rivers and tributaries for pollution threats or other water course issues, there has been an increase in the adoption and use of drones over the past few years.

One Brazilian company, XMobots Aeroespacial e Defesa, has seen a steady if not sharp rise in demand for its drones by users involved in some activities both directly or indirectly protecting and monitoring the Amazon. Some of its larger drones can take detailed photographs of 20,000 to 30,000 hectares during a single flight. Hydropower companies have been some of the main users in recent years, making use of the drones to monitor their lands and banks of rivers checking for illegal settlements, which often deforest the banks all the way to the river.

In the municipality of Alta Floresta, in Mato Grosso state and overseen by the state’s environmental secretariat, a drone from XMobots is being used to monitor how previously lost or deforested areas are being reinstated and reinvigorated by landowners, to see how recovery is progressing. In Altamira, the country’s largest municipality, drones are also being used for similar monitoring activities.

According to XMobots CEO, Giovanni Amianti, the National Institute of Colonization and Agrarian Reform (INCRA) will begin a pilot project in March this year using drones for the georeferencing of rural properties. The institute will use two ECHA 20C and one Nauru 500B drones, both designed and manufactured by Amianti’s company. INCRA researched different drone technologies between 2013 and 2015 and evaluated various products available in Brazil. After flight testing campaigns carried out on INCRA settlements, the company’s equipment was selected from a field of several bids during 2016. ■



Photo: via author

Even though the Brazilian Government is trying hard to fight illegal land grabbing, those parts of the Amazon rainforest that are untouched by humans are getting smaller and smaller.



Finland: Wartime Strength to Grow to 280,000

Mikko Ilkko

Editor-in-Chief of the Finnish Defence Forces' newspaper (Ruotuväki) and Vice President of the European Military Press Association (EMPA)

The Finnish Government's Defence Policy Report to Parliament (Defence White Paper) suggests to increase Finland's wartime force levels to 280,000 troops. According to the Report, the Air Force's fighter programme and the Navy's OPV project, which both are to replace capabilities to be decommissioned, are indispensable strategic factors for the defence of Finland. Moreover, the Government wants to improve the defence forces' readiness and intensify both defence cooperation and the development of national legislation. The timeline of the Report extends into the mid-2020s.

The Government's Defence Policy Report to Parliament (White Paper) was adopted in a plenary session on 16 February 2017. The Parliament is supposed to approve the Report later this month. Major amendments to the Report by the Parliament are not expected since opposition parties have been involved in the preparation of the Report.

The increase of the wartime strength to 280,000 soldiers would constitute a growth by 50,000, over the current force level of 230,000. Most of the personnel is based on reservists. As a matter of tradition, Finland has always taken advantage of significant wartime strengths; only six years ago the number was 350,000.

"Readiness is the keyword," said Defence Minister Jussi Niinistö. He emphasised that Finland must be able to answer possible military pressure and sudden threats, but also traditional military attack. "The Government wants to develop operative, regional and local troops further. We use more effective ways to the resources of the voluntary defence in order to strengthen the local defence", Niinistö said at the press conference.

New Fighters and Naval Vessels Are Required

According to current plans, Finland's defence will face an exceptional situation in the 2020s when the main weapon systems of two service branches will be phased out almost simultaneously. In accordance with the White Paper, preparations for the replacement of the Navy's current fleet of four RAUMA Class FACs (Squadron 2020 project) and HÄMEENLINNA Class MCMVs as well as the Air Force's F/A-18C and F/A-18D HORNET combat aircraft with multi-role fighters (HX programme) have commenced. Both programmes are based on research and analysis of the future operating environment. Maritime and air defence are a prerequisite for the functioning of the entire defence system. As a result, the programmes

are of major importance to Finland's security and defence policy. For the first time, the Defence Policy Report was drawn up as a separate report. It follows a report tabled by a parliamentary working group and the Government Report on Finnish Foreign and Security Policy. One of the reasons for a separate Defence Policy Report was to engage the Parliament in these long-term strategic procurement efforts.

At the moment, the main pillars of Finland's air defence capabilities are the Air Force's Boeing F/A-18C and F/A-18D HORNET multi-role fighters. In 1992, Finland decided to buy 64 HORNETs with deliveries commencing three years later. The HORNET fleet has been subject to regular modernisation programmes. Nonetheless, the fleet is aging. Nationwide air defence and the projection of deterrence necessitate a replacement of the Air Force's key defence system with capable multi-role fighters from 2025 onwards. The new aircraft are expected to be operational for at least 30 years. The cost estimate for the new fighter programme is between €7Bn and €10Bn. Finland has yet to choose its next fighter. The procurement decision will be made in the early 2020s.

In the Navy, the Squadron 2020 project entails replacing and modernising the capabilities of the seven vessels which will have been or are scheduled to be decommissioned. The four planned units of Squadron 2020 would be capable of year-round, long-endurance patrols in all weather and ice conditions in the Baltic Sea, protection of territorial integrity, command and control of maritime operations, mine laying as well as anti-surface warfare and anti-aircraft defence. The maritime defence capability will be preserved with the vessels to be acquired, and the current HAMINA Class fast-attack craft are scheduled for overhaul. The Squadron 2020 vessels are to remain in service until the 2050s. The estimated cost of the project is €1.2Bn.

The Finnish Defence Forces

- 12,000 employees, of which roughly 4,000 are civilians.
- Wartime strength: 230,000 (2017 White Paper: 280,000)
- Conscript training generates the wartime troops. Conscription service lasts 165, 255 or 347 days.
- Tasks of the defence forces: 1. Finland's military defence; 2. Supporting other authorities; 3. International military crisis management
- Finland's defence budget equals approximately €2.8Bn or 1.3 percent of GDP.

Belgian Modernisation Plans in Cooperation with The Netherlands

Jaime Karremann

In 2016, Belgium and The Netherlands embarked on a large bi-national naval programme which will result in at least 16 new naval vessels. Moreover, Belgium wants to equip its new frigates with missiles that can intercept ballistic missiles in space.

Ten years ago the first of two Belgian M-frigates, BNS LEOPOLD I, was commissioned for the Naval Component

Belgium and the frigates in The Netherlands. The four frigates underwent the same mid-life upgrade in Den Helder. On

gian and Dutch ships frequently exercise in a combined group of ships.

The Next Step

As the M-frigates and minehunters approach the end of their service life, bi-national cooperation in replacing the ships had been anticipated. But when Brussels announced new budget cuts in early 2015, this cooperation was in doubt. The budget cuts caused deep concerns in The Netherlands, because a cancellation of the Belgian procurement would have had enormous consequences for the Dutch Navy. However, in late 2015 Belgium decided to invest €9.4M until 2030. The investment plan included two new frigates and six new mine countermeasures vessels.

The decision came as a relief for the Belgian and the Dutch navies. But quite a few challenges remain. Although the two navies are in fact merged, the procurement processes are very different. When Belgium decided to replace the eight ships, The Netherlands had already conducted studies on the new ships, even though a Dutch political decision on the



Photo: BAF

Belgium and The Netherlands ordered the same NH-90 helicopter.

of the Belgian Armed Forces. The frigate had served for 16 years in the Royal Netherlands Navy as HNLMS KAREL DOORMAN. When the second Belgian M-frigate followed one year later, the programme was completed and an important milestone was reached. From then on, Belgium and The Netherlands operated the same frigates, the same TRIPARTITE minehunters and had ordered the same NH-90 helicopter.

To operate with identical equipment was an important goal for the two navies which have cooperated closely since 1948. Especially in the last decade, the two navies have cooperated in all domains and on all levels. Belgian and Dutch navy personnel are trained in bi-national schools in both countries. Dutch and Belgian minehunters receive maintenance in

top of that the military staff of the two navies are combined, the Admiral Benelux is the Commander of the Royal Netherlands Navy and the position of Deputy Admiral Benelux is held by the Commander of the Belgian Naval Component. Of course, both navies cooperate closely at sea. Bel-

Photo: MoD Belgium



The TRIPARTITE minehunters are the first ships to be replaced by the Dutch and the Belgian navies.

Author

Jaime Karremann is the editor-in-chief of the Dutch naval website marineschepen.nl.

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acquisition of the ships is not expected before 2019 because of the strict procurement process. This process came into force when the construction of the WALRUS Class submarines didn't go as planned. In 2016, the M-frigate replacement project entered the A-phase of the Defence Materiel Process (DMP); the project of the minehunters has not even started yet in the Netherlands.

In spite of all the differences, last November the Dutch and the Belgian Ministers of Defence signed a Letter of Intent (LOI) in Brussels. The letter stated that Belgium and The Netherlands intend to jointly procure the new ships. The two nations also hope to reach an agreement on the exchange of classified information, research and development, operational concepts, and budget and procurement strategies. According to the LOI Belgium will lead the procurement of the new mine countermeasures vessels and The Netherlands will lead the project of the new frigates.

Apart from the two different procedures, both parties have reached a consensus on where to build the ships. The Netherlands still has a small naval industry whereas Belgium does not – hence the CASTOR Class patrol vessels which entered service in 2014 and 2015 were built in France. The Netherlands prefers Damen Schelde Naval Shipbuilding and Thales Nederland. The Dutch and Belgian ships have to be delivered between 2023 and 2030.

Mine Countermeasures Vessels: Stand-off

The first ships to be replaced are the TRIPARTITE minehunters. Both navies

Photo: Thales



The Integrated Mast from Thales onboard the HNLMS KAREL DOORMAN. The company is working on a successor, called the Integrated Sensor Suite.

operate six of these minehunters, which were developed together with France in the late 1970s.

Although both countries signed the LOI in November 2016, the navies had been discussing the cooperation for quite some time, especially how to operate the future mine countermeasures vessels (MCMVs). This is a touchy issue as Belgium prefers the stand-off concept whereas The Netherlands prefers mother-ships which can enter a naval minefield.

The benefit of the stand-off concept is that the requirements for the mother-ship's signature (acoustic, magnetic, etc.) are much lower, which brings down costs. The downside is that the ship is ill-suited to enter a minefield, which is counter-intuitive since mine warfare rests

on the presumption that you don't know where the minefield is.

Additionally, unmanned vehicles are a crucial part of the stand-off concept. The mother-ship can stay away from the minefield and use drones to enter it. But there are concerns that the current subsurface drone technology is not yet ready for such a demanding task.

In spite of these concerns, The Netherlands agreed and both countries decided that future MCMVs will be stand-off systems. Although the MCMV's signature will not be reduced, it will have some built-in resilience to prevent the loss of the ship and its crew when accidentally hit by a mine. The ships will have a MCM toolbox of unmanned subsurface and unmanned surface vehicles.

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The future Belgium and Dutch MCMVs will feature facilities to act as command and support ships, because the Belgian command and support ship BNS GODETIA will not be replaced. The first new MCMV is expected to enter service in 2023.

Frigates: Flexible ASW Ships

The M-frigates are multifunctional frigates with an emphasis on anti-submarine warfare (ASW). In addition to the ASW capability, the successor ships will be able to conduct a wide range of tasks. The new ships will have more built-in capabilities for mission modularity; they can be equipped for a specific task thanks to hospital containers or special sensors.

Both countries are currently conducting studies on the ships. The Netherlands started a few years ago. In 2013 an early model was more or less accidentally put on display at a recruitment day. Little is known about the specifications of the current designs. The ships will probably be larger than the current M-class frigates and have fewer crew members. The maximum will be around 100.

Although no choice has been made when it comes to a shipyard and a supplier of the sensors, Thales Nederland is already designing new radars for the future frigates. The company is working on the successor of the Integrated Mast, called the Integrated Sensor Suite. Instead of one mast holding all the sensors, the sensors are now distributed over two masts. On those masts will be four faces of an S-band radar and four of an X-band radar, IFF, electro-optical and infrared sensors, and communication equipment. An important difference with the Integrated Mast is that although the Integrated Sensor Suite comprises two radars with two bands, they will act as one radar system with one radar management. The first models of the new frigates showed a conservative weapon configuration. Now, however, it seems that the ships might carry a more daring range of weapons. New ideas include high-energy lasers against missiles, and Belgium intends to add a ballistic missile defence capability to the frigates.

Belgium: BMD

In the summer of 2016, Belgium published its plans which included another ambitious requirement for the future frigates: an exo-atmospheric interceptor. Belgium wants to focus on missiles to intercept ballistic missiles in space, and it does not plan larger and more expensive sensors like the Dutch SMART-L ELR for its new ships.

Currently no European country in Europe has such a defensive weapon at sea. Only the US and Japan operate an exo-atmospheric interceptor: the Standard Missile 3 (SM-3). In 2018, the Royal Netherlands Navy will be the first European navy with a sensor that can detect and track ballistic missiles in space, when the SMART-L ELR will be installed on the Air Defence and Command Frigates. At this stage, there are no plans to equip these ships with SM-3.

In the Netherlands the M-class frigates are viewed as anti-submarine frigates, albeit with a strong air defence capability to repel air attacks on a lone operating frigate. Because the ship was designed with a MK 41 VLS strike length from the outset, the Belgian requirement doesn't have a large impact on the design. The ships need special on-board communication systems and additional software to be able to communicate with the NATO BMD centre in Ramstein, Germany. The launcher may be already fitted but the missiles are not, and they are expensive: around \$10M apiece. In addition, BMD ships are an important target for opponents, and BMD is a sensitive topic for countries like Russia. However, ballistic missile defence is a NATO priority; with this remarkable step Belgium would fill a capability gap in the defence of the European continent.

Until now, it is unclear whether Belgium will get BMD-missiles. A decision will be made after 2028. ■

Masthead

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The Croatian Armed Forces

Vesna Pintarić

Over the past 25 years of their existence, the Croatian Armed Forces have grown into a respectable military and a guardian of the security of the citizens of the Republic of Croatia. The Croatian Armed Forces have earned recognition and respect from partner militaries and from countries where Croatian soldiers have taken part in international missions and operations building global peace, stability and security.

The unique war experience of the early 1990s and the professionally conducted military operations which ended the war on Croatian territory constituted the foundation for the professional development of the Croatian Armed Forces. In the post-war period the Croatian Armed Forces have adapted to new challenges and organised as modern, professional and mobile forces with developed capabilities for participation in joint operations and NATO-, UN- or EU-led peace support operations.

Tasks and Organisation of the Croatian Armed Forces

To meet evolving requirements, the Croatian Armed Forces have undergone continuous organisational adaptations together with the modernisation of weapons and equipment. The continuous reorganisation entailed professionalisation, with compulsory military service replaced by voluntary service.

Although the Croatian Armed Forces have been organised, prepared and developed primarily for the purpose of protecting the sovereignty and the defence of the national borders – land, maritime and air space – their mission includes an array of tasks, such as contributing to the Alliance's collective defence, participation in crisis response operations abroad, security and trust building measures and assistance to national but also foreign civilian institutions in the event of major disasters if necessary.

The current organisation of the Croatian Armed Forces comprises the General Staff and the directly subordinated units, three services – the Croatian Army, Croatian Navy, Croatian Air Force and Air

Defence – as well as the Croatian Defence Academy "Dr. Franjo Tuđman", the Support Command and the Special Forces Command.

According to the latest figures, the size of the Croatian Armed Forces is 15,966

The professional component of the Army consists of two Guards brigades, the Artillery and Missile Regiment, the Engineer Regiment, the Air Defence Regiment, the Signal Battalion and the NBC Defence Battalion. The manoeuvre battalions of the

Photos: Tomislav Brandt/Hrvatski vojniki



Croatian soldier with a VHS assault rifle

(14,465 active duty personnel and 1,501 civilian employees). In terms of the personnel structure, as many as 18 out of the total number of active admiral and general rank officers have been assigned to the Croatian Armed Forces, over 3,000 officers and some 5,500 NCOs. The Croatian Armed Forces boast a significant proportion of female members (13%).

Croatian Army: The Largest Component of the CAF

The Croatian Army is the largest component of the Croatian Armed Forces (CAF) and the backbone force conducting defence tasks.

two Guards brigades constitute the main modules manning the task forces.

The remainder of the army force belongs to the Training and Doctrine Command, tasked with the training of the active and service component, as well as the establishment and training of the reserve component. The Army also comprises the International Military Operations Training Centre.

The Croatian Army has been provided with new assets and weapons, among them 126 Patria armoured vehicles upgraded with anti-armour systems and the remotely operated weapon station DUOS 30 mm (the delivery of all vehicles is to be completed by the end of 2018), 212

Author

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MRAP vehicles of various types (the Maxx-Pro PLUS, the RG-33 HAGA and the M-ATV) and 75 M-84 tanks. It has also been equipped with the new Iveco light armoured vehicles together with HMMWVs and 130 armoured personnel vehicles.

With regard to small arms, Croatian soldiers operate the new domestic product – the assault rifle, both the shorter and the longer variants – with NATO calibre and the semi-automatic HS pistol of the same manufacturer, whose quality has earned international recognition. The rest of the equipment in operational use, such as the new digital pattern uniform with the pixelated shape of the Croatian territory, the protective vests and helmets, are also indigenous products.

The army forces constitute the main pool of the Croatian forces for NATO-, UN- and EU-led operations, such as the ongoing Resolute Support and NATO Response Force, maintaining the level of key capabilities on a permanent basis.

The members of the Croatian Armed Forces are actively engaged in assisting national civilian institutions, preparing and conducting the activities during the firefighting season, intervening in the event of floods, supporting engineer works and providing logistic support. Due to the assistance for the civilian institutions, the forces are organised into task formations, adequately trained and equipped, operating under the respective task force commands.

Croatian Navy: Protecting the National Interests in the Adriatic Sea

The Croatian Navy protects the sovereignty and interests of the Republic of Croatia in the maritime area. It is composed of the Flotilla, the Coast Guard, the Coastal Surveillance Battalion, the Naval Base and the Naval Training Centre. The Flotilla develops the capabilities of naval warfare and the participation in international naval operations, while the Coast Guard develops the capabilities of surveillance and protection of Croatian rights and interests at sea. The rest of the Navy forces are assigned with the support of the operations conducted by the Flotilla and the Coast Guard. In addition to traditional naval tasks, and participation in international military exercises and operations, the Croatian Navy is assisting civilian institutions, namely with firefighting, search-and-rescue at sea and transportation for the local population living on the islands.

The Croatian Navy operates five missile boats, underpinning its effectiveness in the Adriatic Sea. Over the past two years

the Croatian Navy tested the operability of the RBS-15 missile systems from the missile boats and the mobile coastal launcher, which announced the commencement of the in-country overhaul of the RBS-15 anti-ship missiles. The Navy plans to thor-



The Croatian Navy operates five missile boats, which will be equipped with RBS-15.

oughly upgrade the system in the next couple of years.

The Navy also has several landing crafts, a landing craft minelayer, several patrol, training and salvage boats and some 20 vessels of various types, as well as the Korčula LM-51 minehunter manufactured in Croatia and applicable for civilian purposes. Its main purpose is the detection, identification, marking and destruction of lying and buoyant mines.

In mid-2016 the Navy procured two REMUS 100 autonomous underwater vehicles, state-of-the-art models intended for the search of the seabed which significantly enhances its underwater counter-mine capabilities.

Croatian Air Force: Protecting the Air Space Sovereignty

The mission of the Croatian air forces is the protection of the aerial sovereignty of the Republic of Croatia. The main unit responsible for the mission is the Fighter Aircraft Squadron, with the support of the Airspace Surveillance and Control Battalion. Two transport helicopter squadrons and the Transport Fixed-Wing Aircraft Squadron are responsible to support other components of the Armed Forces in deployment, tactical transport and the conduct of Coast Guard tasks.

The air forces are stationed in two air bases (near Zagreb and Zadar). The 93rd Air Base, located at Zemunik, is the main authority for training Croatian pilots on the Zlin 242L aircraft, used for first solo flights, as well as on the Pilatus PC-9M training

aircraft and the Bell-206B helicopters. The fighter aircraft pilots continue training on the overhauled MiG aircraft.

The competence of the Croatian pilots and flight instructors has earned wider recognition, as exemplified by three generations of pilots from the Royal Air Force of the Sultanate of Oman who trained in the pilot school of the fixed-wing squadron.

The Firefighter Squadron has a prominent role within the Croatian Air Force and Air Defence. It is in charge of firefighting activities and equipped with six Canadair aircraft and six AIRTRACTORS.

The Croatian firefighter forces have earned international recognition and were dispatched to assist several foreign countries hit by devastating fires.

In addition to firefighting, the air forces are engaged in search-and-rescue tasks and emergency medical transportation – a third of all flights are performed to support civilian institutions. The rest of the air forces provide support to the main components.

