

# European Security & Defence

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## Infantry Firepower

- Russian Naval Threats
- Defence Modernisation in Austria
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# Putin's Strategic Error



Europe is on the eve of an anniversary which nobody is particularly inclined to celebrate. Five years ago, in March 2014, Russia annexed the Crimean peninsula. The Western world was shocked, and not only because fundamental principles of international law were being trampled on. No less offensive was the cynical attempt to cloak an act of aggression under the guise of a manipulated referendum as enforcement of the right of self-determination. Following the end of the dictatorships of the 20th century, something like this really should have been unthinkable on the European continent. Even during the Cold War, the changing of borders by the use of force was a taboo which nobody dared to break. Post-communist Russia, which many had courted as a partner for stability in Europe, had without a second thought broken all the bounds.

Putin would undoubtedly not have considered this deadly step, had his allies in Ukraine been successful in the months-long power struggle against the pro-West Majdan opposition.

But now, with President Yanukovich overthrown and fled to Russia, he took the view that a scorched earth policy was the order of the day. If Ukraine, after centuries of common cause, initially under the tsars and latterly as part of the Soviet Union, was no longer to stand as a partner state at Russia's side, then Moscow's response was that there would be a high price to pay for the betrayal.

The consequences of this destructive policy are serious, and far reaching. The hybrid war which Russia is waging together with its separatist partisans in the regions of Lugansk and Donetsk, despite a putative ceasefire, continues to claim victims and tie up resources: around one fifth of Ukraine's state expenditure goes on defence. Regions in the eastern part of the country which were once industrially highly developed have been laid waste, or at the very least have become detached from what is in fact their real economic area. With a GNP growth of just three per cent, the per-capita income can only grow at a snail's pace in relation to the far higher European standard. For the young generation that is too slow. Since the lifting of visa requirements for EU states in June 2017 there has been an exodus of qualified workers. But while European states with over-aged societies are seeking in this way to resolve their problem of lack of skilled people, they are nevertheless very reticent, with an eye to Russia's reaction, when it comes to providing Ukraine with economic support, let alone contributing to its security. Here too, the alleged soft power of the European Union, which is still vaunted as its inherent style of politics, is in fact nothing more than euphemistic sweet-talk to cover the actual weakness in security policy. In Kiev, they are very well aware of this. If reliable partners are being sought in defence against the threat from Russia and separatists, then eyes turn to Washington, and, following that, perhaps even to Ankara, but not to Brussels.

But Russia itself is also paying a high price for its destructive policies. In the short term, it may have succeeded in giving Ukraine an exemplary punishment, and countries in the immediate neighbourhood who might have assumed they could take certain liberties with regard to Moscow may well have understood the warning. But seen in the long term, Russia has backed itself into a strategic dead-end, from which there is no escape without serious loss of face.

The chances of coming to an understanding with Ukraine and the resumption of constructive relations are slim, although this is precisely what would be in the interests of both sides (and not solely for economic reasons). Instead, the relationship is in ruins, and will remain so. Thousands of Ukrainian families mourn their losses to a war orchestrated by Russia. The mistrust of the Ukrainians - Russia at heart does not regard them as an independent nation but as secessionists - is very considerable, and justified. This means that Putin may go down in Russian history as the man who allowed a nation of "brothers" to become bitter enemies. And more still: Russia has also manoeuvred itself into a fatal position in its relationships with the West. At the present time, it is nearly impossible to grasp what Moscow could possibly hope to gain from the course of confrontation it has adopted. But what will happen if the realisation dawns in the Kremlin, either still while Putin is in office or under a successor, that it would actually have been a better idea to opt for partnership with the West? If Russia had not annexed the Crimea, adopting such a change of course would probably have been relatively uncomplicated. But we are now faced with faits accomplis which it will be very hard to lay to rest. Five years ago Putin directed Russia along a strategic path from which any deviation will be very difficult.

**Peter Bossdorf**

## Russian Naval Threats



Photo: MoD Russia

The entire Black Sea is a naval hotspot.

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## Bundesheer Modernisation



Photo: Bundesheer/Harald Minich

Will Austria invest more in procurement?

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Photo: Airbus

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## ■ Collision Warning Radar for UAVs

(df) HENSOLDT has successfully concluded flight tests with its collision avoidance radar system for UAVs, the company has announced. This sensor shall improve safety in military and civilian air traffic. During the flight tests, which were carried out on behalf of the German procurement authority BAANBw and in collaboration with the German Aerospace Center (DLR) in Brunswick, the



Photo: HENSOLDT

radar demonstrated its capabilities in a real setting, thus confirming the results previously achieved in ground tests. In test flights lasting several hours, the radar installed in a Dornier Do 228 belonging to the DLR reliably detected the test aircraft approaching at different altitudes and angles. The detect-and-avoid radar system uses AESA technology (Active Electronically Scanned Array), which allows several detection tasks to be carried out at the same time and enables objects to be detected extremely quickly. A second series of flight tests is planned over the coming year.

## ■ Composite Rubber Tracks from Soucy

(df) Soucy Defense Division exhibited their Composite Rubber Track (CRT) at the Canadian Pavilion during IDEX 2019. These tracks are operationally proven, serving in conflict theatres such as Iraq and Afghanistan on Canada's M113, the UK's BVS10 (VIKING) and Norway's CV90 vehicles. This track so-

Photo: Soucy Defense



lution has undergone several assessments with one of the newest trials being conducted under a joint programme with BAE Systems on a WARRIOR Infantry Fighting Vehicle (IFV) at the UK's Armoured Trials & Development Unit (ATDU), where its advantages surpassed expectations. The 5,000

km, 3-month trial was conducted to strict mission profile parameters directed by the UK MOD, ensuring the CRT was trialled in a realistic operational environment. The 5,000 km durability was fulfilled and an additional 3,000 km extrapolated by the engineering teams. CRT is integrated onto several different armoured vehicles across different vehicle weight categories worldwide, including M113 variants, BRONCO, CV90 and the Polish BORSUK, proving the diversity of CRT as a system. With CRT being on average 50% lighter than conventional steel track and able to operate in temperatures up to 50° Celsius, it is thought that more and more middle east nations may seek to integrate CRT onto platforms such as BMP3, M109 and the MCV-80 DESERT WARRIOR.

## ■ EXPAL Mortars for Switzerland

(gwh) The Swiss procurement office, armasuisse, has ordered 81 mm mortars for the

Photo: EXPAL



Swiss Army from EXPAL Systems in Spain. In 2015 armasuisse initiated the programme with market analyses and technical comparisons to replace existing 81 mm mortars. After final validation, EXPAL was awarded the contract. EXPAL has improved its renowned mortar system in terms of accuracy, reliability and speed and offers it as a complete solution. In addition, the EIMOS fire control system, the SHEPHERD-MIL Mini-UAV as an unmanned forward observer, and a simulator for training are offered.

## ■ BLACK HORNET Nanodrones for France

(gwh) FLIR Systems has been awarded a contract by the French procurement authority Direction Générale de l'Armement (DGA) to support the French Operational Pocket Drone (DrOP) programme. For up to €78M, FLIR will supply BLACK HORNET nanodrones to be used as Personal Reconnaissance Systems (PRS). One system consists of two drones and a ground station for control and result monitoring. The BLACK HORNET PRS is the smallest combat-proven Unmanned Aerial System (UAS) and is currently deployed in more than 30 countries. BLACK

Photo: FLIR



HORNET PRS arms modern warfighters with an easy to carry, truly pocket-sized solution they can deploy anywhere day or night for immediate covert situational awareness. Equipped with electro-optical infrared sensors and the ability to fly for up to 25 minutes, the BLACK HORNET closes the gap between airborne and ground-based sensors and offers the same position and hazard detection capabilities as larger unmanned aerial vehicles.

## ■ Intelligent Rail for Handguns

(gwh) The US Army has certified the T-Worx intelligent equipment rail. Accessories such as optics and range finders are attached mechanically and optically to the weapon quickly and securely using equipment rails - such as the well-known Picatinny rail. The T-Worx rail offers additional power supply for accessories and data connections. This enables easy integration into C2 systems.

Photo: T-Worx



Central power supply contributes to weight saving. The T-Worx rail is to be incorporated into the "Next Generation Squad Weapon" programme for the future.

## ■ New Remote Weapon Stations for Japanese Frigates

(sk) The Japanese Ministry of Defence has contracted the newly developed Machine-gun Mount for Surface Combatant indigenous Remote Weapon Stations (RWS) for new surface combatants of the Maritime Self Defence Force (MSDF), namely two 30FFM (FFM = Frigate, Multifunctional and Mine Standard, displacement: 3,900t). The frigates have been contracted with Mitsubishi Heavy Industries, same as the second unit of the ASAH class, DD SHIRANUI (standard displacement: 5,050t)



which will enter service in April 2019. The MoD will procure 22 FFM with deliveries completed by 2037. The RWS on order are the first remote weapon stations to enter service with the Japanese Self Defence Forces. The costs for four RWS for the two units amounts to JPY152,150,400 (€1.2M), the two 2 RWS for SHIRANUI are JPY43,200,000 (€ 340,000), excluding the costs for weapons. The RWS are based on a development for vehicles of the Ground Self De-



Photo: Shinichi Kiyotani

fence Force (GSDF) by the Technical Research and Development Institute of the MoD. The main contractor is Japan Steel Works, Ltd. The systems were developed and tested between FY2009 and FY2011. The RWS

is equipped with a thermal imager, stabiliser, video camera, laser range finder, and automatic tracking system and is compatible with machine guns of the calibres 5.56mm, 7.62mm and 12.7mm, as well as 40mm automatic grenade launchers.