The Croatian Air Force and Air Defence is the main authority for the integrated air defence system of the Republic of Croatia. The service presently comprises a fighter aircraft squadron equipped with 12 MiG-21 fighter aircraft (91st AFB), 14 Pilatus PC-9M training aircraft and five Zlin 242L aircraft, 12 Canadair CL-415



16 KIOVA WARRIOR OH-58Ds have recently entered service in the Croatian Air Force to serve as scout/attack helicopters.

aircraft and AT-802 AIRTRACTORS. It also has 23 helicopters, of which 10 are multi-purpose Mi-171Sh helicopters (two employed as the main asset used in KFOR) and the remaining are transport helicopters. The Croatian Armed Forces have recently received 16 KIOVA WARRIOR OH-58D, used primarily as scout/attack helicopters, and in combat conditions for anti-armour operations and close air support. Introduced into the operational service of the Croatian Armed Forces, they have additionally upgraded the manoeuvre and combat capabilities of the Croatian Air Force and Air Defence. The Croatian Air Force and Air Defence units are also responsible for training forces in charge of the control and protection of the air space within the NATINAMDS

system. They are also engaged in the joint pre-deployment training of the Air Mentoring Teams for Resolute Support, contributing to NATO's Smart Defence initiative and to the development of the Multinational Air Training Centre.

Investment in Human Resources

The Support Command is the vital component of the Croatian Armed Forces' logistic system. It is responsible for the logistic, medical and other support to the commands and units of the Croatian Armed Forces conducting tasks at home and abroad.

The Support Command supports the civilian population and institutions with disaster relief and is responsible for Host Nation Support to NATO and partner nations sojourning in Croatia. One of its components is the Maintenance Depot, responsible for the maintenance of weapons, complex combat systems and military equipment.

The efficient operation of any system requires synergy of many elements, but it primarily depends on human performance. Only educated and professional enlisted soldiers, NCOs and officers are capable of working successfully in an international environment.

Investing in education is a precondition of successful performance. The educational criteria in the Croatian Armed Forces have been upgraded accordingly, following the standards observed by modern international militaries. The main educational authority is the Croatian Defence Academy, the higher education and research institution which organises and administers

military education. It is also responsible for inter-service education and the training of officers and NCOs for the entire Croatian Armed Forces. It provides several levels of military education – the War School, the Command and Staff School, the Officer School, the Senior NCO School, the Cadet Battalion and the School of Foreign Languages.

Since 2014 the Croatian Defence Academy has administered study programmes at three levels – undergraduate, graduate and postgraduate specialist programmes. In its 25-year history the Academy has trained over 50,000 members, among whom were about 300 members of foreign armed forces.

Contribution to Peace Operations and Missions

By participating in NATO- and EU-led operations, the Croatian Armed Forces contribute to the Alliance's defence capabilities and the EU's Common Security and Defence Policy. They were first engaged in the UN operations, followed by



Croatian forces in Afghanistan

NATO and the EU operations respectively. In 1999 Croatian military observers took part in UNAMSIL in Sierra Leone, the first in the series of 20 operations. Presently, the Croatian Armed Forces members are engaged in three UN missions (seven members in MINURSO, Western Sahara, nine members in UNMOGIP, India and Pakistan, and a liaison officer in Lebanon), two NATO missions (Resolute Support in Afghanistan and KFOR in Kosovo) and the

Legal Framework

The President is the Supreme Commander of all Croatian Armed Forces in peace and war. In peace, the Supreme Commander executes command through the Minister of Defence. In war and in cases where the Minister is not able to fulfil orders, the Supreme Commander executes command directly through the Chief of General Staff. The Parliament executes the democratic control over the Armed Forces by adopting defence strategy, defence budget and defence legislation.

Defence Budget for 2017:
HRK4.38Bn (US\$626M).

members of the 2nd Croatian AVPD team in January completed their term within the EU mission ATALANTA.

Croatia's first participation in NATO-led operations was in 2003, when a 50-member Military Police platoon was deployed to ISAF. Presently the fifth contingent is deployed to Resolute Support. It has 95 members with 22 members coming from partner nations. The Resolute Support Mission is the largest operation for the Croatian forces, which are tasked with mentoring and advising the Afghan National Security Forces and, to a lesser extent, with the protection of the advisor teams and the camp. The Croatian soldiers are assigned to four main advisor teams (the advisors to the ANA Regional Combat Training School, to the Basic Police Headquarters, to the ANA Special Battalion Advisor Team and to the Army Force Advisory Team).

Adapting to the changing structure and tasks of the HRVCON to the Resolute Support mission, the infantry forces have a so-called "Safe Haven" in Camp Shaheen as well as the protection of "Guardian Angels" during their visits to the advised individuals. The Croatian officers at the Resolute Support mission are also advising the helicopter crews of the Afghanistan Air Force.

The Croatian Armed Forces joined KFOR in July 2009 and have been responsible for the airlift of the KFOR forces, cargo and VIPs. Presently the 23rd HRVCON is deployed to the operation.

With respect to the international operations, Croatia has developed the capability for participating in foreign operations with up to 1,000 soldiers. The defence budget contains the funds for the deployment of up to 200 soldiers.

The total forces dedicated to the NRF will account for 1% of NATO's Immediate Response Forces (IRF), comprising 13,000 members. The Croatian Armed Forces will provide up to 130 members, which is equivalent to a manoeuvre company, whereas its engagement in the EUBG will range from substantial contribution (i.e. up to 300 troops) in the three- to four-year intervals to minor contributions to battlegroups within these intervals.

The Croatian Armed Forces take part in peace support operations pursuant to a decision by the Croatian Parliament, upon the proposal of the Croatian Government and with prior approval of the President of the Republic. The decision entails the deployment of up to 23 members of the Croatian Armed Forces to MINURSO (Western Sahara), UNMOGIP (India and Pakistan) and UNIFIL (Lebanon); up to 25

members to the EU NAVFOR Somalia – ATALANTA; up to 100 members to Resolute Support in Afghanistan and up to 40 members to KFOR in Kosovo.

Modernisation and Growth of the Croatian Military Industry

The changes and new tasks assigned to the Croatian Armed Forces have been followed by the modernisation of the equipment and weapons in all three services. The process was accelerated during the pre-accession period and upon the entry to NATO. The main criterion in drafting the plans and strategic documents defining the main projects and the equipment and modernisation timeline was maximised efficiency of the Croatian Armed Forces' performance in current

The most recent modernisation project is the prospective introduction of 12 self-propelled PzH2000 howitzers with built-in communications equipment and a state-of-the-art fire control system into the operational service of the Army units. The howitzers have been acquired from German surplus and are expected to be delivered in the course of 2017.

In due time, the Croatian Navy will receive five inshore patrol vessels built in a Croatian shipyard.

The main issue affecting the future of the Croatian Air Force and Air Defence is procuring a lasting solution for the protection of the air space, especially when keeping in mind the prospective expiry of service of the overhauled MiG aircraft in late 2024. The respective decision needs to be reached by the beginning of 2018.



MiG-21 squadron: These fighters face end of service in late 2024 with Croatia seeking a new solution for their air defence.

and future tasks. The numerous systems introduced into operational service earlier or at present are expected to upgrade the readiness and performance capability of the national defence to fulfil the obligations towards NATO.

Modern military equipment relies heavily on domestic industrial capacities, while the biggest part of imports is given to companies with ongoing joint developmental and offset programmes. The main equipment and modernisation projects account for 70% of total funds allocated for equipment and modernisation, while the remaining 30% involve smaller projects that may be necessary during the next long-term period.

The Croatian Armed Forces today are highly ready to conduct operations side by side with allied forces. Further reform of the defence system will focus on building modern and efficient professional armed forces, manned by qualified and committed personnel, well-trained and equipped, protected and integrated, deployable, flexible and affordable. The new strategic documents will define the future development of the Croatian Armed Forces as well as the modernisation modality, timeline and priorities. What is of paramount importance is the readiness and ability of the Croatian Armed Forces to fulfil their tasks at home and in international environments. ■

Naval Missile Evolutionary Trends

David Saw

Naval missile systems in the context of anti-ship and air defence systems are undoubtedly a broad area to cover, but there is obviously linkage between offensive and defensive naval missile systems. Superficially, it might seem that the naval missile market place is characterised by limited, incremental improvements.

For example, work on the EXOCET anti-ship missile started in France in 1967 and the first MM38 EXOCET, with a range of 70 km, entered service in 1973. While EXOCET is still in production today, the latest variant (the MM40 Block 3) is a far more formidable system with a maximum range in the region of 180 km. It might still be called EXOCET, but it is designed to incorporate a whole series of advanced technologies that were simply inconceivable when

single C-802/NOOR (Iranian version of the Chinese C-802 system) fired from a Hezbollah coastal battery.

Then there is the example of the Iranian-supported Houthi rebels in Yemen, who in October 2016 successfully attacked an Incat high-speed catamaran leased to the United Arab Emirates (UAE) military with anti-ship missiles fired from a shore battery. The Houthi then tried to engage a US Navy destroyer later that month, but were de-

(delivered in 2011), further missiles were supplied in 2013 leading to an Israeli air raid on the Latakia warehouse where the missiles were stored on the basis that the new missiles were to be passed on to Hezbollah. Now Hezbollah has the YAKHONT, though it is unknown whether they have complete Bastion systems or will configure their own coastal defence system, something they are capable of achieving. Why is this important? YAKHONT presents a formidable threat to Israeli naval units, merchant ship traffic heading to or from Israel will have to be routed away from the range envelope of YAKHONT, and Israeli gas extraction platforms in the eastern Mediterranean can be targeted by the missile. This is a big (3,000 kg on launch), high speed (up to Mach 2.5) missile capable of inflicting significant damage on maritime targets.

The YAKHONT missile has a solid-propellant booster for launch and then uses a ramjet, guidance is via an inertial navigation system with a Granit-Elektron seeker offering both active and passive modes for the terminal phase of the engagement. Maximum range is out to some 290 km (dependent on flight profile selected). However, the Russian version of the missile, the P-800 ONIKS, has a range of some 600 km. Russia deployed BASTION-P coastal defence missile systems to Syria last year, where the system demonstrated its land attack capabilities. The YAKHONT has also been acquired by the Indonesian Navy in a four-missile vertical-launch system (VLS) installation on a single AHMAD YANI class (ex-Royal Netherlands Navy VAN SPEYK class) frigate, OSWALD SIAHAN. According to the US Office of Naval Intelligence, Iran is currently negotiating to acquire the YAKHONT missile to use in a coastal defence application.

YAKHONT also provides the basis for BRAHMOS, the joint missile programme between India and Russia. BrahMos Aerospace, a joint venture between NPO Mashinostroyeniya of Russia and the Indian Defence Research & Development Organisation (DRDO) was established in 1998 and the first BRAHMOS missile was fired in 2001. Since then, the missile has



Photo: MBDA Systems

EXOCET MM40 Block 3 is the new generation long range anti-ship missile system from MBDA.

the original EXOCET programme started. The point to remember is to look beyond the name in naval missile programmes.

Proliferation Issues

There are also other factors that are impacting on the evolution of the naval missile environment. The first of these is proliferation, not in the context of recognised navies, but in the development of an asymmetric anti-ship missile threat from non-state actors. The first example of this was the 14 July 2006 attack on INS HANIT, A SA'AR 5 class corvette of the Israeli Navy, some 18.5 km off the Lebanese coast. HANIT was hit by a

feated by the defensive systems of the destroyer. At end of January this year, a Royal Saudi Navy frigate patrolling off Yemen was hit in the stern by a Houthi suicide boat attack, showing another development in the asymmetric threat faced by navies.

Mention must also be made of further developments in terms of asymmetric threat in the Middle East, with Hezbollah in Lebanon once more involved. Hezbollah is now credited with being in possession of the P-800 YAKHONT missile (NATO designator SS-N-26 Strobile) usually the missile is employed as part of the Bastion-P coastal defence missile system. Russia has already supplied Syria with the BASTION-P system



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been developed for multiple applications. The missile has been installed on Indian Navy (IN) RAJPUT class (KASHIN-II class) destroyers, INS RAJPUT had her existing missile-launch canisters replaced with BRAHMOS, while sister ships INS RANVIR and RANVIJAY have an eight-cell VLS. Subsequently BRAHMOS has been installed on a number of other IN destroyer and frigate classes.

A submarine-launched version of BRAHMOS has been developed, while the Indian Army uses the missile in a land attack configuration and an air-launched version of the missile has been developed to equip Indian Air Force (IAF) SUKHOI Su-30MKI combat aircraft. The next phase of the programme will see the introduction of two extended range models of the BRAHMOS, the first of these will have a range of 450 km, with the second variant having a range of 600 km. Initial test firings of both of these weapons are expected this year.

As well as aggressively seeking export customers for their current range of missiles,

developments such as in the Republic of Korea or Taiwan.

British Crisis

It would seem to be self-evident that a serious modern surface combatant would be equipped with an effective anti-ship missile system. Unfortunately, in Britain the Royal Navy is having to confront the fact that it is entering an anti-ship missile crisis. Currently four of the six Type 45 destroyers have eight AGM-84A HARPOON Block 1C missiles (originally these were fitted on Type 22 frigates that were later retired), while the 13 Type 23 frigates also have eight HARPOON 1C missiles. The fundamental problem is that in 2018 the Royal Navy stock of HARPOON 1C missiles will reach the end of their service life and at this point there is no replacement programme or opportunity for a life extension programme in place.

The Type 23 frigates are to be decommissioned from 2023 onwards and replaced by the new Type 26 frigate. It is worth not-

limited to the weapons that can be carried by its WILDCAT helicopters in the form of the MBDA SEA VENOM (ISD 2020) and the lighter Thales MARTLET (ISD 2018).

The lack of an anti-ship missile for its surface combatants puts the Royal Navy in a somewhat embarrassing position of having both a capability and a credibility gap. Assuming that FCASW meets the needs of the Type 26, that still leaves the six Type 45 destroyers and the surviving Type 23 frigates (six are due for retirement between 2030 and 2035) with a need for an anti-ship missile system. Fortunately, should the funding become available, there are numerous European and US anti-ship missile options that could be worthy of consideration.

Solution Sets

Assuming that an off-the-shelf purchase is possible, MBDA would be an obvious candidate to meet any requirement as it has two systems that it could easily offer. The first is the EXOCET MM40 Block 3, this is the latest variant of this highly successful missile family and has a 200 km operational range. The missile was first ordered by the French Navy in 2008 and is currently in service, it is due to be replaced by the FCASW from 2030 (see above). It has been exported to the United Arab Emirates (UAE), Indonesia, Morocco and Qatar amongst others. MBDA could also offer the latest variant of the OTOMAT missile family, this is the OTOMAT Mk 2 Block IV, also called the TESEO Mk2/A in the Italian Navy. The system is deployed on Italian Navy HORIZON and FREMM frigates, as well as other surface combatants. The missile has a range of 180 km and has a weight of 780 kg, of which 210 kg is accounted for by the warhead. According to MBDA the missile is in service with 12 countries.

The Boeing HARPOON system is still in production and is available in multiple variants such as anti-ship, air-launched, submarine-launched and land attack missiles. The US Navy is about to field the latest variant of the missile, the HARPOON Block II+, for use from its F/A-18E/F SUPER HORNET aircraft and in 2021 the missile will enter service with the P-8A MPA. Building on the capabilities of this missile, Boeing is offering the Block II+ ER version of the HARPOON with a range in excess of 248 km. In addition to new-build Block II+ ER missiles, older Block II missiles could be upgraded to the new configuration.

For a number of years, the US Navy appeared to be losing interest in anti-ship missiles, preferring to rely on the strike capabilities of naval aviation. However, it is now having second thoughts on this policy



Photo: Ricarda Schönbrodt/German Navy

BrahMos Aerospace is working on a new missile system known as the BRAHMOS NG that is stated as being half the size of the standard BRAHMOS with a range of 290 km and a speed of Mach 3.5. Additionally, they are working on what has been described as a new "hypersonic" missile design known as BRAHMOS II.

These ongoing missile developments in India demonstrate that the naval missile marketplace is becoming more complicated than ever before. Potential customers who might once have only looked at US, European or Israeli missile solutions are broadening their horizons to look at the possibilities offered by Russia or China. While others are generating their own missile solutions, either via joint ventures as in the Indian approach, or through domestic

ing that while available information on the Type 26 states that it will be fitted with the new MBDA SEA CEPTOR air defence system and that it will also be equipped with a Mk 41 VLS that can accommodate a range of cruise and anti-ship missiles, no specific weapons have been mentioned in terms of anti-ship or land attack capabilities.

That the Royal Navy will have a future anti-ship weapon is not in doubt, under the terms of the Future Cruise and Anti-Ship Weapon (FCASW) programme MBDA is to develop a new missile system for Britain and France (to replace EXOCET amongst other systems). Unfortunately, the in-service date (ISD) for FCASW is envisaged to be around 2030. The problem is that the Royal Navy is without an anti-ship capability for 12 years. In the meantime it will be



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in the face of the profusion of high performance Chinese and Russian anti-ship missiles. This has led to a programme known as Offensive Anti-Surface Warfare (OASuW) Increment 2 to provide new anti-ship missile capabilities for the US Navy, it is a ma-

the NSM had selected to equip the Second Generation Patrol Vessel – Littoral Combat Ship (SGPV-LCS) of the Royal Malaysian Navy (RMN). The RMN will receive six SGPV-LCSs from 2019 onwards. In February of this year, as a part of the collaborative

export opportunities Kongsberg have been working to get involved in the US Navy OASuW programme. The NSM was fired from the USS Coronado (LCS-4) at Point Mugu, California, in July 2014. The ability to offer both NSM and JSM provides Kongsberg with tremendous export potential, in particular the ability to achieve internal carriage on the JSF could significantly expand the potential user base.

The Saab RBS 15 Mk 3 is the latest member of a missile family that originally entered service in the 1980s. The RBS 15 Mk 3 missile is jointly produced and marketed by Saab and Diehl Defence of Germany. Launch weight is 800 kg, with in-flight weight being 630 kg, there is a 200 kg blast/fragmentation warhead, high subsonic speed and its range is in excess of 200 km. The missile is in service with the Swedish Navy, with the German Navy on BRAUNSCHWEIG class corvettes and will be used on other units, and it is also in service with Poland on ORKAN class fast attack craft. Finland operates the weapon in naval and coastal defence applications, with Algeria also having purchased the missile.

Our last anti-ship missile to be considered is the MBDA MARTE MK2/N, which is a lightweight anti-ship missile with a launch weight of 310 kg and a range in excess of 30 km. The missile was ordered in 2009 by the UAE Navy to equip its 24 GHANNATHA multi-role combat vessels, with each unit having four missiles. In February of this year the UAE placed a new order for additional missiles. The MARTE MK2/N is also in service with Turkmenistan, while the MARTE ER extended range variant (100 km range) has been ordered for a coastal defence application by Qatar.

Before going on to briefly discuss naval air defence missile developments it is worth looking at a unique missile system that bridges the gap between the anti-ship and the air defence categories. This is the Interactive Defence and Attack System for Submarines (IDAS) being proposed by a consortium of ThyssenKrupp Marine Systems (TKMS) and Diehl Defence, with TKMS dealing with the submarine aspects and Diehl with the missile aspects. Test firings of the system have taken place from German Navy Type 212A submarines, with the Norwegian ULA Class submarine UREDD test firing the missile last year.

IDAS is launched from the torpedo tubes of the submarine, it has a range of 20 km and is powered by a two-stage solid rocket motor, this is a fibre-optically guided weapon and features an IIR seeker that allows the operator in the submarine to control the engagement until the endgame or re-target



Photo: Kongsberg

Kongsberg's Naval Strike Missile is operational on land and at sea. It can climb and descend according to terrain when it travels over land.

ior programme and immensely attractive to Boeing, as well as to Lockheed Martin and their Long Range Anti-Ship Missile (LRASM). Also in contention is the Kongsberg Naval Strike Missile (NSM), which will be discussed more later, with the Norwegian company working with Raytheon.

The LRASM programme started in 2009, with two systems involved, the subsonic LRASM-A and the supersonic ramjet-powered LRASM-B, with the latter missile then being deferred to put emphasis on the LRASM-A. This missile is based on the AGM-158B JASSM-ER (Joint Air-to-Surface Standoff Missile – Extended Range) and initially is intended for air launched applications, with a ship launch variant utilising the Mk 41 VLS to emerge later. In May 2016 Lockheed Martin were awarded a US\$321.8M contract to support further LRASM research and development to complete the design of all hardware and software, as well as risk reduction. By July 2016 three successful surface-launch LRASM tests had been conducted.

The Kongsberg NSM entered service with the Royal Norwegian Navy in 2012 and is employed by their SKJOLD class missile boats and FRIDTJOF NANSEN Class frigates. The first export order was received from Poland in 2008 for a coastal defence missile version of the system for the Polish Navy, with a second batch order being placed in late 2014. In 2015 it was announced that

agreement over submarine acquisition between Germany and Norway, Kongsberg noted that: "Norwegian authorities announced that the strategic partnership for submarine acquisition expands to include Kongsberg's Naval Strike Missile (NSM). The cooperation entails further development of the missile, and that the German navy intends to acquire a significant number of NSMs for its vessels. This also enables a close cooperation on joint maintenance and logistics between the German and the Norwegian navy."