#### ■ Sky Power Launches SP-210 FI TS Engine

(jh) Following the recent presentation of the SP-110 FI TS, Sky Power GmbH is launching another new product, its second newly developed 2-stroke engine. The SP-210 FI TS is based



Photo: Sky Power

on the same engine concept and can optionally be offered without a system carrier. The engine produces up to 8.2 kW at 5000 rpm and has a system carrier identical to the SP-110 FI TS, mounted above the cylinders along with the HKZ215 ignition system and the engine injection

system. The injection system, as well as the system carrier, are mounted on the engine. All data lines of the sensors, which gather engine data at a variety of measuring points and transmit these to the ECU030, are bundled on the system carrier. In the event of faults the system carrier can be dismantled completely, following which a new system carrier can be integrated. Due to the passive ignition system, which is controlled by the ECU030, the engine is operational after just a few minutes.

#### ■ Estonian Minehunter Upgraded

(ck) Babcock has completed a capability upgrade on the first of three Estonian Navy minehunter vessels. EML ADMIRAL COWAN, the flagship of the Estonian Navy and part of its minesweeping flotilla, underwent a five month docking period at Babcock's Rosyth facilities in Fife between July and December 2018. Under contract to Thales UK, Babcock integrated an upgrade package on the former SANDOWN class minehunter, which included fitting the Thales 2193 Sonar, an upgraded navigation system,

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Photo: Babcock

as well as the Thales M-CUBE command and control system, along with several other upgrades. ADMIRAL COWAN will now return to Estonia prior to undergoing trials in the North Sea to demonstrate full operational capability. In December 2018, the second Estonian Navy minehunter, EML SAKALA, arrived at the Rosyth site to undergo the same package of work. This will be followed by EML UGANDI in the Spring of 2019.

## ■ Smart Mission Display for Airborne Forces

(gwh) ESG Elektroniksystem- und Logistik-GmbH has developed the Smart Mission Display (SMD) - integrated mission system for airborne police, border control and military forces. The small dimensions (24.9 x 15.7 cm) allow integration in both cockpit and passenger areas and mobile use on an optionally available leg support is also possible. The fully encapsulated SMD has a high-resolution 9-inch (HD) daylight and night vision touch screen (suitable for gloves), a powerful processor and a removable battery. Extensive environmental tests according to MIL-STD-810G, RTCA DO-160G, MIL-STD-704F and MIL-STD-461G have already been completed. Other distinguishing features when compared with commercial tablets



Photo: ESG

include military connectors, UN 38.3 and IEC 62133 battery approval, and an aerospace standard manufacturing process. A range of leadership and management software products is available for various missions, and the system includes software and hardware interfaces and data

processing up to NATO Secret. ESG will demonstrate the SMD at the HAI Heli Expo in Atlanta, USA.

## ■ Indian Navy Contract for IAI

(ck) Israel Aerospace Industries (IAI) will provide follow-up services for the Indian



Photo: IAI

Navy's MRSAM (Medium Range Surface-to-Air Missile) systems to a total value of US\$93M. The agreements involve follow up orders for maintenance and other services for various sub-systems of IAI's advanced MSRAM ADS. In January 2019, the Indian Navy, in collaboration with IAI, held an interception test aboard INS CHENNAI, which assessed for the first time potential collaboration between ships. The successful interception demonstrated how the operational force of the defence system "can be doubled regionally, rather than topically" in the company's own words. The MRSAM family is an air defence system used by Israel's and India's navies, and has achieved over US\$6Bn in global sales.

## ■ Training Software for Modern Warfare

(ck) IXTROM, a software engineering company, has developed a training and simulation software called IXVMS (Visualization, Modelling and Simulation Collective Training Management and Awareness System) that prepares soldiers for modern warfare. IXVMS is designed to enhance military training while enabling interoperability with multiple participants across multiple domains. It is a web-based collaborative training platform to support planners in the design and execution of simulations and exercises. The software allows prioritisation of mission objectives

with explicit resourcing conditions while participants are given rights and restrictions according to their role and responsibility within the exercise organisational structure. The software enables various groups and organisations from multiple domains – Land, Maritime, Air, Cyber, Civilian organisations and others – to interoperate and work together. IXVMS is rapidly deployable and interoperable with the vast array of Command, Control, Battle Management, and Communications systems.

## ■ Blast Mitigating Seats

(ck) The US-based company Jankel Tactical Systems, a designer of armoured vehicles and survivability systems, has been awarded three contracts to supply their BLASTech mitigation seats to a US based MRAP provider. The contracts have a total value of several million dollars. Under these contracts, Jankel will be delivering MK 2.5 BLASTech X900194 commander seats and X900003 troop seats in support of MRAP based programmes which aim at upgrading these tactical wheeled vehicles that have now had older Jankel seats fitted for almost a decade. These latest orders will be delivered by mid 2019. Jankel has also presented its latest and most advanced MK 4.0 BLASTech blast mitigating seating line. The new seats have been developed to be lighter in weight and more competitive in terms of price than the existing MK 2.5, 3.0, and 3.5 designs, while delivering increased capability.



Photo: Jankel

## ■ More Capabilities for GENASYS Platform

(ck) Marvin Test Solutions, Inc., a provider of test solutions for military, aerospace, and manufacturing organisations, has announced the release of the new GX6188 High Density Matrix 6U PXI switch card for test applications. The GX6188 is compatible with the GENASYS platform. The GENASYS architecture incorporates "any resource to any pin" architecture and the end-to-end switching software SWITCH-EASY, which greatly simplifies the routing



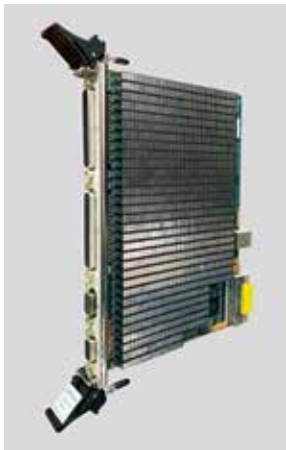


Photo: Marvin Test Solutions

of signals from an instrument resource to the UUT. Additionally, GENASYS switching modules include on-board circuitry for counting and recording the total number of relay closures, providing prognostic data for predicting

relay life. Building on the architecture of the GENASYS platform, the GX6188 features an integral, 3-dimensional 104x8x8 switching architecture which accommodates multiple resources and facilitates the creation of larger switch matrices through the interconnection of multiple cards to the 8-wire global bus which is available on the GX6188's front panel.

### ■ Peli Modular Light

(gwh) Peli has launched the Model 9600 modular LED light with high luminosity. A rectangular housing accommodates two rotating light strips that together emit light



Photo: Peli

of 3,000 lumens. Power consumption is 24W. The design and associated cables allow several lights to be connected in series to increase output. Integrated mounting brackets allow the lights to be mounted on masts up to three metres high. This allows good illumination of paths, squares and facilities. The scratch-resistant polycarbonate cover protects the LED lighting elements and distributes the light evenly. Robust construction with internal shock absorption allows the light to survive drops from a height of 1.80 m onto concrete. Last but not least, the stackable light can be transported in a space-saving manner.

### ■ Personal Power Management from Revision

(gwh) The US Marine Corps and the Air National Guard (ANG) have now introduced Revision Military's NERV CENTR Power Management Systems. NERV CENTR elements are operated as a portable system on the body of the individual soldier. Based on a lithium battery, the system distributes power from the central battery to multiple consumers. The battery can be replaced during operation (hot-plug-in) and charged via the manager. The system consists of the NERV CENTR SharePack Power Manager, a NERV CENTR SoloPack battery, an Enhanced Charger and selected cables. In addition to the plug adaptation for PRC 117G radios, an app for mobile telephones has been delivered that supports intuitive operation of the system. The ANG uses the



Photo: Revision

systems for Joint Terminal Attack Controllers, who use them to operate reconnaissance and fire control systems. The operating time exceeds 20 hours.

### ■ New Radar Sensor for PREDATOR B UAS

(gwh) General Atomics Aeronautical Systems (GA-ASI) and Raytheon Germany have integrated the recently developed Advanced Radar Detection System (ARDS) into an MQ-9 RPAS (PREDATOR B). For the test, the electronic reconnaissance sensor was mounted in a pod under the wing. ARDS is a fully digital, high-precision radar detection sensor developed by Raytheon Germany. It is a platform-independent follow-up development of the digital Emitter Location System (ELS), which is now in operation on the TORNADO ECRs (Electronic Combat / Reconnaissance version) of the German Air Force. In flight tests against ground radar targets, the system checked its performance in terms of processing speed and geolocalisation accuracy. In addition to sensor performance, the use of aircraft data link and ground station elements was successfully demonstrated. Precise direction finding and identification of multiple civil

radars was demonstrated, with the resulting data downloaded in real time to the aircraft's ground control station. The



Photo: GA-ASI

flight test was a jointly funded initiative of GA-ASI and Raytheon Germany. For GA-ASI, this means an expansion of the sensor options and operational spectrum of its MQ-9 aircraft. For Raytheon Germany, this commitment was an important milestone in the international marketing of ARDS, which was developed exclusively in Germany as a non-ITAR, "sovereign payload".

### ■ Bundeswehr to Modernise G22 Sniper Rifles

(ww) The Bundeswehr is modernising its G22 and G22A1 sniper rifles. Accuracy International Ltd., (AI) and its German representative, Pol-Tec, from Fürth,



Photo: via author

will upgrade all 780 weapons to the G22A2 standard by 2020. The G22 was introduced in the course of a new sniper concept in the mid-1990s: AI and Pol-Tec presented the G22A2 in 2018 for the first time. The most striking difference is the new stock of the AX series. It replaces the old standard AWM-F, which is no longer in production. The AX stock features a long STANAG 4694/Mil-Std 1913 rail on the top and patented AI KeySlot interfaces on the side. This offers a high degree of modularity. The shoulder rest can be folded to the right side of the weapon. The G22A2 is now available in the AI Pale Brown colour. Also new is the Steiner Military 5-25 x 56 rifle scope with the TRemOR 3 reticle, which is also used on the G29 sniper rifle. This should standardise training and handling. The existing caliber of 7.62 x 67 mm (.300 Winchester Magnum) is retained for the new G22A2.