The NSM weighs 408 kg, travels at high subsonic speed, it uses a GPS/INS navigation system and has an imaging infrared (IIR) seeker with automatic target recognition, the warhead weighs 125 kg and its operational range is 185 km (range is dependent on flight profile). Emphasis has been put on signature reduction in the shaping of the missile and this is assisted by the IIR seeker being a passive system. There is also an air-launched version of the weapon known as the Joint Strike Missile (JSM), this has been designed to fit into the internal bays of the F-35 Joint Strike Fighter (JSF) that Norway is acquiring. Australia is said to be interested in the JSM for its future F-35 fleet.

Future developments of the NSM/JSM potentially include a version that can be launched from the MK 41 VLS and a submarine-launched variant. In terms of future

the missile. The missile gives the submarine the ability to engage MPA and helicopter targets, with its precision targeting capabilities allowing it to successfully engage surface combatants as well.

Air Threats

Our extended discussion of anti-ship missile systems has demonstrated the scale of the threat faced by surface combatants and the obvious requirement for effective defensive countermeasures. Indeed the threat is actually broader than that of supersonic or high subsonic anti-ship missiles, for example there is the DF-21D Anti-Ship Ballistic Missile (ASBM) being fielded by China to attack high-value targets such as aircraft carriers. Furthermore there are ongoing anti-ship missile developments in China including a long-range anti-ship cruise missile featuring 'artificial intelligence' capabilities.

Naval air defence has broadened in scope, for example the US Navy and the Japan Maritime Self-Defence Force (JMSDF) operate the Standard SM-3 missile and the AEGIS combat system to defeat ballistic missile threats, including those to the Japanese homeland. The other current generation US system, RIM-174 Standard SM-6, has a different mission profile in that it is designed to engage aerial targets, including UAVs, and incoming anti-ship missiles. Apart from the US Navy, the SM-6 has been acquired by Australia, Japan and the Republic of Korea.

The European equivalent of the Standard is the ASTER family of missiles in the form of the ASTER 15 for short to medium-range engagements and the ASTER 30 for long-range engagements. Currently in development is a version of the ASTER to deal with ballistic missile threats. In Europe ASTER is in service with Britain, Italy and France and has been exported to Algeria, Egypt, Morocco, Qatar, Saudi Arabia and Singapore.

Britain contracted MBDA to develop the Common Anti-Air Modular Missile (CAAM) for airborne, land and maritime applications. The maritime variant CAMM(M) was selected by the Royal Navy, where it is known as SEA CEPTOR. It is being installed on Type 23 frigates as they complete their life extension programmes and will be installed on the future Type 26 frigate. With a range in excess of 25 km, the missile exceeds the performance of its predecessor, the VL SEA WOLF, which only had a 10 km range. The Royal New Zealand Navy became the first export customer and will use the missiles in the upgrade of its two ANZAC frigates, with Brazil and Chile also ordering the system.

MBDA can offer another area air defence system in the form of the VL MICA, developed from their MICA medium-range air-to-air missile for both land and naval applications. The weapon has been selected by the navies of Egypt, Oman, Indonesia and Singapore, while Malaysia will install the system on the six SGPV-LCSs that will enter service from 2019. Occupying a similar market niche is the Raytheon Evolved Sea Sparrow Missile (ESSM), this is in service with the US Navy and some 11 other navies. Also from Raytheon is the RIM-116 Rolling Airframe Missile (RAM) for close-in defence applications, the product of a joint venture between the US and Germany, at the recent IDEX exhibition in Abu Dhabi it was disclosed that the UAE Navy had purchased RAM Block 2 missiles for its six BAYNUNAH class corvettes that currently operate RAM Block 1A missiles.

Mention should also be made of the wide variety of air defence missile systems that are available from China and Russia, as well as other potential suppliers. The diverse nature of air and missile threats faced by modern navies inevitably leads to a diverse range of possible defensive solutions. There is always much to discuss in terms of naval missile systems, with offensive and defensive systems evolving at a rapid pace. ■

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Protecting Naval Vessels

Threats, Concepts and Systems

Bob Nugent

In October 2016, an attack on the UAE high-speed logistics vessel **SWIFT** by anti-ship missiles (assessed as C-801 or C-802 types) inflicted severe damage on the vessel. A similar attack on a Saudi Arabian **AL MADINAH** Class frigate in January 2017 killed several crew and damaged the ship.

These attacks are a reminder of the continuing requirement for navies to develop concepts and deploy systems that protect their vessels from attacks in an increasingly lethal naval security environment.

That environment challenges the defence of ships and forces with a spectrum of threats ranging from new generation anti-ship cruise and ballistic missiles to

missiles such as those that hit the **SWIFT**. Adding to the challenge of protecting naval vessels are constrained budgets, smaller force structures and, as a result, fewer ships available to operate for most navies around the world. This strategic setting induces trade-offs between offensive and defensive systems, as well as hard decisions about what kinds of threats are the most pressing, and therefore which defensive

small groups, they are less able to draw on the proven principles of protecting naval vessels: stand-off distance, safety in numbers and layered defence.

This article will review contemporary naval vessel protection concepts and systems. It begins with a look at the threat environment, then presents a conceptual framework for naval vessel protection that helps assess the strategic choices available for



Photo: US Navy



Photo: US Navy

The hybrid catamaran HSV-2 SWIFT was originally built for the United States Navy Military Sealift Command, primarily for mine countermeasures and as a sea basing test platform. Then it was leased by the United Arab Emirates' National Marine Dredging Company in 2015, where it was attacked by Houthi fighters in October 2016.

high speed jet aircraft. Ships must also protect themselves from the "simpler" but more numerous threats posed by high speed small craft armed with crew-served weapons and grenade launchers, low speed and low visibility manned and unmanned aircraft, shore-based artillery as well as the older generation anti-ship

systems will have the highest priority in allocating resources. Indeed, the US Navy's "Distributed Lethality" operating concept now guiding the surface forces is a response to the critique that modern warships have become so focused on defending themselves against the whole spectrum of threats that they are underinvested in offensive capabilities that historically defined most fleet and ship designs for the last century.

And as these fewer surface ships operate in coastal or constrained waters such as the Arabian Gulf, North Arabian and South China Seas, often as single ships or in very

naval design, operation, and acquisition. It closes with a comparative review of how US, European and especially other navies are choosing to protect their newest frigates and destroyers – those recently built or currently under construction. That review will use proprietary data drawn from AMI International's naval market and technical databases.

While the article considers concepts and systems that apply to protecting all types of naval vessels – from aircraft carriers to submarines to patrol craft – it focuses mostly on the general purpose surface combatant. Destroyers and frigates represent the main

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Photo: Crown Copyright

LYNX helicopter of the Royal Navy fired its flares as part of an exercise in the Indian Ocean.

body of most navies today and a significant part of planned shipbuilding investments globally over the next 20 years. They are also the types of ships most often operating “in harm’s way” and are the ships most likely to be found operating alone in high threat environments, and so provide insight into how navies are prioritising their investments to protect naval vessels.

Threats

Threats to naval vessels come from all directions. The subsurface, surface, air, space and increasingly the electronic/cyber domains all represent threat axes when planning ship or force defence. As described in our recent article on contemporary anti-submarine warfare challenges, investments in modern, and increasingly missile-armed, submarines are drawing increased attention to the lack of modern ASW capabilities (systems and trained personnel).

Judging from defensive systems equipping frigates and destroyers being built now, the threat from the air – missiles and aircraft – remains the priority driving ship protection concepts and investments. The resources devoted to radars, other sensors, combat management systems and weapons that are optimised for air and missile defence outstrip those for anti-submarine and anti-surface defence systems.

The Air Threat Matrix

Conventional short range weapons include airborne weapons typically used in direct attacks at short range – bullets and bombs from helicopters and manned fixed wing aircraft. Attacking platforms gain stand-off advantages with tactical missiles such as

the laser-guided BRIMSTONE missile at a range of about 8 nautical miles.

Longer-range precision anti-ship missiles such as EXOCET and HARPOON (maximum ranges 75-100 NM) are being superseded by the newer generation of weapons such as Indian-Russian joint venture BRAHMOS missile – claimed to be the fastest ASCM (Anti-Ship Cruise Missile) currently in service at an operational range of up to 250 NM.

As more navies add to the numbers and sizes of ships in their fleet structures, the once firm dividing line between ASCM and LACM (Land-Attack Cruise Missile) is blurring. A mission kill or even sinking of an adversary’s ship – even those as small as corvettes – can have a dramatic political effect, as shown in the attacks on UAE and Saudi Arabian ships, along with a similar attack on the INS HANIT off Lebanon in 2006.

The Russian KLUB series of missiles (NATO designation SS-N-27/SS-N-30) is one example of this increasingly complex missile threat confronting the next generation of air and missile defence systems. KLUB uses

a common missile design for long range (up to 600 NM for some variants) land attack and anti-ship variants. KLUB is widely exported (India, Algeria, Vietnam, China, possibly Iran) and can be launched on short notice from a wide variety of platforms. Recent marketing literature on the system promotes its ability to be adapted to commercial shipping containers for sea, road or rail launch, as well as conventional submarine tube and surface ship vertical launch systems.

Missiles like the KLUB series will be increasingly difficult to identify, locate and destroy prior to launch, making post-launch neutralisation by sea-based air/missile defence systems the main line of missile defence – for the fleet or the homeland.

Conceptual Framework: Active and Passive, Kinetic and Non-Kinetic

In reviewing the difficult strategic choice of what systems to acquire to protect the vessels, two general categories can be seen. Active measures reach out to deter

	Passive	Active
Kinetic	Chaff Flares Acoustic Decoys	Small Calibre Guns (up to 40 mm) Medium Calibre Guns (up to 127 mm) Short Range Missiles Medium Range Missiles Anti-Torpedo Torpedoes Directed Energy-Laser
Non-Kinetic	Stealth Design Features Speed Maneuver Cover and Concealment (clutter in near-shore environments) Intelligence & Electronic Surveillance	Electronic Warfare-Jamming Directed Energy/Pulse

or destroy the threatening platform (aircraft, ship, boat, submarine, land-based launcher) prior to the employment of the weapon (shell, projectile, missile, torpedo) that will damage the ship. And in the event of an attack, active systems neutralise or destroy the weapon that is directed at the ship. Active naval protection is mainly performed by guns (especially small calibre, high rate of fire close-in weapons systems) and missiles.

Passive means that contribute to force or ship defence have traditionally been intelligence, long range sensors, communications and command/control systems that provide the location, classification, posture and, finally, notification of the attack of a threatening platform. These systems enable ship countermeasures such as manoeuvre and emissions control that enhance the protection of the threatened platforms. On the ship itself, systems such as chaff, flares, decoys (physical and electronic), noisemakers and the like that aim to counter the attack system's guidance and control prior to the weapon reaching its effective engagement range.

Another related way of categorising naval protection systems is whether they are kinetic or non-kinetic. Kinetic systems protect by physical impact or destruction of the threatening platform and/or weapon.



Photo: Lockheed Martin

The AEGIS system has been developed continuously to stay one of the most modern missile, and especially BMD, assets.

Non-kinetic protection, heretofore mostly electronic warfare and related systems, counter the threat by directing energy in ways that neutralise critical elements of the threat platform or system without its complete physical destruction.

For the purposes of this article, this framework serves as a "menu" to evaluate how navies, ship and system designers are al-

locating resources for protecting naval vessels.

Directed Energy systems, however, blur some of the distinctions above and offer the prospect of "changing the game" on ship protection in which guns and missiles remain the predominant technologies.

As noted by Congressional Research Service naval expert Ron O'Rourke: "The (US) Navy is currently developing three potential new weapons that could improve the ability of its surface ships to defend themselves against enemy missiles – solid state lasers (SSLs), the electromagnetic railgun (EMRG), and the hypervelocity projectile (HVP) (...). Rarely has the Navy had so many potential new types of surface-ship missile-defence weapons simultaneously available for development and potential deployment (...). Although the Navy in recent years has made considerable progress in developing

Country	Ship Class	Displacement Tons (FLD)	Air Defence Missile System
Bangladesh	SHADHINOTA (C13B)	1,300	8-cell FL-3000N
Brazil	TAMANDARE (Barroso)	2,400	16-cell SYLVER VLS with MBDA Common Anti-Air Modular Missile – Marine (CAMM-M)
Egypt	GOWIND	2,400	16-cell VL MICA
Indonesia	MARTADINATA (Sigma)	2,400	2x six cell VLS with VL MICA

Country	Ship Class	Displacement Tons (FLD)	Gun Armament	Ship ASW Systems
Bangladesh	SHADHI-NOTA (C13B)	1,300	x1 Chinese H/PJ-26 76 mm gun x2 P/J-17 30 mm RWS x2 12.7 mm machine guns	None (embarked helicopter provides)
Brazil	TAMANDARE (BARROSO)	2,400	x1 BAE 76mm x1 40 mm BOFORS x2 20 mm	Harris hull-mounted sonar x6 Raytheon Mk46 Mod 5 torpedoes in two triple tubes
Egypt	GOWIND	2,400	x1 OTO Melara 76 mm/62 x2 Nexter NARWHAL 20 mm remote weapon stations x4 12.7 mm machine guns	x2 Whitehead B 515 324 mm triple torpedo tubes for EuroTorp MU90 Thales KINGKLIP hull mounted sonar (HMS) and CAPTAS 2 variable depth sonar (VDS)
Indonesia	MARTADINATA (SIGMA)	2,400	x1 OTO Melara 76 mm/62 SUPER RAPID gun	Thales KINGKLIP hull mounted sonar x2 Whitehead B 515 324 mm triple torpedo tubes for EuroTorp MU90 Embarked helicopter with dipping sonar, sonobuoys, torpedoes

SSLs, EMRG, and HVP, a number of significant development challenges remain."

Current Ship Protection Systems – The Balancing Act

AMI forecasts of new large surface combatants construction over the next 20 years include 438 new destroyer and frigate hulls at a total acquisition cost of US\$346Bn. This represents about 34% of all new naval construction spending on all types of naval ships and craft through 2037.

That the navies of the world plan to spend about 1/3 of their new ship acquisition resources over the coming two decades on destroyers and frigates is largely explained by an expanding range of threats in the naval domain detailed above.

The most expensive defensive system being acquired for these frigates and destroyers are air defence missiles and related radars. While virtually all the frigates and destroyers forecast to be built over the next 20 years will be equipped with small calibre guns, and most with medium calibre (57 mm-127 mm), the cost of the gun systems being acquired is generally lower than that of missile systems. The same can be said of ASW systems (sonars and torpedoes) compared to air defence radars and missiles.

The reference points for integrated air and missile defence for frigates and destroyers will continue to be the AEGIS systems – still the "state of the art" for ship-based fleet and national air/missile defence. The AEGIS combat system on US BURKE class destroyers are an example of successful evolution in both ship and system design to manage high-end ballistic missile defence (BMD) as well as general naval missions.

However, most navies are not resourced to invest in AEGIS-level integrated air and missile defence. Rather, most of the world's frigates in service or under construction rely on short-range air defence missiles for air defence. A representative sample of air defence missile systems equipping smaller frigate programs (3,000 tons or below) under construction is provided on the left.

The gun and ASW defensive armament on the same set of ships (shown left) demonstrate that

navies are investing to provide anti-surface and even ASW defense capabilities on even these smaller hulls, where "real estate" available to add systems is even more limited than is the case for frigates and destroyers 4000 tons and larger.

Conclusion

Torpedoes, suicide boats, and mines are all threats to naval vessels. All are capable of crippling or sinking ships, and all have done so in the post-World War II era. Yet a review of the systems being selected to protect frigates and destroyers today signal

that navies continue to see air and missile attack as the most likely and most difficult to counter among the array of threats to naval vessels, and are investing accordingly. This is not to say that ASW and anti-surface defence systems are neglected. As seen above, even the smaller frigates now being built for non-NATO navies around the world are being fitted with small calibre guns, sonars and torpedoes to counter a broad range of potential threats. But it remains the case that naval investment continues to be weighted toward kinetic systems for air and missile defence onboard frigates and destroyers. ■

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Assault Rifle Developments and Acquisition Programmes in Europe

David Saw

Europe has become an extremely active market for assault rifles. In September 2016 the Direction Générale de l'Armement (DGA), the French defence procurement agency, announced that Heckler & Koch (HK) and its HK416F 5.56x45mm NATO assault rifle had been selected to meet the requirements of the Arme Individuelle Futur (AIF) programme to replace the existing FAMAS assault rifle in French service. Now Germany is also looking at a new assault rifle programme in the form of System Sturmgewehr Bundeswehr.

It is worth noting the contraction of the small arms industry in Europe at this point. With the closure of Manufacture d'Armes de Saint-Étienne (MAS), France had no alternative but to have an international competition to meet the AIF requirement, as it

through the provision of effective sighting systems, ergonomic enhancements and improvements in ammunition performance, to the point where the weapon itself is a platform to which additional components and enhancements can be added.

Kalashnikov in 1947. AK-47 prototypes were tested between 1947 and 1949, at which point the weapon was approved and entered service. The standard AK-47 was superseded in production by the AKM from 1959 onwards, with these weapons being manufactured in the tens of millions in the Soviet Union, satellite states and elsewhere (often without a production licence).

While the Soviet Union advanced with the assault rifle, the newly-emerging NATO military alliance did not. The US Army was more interested in a full-power machine gun cartridge and this led to the 7.62x51mm round being adopted as the NATO standard calibre. NATO, at the behest of the US, opted for a round that was not suitable for an assault rifle but was useful for what today we would call a battle rifle. Typical battle rifles from this era were the FN FAL, the M14 and the HK G3.

By the early 1960s, but not without resistance from those who preferred a battle rifle solution, the US finally equipped itself with an assault rifle. The Armalite AR-15 design provided the basis for the M16 assault rifle in .223 Remington (5.56x45mm M193), with the first order for 85,000 weapons being placed with Colt by the US Army in 1963, followed by the first major order for 840,000 weapons in 1966. One advantage of the 5.56x45mm M193 was the fact that the round was lighter, so an individual soldier could carry more 5.56 mm rounds than 7.62x51mm NATO rounds.

In 1977, the 5.56x45mm round would become a second standard NATO calibre, the round chosen being the Belgian SS109, classified as the M855 by the US Army. The Soviet Union also saw the value of a smaller intermediate cartridge, developing the 5.45x39 mm round and mating it with a new rifle in the form of the AK-74, which remains the standard assault rifle of the Russian Army. The 7.62x39mm, 5.56x45mm and 5.45x39mm are still the standard cali-

Photo: ESD archives



The AK-103 is the modern version of the AK-47 designed by Mikhail Kalashnikov. The AK-47 was the first of the AK family, the variants of which are the most widely used rifles worldwide.

had no assault rifle design and build capability, and the same applies to the British when they eventually decide to replace their L85A2 assault rifle without any national design or build capability to call upon.

Definitions and Background

An assault rifle is a select-fire weapon that is fully controllable in automatic fire, uses a detachable magazine and intermediate-power cartridges and has an effective range of at least 300 metres. Assault rifle performance has improved in the modern era

Ammunition is a key part of the assault rifle package: to be able to fully control the weapon in automatic fire and to have a weapon that meets appropriate size and weight constraints an intermediate cartridge is used, which has less power than a conventional battle rifle cartridge. The first intermediate cartridges that entered service were German 7.92x33mm Kurz and the Soviet 7.62x39mm M1943, with the latter still in worldwide use today.

The most significant use of the 7.62x39mm M1943 round was with the Avtomat Kalashnikova or AK-47 designed by Mikhail



HK433

Heckler & Koch's fourth assault rifle family sets new standards

The new HK433 is a modular and compact assault rifle chambered for 5.56 mm x 45 which combines the strengths and outstanding features of the G36 and the HK416 families of assault rifles.

- Modular and light design. Compact dimensions
- Barrel length individually configurable. Easy barrel exchange at the operators or maintenance level
- Fully ambidextrous weapon operation for both right-handed and left-handed shooters
- Non-reciprocating charging handle. Switchable from left to right without tools
- Lower receiver with double-sided operating concept for G36 or HK416/AR-15 users
- Drop safety as per AC225/D14 when on or off safety
- Monolithic upper receiver with STANAG 4694 profile at 12 o'clock position. Modular Slim Line handguard with HKey interfaces on 3 and 9 o'clock positions as well as Picatinny rail as per MIL-STD 1913 on 6 o'clock position
- Foldable, retractable buttstock with height-adjustable cheek rest. Weapon can also be used with the buttstock in the folded-in position
- Optional maintenance-free round counter integrated in receiver
- Tool-free assembly/disassembly of the main assemblies
- Cocking in all safety positions possible
- Wide variety of accessories available
- 100% „Made in Germany“



bres for assault rifle applications. The AR-15 action has been extremely influential in subsequent assault rifle designs, as has the KALASHNIKOV action.