# Russian Naval Threats in the Black Sea

**Stephen Blank**

**When Russia invaded Ukraine it triggered the militarisation of the Black Sea. Today, the entire Black Sea region is a military hotspot with constant and growing Russian threats.**

The November 2018 incident in the Kerch Strait and Sea of Azov where Russia rammed and boarded Ukrainian ships and then seized Ukrainian sailors amounts to an act of piracy that obliges us to refocus our attention on the Black

This incident highlights not only Moscow's mission to undermine if not destroy the Ukrainian state but also its equal determination to convert the Black Sea and its maritime approaches like the Sea of Azov and Kerch Strait, into a closed Russian sea,

Azov by resorting to force and even piracy. Even before this incident, the entire Black Sea had become a military hotspot with constant and growing Russian threats and allied ripostes. But it has grown worse since then as Russia continues a buildup of Russian forces there along with its illegal encroachment on Ukraine. These threats and ripostes include aerial overflights and shadowing of naval vessels that are generally initiated by Moscow, not NATO. But NATO members like Germany, the UK, and the USA, are now sending more ships into the Black Sea as a matter of course. And NATO has labelled the Black Sea as a priority. These developments are the latest fruits of Moscow's invasion and annexation of Crimea in 2014.



Photo: US Air Force

*A Russian Su-27 FLANKER intercepting a US Air Force B-52H STRATOFORTRESS. Flight intercepts are a regular occurrence.*

Sea. We now know that Russia's ramming, firing upon, and seizing of Ukrainian ships in the Kerch Strait and imprisoning their sailors on 25 November 2018 was an act of premeditated aggression. Typically Moscow also preceded the operation with an information warfare "fake news drive."

## Author

**Dr. Stephen Blank** is a Senior Fellow at the American Foreign Policy Council. He is the author of numerous foreign policy-related articles, white papers and monographs, specifically focused on the geopolitics and geostrategy of the former Soviet Union, Russia and Eurasia. He is a former MacArthur Fellow at the US Army War College.

a Mare Clausus. A major reason for this determination is bound up with defending those waters against a presumed NATO attack but also with claiming the imperial heritage of a great Mediterranean and Middle Eastern power as well as hegemony over the Black Sea. In turn, reclaiming that imperial and Soviet heritage means retaining a permanent capability in the Mediterranean to deter NATO and other adversaries and project offensive power beyond Russia and the former Soviet Union's boundaries.

Russia's invasion of Ukraine in 2014 triggered the militarisation of that Sea and that militarisation represented the precipitating factor of this incident. Apparently, the immediate precipitating factor in the Kerch Strait incident was that Russia sought to prevent Ukraine from further reinforcing its maritime forces in the Sea of

## The Militarisation of Crimea

Moscow's determination to retain the fruits of its aggression and close the Black Sea, juxtaposed to NATO's growing resolve to keep that sea open to its warships, support Ukraine, and prevent further Russian encroachments creates a very tense situation. Since invading Ukraine and annexing Crimea, Moscow's main theatre of military reinforcements has been here — not the Baltic — and it has deployed a formidable combined arms force to the Black Sea, including nuclear-capable missiles, not only to deter NATO but also to project power outward. Indeed, Moscow has recently conducted drills near the Black Sea coast for a scenario where Russia is attacked by a chemical or nuclear weapon. But there might also be a nuclear component to all this as at least one Russian military expert, the correspondent Pavel Felgengauer says there is "no doubt" that Putin has placed nuclear missiles into Crimea. Russia has also deployed nuclear-capable weapons to the Black Sea while building a nuclear storage facility there, claiming that it is Russia's territory; therefore it can deploy whatever it likes there and suggesting it will base if not deploy nuclear weapons there. And since the Kerch Strait incident Russia has taken steps to reinforce this Black Sea force with new BUYAN class cor-



vettes armed with the medium-range nuclear-capable sea-launched KALIBR cruise missile. Russia has also just announced the development of a new version of the KALIBR with a range of over 4500 km for deployment on frigates and submarines. The recent announcement that Russia will leave the INF Treaty and develop a land-based version of this missile also adds to the layered A2AD bubble for the Black Sea and beyond.

There is no doubt that Moscow has introduced nuclear-capable platforms into the Black Sea. Indeed, Russia in 2014 claimed the right to introduce nuclear weapons into Crimea since it was Russian territory no longer covered by the Budapest Agreement of 1994 banning nuclear weapons in Ukraine. Subsequently, in 2015, Vladimir Putin has approved basing two dual-capable systems in Crimea: the ISKANDER-M short-range ballistic missile and Backfire bombers. Also since then, Ukrainian officials have charged that such nuclear-capable or dual-use weapons have been deployed to Crimea. In 2014 as well, General Phillip Breedlove (USAF), then SACEUR (since then retired), announced that Moscow had deployed nuclear-capable weapons in Crimea. Even more alarmingly, hacked EU cables reveal the EU's concerns that Moscow had actually deployed nuclear weapons in Crimea. Certainly, the hostility to NATO is palpable. Meanwhile, Kalashnikov is about to start building warships in Crimea, further signifying Crimea's militarisation. Beyond highlighting the apparent nuclearisation or at least deployment of weapons of mass destruction in the Crimea, these deployments also provide evidence of Moscow's belief that it will have to fight under conditions of nuclear operations.

Among the weapons being deployed are nuclear-capable KALIBR sea launched cruise missiles that have now also been deployed to the coast of Syria. It is clear that Moscow intends to raise the spectre of nuclear escalation in the Black Sea and the Mediterranean. Thus, today we are at a point where prominent experts, for example, James Sherr of Chatham House, and former USAREUR Commander Lt. General Fredrick (Ben) Hodges (USA ret.) all see "the wider Black Sea region as the major area of potential friction with Russia in the next decade."

## Threats Against Ukraine

At present, the specific threats we see in the Black Sea are directed against Ukraine and Romania. But because Romania is a NATO ally and Ukraine is steadily drawing

ever closer to European security organisations who identify its cause with their own, any further fighting in this maritime zone is fraught with danger and is unlikely to be confined to the Black Sea. Indeed, there is good reason to believe that naval operations in and around the Black Sea

ticipated in the Vostok-2018 operation in the Far East suggests its preparation for a potential "desant" upon Ukraine's Black Sea coast. The many signs of a buildup of Russian land and naval forces around Ukraine suggest that in the spring, when the roads are more passable, we could see

Photo: US Department of Defense



***A Russian Su-24 FENCER attack aircraft repeatedly flew near the USS DONALD COOK in international waters in the Black Sea on 12 April 2014, the Pentagon reported. In recent years, incidents like these have become a frequent occurrence.***

will inevitably entail operations on shore and against land-based forces and defences in both countries. Russian writers, in assessing the lessons of Syria, have argued that, "It follows from what has been said that in implementing future construction plans for new submarines, and also in the modernisation of the majority of the surface fleet, the Russian Navy will, by the end of the next decade, be capable of carrying out massed missile strikes against the surface and land targets of the likely opponent. Each fleet will have enough ships and submarines armed with KALIBR and POLYMET-REDUT missiles to have a seriously enhanced combat capability". Beyond this possibility or possibly combined with it, is the option of an amphibious operation on Ukraine's coast to isolate Mariupol and the southern Ukrainian coast all the way to Odessa from the Ukraine. This amphibious operation could easily entail ship-based massed fire strikes. Another possibility is the use of Russia's airborne forces alone or in conjunction with an amphibious operation or a naval operation based on fire strikes from ship to shore. The fact that Moscow's entire airborne force par-

an offensive along these lines. Certainly many Ukrainian officials and foreign experts are warning about these types of potential contingencies. And in fact, Russian corvettes now have the mission of supporting ground operations. Moreover, nuclear submarines also have the mission of shooting GRANIT anti-air missiles at incoming targets as well as the supersonic naval version as an anti-ship missile. Indeed, there is good reason to believe that the original military objective of the Ukrainian campaign in 2014 was to carve out a belt of Russian territory embracing Donetsk and Luhansk provinces in Ukraine, Ukraine's entire Crimean coast and Crimea itself all the way to Transnistria, thus destroying any basis for Ukrainian independent statehood, amputating its territory, and creating a new jurisdiction called "Novorossia". The plan apparently entailed inciting uprisings in Odessa that would be the trigger for a force of 2000 previously deployed Special Forces at Tiraspol airport in Transnistria to march the 80 km to Odessa and annex not only Crimea but also all of Ukraine's Black Sea coast and Transnistria to Russia in a single contiguous belt. So Russia's current opera-

tions here along with the construction of the bridge over the Kerch Strait that has triggered the activity in the Sea of Azov suggest both the persisting objective and consistency of the operation to create an unbreakable and irrevocable land bridge from Russia to Crimea if not beyond.

Moscow's blockade of the Sea of Azov appears likely to extend to the coast of Ukraine, including Odessa, and may also be directed at seizing energy deposits that still remain under Ukrainian control on Ukraine's Black Sea shelf or even under the shelf just as the seizure of energy facilities was a primary

of Azov to harass and then evict Ukrainian shipping from the Sea of Azov, waters that both states have officially described several years ago as important "internal waters." So even though technically Moscow may be legally within its alleged rights, it has essentially instituted a floating blockade of Ukrainian ships in the Sea of Azov and down the coastline to Odessa. In effect, if not formally, Moscow has declared a unilateral maritime exclusion zone in the Sea of Azov and is seeking to have the Black Sea declared off limits to NATO vessels except those of other littoral states.

possibility that there is shared military learning occurring between Moscow and Beijing or at least their navies. Numerous recent statements suggest that the Sino-Russian partnership is indeed an alliance, albeit an informal one and that maritime cooperation like this example of shared learning is an important part of it. Similarly, Iran's threat to close the Strait of Hormuz partakes of this similar mindset that aims to threaten the principles of open navigation and freedom of the seas. Indeed, Iran's contentions that it has taken full control of the Strait are fuelling a potential escalation of tensions with the US and could lead to military actions in these waters.