Fringe Developments

Moving towards a new assault rifle does not mean that you absolutely have to use the calibres discussed above. Nor does it mean that an assault rifle is really the answer to the requirement. Such a contradictory situation emerged as Turkey looked for a new assault rifle to replace its G3A3 and G3A4 7.62x51mm battle rifles and HK33E 5.56x45mm assault rifles in the Turkish military – all manufactured under licence in Turkey by MKEK.

Initially MKEK developed an assault rifle in 5.56x45mm known as the MEHMETÇIK-1. Prototype weapons were taken for field testing, but the response was less than positive, with the feeling being that 5.56x45 mm did not have the necessary range characteristics. This led to a redesign of the weapon into a larger version in 7.62x51 mm calibre, along with other modifications resulting in the MKEK MPT-76 battle rifle. In 2015 contracts for the first tranche of 35,014 rifles were drafted, with the estimated requirement for the MPT-76 being up to 600,000 weapons.

On deciding that it needed a modern assault rifle, Finland decided to licence-produce the AK-47 in 7.62x39mm and modify it to meet local needs. The initial weapon was classified as the Rk.60, which was then developed into the Rk.62, the production version of which saw some 350,000 being built into the 1990s. In the mid-1990s the Rk.95TP was taken into service, although only limited numbers were procured.

Rather than purchase a new generation weapon, Finland has decided to upgrade and modernise the existing Rk.62 inventory to the Rk.62M standard. The configuration of the weapon will be changed with the fixed stock being replaced and with provision for new sighting systems. In many respects this is logical as the Rk.62 is a well engineered assault rifle and the 7.62x39mm round is still more than viable.

A British Quandary

Another nation in no hurry to change its assault rifle is the United Kingdom, where the L85, otherwise known as the SA80, had a painful and problematic introduction into service. Resolving the difficulties proved beyond domestic capabilities and eventually Heckler & Koch were tasked with a rectification programme that led to the fielding of a new variant in the form of

the L85A2 in 2002. The plan was for the L85A2 to remain service until 2025, but at this point, there is no real movement on an L85A2 successor system. British Special Forces, other specialist units and the Royal Military Police (RMP) use some 19 different weapons, among which is the COLT CANADA C8.

The most recent L85A2 activity in Britain was in August 2016, when the following contract information was released: “The Dismounted Close Combat Programme team, part of the UK Ministry of Defence, intends to place a contract for the Equipped to Fight Improvement (EFI) programme for the modification of 5,000 SA80 weapons with Heckler & Koch for work to be completed by March 2017. The estimated contract value is £2.7M. The contract will

list of priorities, but the UK MoD’s – and Heckler & Koch’s – apparent willingness to accept significant technical risk, even in the light of other recent procurement disasters, suggests a surprising willingness to flirt with fortune.

Northern Lights

In the latter part of the 20th century the Swedish Army adopted the G3 battle rifle, manufacturing it locally as the Ak 4. Later, in the 1970s, requirements changed and Sweden looked to acquire an assault rifle in 5.56x45mm calibre. Some 11 different weapons were evaluated, and eventually two weapons were chosen: the FN FNC and the FFV 890C, the latter weapon being a Swedish version of the Israeli GALIL



Photo: Crown Copyright

British soldier with his SA80 during Operation Qalb in Helmand, Afghanistan

require the supplier to modify the existing SA80A2 weapon by fitting a combination of new and modified components. Specific tolerances of materials are needed along with exact dimensions and surface finishes on the components to allow for interoperability with the existing system, particularly when managing the variable interface caused by differing rates of wear of existing components which are recycled as part of the programme. There are very high risks involved in managing the variable tolerances and manufacturing processes when combining new and existing weapon components.”

It would seem, therefore, that the British intend to retain the L85A2 in service and incrementally upgrade the weapon as necessary to meet evolving requirements. At this point a replacement programme hardly appears to be on the top of the British Army

system. Further tests took place and eventually Sweden decided to go with the FN FNC, modified to meet Swedish requirements and manufactured locally. The resulting Ak 5 entered service in Sweden in 1986, some 10 years after the rifle programme started. The most recent variants of the system are the Ak 5C and Ak 5D, with 40,000 Ak 5 rifles being upgraded to the Ak 5C/D standard under a contract signed in 2005.

The Ak 5 still remains in service, with a successor system envisaged from 2020 onwards. The Special Operations Task Group (SOG) of the Swedish Armed Forces already operates a range of weapons that could contribute towards the selection of an Ak 5 successor: SOG has the HK G36C and G36K in service and also operates the COLT CANADA C8SFW. According to Swedish media reports, the SOG placed a contract with LWRC International of Cambridge,

Maryland, US, to acquire a number of M6G assault rifles in 5.56x45mm, that weapon being an evolution of the standard US Army M4 carbine. It is likely that the M6G will be one of the weapons evaluated in the context of an Ak 5 successor; other weapons that have been mentioned in this regard include the HK416 and the FN SCAR.

Norway fielded the G3 battle rifle for many years and then looked for an assault rifle as a replacement, leading to an order for 40,000 HK416N in 2008. Denmark started its G3 replacement programme earlier, purchasing the Colt Canada C7 and C8 from 1995 onwards, with the LSW variant being acquired in 2004. In 2010 new upgraded versions of the C7 and C8 were acquired from Colt Canada.

Western Europe

Among the other major European armies, the Netherlands Army also adopted the C7 and the C8, and in July 2015 the Netherlands Maritime Special Operations Force (NL-MARSOFF) was the subject of a tender covering the acquisition of 195 carbines and 1.82 million rounds of ball, subsonic and lead-free frangible ammunition. What was significant was that NL-MARSOFF had chosen the Advanced Armament Corporation (AAC) 7.62x35mm Blackout cartridge for these weapons, making them the first military customer to officially adopt the round. Late in 2016 it was disclosed that the SIG SAUER MCX had been selected as the carbine for the NL-MARSOFF requirement.

The French Army AIF requirement saw the evaluation of the FN SCAR, HK416, HS Product VHS-2 from Croatia (the only bullpup format rifle included), the SIG SAUER MCX and the Beretta ARX160 in response to a tender for a replacement for the existing FAMAS system, issued in May 2014. In September 2016 the DGA announced that the HK416 had been selected as the winner and that the contract would cover the acquisition of 102,000 HK416 5.56x45mm assault rifles, 10,767 HK269G 40x46mm grenade launchers, accessories, ammunition, spares and support services over 15 years. The French Army portion of the AIF order covers 93,080 weapons, to be delivered between 2017 and 2028, with 50% to be delivered by 2022. Two rifle variants will be acquired, 36,505 HK416F-S with a 14.5" barrel, of which 14,915 will be configured to operate as part of the FELIN future soldier system. The HK416F-S will be the only variant capable of supporting the HK269G grenade launcher. The second variant is the HK416F-C with an 11" barrel. A total of 54,575 of these weapons is to be acquired. With resolution of the French AIF pro-



Photo: Heckler & Koch

Heckler & Koch have just launched the new HK433 to enter competition in Germany.

gramme, the next big prize in Europe is the German System Sturmgewehr Bundeswehr (SSG) programme to replace the current G36 5.56x45mm assault rifle in German service from 2020 onwards. That the weapon performs well according to its specific, stated requirements is not in dispute, but this matter has become a political football in Germany, so let us simply report that this weapon's life in the Bundeswehr is expiring. However, the G36 will still remain the standard assault rifle in two NATO member countries – Spain and Lithuania – as well as being used all over the world by Special Forces and law enforcement. Nevertheless, the German plan is to decommission some 167,000 or so G36s in Bundeswehr service. Programme timelines include a Request for Proposals (RfP) to be issued before mid-2017, and an in-service date "by 2020", and all deliveries complete by 2026.

The aim is, obviously, to obtain the best possible 5.56x45mm assault rifle, but there remain strong political and industrial considerations and a German supplier is regarded as essential. Despite the G36 controversy, Heckler & Koch remains the small-arms industry leader in Germany, although for the new assault rifle it could face "significant" domestic as well as international competition. It had been assumed that H&K would offer the HK416, but they have recently unveiled a new rifle system in the form of the HK433, so the company can offer a 100% German solution that would be manufactured in Germany. It has also been stated that the HK433 is significantly more affordable than might have been expected.

Other contenders include Rheinmetall with Steyr Mannlicher of Austria, offering the RS556 assault rifle, with Rheinmetall declaring a German workshare content of

60%, and SIG SAUER with the MCX. Such is the dominance of these companies that input from smaller German companies such as Haenel with their CR223 or Schmeisser with their M4 variants is thought to be unlikely in the extreme. International competition will potentially include the FN SCAR, the Swiss B&T APC 556, and the Italian Beretta company. The prospect of greater international participation will depend on how open the competition is perceived to be – probably quite limited. Interestingly, in January 2017 Germany floated a tender to provide their KSK (German Special Forces) with 1,705 5.56x45mm assault rifles for delivery between September 2017 and June 2019. All things considered, the KSK and Bundeswehr programmes have the potential to be among the most competitive European assault rifle procurements for many years.

The Industrial Network

From the relatively minor development of the Rk.62 in Finland comes another modern "great" with significant design impact within Europe: at the end of the 1960s Israel started work on the development of a new assault rifle in 5.56x45mm. The resulting GALIL design owed much to the Finnish Rk.62 and its KALASHNIKOV heritage, and the current GALIL ACE benefits from reduced weight through the use of new materials and other product improvements. The weapon is available in three different calibres – 5.56x45mm, 7.62x51mm and 7.62x39mm – and it is being built under licence in the Ukraine, as well as in Chile, Columbia, and Vietnam, with Peru intending to manufacture the weapon. One of the difficulties confronting Israel Weapon

Photo: FN Herstal



The FN SCAR-H CQC assault rifle

were charged with developing a new assault rifle for the IDF to replace the M16A1 and variants, and early models of the GALIL. This resulted in the TAVOR, a bullpup-configuration weapon using advanced materials, in 5.56x45mm. Between 1999 and 2001 the TAVOR was put through an extensive operational evaluation by IDF units, where it prevailed over the American M4. The TAVOR entered service with the IDF in 2003, and it was classified as the standard IDF assault rifle in 2009. Internationally the TAVOR has been widely adopted by Special Forces, the largest single export customer is the Royal Thai Army (RTA) that has ordered some 106,000.

Beretta has long met the needs of the Italian military for rifles, initially with the BM59 in 7.62x51mm (based on the M1 GARAND), which was superseded from 1990 by the AR70/90 in 5.56x45mm. The latest-generation assault rifle for the Italian military is the Beretta ARX160, again in 5.56x45mm, although a variant in 7.62x39 mm is available for export customers. Beretta has also introduced the ARX200, a battle rifle/DMR version in 7.62x51mm, which has recently been adopted by Argentina for local production to replace their FN FAL.

FN Herstal in Belgium continues to be one of the world's main small-arms manufacturers and the company has an extensive product portfolio. In 2001 it revealed the F2000, a compact bullpup weapon built using advanced materials and with a modular structure to accommodate diverse customer requirements. The F2000 was adopted by numerous Special Forces, and within NATO

in 2006 Slovenia procured the first 6,500 of a potential 14,000 weapons. The largest customer for the weapon is reportedly the Saudi Arabia National Guard (SANG) who are said to have acquired 55,000 weapons to date.

Another assault rifle option from FN is the SCAR family of weapons. In 2003, the US Special Operations Command (US SOCOM) issued a requirement for a rifle to be known as the SOF Combat Assault Rifle (SCAR). What they wanted was a weapon that was available in two versions: SCAR-L in 5.56x45mm and SCAR-H in 7.62x51mm, although the latter weapon should also be able to accommodate other calibres and be convertible in the field. Both SCAR systems would also be available in a range of different variants as well. In 2004 SOCOM announced that FN America had been selected as the winner of the SCAR programme, with the first weapons being fielded in 2005. In 2010 SOCOM changed its thinking and decided to cancel procurement of the SCAR-L, instead focussing on the SCAR-H, with existing SCAR-L converted to the SCAR-H configuration. Elsewhere others were opting for both variants of the weapon: in Chile the Marines (CIM) purchased 1,800, while Peru acquired an estimated 8,100 weapons. The SCAR was also widely adopted by Special Forces, counter-terrorist units and law enforcement. The Belgian Armed Forces Land Component has selected the SCAR-L to replace its existing FNC rifles, contracting for an initial 4,500 units. In Poland FB Lucznik in Radom, was tasked with providing the Polish military with a new 5.56x45mm assault rifle to replace their elderly AKM weapons, resulting in the Wz.96 BERYL which entered service in Poland in 1997. This was followed by the MINI-BERYL, a compact version for specialist applications. In 2014 and 2015

Lucznik received orders for 1,500 M762 versions of the BERYL in 7.62x39mm from Nigeria, with more orders anticipated. FB Lucznik is now on the crest of a wave of BERYL orders: in May 2016 they received an order for 26,000 BERYL from the Polish Land Forces, and that was followed by an order for 53,400 Wz.96C BERYL and 3,800 MINI-BERYL for Polish Territorial Forces. The Polish military now seems to be willing to move forward on its MSBS modular small arms programme and will acquire some of these assault rifles as a part of its TYTAN future soldier programme. The MSBS will have to pass state testing and demonstrate its ability to integrate into TYTAN, but it is highly likely that some MSBS will be acquired from FB Lucznik before the much-delayed TYTAN programme gets underway.

In the Czech Republic, the need to replace the old 7.62x39mm Vz.58 assault rifle saw CZ develop the CZ805, with the Czech Army eventually starting on a new rifle programme in 2009. The objective was to acquire a 5.56x45mm assault rifle, and after an international competition some 6,687 CZ 805A1 and 1,250 CZ 805A2 weapons were ordered in 2010. Subsequently Slovakia is thought to have acquired some 680 CZ805 assault rifles. In 2015 CZ introduced the CZ 806 BREN 2 version of the system, which was a significant advance on the original, and the Czech Army placed an order for 2,600, with first deliveries in November 2016. Apart from its 5.56x45mm assault rifles, CZ has also developed the CZ807 assault rifle in 7.62x39mm, which is attracting considerable interest in Pakistan as part of a programme to replace the Pakistan Army stocks of G3 battle rifles and Type 56 7.62x39mm assault rifles. If selected, the CZ weapon would probably be manufactured in Pakistan by Pakistan Ordnance Factories, and the estimated total is some 1 million weapons.

Conclusion

While this report addresses some of the background to assault rifles and their current deployments, major users and some European manufacturers, it does not seek to illustrate the technological developments of the weapons or – perhaps more importantly – their ancillaries, which will be addressed in a later edition of ESD. It also, for the moment, sets aside developments, capabilities and plans in Eastern and South-Eastern Europe, which also follow. As stated earlier, Europe has become an extremely active market, and the influence of programmes, technologies, quality and reliability from Europe is likely to continue to have global resonance. ■

SIG SAUER Awarded US Army Modular Handgun Contract

Sidney E. Dean

On 19 January 2017 the United States Army announced that SIG SAUER had won the competition to supply the Army's new Modular Handgun System (MHS), officially designated the M17.

The MHS will replace the full-sized M9 and the compact M11 sidearms. SIG SAUER confirmed that the MHS will be based on the civilian P320 model in the 9mm configuration, but will feature modifications to optimise the weapon for military service.

As a "System" the MHS procurement package encompasses firearms, ammu-

are to be delivered in the "Coyote Brown" colour scheme.

While SIG SAUER is headquartered in Eckernförde, Germany, the firearms for the US armed forces will be produced by the firm's North American sister, SIG SAUER Incorporated, in Newington and Exeter, New Hampshire. The firm has partnered with Winchester to provide lethal ammuni-

While the formal procurement decision has, to date, been made only for the United States Army, other services could eventually join the contract, purchasing up to 212,000 additional pistols. The cost of those weapons has already been factored into the current contract, which has a potential value of \$580.2M. "The contract ceiling [of] \$580M (...) is sufficient to procure Army requirements, other service requirements, and potential Foreign Military Sales requirements. The government is not obligated to use the entire \$580M contract ceiling," the Army stated in a press release. Accessories and ammunition are expected to account for half of the total procurement cost.

Replacing the M9

The MHS is only the third standard sidearm selected by the US Army over the past century. The .45 caliber Colt M1911 remained the standard issue for all US service branches except the Air Force for nearly 80 years until the 9mm M9 entered service in 1990 as the standard pistol for all branches (including USAF). The choice of a weapon chambering the standard NATO 9x19mm round was largely driven by Cold War logistical concerns, and was intended to simplify wartime resupply of US forces in the European theatre. Reception of the M9 was mixed. Personnel serving in Afghanistan and Iraq complained that the weapon was unreliable, difficult to maintain in the field, and underpowered.

These concerns, together with significant advances in handgun technology since the 1980s (lighter-weight materials, improved ergonomics, accessory rails) spurred interest in replacing the M9. From the beginning the Pentagon intended to choose a weapon based on an existing but state-of-the-art civilian design which would be further optimised for military requirements. The effort to replace the M9 began in 2008 with a service-specific Air Force initiative, but was plagued by administrative delays. In 2011 the Army itself requested a delay in the MHS programme, prioritising development of a new lightweight machine gun.



Photo: US Army

The M9 entered service in 1990 as the standard pistol for all branches.

nition, and ancillary equipment including spare barrels and grips, cleaning and maintenance kits, holsters, sound suppressors, and magazines. The Army plans to procure 280,000 full sized pistols (fitted with standard 17- or extended 21-round magazines) and 7,000 compact variants (15-rounds, suitable for concealment under loose clothing). All production pistols

tion and with Ultimate Training Munitions (UTM) for non-lethal ammunition and for conversion components for use in training. UTM will continue to provide the training solutions to the Army under the MHS contract.

The first MHS will be assigned to units designated to participate in initial operational testing. This rollout is expected during the fourth quarter of fiscal year 2017 (July-September). Deliveries are expected to reach full rate of production in 2018, and continue through 2027. Army acquisitions executive Steffanie Easter predicted in January that the procurement programme will remain on schedule and budget.

Author

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The Army finally assumed the MHS lead in 2013 with an initial industry request for information. The Army's official request for proposals or RFP – which ultimately grew into a 367 page document – was promulgated in August 2015 and resulted in nine bids by February 2016. While the Army largely withheld details from the public as the competition progressed, the field is thought to have been narrowed in August 2016 to four competitors including SIG SAUER (offering the P320 in both 9mm and .40 calibre), Beretta (offering its new APX), Glock (17 and 19), and FN America (FNS 9). Those weapons were tested at Picatinny Arsenal (New Jersey). In December the Army again down-selected to only two finalists, Glock and SIG SAUER. The latter won after several weeks of intense comparison. "The Army determined that this MHS (full size handgun, compact handgun, ammunition, and ancillary components) was the best value in terms of its performance capability, the terms and conditions of the vendor's proposal, and price," the Army wrote in a press release. However, given the potential value of the contract, Glock and perhaps Beretta are widely expected to challenge the award. As was widely expected, Glock filed a challenge to the award on 24 February. The Army has until 5 June to respond to the complaint. Until the issue is resolved the Army's planned XM17 testing programme is on hold. Unless Glock can demonstrate irregularities in the selection process their protest is likely to be rejected, but IOC of the weapon could still be delayed by several months past the current timetable.

Modular Design

Short of proving procedural irregularities, however, the contenders would likely have a difficult time overturning the Army's decision. The chosen weapon seems to fully satisfy all requirements laid out by the Army. The P320 was introduced on the civilian market by SIG SAUER in 2014, making it one of the newest and most advanced high-powered handguns available. More importantly, the Army clearly defined modularity as one of the most decisive attributes for the new weapon system. The P320 is touted by the manufacturer as

the most adaptable pistol available today. Aside from the stainless steel frame most aspects of the weapon can be switched out to personalise the pistol for the user and mission. Grips come in small, medium and large and can be exchanged to fit the shooter's hands (particularly important in light of the increased number of women deployed in the field); barrel and chamber can be swapped out to alternate between 9mm Luger, .357SIG, and .40 S&W. Many independent firearms experts agree with the company's assessment. Bob Owens, writing in the website Bearing Arms, wrote that "only the SIG SAUER P320, with a serialised core frame and the ability to swap different grip lengths and slide-barrel combinations, seems to meet the requirements – among the named designs." The MHS-configured variant can be equipped with a sound suppressor, and has an integrated Picatinny rail for mounting a laser aiming module or a tactical light.



The Modular Handgun System (MHS) offered by SIG SAUER will be based on the civilian P320 model in the 9mm configuration.

Compared with the three-decade-old M9, the P320 features better ergonomics, improved sights and a smoother trigger action, increasing a soldier's chances of hitting and stopping the enemy.

As a striker-fired pistol, the P320 lacks the hammer associated with traditional handguns; instead, an internal striker detonates the cartridge primer. Striker-fired pistols are carried pre-cocked, reducing pull weight and distance; this allows the shooter to fire more quickly in an emergency, and can make it easier to hold the sights on target while pulling the trigger for the first shot. As required by the Army, a trained shooter should consistently place rounds within a ten centimetre target area at 50 meters distance.

The MHS-variant of the P320 has an ambidextrous thumb safety, a reversible magazine catch, and a loaded chamber indicator to reduce the risk of accidental discharge. The weapon can be field stripped without tools and without depressing the trigger, which again reduces the risk of accidental discharge. Moving elements such as the trigger and slide are designed to prevent dirt entering the mechanism. The weapon is considerably easier to maintain than its predecessor.

Ammunition Policy

One factor not spelled out in the RFP was calibre. Most candidate firearms were either 9mm or .40 calibre. Since soldiers had intensely criticised the insufficient terminal effects of the M9 and its 9x19mm rounds under combat conditions, many observers



The Army wants its contract partner to submit not only firearms but also the most suitable ammunition for the weapons.

Photo: SIG SAUER

had expected the Army to select at least a .40 calibre weapon. However, military and law enforcement experience shows that multiple rounds on target are usually necessary to kill or incapacitate an opponent, regardless of calibre. The FBI has found that the .40 has only a marginally stronger stopping power than the 9mm, but therefore has reduced accuracy and rate of fire because of the stronger recoil. From this perspective the 9x19 round might offer the optimal balance between accuracy and kinetic effect.

The Army's RFP explicitly did require that all vendors submit not only firearms but also the most suitable ammunition for their weapons. The various makes and variants of ammunition were tested just as thoroughly as the pistols themselves, with an eye to reliability, recoil, potential for fouling, ballistic performance and impact characteristics. Testing was conducted using a variety of target systems as well as gelatin blocks. The MHS contract announced in January explicitly includes options for the purchase of the XM 1152 Full Metal Jacket (FMJ) and XM 1153 Special Purpose (SP) ammunition used with the P320 in testing.

The inclusion of the XM 1153 munition is of particular interest. Special Purpose in this context is a euphemism for hollow point projectiles, which have been shunned by most western armed forces for over a century. The United States is not a signatory to the 1899 Hague Declaration banning wartime use of expanding munitions. Neither is the United States a party to the International Criminal Court which has accepted the prohibition as customary international law. Nonetheless the US has generally refrained from using such munitions except by law enforcement and special operations personnel.

This policy has been under review since 2015, paving the way for regular combat and support units to use either FMJ or expanding ammunition, as deemed necessary. Current US Army reasoning justifies a general use of such ammunition by arguing that full-metal jacket munitions are more likely to exit their intended target and cause collateral damage, especially in urban scenarios. In this context it has also been ac-

knowledge that some smaller calibre FMJ projectiles are prone to tumble early upon impact, creating large wounds comparable with hollow-point ammunition (although this has primarily been observed with rifle bullets).

The Pentagon furthermore suggests that the rise of asymmetric warfare requires a rethinking of the use of special purpose munitions. From the standpoint of international law it has been argued that the 1899 Convention's Maarten's Clause exempts irregular combatants such as terrorists, pirates, and non-uniformed insurgents from the Treaty's protection, so that any

type of ammunition could be deployed against them. Furthermore, the Declaration is only binding for conflicts in which all combatant parties are state signatories. In an asymmetric conflict including, for example, regular armed forces and insurgents on one side, the prerequisites of the Hague Declaration would be moot.

Operationally the Army would like the option of using either FMJ or hollow point projectiles because the latter generally provide greater stopping power. For this reason the capability to handle both munition types is a formal requirement for the Modular Handgun System. ■

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TYPHOON Evolves to Meet Future Threats

Doug Richardson

For many people, New Year's Day (1 January) is a public holiday, and for those of us who follow the Scottish tradition of remaining awake until midnight on 31 December to "see the New Year in", it may be a day for regretting how much whisky we drank to celebrate the arrival of the new year. But for a mortar team of the so-called Islamic State (ISIL) who were manning a position just north of the Iraqi city of Mosul on 1 January 2016 it was just a routine day.

It was also a routine day for the Eurofighter TYPHOON that successfully targeted their mortar position using a Raytheon PAVE-WAY IV guided bomb. The incident illustrates how, despite a protracted development involving new levels of technological complexity for the companies involved, TYPHOON has become a dependable workhorse for its users.

Programme History

The origins of the TYPHOON lie in an outline staff target issued in December 1983. This resulted in an initial feasibility study begun in July 1984. The definitive European Staff Requirement was issued in September 1987, and the main weapons system and engine development contracts followed in November 1988.

Progress was slow. A German proposal in 1992 for substantial cost-reduction measures and studies of alternative proposals was finally dropped, but the process of getting all partners to make a firm production commitment did not end until December 1996. Work on the first prototype started in 1988, leading to the first flight on 27 March 1994.

The first production delivery was made to the Luftwaffe on 17 February 2003, and the aircraft entered service later that year. By the start of 2017, more than 490 Typhoons were in service, and the fleet had accumulated more than 380,000 flying hours.

In terms of its avionics, TYPHOON introduced its designers, builders, and end

Photo: Eurofighter



The CAPTOR-E antenna can be repositioned well off the centreline of the aircraft. While the US, France and Russia allow fighter-mounted AESA antennas to be photographed, the CAPTOR-E antenna coyly lurks behind a cover in all the photographs released to date.

users to new levels of complexity. The Panavia TORNADO was an aerodynamically stable aircraft fitted with an analogue triplex (three-channel) fly-by-wire system, but TYPHOON would be aerodynamically unstable, and would rely on a quadruplex (four-channel) digital fly-by-wire system. Hand on Throttle and Stick (HOTAS) controls allow the pilot to manipulate some functions of the aircraft and its engines without the use of switches or selectors mounted on the cockpit consoles, while Direct Voice Input (DVI) allows the pilot to manage aircraft systems such as radar, displays and navigation. Each aircraft is

"trained" to recognise the voice of its pilot by using a template based on that pilot's voice that has been plugged into the aircraft. The DVI system has been designed to cope with the noisy in-flight environment, as well as factors such as high-G stresses which can affect the pilot's voice.

The flow of voice data is two-way; the aircraft can use a synthesised "voice" to provide safety-related warnings to the pilot such as high or low airspeed, and ground proximity. Coupling the DVI system with the synthesised "voice" allows the pilot to verbally request information such as fuel-state and bearing to base, and receive a verbal reply.

For the previous generation of European combat aircraft, electronic warfare (EW) for self-protection had involved a built-in radar-warning receiver, and a variety of add-on chaff/

flare dispensers and externally-mounted jamming pods that were often added as an afterthought. TYPHOON's designers rejected such an ad-hoc approach, and created a built-in and fully-integrated Defensive Aids Sub-System (DASS) intended to provide protection against air-to-air and surface-to-air threats.

The passive Electronic Support Measures (ESM) receiver system and the active Missile Approach Warner (MAW) provide warning and identification of threats, allowing the Electronic Countermeasures System (ECM) to automatically activate a suitable response using on-board countermeasures

Author

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or off-board countermeasures including towed decoys.

Upgrades

TYPHOON avionics and weaponry continue to evolve, giving the aircraft ever-greater capability, but raising inevitable problems

trial installation last year, P1Eb FW began operational evaluation by 41 Squadron, the UK's Coningsby-based Test and Evaluation Squadron.

The next stage of Project Centurion will introduce the P2E upgrade. This involves additional human-machine interface and availability improvements, as well as initial

clearance envelope of the weapon, and to validate the modelling and simulation being conducted by MBDA and Selex.

In January 2014, Airbus Defence and Space started flight tests of the TAURUS KEPD 350 cruise missile using the IPA7. This work is linked to that being conducted for STORM SHADOW, since concurrent testing of these two similar missiles will facilitate integration of the German/Swedish missile, which is manufactured by Taurus Systems GmbH.

Part of the Phase 2 Enhancement (P2E) package, the P2Ea upgrade tested last year brings some major capability changes and improves some existing capabilities, and involves software and avionics improvements such as upgrades to the radar, defensive aids systems and targeting pods. It makes the aircraft easier to employ in close air support missions or for more complex roles such as convoy over-watch.

A follow-on P3E standard will complete the integration of METEOR and STORM SHADOW, and introduce the MBDA BRIMSTONE 2 close air support air-to-surface missile. By the summer of last year, the IPA6 had completed an initial series of BRIMSTONE flight trials to test communication between the aircraft and missile, part of the process of clearing the way for initial firing trials which are due to take place in the first quarter of 2017.

In 2015 the UK Ministry of Defence provided £1.7M of funding to research a common weapon launcher for TYPHOON that could be capable of carrying multiple weapons and weapon types on one aircraft attachment point. If successfully developed and adopted for service, the new launcher could potentially carry weapons such as the Dual Mode BRIMSTONE 2 Missile and the PAVEWAY IV guided bomb.

The first launch of an MBDA SPEAR air-to-surface missile was announced in July of last year. Following its release from TYPHOON



Initial flight testing of the MBDA STORM SHADOW on the TYPHOON was conducted in a programme led by Leonardo using Italy's Instrumented Production Aircraft 2 (IPA2).

that result when an air force may have to operate a fleet that includes aircraft of different internal configuration.

A TYPHOON upgrade known as Evolution Package 2 was placed under contract in 2013. This includes enhancements to the radar, DASS, Multifunction Information and Distribution System (MIDS), Flight Control System (FCS), and the Utility Control System (UCS).

The Phase 1 Enhancements (P1Eb) entered service on the UK's Tranche 2 aircraft in 2015. Predominantly an air-to-ground capability upgrade, P1Eb introduces new capabilities such as additional Human-Machine Interface technologies and improvements to the aircraft's air-to-surface targeting capability. The aircraft's LITENING III Laser Designator Pod (LDP) and Helmet Equipment Assembly (HEA) – the helmet mounted sight – are given improved integration, allowing their seamless use to visually identify air tracks at long range, and to identify, track, and target points on the ground.

The UK is currently conducting the first phase of Project Centurion, a package of enhancements intended to allow its TYPHOONS to take over the role of the Panavia TORNADO by 2019. This involves modifying the current Tranche 2 TYPHOON to the Phase 1 Enhancements Further Work (P1Eb FW) standard. Following a successful

integration of the MBDA METEOR beyond visual range air-to-air missile and the MBDA STORM SHADOW air-to-surface cruise missile.

Missile Integration

STORM SHADOW integration is being led by Leonardo, with two successful releases of the weapon from Italian Instrumented Production Aircraft 2 (IPA2) in 2015. In 2016 the same company also used IPA2 to complete the sixth series of METEOR test firings at the UK's Hebrides range. These firings were intended to further expand the



Flight tests with the TAURUS KEPD 350 cruise missile are being conducted concurrently with those of STORM SHADOW.



Photo: BAE Systems

Tranche 3 aircraft will have the internal “plumbing” needed to allow the use of conformal fuel tanks (CFTs), seen here being tested on a wind tunnel model.

production aircraft BS116 at the UK Ministry of Defence’s Aberporth range in Wales, the weapon transitioned to powered flight, then flew a series of manoeuvres before reaching its pre-planned point of impact. Further development of SPEAR is expected to continue until 2020.

Improvements to follow on after P3E are expected to include avionic enhancements such as MIDS JTRS, and the potential integration of other weapons such as SDB II and the MARTE-ER anti-ship missile.

Radar and IFF

Currently-deployed versions of TYPHOON’s Euroradar CAPTOR nose-mounted radar use a mechanically-scanned antenna, but flight trials of the CAPTOR-E AESA (active electronically-scanned array) radar started on 8 July of last year using IPA5. German-based test aircraft IPA8 is also being used for CAPTOR-E trials. This work is expected to ensure that P3E Standard capability will be available in time for first TYPHOON deliveries to the Kuwait Air Force.

Since the antenna of a mechanically-scanned radar is steered ahead, or is pointed directly at an object of specific interest, it always functions at full efficiency. While an AESA array allows near-instantaneous electronic scanning, its performance against targets well off the antenna’s boresight is less than optimum. So if the array is mounted in a fixed position in which it is tilted to avoid becoming a conspicuous radar target for an approaching enemy fighter, its performance against near-boresight targets could be degraded by around 15%.

CAPTOR-E gets around this problem by having the AESA mounted on a mechanism that allows it to be repositioned as required in order to obtain the best long-range performance of a specific sector of interest. Once an air-to-air missile has been fired, the aircraft can fly a turnaway manoeuvre in order to avoid closing range with its op-

ponent, while slewing its array to keep it directed towards the target area.

TYPHOON’s current Identification Friend or Foe (IFF) system will have to be upgraded in order to meet the new military “Mode 5” and civilian “Mode S” standards. During last year’s Farnborough Air Show, Leonardo-Finmeccanica, which provides the TYPHOON’s existing IFF system, announced that it had been commissioned by the UK MoD to study a new electronically scanning IFF system that would be able to interact digitally with aircraft’s CAPTOR-E radar.

Since the electronically-scanned IFF antenna arrays will be able to look in a different direction to the TYPHOON’s radar, the pilot will be able to use the CAPTOR-E radar to identify targets that require identification, and assign a list of these to the IFF system.

In its initial phase of the planned Technology Demonstrator Programme (TDP), the company will demonstrate the fully European-manufactured M428 compact transponder and SIT2010 crypto, along with an electronic scanning system including the interrogator, Transmit/Receive Unit (TRU) and wing-rooted antenna arrays.

Working with the Italian Defence General Staff, last year Leonardo-Finmeccanica demonstrated the successful integration of a Mode 5 Reverse-IFF (Identification Friend-Foe) system, providing air-to-ground IFF capabilities for a Tranche 1 Eurofighter TYPHOON. The demonstration was witnessed by representatives from the NATO Battlefield Combat Identification Capability Team.

In its normal mode of operation, an IFF system uses an aircraft-mounted transponder to respond to interrogation signals received from other airborne or surface radars. The Reverse-IFF technique involves the aircraft and uses its transponder to scan ground vehicles. During the demonstration, an Italian Air Force TYPHOON flying a simulated close air sup-

port mission interrogated a number of Italian Army LINCE armoured vehicles, which responded by sending “friendly” signals back to the TYPHOON.

Increasing the Combat Radius

Potential improvements are not confined to the avionics. Wind tunnel trials of conformal fuel tanks were completed by BAE Systems in 2002, and a mockup showing the proposed installation on the upper fuselage spine was displayed at the Farnborough Air Show in July of that year. Further tests were conducted in 2014. Tranche 3 aircraft are being “plumbed” for conformal tanks, but no TYPHOON operator has announced plans to procure these. Each tank would be able to carry 1,500 litres of fuel, and the combined total of 3,000 litres would increase the aircraft’s combat radius by 25%.

Mid-2015 saw the completion of 36 sorties from Manching, Germany, by IPA7 in a programme conducted to test the Aerodynamic Modification Kit (AMK). Developed following five years of studies, this forms part of a wider Eurofighter Enhanced Manoeuvrability (EFEM) programme. The installation of fuselage strakes and leading-edge root extensions increases the maximum lift created by the wing by 25 per cent, producing an increased turn rate, tighter turning radius, and improved nose-pointing ability at low speed.

Until 2016, a four-nation agreement was needed for any changes to the weapon system, or limitations to, or modification of, the type design. On 1 February of that year, Eurofighter Jagdflugzeug and NETMA (the NATO Eurofighter & Tornado Management Agency) signed an agreement to adopt European Military Airworthiness Requirement 21 (EMAR21). Participating member states would now share a common certification process that also includes a delegation capability to other partner nations and industry.

Two contracts signed on 21 December 2016 between NETMA and Eurofighter Jagdflugzeug GmbH covered five years of support for the TYPHOON fleet. The first covered the sustainment of engineering capabilities and programme management, while the second covers logistics, repairs, and the provision of spare parts. Leonardo provides more than 60 percent of the avionics for the TYPHOON. It is already responsible for maintaining the Italian Air Force’s TYPHOON fleet via an Avionic Maintenance Center (CMA). This arrangement, which is based on aircraft availability, has proven to be a great suc-

cess, the company has stated. Leonardo and BAE Systems are working together under a scheme known as the Joint Avionics Solution (JAS) to support the TYPHOON's avionics for at least the next ten years.

Customers

The largest operator of TYPHOON is the UK's Royal Air Force (RAF). According to the latest figures released by Airbus Defence and Space (which owns a 46% share in Eurofighter), 138 have been delivered to the UK from a total order of 232. The RAF had planned to retire its oldest TYPHOONS in 2019, but following a defence review conducted in 2015 it decided that these aircraft – a total of 24 that had been delivered to the original Tranche 1 standard – would be kept in service until 2040, the planned end-of-life date for the rest of the UK's TYPHOON fleet. There are no plans to update these aircraft to a multirole standard. They will be used to form two air-defence squadrons.

Germany has taken delivery of 125 of the 180 it has ordered, Italy has received 83, and is due to take delivery of 38 more,

while Spain has 61 out of an order for 87. Since 30 of the current fleet are Tranche 1 aircraft, these are used only in the air-defence role. When the US Air Force's Lockheed Martin F-22 RAPTORS took part in their first Red Flag-Alaska war games in June 2012, the stealth fighter's opponents included Luftwaffe TYPHOONS.

The first export customer was Austria, which in July 2002 announced a plan to acquire 18 Tranche 2 aircraft. This plan was later revised to save money, with the order being cut back to 15.

In 2006 Saudi Arabia agreed to purchase TYPHOONS, and deliveries began in 2009. The Royal Saudi Air Force has received 66, from a total order of 72.

In December 2012, Oman became the third export customer, when it ordered twelve aircraft. Kuwait announced its selection of TYPHOON in September 2015, and plans to take delivery of 28.

Potential customers include Bahrain (where TYPHOON faces competition from the JAS 39 GRIPEN, RAFALE, and F-35 LIGHTNING II), Belgium (where it faces the same three candidates, as well as the SUPER HORNET), Bulgaria (which has been offered eight second-hand Eurofighters that would be taken from the

Italian fleet), Finland (where it is one of five candidates being considered under the HX programme intended to replace the current F/A-18 HORNET), Malaysia (which is considering TYPHOON and RAFALE as potential replacements for the MiG-29), Poland (which plans to order 64 multirole combat aircraft of as-yet undecided type to replace its MiG-29 and Su-22M4 fleets). A Greek plan announced in 1999 to acquire 20 TYPHOON has been stillborn, at least in the short term, given that country's current financial problems.

Air Policing and Combat Operations

TYPHOONS from several nations have taken part in operational deployments to bases in other countries. Estonia, Latvia and Lithuania joined NATO in 2004. These three Baltic countries operate only nominal air arms and have no fighters, so aircraft from the alliance were needed to police Baltic airspace.

Different NATO partners deploy fighters to the area for several months at a time. Germany has been a regular participant, and was conducting its tenth deployment as this article was being written in early

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Photo: Airbus Defence and Space

Flight tests of fuselage strakes and leading-edge root extensions conducted under the Eurofighter Enhanced Manoeuvrability (EFEM) programme demonstrated angle of attack values around 45% greater than those of standard aircraft, and roll rates up to 100% higher.

2017. Its first two deployments used F-4F PHANTOMS, but in September 2009 it used TYPHOONS. Only two weeks into their initial deployment to an air base in Lithuania, they intercepted what turned out to be a Russian Air Force BERIEV A-50 airborne early warning and control aircraft. UK TYPHOONS participated in Baltic Air Policing for the first time in 28 April – 1 May 2014, while Italian and Spanish TYPHOONS made their Baltic debut in January 2015.

On 28 October 2014, the German TYPHOONS intercepted seven Russian Air Force aircraft flying in international airspace over the Baltic Sea. One of the largest groups of Russian aircraft intercepted by NATO in recent years, it consisted of two MiG-31 FOXHOUND interceptors, a single Su-27 FLANKER fighter, two Su-34 FULLBACK strike aircraft, and two Su-24 FENCER swing-wing strike aircraft.

The Baltic operations involved monitoring what were probably Russian deployments of combat aircraft to and from its Kaliningrad enclave, but the Middle East region had seen the aircraft committed to combat.

In March 2011 RAF and Italian Air Force aircraft were deployed to the forward air bases at Gioia del Colle in southern Italy, and Trapani in Sicily respectively as part of the NATO Unified Protector mission in support of Libyan insurrection.

Warned on 17 March 2011 of the need for a possible deployment for use against targets in Libya in support of UN resolution 1973, three days later the RAF despatched aircraft to Gioia del Colle to take part in operation “Ellamy”, the

UK contribution to NATO’s operation “Unified Protector”. After initially operating in the air defence role, notice of the need to transition TYPHOON to the air-to-surface role was given on 31 March. On 7 April, the first TYPHOON operational multi-role sortie was flown. A subsequent tasking of four missions

own target designation. RAF TYPHOON missions over Libya averaged 5.5 hours in duration, with the longest lasting more than 8 hours. This required the aircraft to receive three air-to-air refuellings. Over a six-month period, the aircraft had flown more than 600 operational sorties and a total of 3,000 flying hours. By late June 2011, Italian Air Force TYPHOONS of 4 and 36 Stormo had clocked up a total of 1,000 flying hours while participating in “Unified Protector”, which finally ended on 31 October 2011.