Thus these cases suggest not just a unity of purpose among Iran, China, and Russia as well as shared learning, they all reflect a trend towards using the tools of lawfare and "gray area operations" below the level of actual combat to wage what some have called hybrid naval warfare against the West. As Admiral James Stavridis (Ret), former SACEUR of NATO, observed, before Russia began its campaign, Iranian and Chinese operations cited above "are starting to show characteristics of hybrid war."

Whatever Moscow's intentions are, though, there is no doubt that the operations to interdict Ukrainian maritime commerce, blockade the Sea of Azov and the Black Sea coast combine economic warfare, territorial aggression, and threats of various maritime or combined arms operations, such as an amphibious landing operation on the coast of Ukraine, an airborne operation buttressed by the projection of ship-based artillery onto shore and land-based targets, and the threat of nuclear use behind that with the KALIBR and other potential nuclear or WMD capabilities. There is also some evidence, that Moscow is combining its maritime pressure with efforts, as in 2014 to incite unrest and uprisings in Ukrainian cities like Mariupol to furnish a pretext for such operations or to further erode Ukrainian capabilities by combining urban unrest with maritime or combined arms operations against the Ukrainian coast.

## Romania and Beyond

However, Moscow's threats in the Black Sea do not end with Ukraine. Apart from the fact that command of the Black Sea is vital to Moscow's efforts to project its power into the Mediterranean, the Levant and beyond into Africa or the Persian Gulf, its efforts to secure its exclusive dominion over the Black Sea entails



Photo: Vitaly Kuzmin

**A Russian submarine-launched land-attack cruise missile of the KALIBR family**

goal of the initial Crimean operation. In other words, Russian naval forces in all of these waters also facilitate economic warfare, for example, a slow but steady strangulation of Ukraine's maritime commerce or what Admiral Ihor Kabanenko called a "boa constrictor" strategy. Thus, Russian operations in this sea consist not only of straightforward military coercion but also of economic warfare. And thus, without firing shot or acting in an ostentatiously illegal manner, Russia has deftly managed to combine military and economic pressure together, a sure indicator of what has now come to be called maritime or naval hybrid warfare.

## The Sea of Azov and the Ukrainian Coast

Since completing the bridge over the Kerch Strait, Moscow has been steadily pursuing this "boa constrictor" strategy in the Sea

This effort to suppress rival claims to the Sea of Azov and convert the Black Sea into a closed sea (Mare Clausus) conforms to Russian naval practice elsewhere. Moscow would like to declare the Northern Sea Route in the Arctic to be internal waters and thus off limits to foreign trade or navigable only under conditions of a steep tariff. And other states interested in the Arctic, not least China, have expressed concerns about this. Even more revealingly, when the UN Commission on the Law of the Sea granted Russia control over the Sea of Okhotsk Moscow closed the formerly open sea to international fishing and exploration and has since begun energy exploration there in the belief that it contains potentially valuable energy deposits as well. At the same time, Russia's actions in the Black Sea closely resemble China's activities in the South China Sea, leading to the



threats to NATO members, either individually or collectively. For example, during 2018, Moscow trumped up a theory that the West is preparing to launch its own chemical strike in Syria, attribute it to the Assad regime, and then use that pretext to strike at that regime. Based on this combination of typical paranoia and mendacity, Russia has deployed ships from the Northern Fleet, Black Sea Fleet and Mediterranean Squadron off Syria, including the deployment of nuclear-capable KALIBR missiles, supposedly to deter NATO and prepare for the Russo-Syrian attack on Idlib, the Syrian rebels' last holdout. But in fact, according to President Putin, these vessels will be on permanent rotation in the Mediterranean.

Instead, it is more likely that this exercise was part of the larger combined arms exercise Vostok-2018 in September 2018, but because it is quite impractical to move those fleets to the Far East, Moscow has exercised its capability for a surge deployment to deter NATO, threaten nuclear use, and push it back from the Eastern Mediterranean and Black Sea. This could also be in preparation for another operation against Ukraine. Given Moscow's blockade of the Sea of Azov and Ukrainian shipping there, Ukraine's counter-moves in the Black Sea, and the continuing training and deployment of weapons and forces by Russia to this area, another invasion of Ukraine with a strong deterrent aimed at NATO cannot be excluded. This bizarre theory about chemical weapons probably was a smokescreen to conceal another part of Vostok-2018, namely a surge of the nuclear capable fleet into the Mediterranean to deter NATO from resisting an attack on Ukraine and threatening nuclear use.