Given current instability in the Middle East, in 2015 the aircraft was once more in combat action. In September 2014, the US, Bahrain, Jordan, Qatar, Saudi Arabia, and the United Arab Emirates began air-strikes against ISIL targets in Syria. Royal Saudi Air Force TYPHOONS were committed to the anti-ISIL campaign, and February 2015 saw reports that these had used PAVEWAY IV laser/GPS guided bombs to attack ISIL targets. This would have been the Raytheon weapon’s combat debut.

Operation “Shader” is the code name for the British participation in the ongoing military intervention against ISIL. On 2 December 2015, the UK House of Commons approved British air strikes against ISIL targets in Syria. The resulting deployment included six TYPHOONS incorporat-



Photo: Gordon Zammit – GNU Free Documentation License

Saudi Arabia has ordered 72 TYPHOONS, and could decide to procure a follow-on batch.

per day was maintained with only 31 support personnel.

The first attacks were made on 12 April, when an RAF TYPHOON dropped PAVEWAY II guided bombs on two Libyan government tanks. For this first strike, the targets were laser-designated by an accompanying Panavia TORNADO, but from then on the TYPHOONS did their

ing the P1Eb upgrade, and eight TORNADOs, and involved the RAF operating at its highest intensity in a single theatre of operation for 25 years. With anti-ISIL ground and air campaigns of various types currently under way in Afghanistan, Iraq, Libya, and Syria, it may be a long time before combat operations by TYPHOON come to an end. ■

Electronic Scan Transforming Ground Radars

Tamir Eshel

Radar technology has developed a lot since the first systems were fielded in World War II; the first big leap came in the 1960s with the introduction of solid-state technology that opened the door for increased processing power, higher frequency bands, and better resolution. Nowadays, scalability and agility are derived from electronic scan technology. Today's radars are mostly phased array systems tailored for specific applications using agile, software-based Active Electronic Scanned Array (AESA) systems.

Large, powerful phased array radars were used in the past for strategic air and missile defence, to track objects in space and spot missiles ascending from launch pads thousands of kilometres away. Those large arrays have improved in recent years, particularly in Russia and China, as part of evolving counter-stealth systems.

Strategic Radars

The Russian VORONEZH radars introduced in VHF and UHF variants are part of the growing early warning network established by the Russian strategic forces, as part of the missile defence systems. The first site was established in Lekhtusi near St. Petersburg in 2009. Two additional sites became operational in 2014, and more radars of this type are expected to deploy in 2017-2020 to complete nation-wide coverage. Effective at line-of-sight range of up to 8,000 km, the VORONEZH radar can detect a football-sized target in space, or spot stealth aircraft from hundreds of miles, a task that cannot be achieved by other means.

While the huge VORONEZH radars operate from fixed sites, Russia has also deployed the relocatable NEBO-M anti-missile and counter-stealth radar. Based on an AESA design, NEBO-M can detect targets with small radar cross section that are flying at very high velocity (hypersonic speed), thus providing an essential element for the country's air and missile defence capability. Featuring a programmable, multi-band design, NEBO-M includes three radar systems in one, operating simultaneously in the VHF, UHF and S/X bands. All the radars are AESAs. The principle behind NEBO-M is the fusion of data from the three radars to generate the intercept solution. In a rotating scan mode, the radar covers 360 degrees

and tracks 200 aerodynamic targets at a maximum distance of 600 km. In sector scan NEBO-M can track up to 20 ballistic missile targets at ranges of up to 1,800 kilometres and at an altitude of up to 1,200 kilometres.

Another multi-band radar is the TERRA system from Israel's IAI Elta Systems. Each TERRA site integrates two huge ra-

tablish tracks accurately enough for target acquisition and fire control. TERRA is designed to offer extended air- and missile defence coverage against new and evolving ballistic missile threats that are becoming more capable, covering longer ranges at higher speeds, and which require new capabilities for missile warning and defence.



Photo: KMZ

Russian over-the-horizon VORONEZH radar at the Lekhtusi site, which became operational in 2014

dars – the UHF radar – ELM-2090U Ultra and ELM-2090S SPECTRA S-band radar. The ULTRA operates as an early warning asset, detecting all types of threats, including ballistic missiles, stealth aircraft and unmanned aerial systems (UAS). It does so well beyond the range of existing sensors. Once such targets are detected, tracks can be transferred to the higher resolution S-band SPECTRA to es-

The basic module, designated ULTRA-C1, comprises a single AESA cluster measuring 3x3 metres. It is mounted on a rotating pedestal covering 360 degrees. ULTRA C-1 is configured as a relocatable system designed to provide an autonomous search and detection capability at a range of up to 500km for a typical fighter aircraft. A larger variant is the ULTRA-C6, comprising six clusters (three stacks

of two units), while ULTRA C-22 uses a 22-cluster configuration measuring 10 high by 30 metres wide. Although this radar is considered a strategic system it can be moved between operational sites using special trucks. While the radar array is fixed, it is mounted on a trainable assembly to enable wider field of regard up to 320 degrees.

turers, who have implemented GaN technologies in their T/R production lines. Raytheon's AN/TPY-2 is one of the several operational X-band radars that provides essential early warning against missile attacks at global hot spots, such as the Middle East, the Far East and Pacific Ocean. As a primary sensor for the US ballistic missile defence capability, AN/

detect, acquire, track and discriminate ballistic missiles in the terminal (descent) phase of flight. The terminal-mode AN/TPY-2 also leads the Terminal High Altitude Area Defense ballistic missile defence system by guiding the THAAD missile to intercept a threat.

The Russian company Radiofizika is also developing the DEMONSTRATOR phased array radar, a deployable, long-range radar complex that can detect non-strategic ballistic missiles and high-speed air breathing targets. DEMONSTRATOR employs three main elements mounted on trailers – the transmitter, receiver and signal processing unit with the command and control post. Set-up time for the entire system is 30 minutes. The radar provides an automated search, track and detection of targets at a theoretical range up to 1,500 km. In more pragmatic terms, it can establish lock-on on a fighter aircraft (1 m² RCS) at a range of 600 km. Area coverage is +/- 60 horizontal and 0-75 degrees vertical.

The system can handle 100 tracks simultaneously. It can recognise and classify targets by type and is also capable of tracking emitters (including jammers) at an accuracy of less than five metres, target velocity of less than five m/sec and angular rate lower than half a degree. According to the manufacturer, the track accuracy provided by the system is sufficient for target designation for missile defence systems.



Photo: Finnish Defence Forces

GROUND MASTER 400 from Thales, known as KEVA 2010 in Finnish use

The Spectra radar is also the first ultra-large-scale radar relying on Elta's Gallium-Nitride (GaN) transmit-receive modules, which offer great advantages in terms of power and size optimisation. The addition of the high-power S-band radar enables the system to combine early warning and target tracking at a long range, high resolution and capacity that would not be achievable with a single radar.

Moving such radars to higher frequency bands results in smaller arrays that accommodate many more Receive/Transmit (R/T) modules on board. Using GaN technology in a Monolithic Microwave Integrated Circuit (MMIC) or even on a single chip enables designers to produce RF modules that can drive higher power levels, and operate with low-noise levels, thus extending the range and providing higher resolution, while reducing the overall size and power consumption.

The manufacturing of such modules has become a significant factor in systems' performance and becomes an important differentiator for leading tier I manufac-

TPY-2 is also the radar associated with the Theater High Altitude Air Defense (THAAD) missile defence system. These deployable radars can spot a baseball-sized target from hundreds of miles away. As a truck-transportable system, AN/TPY-2 can be deployed anywhere in the world in hours, flown to its destination by C-17 transport planes. Raytheon has delivered ten AN/TPY-2s to date, and is in the process of building four additional systems for the US and the UAE.

Depending on the needs of the warfighter, the AN/TPY-2 radar can be deployed in two different modes. In forward-based mode, the radar is positioned near hostile territory and acquires ballistic missiles in the boost (ascent) phase of flight, shortly after they are launched. It then tracks and discriminates the threat, and passes critical information required by decision makers to the command and control battle management network.

When the AN/TPY-2 radar is deployed in terminal mode, for example in support of THAAD systems, the radar's job is to

Multi-Mission Radars

As military threats have evolved and become less predictable, the accuracy and granularity of data available from radars is increasingly important to the air defenders. This is the domain of Thales' S-band GROUND MASTER air defence radar, developed by the company's ThalesRaytheon Systems Joint Venture with US-based Raytheon. Designed for the protection of key assets or forces deployed on contingency operations, GROUND MASTER can detect all modern threats including UAVs, missiles, mortars and rockets and at critical ranges and altitudes. The GROUND MASTER 200 is the medium range tactical variant available in an autonomous, mobile or deployable configuration, while the GM 400 provides extended range coverage and is available in mobile or fixed configurations. Both variants are complementary and share many building blocks for operation. The primary mission of the GROUND MASTER radars is air surveillance, providing accurate detection of all types of aerial targets including hov-

ering helicopters, UAVs, aircraft and missiles from very low to high altitudes, at surveillance ranges of up to 250 km and engagement ranges of up to 100 km. The radar also supports air defence systems with the coordination of various weapon types – from VSHORAD to medium range missile system.

The 3D radar uses a rotating antenna with a digital stacked beam covering 7-70 degrees in elevation. The GROUND MASTER family includes the 200 and 400 versions of multi-role air defence radars; both are trailer or truck mountable and deploy within 15 minutes from halt. The GROUND MASTER 200 can also operate from standard 20-ft ISO shelter. In addition to air defence, the GROUND MASTER can also provide rocket artillery & mortar warnings, as well as launch and impact points computation (C-RAM).

The same properties that can detect small targets at long range, also support other applications. Configured into smaller, and agile sensors, several manufacturers are offering multi-mission radars (MMR), for use in supporting contingency operations at division and theatre level. A typical system is the new AN/TPS-80 Ground/Air Task Oriented Radar (G/ATOR) from Northrop Grumman, developed to provide air surveillance, air defence, ground weapon location and air traffic control capabilities for deployed US Marine Corps task forces. Under Northrop Grumman funding, G/ATOR has also demonstrated its ability to reliably detect high-speed rocket and missile systems. Currently in low rate initial production, Northrop Grumman is expected to deliver the new radars in 2017.

The Marine Corps has structured the G/ATOR procurement programme in four

increments. The first increment was delivered in 2016 with software loads optimising the radar operation to perform missions such as air surveillance, air defence and battlespace awareness. Follow-on increments will feature Ground Weapon Locating Radar (GWLR) capabilities on the same G/ATOR hardware. The modular architecture also contributes to the system's reliability, usability and reduced maintenance cost, compared to existing systems. The G/ATOR is expected to reach Initial Operational Capability in 2018.

Elta Systems' ELM-2084 is part of IAI's multi-mission radar (MMR) family of systems. The system has been operational as a weapon locating, air defence and C-RAM radar with the Israel Defence Forces for several years and is an integral part of Israel's IRON DOME and DAVID'S SLING anti-rocket and anti-missile systems.

The radar is designed with a high level of scalability, offering flexible solutions for multiple missions. The system provides the main sensor for Rafael's IRON DOME C-RAM system, as well as the theatre-level DAVID'S SLING air and missile defence system which has recently passed acceptance tests with the Israel Defence Forces. The same radar, with different software load, provides a weapon location and force protection system, supporting the IDF artillery corps.

ELM 2084 is an S-band radar that covers 120° in azimuth and 50° in elevation. Site preparation and adaptation are accelerated with automatic terrain following. Using the multi-beam Active Electronically Scanning Antenna, the ELM-2084 can operate in static sector scan or 360° rotating modes. In the rotating mode, the ELM-2084 can track manoeuvring targets three times faster than conven-

tional radars, effectively discriminating between multiple targets in a formation, and following evasive manoeuvres without compromising the primary air defence mission.

The radar is designed to operate effectively in dense environment and heavy clutter, handling more than 200 targets per minute in weapon location mode, or up to 1,100 targets in air surveillance operation. Typical operating range in weapon location mode is 100 km. It will detect a fighter-size target from 330 km. This radar features advanced ECCM capability and offers very high reliability, measured in years of continuous operations. In fact, the MMR is designed to enable 'hot swap' of complete modules, without degrading the system's operation. The system is air transportable by C-130 and can be operated independently and remotely, or as a sensor integrated in a larger network.

Another radar offering multi-mission flexibility is GIRAFFE 4A from Saab. This radar combines two proven mission-specific product families – the ARTHUR weapon location radar and GIRAFFE AMB (Agile Multi-Beam) – a short-range air defence (SHORAD) sensor. The new GIRAFFE 4A introduces an all-new radar sensor utilising AESA technology to offer multi-function operational flexibility in a single solution.

Using mission specific software loads, GIRAFFE 4A can identify and simultaneously track a large number of airborne or surface objects, performing air or sea surveillance as well as military air traffic control (ATC) or SHORAD radar. Used as a primary Ground-Based Air Defence (GBAD) sensor tracking air targets together with identification capability, GI-



Photo: Saab

Radar solutions from Saab

RAFFE 4A can support multiple simultaneous engagements.

Tracking ballistic projectiles, calculating point of origin and point of impact for counter-battery fire or adjustment of own fire, the same radar can perform force protection – providing early warning, supporting C-RAM and weapon locating applications. Different missions require different scan rates – the GIRAFFE 4A can search the entire 360° volume or focus on an optimised sector (40°-120°). Both with coverage up to 70° of elevation.

As a compact system, GIRAFFE 4A is deployed by two persons in less than 10 minutes, while teardown takes only five minutes. The radar can be transported in

Coverage Mode’ – providing air surveillance from the horizon (terrain) to ~18 degrees, providing balanced height coverage. A special Low Altitude Coverage Mode also conducts surveillance from the horizon to ~5 degrees. With energy focused on fast revisit times, optimised for the detection and tracking of low altitude advanced target threats, the SENTINEL offers a better solution against cruise missiles and UAVs.

Mobile Force Protection

While the larger air defence and multi-mission radars are often used for strategic defence, maintaining air situational

enabled by the latest generation GaN technology, introduce new and affordable applications of radar sensors never before possible. An important application for such radars is force protection.

Saab’s GIRAFFE 1X is one such mobile, lightweight radar designed for force protection. With a total weight of less than 150 kg, this radar can be mounted on vehicles or tripods to deploy with and protect combat forces. The complete radar can be transported on a pickup truck, or carried in a helicopter. The radar is designed as a compact assembly and can be disassembled into several man portable units for dismounting and relocation from the vehicle to a rooftop of a building when necessary. The radar can be operated locally or remotely.

Elta’s latest offering for the Very Short Range Air Defense (VSHORAD) application is the ELM-2026B, a ‘fifth generation’ of the company’s family of 3D tactical air defense radars. The radar detects a wide variety of low RCS targets such as low flying fighter aircraft, low velocity ultra-lights and UAVs. The radar provides accurate target measurements of velocity, range, azimuth and elevation angles. This new X-band radar is a lightweight transportable system implementing solid-state electronically scanned, pulse-Doppler radar delivering early warning and target data for surface-to-air weapon systems. Similar to other rotating arrays the ELM-2026B employs multi-beam elevation coverage by applying Digital Beam Forming (DBF) and 360 deg. azimuth coverage by antenna rotation.

A different implementation of radar technology for land based application is a real-time threat detection and response, as part of active protection systems on armoured fighting vehicles. ELM-2133 WINDGUARD from Elta Systems is part of the TROPHY active protection system. This radar also implements AESA technology, and is designed to operate autonomously and automatically as part of the APS. Elta is also working on a new variant designated ELM-2135 STORMGUARD, a dual-mode radar that will conduct both self-protection (APS) and ground surveillance, securing the vehicle in stationary positions. In self-protection mode, the radar detects and automatically tracks Anti-Tank Rockets (ATR), Anti-Tank Guided Missiles (ATGM), tank rounds and mortars providing the APS the targeting data necessary for selective response (intercept or employment of countermeasures).

Mounted on combat vehicles, radars become an essential sensor for situational



Photo: Björn Trotzki

Woods are still challenging terrain for most radars, with this LEOPARD main battle tank being hard for optical and radar sensors to see.

ready to deploy configuration in A400M, C-17 or IL-76 aircraft and be disassembled into a container load for airlift by a single C-130.

The latest iteration of the Thales-Raytheon Systems is the IMPROVED SENTINEL AN/MPQ-64F1 tactical air defence radar, the primary mission of the new, IMPROVED SENTINEL is to automatically detect, track, identify, and report airborne threats, including helicopters, high-speed attack aircraft, cruise missiles and unmanned aerial vehicles (UAVs). The radar will detect, identify, classify and track aircraft (i.e., fixed wing, rotary wing, etc.) from the nap of the earth to 55° in elevation and 360° azimuth within an airspace search range of more than 75 km. The same radar can also perform rocket artillery and mortar detection, supporting C-RAM operations.

To support these functions operators can select one of several operating modes to best match the expected threat – a ‘Full

awareness is critical to tactical combat forces in the battlefield, even when fighting insurgents and engaged with guerrilla forces, where threats often consist of rockets, mortar, and potentially lethal unmanned aerial systems. Overall, the most demanding evolving requirements for these tactical radars is to detect low, slow and small (LSS) targets that often blend into the environment and clutter of the natural and man-made terrain.

Until recently these capabilities were provided by a combination of passive and active optronic and radio-electronic sensors, since the clutter and interference encountered on low-level surveillance prevented effective operation by a single sensor. However, the new generation of compact multi-mission AESA radars that evolved in recent years is becoming more suitable for asymmetric warfare.

The inherent agility provided by AESA technology, combined with electronic miniaturisation and power efficiency

Photo: RADA



RADA's Multi-mission Hemispheric Radar (MHR)

awareness and early warning against incoming attack. Upon detection of a missile, tank round or anti-tank rocket, the radar instantly discriminates the type of target, and calculates the direction and elevation of the incoming threat. When a threat to the protected platform is determined, the radar would deliver a warning to the crew, and process the projected Point Of Impact (POI), calculated Time-To-Impact (TTI) and, if possible, the Point Of Origin (POO). This information pro-

vides cueing for remote weapon systems, to engage the threat. The radar continues to track all targets while searching for others, supporting the vehicle's crew and tactical formation with battlespace awareness.

The Multi-mission Hemispheric Radar (MHR) family from RADA represents a different approach to tactical, multi-mission radar. Implementing an AESA based system, MHR introduces a compact, mobile radar that can operate on the move, as

an air or ground surveillance sensor. This radar has already been adapted to provide air surveillance and target acquisition for tactical air and missile defence systems, including laser- and gun-based systems. When integrated with EO/IR sensors and RF jammers, these systems can also provide counter-UAV (C-UAV) solutions.

RADA has recently expanded its MHR radar family, introducing the compact and man-portable pMHR radar, weighing approximately 20 kg. The larger eMHR and ieMHR radars provide longer detection ranges, applicable for Very Short Range Air Defence (VSHORAD), sea and air surveillance missions.

From strategic mega-radars designed to detect ballistic missiles in space to miniature sensors that spot drones behind the treetops and crawling men at a distance, modern radars have become indispensable sensors for defence and security, protecting combat forces and civilians. With technology advancing faster than ever before, new architectures such as AESA, digital beam forming and GaN enable designers to introduce sophisticated and versatile radars that address new and evolving requirements, responding to the challenges posed by an ever more sophisticated and agile enemy. ■



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An Overview of Trends and Developments in Decontamination

Dan Kaszeta

CBRN weapons and agents can cause either short-term or long-term contamination. Decontamination, is the (hopefully) orderly and systematic removal of liquid and solid contaminants. Decontamination is necessary to reduce casualties, to prevent the spread of contamination to clean areas, to return vital equipment to service and to allow for operations to be performed without the need to wear cumbersome protective equipment.

Decontamination is an essential component of CBRN defence, both in terms of doctrine and technology. Most modern militaries place great emphasis on “contamination avoidance” by using detection, hazard prediction, and reporting systems to

minimize the amount of personnel, terrain, and equipment that are contaminated by persistent agents. Some militaries, such as the UK’s, place a high premium on contamination avoidance, with the aim of much lower costs for protection and decontamination. However, no avoidance measures can completely assure that soldiers, equipment or vehicles are not contaminated. Militaries must assume that the use of CBRN weapons will result in something getting dirty somewhere.

From the viewpoint of technology and industry, it is useful to break decontamination into three segments: hardware, chem-

istry and fumigation are distinct segments. Some companies operate in a single segment; others operate in all three. The hardware segment is largely composed of sprayers, pumps, dispensers and ancillary hardware for dispensing either proprietary or generic decontaminants.

and methods to deal with contaminated rooms and building, or things that are harmed by more traditional wet methods, such as aircraft interiors and electronics. Numerous companies provide generic materiel such as tents and hoses, but this is a segment too broad and non-specialised to examine here. There is ample opportunity for crossover in this market as a customer can easily buy one company’s sprayer and use it with another company’s chemistry. There’s nothing stopping a customer from spraying Cristanini decontamination agent or soapy water with, say, an OWR sprayer.

Systems and Chemicals from the 80s and 90s

Decontamination is an example of a portion of the CBRN space which resists dominance by US companies. Non-US firms are quite a large segment of the decontamination industry. Whereas the detection market is heavily driven by a series of major US military procurements, decontamination has not been as seriously influenced in recent years. US acquisition has been largely following the market rather than leading it.

In both hardware and chemistry, the US Army is still heavily reliant on systems and generic chemicals purchased in the 1980s and 1990s. These include the large M12 and M17 decontamination sprayers, which the author learned to use in 1993 as a junior officer. Indeed, the US Defense Department investment and procurement in the decontamination space is somewhat low compared to other areas of CBRN defence. While the US government is spending money on research and development in this area, very little is being spent on actual procurement. The last major investments were the Joint Service Transportable Decontamination System (JSTDS), a procurement which commenced ten years ago, and the adoption of Reactive Skin Decontamination



(Photo: USMC)

Decontamination training of the US Marine Corps with the M26 Joint Service Transportable Decontamination System.

istry and fumigation are distinct segments. Some companies operate in a single segment; others operate in all three. The hardware segment is largely composed of sprayers, pumps, dispensers and ancillary hardware for dispensing either proprietary or generic decontaminants.

The chemistry segment comprises a variety of wet and dry substances used to remove, absorb, adsorb, and/or neutralize contaminants. Some products work through multiple mechanisms. Some chemistry products are designed for use on equipment, while others are designed for use on human skin. The fumigation segment includes systems

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Author

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(Photo: OWR)

MPD 100i is an improved version of the OWR-developed decontamination system in service with NATO.

Lotion, a procurement that is well past initial buy and which is now in long term sustainment, i.e. replacement of stocks as shelf life expires. Much innovative research occurred in the past, but from about 2012 a refocus of R&D effort onto medical countermeasures greatly reduced US military research in decontamination.

The most recent (June 2016) Chemical and Biological Defense Program Annual Report to Congress shows very little procurement of decontamination materiel – literally only a few dozen inflatable tents – for Fiscal Year 2015. Procurements in decontamination in FY 2013 and FY 2014 were even leaner. Clearly, this level of procurement does not drive an industry.

European Stronghold

Six European companies are quite active in the decontamination space: OWR (Germany), Kärcher (Germany), Bioquell (UK), NBC Sys (France), Hispano Vema (Spain) and Cristanini (Italy).

OWR produces a wide variety of sprayer systems, ranging from handheld to crew-served in size, which can spray either decontamination solutions or generic products, such as water. Additionally, OWR produces GD-6, a water-less decontamination solution for both chemical and biological contamination. OWR products are in use in at least eight countries. A number of NATO armies rely on OWR for hardware and chemistry. Kärcher, which bases its decontamination offerings on its well known lines of civilian products and cleansing agents, has robust decontamination offerings. Their range of sprayers and applicators includes the US JSTDS, of which more than 500 have been procured by the US Defense Department as a joint project with DRS, a Leonardo (Italy) subsidiary. Kärcher has a respectable market share, with products in service in at least nine militaries around the world. Their GDS (chemical), RDS (radiological), and RM 21 (personnel) decontamination solutions are well regarded. Kärcher's C8 emulsion was a benchmark product for many years, having been stocked in large quantities during the Cold War, although it is no longer pro-

duced because of environmental reasons. Bioquell (UK) operates principally in filtration within the military market but has a sizeable presence in fumigation-type chemical and biological decontamination and has peroxide-based systems that have some use in military and security settings. They may be one to watch for future developments in sensitive equipment decontamination.

The French firm NBC SYS and the Spanish firm Hispano Vema produce military decontamination sprayers and applicators of a wide range of sizes and varieties. However, these firms appear to be largely devoted to servicing their own domestic market requirements. Uptake of their systems outside the French and Spanish militaries appears very minimal.

Cristanini, a firm based near Verona, Italy, is proof that a relatively small company can have an impact in decontamination. Having started with the Italian Army, their products are used in dozens of countries. Cristanini's product line includes sprayers of many sizes and a family of decontamination solutions. Cristanini appears to seriously address the issue of sensitive equipment. It has developed and fielded the SX-34 system for decontamination of electronics and sensi-

tive items, having been successfully demonstrated on items like laptops and aircraft cockpits. Their newest offering, LDV-X, is a peroxide-based system for fumigation of rooms and interior spaces, and this system promises to be far less harsh than more traditional fumigants such as (now largely banned) methyl bromide and chlorine dioxide.

North American Footprint

Canada fights above its weight in decontamination. The most radical product innovation in recent decades has been Reactive Skin Decontamination Lotion (RSDL). Originally invented by RS-Decon, a Canadian firm now part of Emergent Bio-Solutions (US), RSDL is a user-friendly gentle lotion that reacts with chemical warfare agents without damaging human skin. It has achieved status as one of the most widely adopted proprietary products for personnel decontamination. At least 13 countries use RSDL. Various US government agencies have been using it since at least 2002, and the US military has adopted it. RSDL is Emergent's only decontamination product. Another Canadian firm, Allen Vanguard, developed products called SDF or CASCAD foam (the products are very similar) as well as various sprayers to dispense it. At least 14 countries use Allen Vanguard foams, although the recent restructuring of Allen Vanguard leads to some confusion as to where this product line now resides.

As would be expected, there are a number of US companies in decontamination. Steris, the large medical products company with a high market share in medical sterilisation, has now entered the decontamination

(Photo: Kärcher Futuretech)



TEP 90 from Kärcher Futuretech/Veco is the modular decontamination system of the Bundeswehr.



(Photo: Cristanini)

An equipment kit from Cristanini for the decontamination of sensitive material

market with hydrogen peroxide fumigation systems. Like that of their rival Cristanini, this technology shows promise in the sensitive equipment and building interior decontamination mission. Steris is known to be working on other decontaminants. One product that is in use in the US is "Sandia Foam", which is a chemical and biological decontaminating foam that was originally invented by the US government at Sandia National Laboratory. This product was used in the 2001 anthrax decontamination efforts. At least two companies make it under license. One is Modex, now known as Span-World. Intelagard, produces DF200, their version of Sandia Foam. Intelagard also produce more conventional cleansing agents and a large number of sprayers and dispensers aimed largely at the civil / emergency services market. Scott Safety, a name in CBRN protection equipment, now part of Tyco International, is known for its protective masks and self-contained breathing apparatus. Building on backpack air tanks, they have opened a new product line in man-portable decontamination sprayers. Like many commercial sprayers, they are useful with a wide variety of chemistry, both generic and proprietary. This product line is one of very few product launches in the last year in the decontamination space.

Changing Market

Product differentiation is more difficult in this sector than in, say, protection or detection. The various liquids and foams are all quite effective at what they do or they would not be in service. Extensive testing is obligatory. As decontaminants need to be stockpiled for long periods of time for contingency use, factors such as storage, environmental footprint, shelf-life, price, and the industrial capacity to

replace products in a timely manner if the stockpile is expended are important considerations.

For sprayers and applicators, which are functionally very similar to each other, ease of maintenance, training, and reliability after long-term storage become critical factors. The decontamination market can be highly variable because the customer does not end up using the product and the big customers may lay in a stockpile of goods and then not buy anything for years. Within the decontamination chemistry space there is a fundamental paradox. The oldest technologies are cheap and generic. Water, on its own, even as wastewater or seawater, is not a bad decontaminant. Clean, warm, soapy water, even with the lowest-grade soap or detergent, actually is not bad for general-purpose decontamination. In some instances it is even preferred over specialty decontaminants.



(Photo: US Army)

2nd Brigade Combat Team Soldiers train on CBRNE tasks.

Generic hypochlorite bleaches are useful in many circumstances, as is the mineral "Fuller's Earth". Formaldehyde and hydrogen peroxide are both useful for biological decontamination. When one examines the available proprietary decontamination solutions that are available, some are many orders of magnitude more expensive than generic equivalents. Customers may or may not feel that there is value to be had in stockpiling large quantities of expensive shelf life-limited decontamination products.

Two Upcoming US Programmes

As is often the case, the "next big thing" in military CBRN decontamination is likely to be led by a US acquisition programme. The two upcoming US programmes are the "General Purpose Decontaminant" (GPD)

for heavy equipment and the "Joint Service Equipment Wipe", both of which are behind schedule.

Steris, Allen Vanguard, the ex-Modex, and Intelagard have all sent in demonstration products. As two of these are "Sandia Foam" an easy guess may be that the GPD may easily be "Sandia Foam" with a new label. If so, you read it here in ESD first. The projected GPD procurement is likely to be about \$30 million.

The JSEW is expected in FY 2018 at the earliest, and will replace the 1990s-era sorbent-based M295 kit. US military contracts will be a reasonable worldwide marketing boon to whoever wins these contracts.

Other US programmes, such as the "Joint Sensitive Equipment System", are not likely to see procurement until well into the 2020s.

The "General Purpose Decontaminant 2" has been slated, on at least one briefing

slide, as going into production in FY 2045. The DoD is taking the long view, evidently.

Higher Standard for More Product Development

On the technology front, the frontier is largely in sensitive equipment decontamination and fumigation. This is also the segment with the most possible crossover into the civil sector, as the 2001 anthrax attacks in the US demonstrated the difficulty and expense of returning civilian facilities back to their normal use. A further line of inquiry in technology is the issue of answering the question "how clean is clean enough" to a satisfactory level.

Much US and European research has been devoted to this issue. A higher standard of post-decontamination cleanliness will drive more product development. ■

Lightening the Loads

Load Carrying Equipment, Clothing and Body Armour

Andrew White

As the operating environment continues to develop, armed forces around the world are being forced to adapt and overcome combat issues relating to personnel apparel, body armour and load carrying equipment.

Variable Concepts of Operation (CO-NOPs) and Tactics, Techniques and Procedures (TTPs) relied upon the facts that across multiple types of Areas of Operation (AOs) combat elements need to be properly equipped with modular solutions capable of being moulded for specific missions in hand. To this end, armed forces require an inventory of personal equipment capable of being operated across a multitude of civil and combat environments. The past decade of coalition operations in the Middle East and South Central Asia, in particular, have illustrated evolving trends in all of these areas, with patterns remaining cyclical, coming in and out of fashion dependent upon mission parameters. Referring to current trends in the wearing of body armour and load carriage equipment, for example, one defence source associated with the NATO Special Operations Headquarters (NSHQ) in Mons, Belgium, explained how the Special Operations Forces (SOF) had returned to wearing minimalist plate carriers for ballistic protection and battle-belt load-carrying options in the contemporary operating environment (COE). Previously, operators had relied upon carrying the majority of personal equipment attached to larger and more cumbersome plate carriers.

"The threat of IEDs – improvised explosive devices – detonating beneath you in a vehicle, could see all the contents of your pouches, integrated onto the chest of your plate carrier, pretty much slicing off your face with the power of an explosion," the source explained to ESD. "So as is the case with most SOF equipment, operators adjusted their kit and equipment to minimise this threat by repositioning it around their hips and waist to reduce similar effects."

Body Armour

According to DSM Dyneema's global business director for life protection, Marcio Manique, the most prevalent trend

across the COE is one which recognises the tactical importance of weight reduction for dismounted warfighters.

"Decision makers are looking for light-weight life protection equipment – vests, helmets, inserts – to increase comfort and freedom of movement for their personnel," Manique explained.

"Our pipeline is based on light weight, comfort and higher performance, as well as meeting the needs of specific markets. We continue to pursue radical innovations while providing incremental innovations for local market needs," he added. "In ballistic protection, any weight reduction greater than 10 percent represents a

– helmets, soft ballistics (vests) and insert plates – because they offer significant opportunities for growth. The helmet sector is currently undergoing a transformation as legacy products based on the Army model are replaced by lighter designs," Manique continued.

"Demand for insert plates for soft vests is growing because of law enforcement's need for protection against AK-47s, AR-15s and other types of assault rifles that have been used in a number of recent incidents. Both law enforcement and the military are purchasing vests that provide less weight and greater comfort as part of modernisation programmes," Manique explained.

Combat Helmets

In the area of combat helmets, current trends continue to focus on light weight and modular designs with the mar-

Photo: NATO



In the past, armed forces including the special operations community have focused on load carriage on board body armour plate carriers although this trend fluctuates due to operational environments.

major benefit. When a new technology can deliver 20 percent or even 35 percent less weight at the same level of ballistic performance, law enforcement and military organizations typically want to purchase it. We are concentrating on all three major categories of life protection

ket's most innovative solutions including programmes such as the US Special Operations Command's Family of Tactical Headborne Systems (FTHS) which is considering multiple options from Revision Military, 3M Ceradyne and Gentex. Designed to replace legacy inventories of

Photo: 3M



In 2016 3M launched the 3M Ultra Light Weight (ULW) Ballistic and Bump Helmet.

Ops Core FAST helmets, the winning FTHS solution will provide warfighters with a next-generation replacement in September 2017 onwards with options including "Coastal Marine, Riverine, Ground Ballistic, and Ground Bump" helmets which can be quickly upgraded for ballistic protection with an applique kit.

The concept is designed to reduce any requirement for operators to carry multiple combat helmets on deployments, with the add-on kit integrated onto a base bump helmet as and when required.

As a Revision Military spokesperson explained to ESD, such a "novel" idea assists in reducing the burden on soldiers, especially around the neck, which has been an area under strain with the weight of legacy low-cut combat helmets and integrated accessories. "This, coupled with the skeletonisation of all system components, has significantly reduced the overall weight compared to helmets on the market today," Revision Military explained.

The selected helmet will also be made available with a series of add-on accessories including blunt and ballistic protection mandible face guards and visors; night vision device splash shield; and lined comfort system for enhanced ergonomic fit, USSOCOM officials explained.

Vice President for Armour and Global Operations at Revision Military, Eric Houchell, explained how the development had resulted in a "product that will give some of our country's most elite forces the protection, versatility, and manoeuvrability they require for demanding operations."

Load Carriage

Despite the reverse away from all-encompassing ballistic plate carrier and load carriage ensembles, this particular area of the market is witnessing renewed emphasis on the support of dismounted warfighters by

unmanned ground vehicle (UGV) technology with options including the development of the US Army's Squad Multipurpose Equipment Transport (SMET).

Currently being considered by the army's Tank Automotive Research Development and Engineering Center (TARDEC), the SMET concept is considering alternative and efficient means of reducing the burden on dismounted soldiers who sometimes carry more than 100 lbs of equipment on patrols and missions.

The army is looking at options which would allow soldiers to offload specialist equipment as well as resupplies onto an autonomous platform capable of following a combat unit. Tasks could include Surveillance/Reconnaissance missions, as well as target acquisition (with the addition of a C4ISTAR mast); logistics support; as well as explosive ordnance disposal missions. Additionally, the platform could be equipped with communications equipment, as well as gunshot detection technology. The US Army envisages a UGV platform capable of operating for up to 72 hours in support of low level tactical combat echelons with ability to recharge on the move.

Such technology would allow dismounted close combat troops to patrol more effectively and efficiently without carrying heavy packs full of ammunition, water, food and other specialist equipment. However, the ability of a UGV to accurately navigate behind a squad in a covert/discreet enough capacity has yet to be proven and could see it quickly become redundant again in combat roles, defence sources explained to ESD.

Clothing

Finally, improvements continue to be made in the area of clothing with more efficient materiel suitable for personal camouflage as well as exo-suit technology derived from the medical industry, designed to enhance the ergonomic capacities of future soldier technology. Examples include US Defense Advanced Research Agency (DARPA) efforts in collaboration with academia, which is considering the integration of exosuit technology onto dismounted combatants with each solution comprising "battery powered sensors, motors, gears and cables" integrated into fabrics to assist warfighters with mobility, protection and situation aware-

ness of their own physical condition. Such technology will be of interest to the USSOCOM Programme Office running the next-generation Tactical Assault Light Operator Suit (TALOS) concept which is also considering the integration of exoskeleton technology onto the dismounted warfighter to assist in load carriage, extension of endurance and protection.

Conclusion

As the COE continues to evolve, armed forces globally continue to pay significant interest and investment in lightening the loads of dismounted combatants in particular as they seek to enhance not only mobility but also protection and lethality. Additional programmes and concepts include lightweight small arms ammunition as developed by the likes of General Dynamics Ordnance and Tactical Systems (GDOTS). Such technology is designed to reduce weight of ammunition by replacing brass casing with polymer materials, while maintaining bullet size and subsequently stopping power. ■



Photo: Hexonia

Using the latest ballistic fibers, Hexonia developed a knitted ballistic underwear that protects against fragments and blast. The strong polyethylene, knitted seamless, reduces the depth and number of penetrating fragments and the product's high burst load and tearing strength makes it withstand blast waves. By adjusting weave and thickness different ballistic requirements can be met.

Dutch Naval Industry

Jaime Karremann

Although the Dutch government is slowly replacing its Cold War-era submarines, frigates and mine hunters, the future for the Dutch defence industry gives reasons for concern, to put it mildly.

In November 2016 Gerben Edelijn, CEO of Thales Nederland, said in the newspaper *Tubantia* that his greatest concern was how the Netherlands deal with defence: "If our own navy isn't buying our systems anymore, we don't have a right to exist." This sounds strange especially at this moment in time, when the Dutch government is starting to replace the M-frigates, which will probably be fitted with Thales radars. Moreover, quite a few Dutch politicians said last year they were impressed by the Ballistic Missile Defence (BMD) capabilities of the new Thales SMART-L EWC radar. The concerns of Edelijn however are very understandable, when one takes a closer look. Although the Royal Netherlands Navy needs to replace more than 23 of a total of 28 ships in the coming decades, things have to change very soon and very drastically if the Dutch want a viable defence industry.

Photo: Wim Kosten



The Indonesian Navy's order of the SIGMA 9113 class corvette KRI SULTAN ISKANDAR MUDA presently outsizes any order made by the "home navy".

Author

Jaime Karremann is the Editor-in-Chief of the Dutch naval website *marineschepen.nl*.

Improvement

For the Dutch naval defence industry, 2015 was a dreadful year: Damen Schelde Naval Shipbuilding (DSNS) which has been the only Dutch naval shipyard for decades, was not even working on a single vessel for the Royal Netherlands Navy. That was the first time in the company's 142-year history, and DSNS will have to wait for years before they

will receive the next Dutch naval order. Also for Thales Nederland 2015 was a difficult year, which resulted in a reduction of its workforce by 100 jobs. For Imtech Marine, 2015 was even worse when the holding company Royal Imtech went bankrupt. Imtech Marine was taken over by Pon Holdings and Parcom, but the new RH Marine had to reorganise again and cut back 160 jobs in early 2016.

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Now things are getting better. Thales Nederland is expecting more sales and its workforce is growing. DSNS received two important foreign orders in 2016, remarkably though both for civilian vessels. One was the construction of a research vessel for the Angolan Ministry of Fisheries, worth €70M, and the other was a 156-meter ice-breaker for the Australian Department for the Environment and Energy. In the meantime DSNS is working on the second of two SIGMA class frigates for the Indonesian Navy, which was constructed in Surabaya with some modules made at the Damen Shipyard in Galati, Romania and in Flushing, the Netherlands. In December 2016 work started on two OPVs for Tunisia. Damen has been waiting for months now to receive an order from Romania for four

tional cooperation is business as usual. But even for Damen the rapidly changing environment had its surprises. For the MKS 180 bid, Damen teamed up with Blohm + Voss, and Thales worked together with several shipyards to provide sensors. The cooperation for Damen didn't go as planned when rival Lürssen Shipyard took over Blohm + Voss. Damen denied rumours it would step out of the bidding for MKS 180, but for sure the chances of winning the bid haven't improved in the new situation. After the Second World War it was mainly the Rotterdamsche Droogdok Maatschappij (RDM) who constructed the submarines for the Royal Netherlands Navy. But before the war also DSNS (De Schelde) built submarines. Damen decided to bring back submarine construction to Flushing, but it

The fact that politicians were criticising the cooperation is however remarkable. After all, Dutch politicians have been pressuring industry for years for a much closer international cooperation. They wanted not only the armed forces to cooperate internationally, but also the defence industry.

Attitude of the Government

The conflicting goals of international cooperation and preservation of national strategic capabilities compete regularly for the highest priority. In recent years, Dutch politicians often preferred international cooperation. Protecting strategic industries has rarely been on the political agenda. It only recently gained interest in the Netherlands, when in 2013 the Dutch telecommunications company KPN was almost sold to a Mexican billionaire. In 2015, the cyber security company Fox-IT, which among other things provides the security of state-secrets, was sold to a British company. An earlier sale of former Holland Signaal to Thomson-CSF, now Thales, caused even less discussion. When recently the test version of the SMART-L EWC radar tracked a satellite which was 2,000 km away from the factory in Hengelo, some Dutch journalists lauded that as a French success. Similarly, the Minister of Defence Jeanine Hennis-Plasschaert recently issued statements which did not have the interest of the Dutch industry in mind. In the Dutch parliament she commented on the replacement of the WALRUS class submarines in March 2016: "Unfortunately one can't buy submarines off the shelf. If only it were true." In order to acquire new submarines that meet the Navy's requirements, they have to be newly developed. Of course that is more complicated, but also a chance for the Dutch industry. When asked about the role of the Dutch industry in the acquisition of new submarines, she said: "I'm not here for the interests of the industry. It is all about the operational needs of the armed forces." On the other hand, Hennis-Plasschaert often stressed the importance of the Dutch industry. Nonetheless, her focus is on international cooperation and achieving a level playing field in Europe, which is difficult according to Hennis-Plasschaert because many countries favour their domestic industries. In contrast, the Dutch Ministry of Economic Affairs is very supportive, of the industry. Last September the second edition of the exercise "African Winds" was planned – an exercise and trading journey starring the landing platform dock HNLMS Rotterdam. For six weeks the ship, with marines from the UK and USA and paratroopers from Belgium, would exercise and organise train-



Photo: US Navy

HNLMS ROTTERDAM was planned to take part in the exercise "African Winds" to promote the Dutch defence industry in that area, but the trip was cancelled shortly beforehand.

corvettes for its navy, worth €800M. A much larger order might also come from Australia, which put DSNS on a shortlist together with two German shipyards for twelve Offshore Patrol Vessels (OPVs). On top of that, both Thales Nederland and DSNS are competing for the Mehrzweckkampfschiff 180 (MKS 180) programme resulting in four large multirole combat ships for the German navy.

International Cooperation

The bid for the MKS 180 is just one of many examples of international cooperation. To survive decade long budget cuts on the Royal Netherlands Navy, the Dutch defence industry was forced to shift its focus more and more abroad. This resulted in many different partnerships. For DSNS, the part of Damen Shipyard which operates around the globe, interna-

lacked the knowledge and skill to design and build new submarines on its own. When the Swedish submarine yard Kockums was bought by Saab, Damen stepped in and both companies announced in 2015 they would work together on the bid for new Dutch submarines. The Damen-Saab partnership caught the Royal Netherlands Navy off guard, and especially some politicians were not amused. By selecting a partner even before the start of the long procedure called the Defence Materiel Process which would result in new submarines being ordered, Damen seemingly reduced the options on international cooperation for politicians and the armed forces. Last September Fred Teeven, member of the centre-right VVD, said during a conference in Rotterdam he was not happy with the Damen-Saab cooperation although it is accepted by most Dutch politicians.

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Photo: Royal Netherlands Navy

The Royal Netherlands Navy contributes to security in all parts of the Kingdom of the Netherlands, including the Dutch territories in the Caribbean. Commander Netherlands Forces in the Caribbean (COMNLCARIB) is responsible for the activities of Dutch naval units in the area. There are two Dutch naval bases on Curaçao and one on Aruba.

ing for local navies and coast guards as part of African Partnership Station. In contrast to the first African Winds, the Ministry of Economic Affairs played a large role in African Partnership 2016. In cooperation with Economic Affairs and Dutch embassies in Africa, HNLMS Rotterdam would promote Dutch business during its port visits. Comprehensive programmes were developed, which made good use of the space the LPD provided. Of course, the Dutch defence industry could get a share of the promotion. Ultimately, the trip was cancelled in early 2016 when the navy had to scale down the number of sailing days. In fall 2016 the Rotterdam was deployed to the Mediterranean because of the refugee crisis. The unexpected letter Minister Hennis-Plasschaert wrote to the parliament last December is typical of the inconsistent approach of the Dutch government. Hennis-Plasschaert wrote that she intends to sign a contract with Thales in early 2017 for the development of new radars. "It is well known that Thales is one of the world's leading companies in this field. It is therefore obvious that Thales will develop the radar and fire control systems for the next generation of frigates and the Netherlands will be a launching customer," she wrote. Another important reason is that by signing the contract Hennis-Plasschaert helps Thales to meet the requirements of the German MKS 180 programme as the German Navy wants a proven system.

Future

The absence of a long-term shipbuilding plan is the root cause for contradictory and inconsistent government actions. Although

the government is well aware of its procurement goals, new ships are ordered at short notice, and the government rarely publishes information about the progress of procuring new submarines, frigates and mine hunters.

In a TV show in mid-January Minister Hennis-Plasschaert announced unexpectedly and quite casually that she wants to put before parliament a plan for the armed forces in which she outlines investment possibilities. Although this seems to be an important improvement, her proposal is of questionable value as there are general elections in March in the Netherlands, and the plan will not be implemented before the elections. It is highly unlikely that the plan will become law like the one in Belgium, which allows for long-term clarity on procurements and replacement of equipment. It seems that her plan is intended as a bid book for another term as Defence Minister.

As mentioned above, the Dutch Navy has to retire a large part of its fleet in the next decade. All the warships of the Royal Netherlands Navy entered service before 2008, except the Joint Support Ship HNLMS Karel Doorman and the four Oceangoing Patrol Vessels (OPVs) of the Holland class. One would expect a bright future for the Dutch industry, but appearances are deceptive. Procurement decisions constantly being put off have caused a kind of bow wave. Unfortunately the delay of procurement orders is not a thing of the past; the three current procurement programmes proceed very slow. For example, the next step on new Dutch submarines is not expected before the end of 2018.

It needs to be said that the budget will never allow replacing 82% of the navy in

one or two decades. There is not enough money to replace even one class of vessels, let alone 23 ships. In recent years, the €1Bn budget cut of 2011 has been reversed, but the damage to the operational units of the armed forces has been done. There is room for investments when that damage has been repaired. In any case, the Royal Netherlands Navy will become smaller rather than larger unless the budget sees a steep increase.

Even if the budget grows extraordinarily and the industry receives orders to build new ships right away, problems will not disappear as the shipyards have not enough capacity in terms of engineers, technicians and space. It is impossible to design, test and build so many sophisticated warships in such a short time span. And then there is the risk that the industry will suffer from excess capacity for years to come.

In short: the future of the Dutch defence industry is uncertain when it comes to Dutch naval orders.

There is hope, however, as Dutch companies have scored several international successes. A recent success is the Thales Nederland SMART-L EWC radar. This BMD-sensor will be installed on the first Dutch frigate in 2018 and Danish and German frigates will probably follow and replace the SMART-L radar. MARIN cooperates with the UK, USA and Australia on research on launch and recovery of small (unmanned) boats. And Damen exported a broad range of patrol vessels, corvettes and frigates.

Behind the scenes preparations are being made for the future Dutch naval vessels. For many years the Dutch Underwater Knowledge Centre (DUKC), research institutes and the Ministry of Defence have been collaborating to design a new generation of Dutch submarines. A new hull form has already been tested by MARIN. In 2015, Thales presented plans for an integrated sensor suite for the replacement of the Dutch and Belgian M-class frigates. These radars are developed from the radars in the integrated mast on the HOLLAND class. These new radars might allow Thales to attract new customers. The same applies to Damen, which prepares for the new frigates because these vessels will probably be built by Damen. Of the previous ships patrol ships were quite successful, of which a dozen are being built by Bollinger for the US Coast Guard.

Until now, the Dutch industry has to sit and wait for the government to proceed with the procurement process. The future of the navy and the industry is in the hands of the next government. Without new orders, the Dutch Navy will shrink dramatically and the Dutch naval industry will have no future. ■

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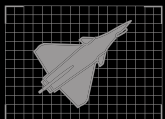
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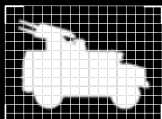
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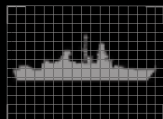
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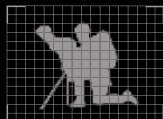
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“RUAG is currently involved in various tenders of the Brazilian Armed Forces.”

Photos: RUAG



**Interview with Lutz Kampmann,
Senior Vice President Marketing &
Sales, RUAG Defence**

The Swiss defence group RUAG will be present at this year's LAAD exhibition in Rio de Janeiro. ESD spoke with RUAG Defence's Senior Vice President Marketing & Sales, Lutz Kampmann, about the company's perspectives in the Latin American market.

ESD: As a state-owned element of the Swiss defence industrial base, what exactly are the duties and responsibilities of RUAG as a group in general and RUAG Defence in particular?

Kampmann: RUAG develops trailblazing products and internationally sought-after high-tech applications in the fields of aerospace and defence. The company uses its technological expertise combined with a long-term vision and a strong sense of responsibility to boost security and innovation in society. RUAG's tried-and-tested group strategy is based on three principles: "combining civilian and military applications", "focusing on the core business" and "international growth".

RUAG Defence has a service mandate from the Swiss Confederation to ensure that the systems of the Swiss Army are highly available and can be deployed reliably, even in crises. And as an international technology company, it also supports armed forces, search and rescue services and security organisations across

the world. By doing so, RUAG Defence plays an important role in ensuring civic security worldwide.

ESD: To what extent does the Swiss Government support or restrict export efforts of your organisation? In which export markets are you active?

Kampmann: Switzerland has clear laws and binding rules governing arms exports. These include the War Material Act, the Goods Control Act and the Embargo Act. Military applications may only be exported if they meet the relevant provisions and have passed the standard approval procedure of the Swiss authorities. RUAG Defence stringently adheres to the applicable laws and regulations at national and international level.

RUAG Defence is an international company. In addition to the European market, the company mainly targets growth markets in Latin America, South-East Asia, North America and the Middle East.

ESD: As this interview is to mark RUAG Defence's presence at this year's LAAD exhibition in Rio de Janeiro, do you have reference programmes in Latin America, particularly in Brazil? Are there any industrial partnerships with RUAG's involvement?

Kampmann: In the Brazilian defence market, RUAG focuses on various solutions in the field of indirect fire support (e.g. M109, mortars), tactical communications (mainly interoperability) and simulation and training (S&T, especially live). RUAG is currently involved in various tenders of the Brazilian Armed Forces. In the other Latin American countries, the scope of RUAG's offer is the same, with S&T at the forefront. RUAG is committed to creating value not only for the military but also for society and the economy, which is why the company is currently in discussions with representatives of Brazilian industry and academia to maximise local input and development.

ESD: Which elements of your company's product and capability portfolio do you consider to be of particular relevance/interest to Latin American markets, and what are the highlights of your display at LAAD 2017?

Kampmann: RUAG's solutions in the field of platform modernisation – notably digitisation – helps customers in Latin America make their legacy platforms fit for the digital age. Furthermore, RUAG's ARANEA solution portfolio helps customers to achieve real joint-mission readiness by connecting various communication standards and products in one communication network. Its vast experience in helping various armed forces develop their S&T capabilities and its cutting-edge S&T solutions are second to none.

At this year's LAAD exhibition, RUAG Defence showcases its high-tech 120-mm RUAG COBRA mortar system, in addition to its products and extensive expertise in the fields of live simulation and tactical communications.

ESD: In more general terms, how do you envision the development of the defence market in Latin America and especially Brazil and – from your point of view – which countries on the South American subcontinent constitute promising cooperation potential for your organisation?

Kampmann: Countries in Latin America are facing a major modernisation challenge, and are either in the process of acquiring or set to acquire new capabilities in the form of new platforms and systems. The most prominent example is Brazil's GUARANI armoured vehicle programme. The Brazilian armed forces cannot afford to replace all legacy platforms and systems at the same time. In many cases, the army has to either postpone the replacements or upgrade existing capabilities. Working in partnership, RUAG can help develop the most effective solutions for the medium term. Customers tend to end up with a varied inventory of platforms and systems that



In response to contemporary requirements for modern artillery systems RUAG Defence has developed the COBRA mortar system.

need to be able to communicate with each other. This is where RUAG can add value by ensuring interoperability. Mission success, however, is impossible without adequately trained soldiers and operators. RUAG has the experience and technology to support

its Latin American customers in getting their S&T capabilities to the right level. Currently, RUAG sees the most potential in Brazil, Argentina, Peru, Chile, Colombia and Mexico. These countries also offer unique opportunities to cooperate

with military organisations, industry and academia in order to optimise the security of supply and local development. ■

The questions were asked by Jürgen Hensel

ESD Spotlight

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Next CEO at BAE Systems: Charles Woodburn

(df) Ian King, Chief Executive, BAE Systems, has announced that he will retire on 30 June 2017. Charles Woodburn, currently Chief Operating Officer at BAE Systems, will be appointed as Chief Executive at BAE Systems from 1 July, 2017. Until that time, King and Woodburn will continue in their current roles. Charles Woodburn joined BAE Systems in May 2016 as Chief Operating Officer and Executive Board Director, following over 20 years' international experience in senior management positions in the oil and gas industry.

"After a distinguished career, Ian will retire leaving a legacy of disciplined performance, ethical behaviour, a burgeoning order book, a track record of delivering shareholder value and a strong leadership team. During his tenure as Chief Executive, Ian has built a world-class defence engineering and technology business, providing vital capabilities to our customers and contributing to the security and economic prosperity of the nations in which we operate," said Sir Roger Carr, Chairman at BAE Systems. "Since his appointment last year, Charles has made an important contribution to the company, bringing impeccable engineering credentials, broad international experience and fresh perspectives to build on our existing strengths. In his new role, he will build on an enviable inheritance to create an exciting future."

IDEX Recap

(df) According to official numbers IDEX – inaugurated with a grand ceremony led by His Highness Sheikh Mohammed bin Rashid Al Maktoum (photo) – was the most successful defence trade show that has ever been held in the Middle East North Africa (MENA) region. At least €4.93Bn worth of contracts were signed by officials of the United Arab Emirates to equip their armed forces with modern systems during the show. Over 105,000 visitors attended and 1,235 companies exhibited.

Contracts were awarded both to national and international companies. Local company NIMR was contracted to supply 1,500 JAIS 4x4 vehicles and other types to the UAE Armed Forces. The Russian state-owned agency Rosoboronexport

Photo: Dorothee Frank



won a contract to supply the UAE with 5,000 anti-armour missiles worth several million Euros. The US company Raytheon and the European company MBDA Systems each won multi-million Euro contracts to deliver missiles.

The technologies on display came from all over the world – from assault rifles to communications, tanks, vehicles, missiles, fighter jets, robots, helicopters and even cyber defence and cyber security. The world moved a little bit closer during the four days in Abu Dhabi, when the major defence companies showed their solutions for fighting off "the bad guys". Since the region has not become any safer over recent years, the UAE need these systems to keep their country safe. The next IDEX will take place in Abu Dhabi in February 2019.

HENSOLDT Starts with CEO Thomas Müller

Following closure of the transaction between Airbus Group SE and KKR, a leading global investment firm, a new European defence company headquartered in Germany, HENSOLDT, has been launched.

The new company employs 4,000 highly qualified staff, about 3,400 in Germany and 600 in South Africa. The main industrial sites are Taufkirchen/Munich, Ulm, Friedrichshafen and Oberkochen in Germany and Pretoria in South Africa.

A dedicated representative office in Berlin has been established and several offices represent the new enterprise in countries like India, the USA, Chile, Brazil, South Korea and Spain. HENSOLDT will provide leading edge technology solutions to armed forces and security agencies.



Photo: HENSOLDT

The new company, headquartered in Taufkirchen near Munich, will be led by an Executive Committee with Thomas Müller as CEO.

Harris Wins Contract

(jh) Harris has received a two-year, \$189M contract to provide an integrated Battle Management System (BMS) to the United Arab Emirates Armed Forces. The contract was received during IDEX. The system will provide the UAE with initial operational capabilities as the country implements enhanced battlefield management solutions. The contract was issued under the Emirates Command & Control System (ECCS) Land Tactical System (ELTS) programme, a major C4ISR programme that will integrate, coordinate and maximize the combined efficiency of UAE Armed Forces assets.

New Director OCCAR-EA

(gwh) Brigadier Arturo Alfonso-Meiriño has been introduced as the new director of OCCAR-EA by the Chairman of the Board of Supervisors, Ministerial Director Hubert Blahník (German MoD). On 1 March 2017 he succeeded Tim Rowntree,



Photo: OCCAR

who served as director of OCCAR-EA for the last four years.

Since 2011 Alfonso-Meiriño has been chief of International Relations within the Spanish armaments authority DGAM (Dirección General de Armamento y Material). Prior to that he was Industry and Market (I&M) Director of the European Defence Agency (EDA).

UAE Procures Anti-Ship Missiles From MBDA

(df) During IDEX MBDA was awarded a contract by the UAE Navy to supply additional MARTE MK2/N anti-ship missiles. This is a follow on to the contract signed in February 2009.

Each high speed multi-role combat vessel of the UAE Navy will be equipped with

Photo: MBDA



four-canister launchers. The MARTE Mk 2/N guided missile is able to strike targets at ranges in excess of 30 km, flying a fire-and-forget sea-skimming profile using mid-course inertial guidance and active radar homing.

Antoine Bouvier, CEO of MBDA, commented: "I am delighted that the UAE has confirmed the trust placed in MBDA for its defence requirements. MBDA is one of the country's leading defence suppliers and will continue to show our long-standing commitment and support for the UAE Armed Forces."

Pasquale Di Bartolomeo, MBDA's Executive Group Director Strategy and Managing Director of MBDA Italia, said: "This new contract reaffirms MBDA preeminence in the anti-ship sector and it is a clear proof

of the technology leadership of the MARTE missile family that, over the years, has continued to be competitive and able to respond to increasing customer requirements, thanks to its modular design."

Supacat and RMMV NL Team for Dutch Tender



Photo: Supacat

(df) Supacat and Rheinmetall MAN Military Vehicles Netherlands (RMMV NL) have teamed for the tender of the Dutch Army to procure new vehicles. Under the teaming agreement and in the event of contract award, the Supacat-designed vehicles will be built by RMMV NL and the production line will be supported by their existing supply chain in the Netherlands. The Royal Netherlands Army has started the Wheeled Vehicle Replacement Programme (DVOW)

in order to exchange the ageing platforms in its existing vehicle fleet. Both companies hope to improve their prospects through cooperation. The proposed solution includes substantial local industrial content for a fleet of more than 500x 12kN air assault vehicles (AASLT) and 900x 12kN light-weight protected vehicles.

Leonardo and PGZ Team for Helicopters

(df) The Polish Armaments Group (PGZ) and the Italian company Leonardo have signed a helicopter-related Cooperation Agreement. This agreement focusses on the recently published procurement plans of the Polish Ministry of Defence. "The aim of the agreement is to strengthen cooperation between the PGZ Group and Leonardo for the supply of helicopters offered by the Italian company to the Polish Ministry of Defence," Leonardo stated. It includes the AW149, AW101 and W-3PL GLUSZEC models. Should Leonardo be selected by the Polish MoD for the new helicopter requirement, companies in the PGZ Group will take part in the servicing and manufacture of helicopters. This

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also involves extension of the industrial capability of the companies included in the PGZ Group in servicing or production of components, systems or levels of the chosen helicopter.

CONTROP Appoints New Vice President Marketing & Sales

(pb) CONTROP Precision Technologies Ltd. – a company specialising in the field of electro-optics and infrared defence and homeland security solutions – has appointed Hagay Azani as its new VP Marketing and Sales. He will be responsible for increasing the company's international activities by developing cooperation with strategic partners in target countries. Furthermore he will work with the company's R&D department to create the roadmap for future offerings. Since 2012, Hagay Azani has served as CONTROP's Chief Operating Officer (COO), and in this



Photo: CONTROP

role was responsible for managing the company's pre-sale and post-sale programmes and activities. He served in the Israel Defense Forces in a wide variety

IDET, PYROS and ISET 2017

(pb) Security has become a clear priority. At a time of increased risk of new outbreaks of war and terrorist attacks as well as other threats, governments tend not to hesitate to invest in defence and security technology. In the Czech Republic, companies introduce their novelties for security forces at specialised trade fairs, which have included IDET in Brno since 1993. This year on 31 May, its fourteenth edition begins, again in partnership with PYROS and ISET, trade fairs which present fire and safety equipment and services. Participation in the fair is already attracting considerable interest since the Ministry of Defence and the Czech Police and Fire Rescue Brigade increased their budgets for medium-term purchase plans.

IDET is an essential platform for the presentation of the Czech defence and security industry. As in previous years, it will offer exhibiting firms direct contact with both domestic and foreign customers. As an exhibition of defence technology in Central and Eastern Europe, it regularly enjoys the participation of the Ministries of Defence of Poland, Hungary, Slovakia and other countries, while delegations of ministries of defence from many countries around the world arrive to attend the fair.

The Brno Exhibition Centre facilitates presentation of technology in action in a unique outdoor field named IDET ARENA, which will feature dynamic demonstrations of military, fire and police technology in action for all visitors during the fair.

ESD is an official partner of the exhibition.

More information: www.idet.eu



of roles, including Lt. Col. in the Rocket Division of the Artillery Corps. He is an Industrial Engineer with an Executive MBA from Bar Ilan University.

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