Alternatively, Moscow can use its forces in and around the Black Sea to threaten and attempt to coerce the other littoral states there, particularly Romania. In fact, this Russian buildup links the threats to Ukraine with those that Russia now poses to Romania. For some time, Romania has

been acutely aware that Russia's seizure of the Crimea and buildup in the Black Sea makes its maritime zone contiguous to that of Russia and that this puts it at great risk from both maritime operations and land attacks to the Dniester or beyond. Indeed, the treaty on Crimea's annexation to the Russian Federation states that, "the demarcation of Black Sea territorial waters is established based on the international treaties made by the Russian federation." According to the Munich-based expert Vladimir Socor, "This vague wording appears to imply

that Russia deems the agreements made with Ukraine on territorial demarcation with other countries are no longer valid, and suggest that Russia might try to negotiate and modify the current demarcation agreements." Indeed, in 2016, in advance of NATO's Warsaw summit, a Romanian presidential conference (attended by this author) called for a kind of Black Sea littoral force comprising Romanian, Bulgarian, and Turkish ships to enforce security. But the proposal went nowhere. Meanwhile, Russian pressure upon Romania has grown.



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Precisely because Moscow is building its robust, combined arms, anti-access area denial network in the Black Sea, the US air base in Costanta and the missile defence base at Deveslu Air Base are primary targets for repeated Russian overflights that have occurred since 2014 right up to the present. Indeed, the Russian embassy in Bucharest

investors. Russian threats put all of this into jeopardy. Therefore, as Prime Minister Victor Ponta declared in 2014, Romania not only expects the US to defend Romania's territorial security and independence through NATO; it also expects American assurances of energy independence against Russia. Nevertheless, problems have arisen be-

territorial integrity but also its energy and thus economic-political independence against Russian energy depredations and corruption. And in response to these Russian pressures, NATO's presence in Romania and the Black Sea has begun to grow, and its more overt presence is already leading to confrontations with



Photo: Vitaly Kuzmin

***The US Mihail Kogalniceanu Air Base in Romania has become a primary target for repeated Russian flyovers.***

openly attacked the missile defence base and its weapons as undermining global strategic stability but also as constituting a direct threat to Russia's national security because of its geographical position and due to the US withdrawal from the ABM treaty. Thus, Romania now experiences what one writer calls "periodic threats of annihilation for hosting American ballistic missile defence, exercises simulating Romania's invasion, and repeated violations of air (and naval) space."

But Russian pressure is not confined to military threats either by land through Transnistria and Moldova or by sea and air from the Black Sea. Russia's maritime and other incursions or probes also seem to be directed against Romania's efforts to secure its energy independence and integrate fully with Western energy institutions and companies. It is quite likely that Moscow, for example, wants to prevent Moldova from escaping its dependence on Russian gas transmissions from Ukraine or perhaps from Russian gas in general, as President Igor Dodon has now expressed interest in alternative gas routes like the Iasi-Ūngehni Romania-Chisinau gas pipeline.

Inasmuch as Romania's overall energy programme is wholly oriented towards securing its energy independence and potentially that of Moldova from Russia and becoming not only independent but an exporter to other EU members, it depends not only on there being security in and around its offshore energy facilities but on foreign in-

tween Hungary and Romania over the volume of gas exports to Hungary and disputed claims over a pipeline project called BRUA (Bulgaria, Romania, Hungary, and Austria). Since conservative estimates of gas discoveries off Romania's Black Sea coast are at least 40 BCM, and some say 200 BCM, Romania could become a major regional exporter in Europe. But it would have to both build this pipeline and put in place a fiscal regime for the gas that would allow foreign companies to help recover it and thereby maximise Romania's gains. Not only does Russian pressure put this all at risk but if Hungary, due to its intimacy with Russia, is acting as a spoiler here, these forms of pressure and obstruction could gravely set back Romania's efforts to become independent from Moscow and to enhance its European standing while adding to overall Balkan security.

Thus, it is apparent that Russia's invasion of Crimea and Ukraine has given Moscow the means and tools with which to threaten other littoral states as well as Ukraine and, as it is to be expected, Moscow's appetite for further gains in the Black Sea has grown with the eating. Moreover, such threats are simultaneously economic and political as well as overtly military. This is what makes the strengthening of NATO and the EU so manifestly necessary. Clearly, a stronger NATO as well as a stronger EU are needed to guard Romania's independence and

Russia in the air and sea. And since the Kerch Street incident, NATO's presence has increased further, increasing the risk of allied operations in the Black Sea and Russian reactions.

## Conclusion

Given the military forces now being brought to bear in and around the Black Sea and the fact that its importance to European energy will grow with the recently concluded Caspian Sea demarcation, Russian plans for the Turkstream pipeline, and Romania's energy programme, we can only expect the likelihood of confrontation around Ukraine and its neighbours to grow. But while more confrontation is likely, will it lead to enhanced deterrence or to increased violence? Since the Black Sea could be the real theatre of future conflict we must do everything possible to deter Russian aggression lest it set this entire region aflame. NATO and the EU may have unduly overlooked this region in the past. But today that policy is no longer sensible or affordable and is rapidly being discarded. NATO is right to do so for no matter how one interprets events there. It is clear that Russia has committed and continues to commit aggression against Ukraine and has now expanded that to piracy and a threat to the maritime foundations of international order. If NATO does not uphold the freedom of the seas and Ukraine's sovereignty, it and other states or alliance will assuredly face even more severe trials in the future. ■



# 5G and Battlespace Dominance

Chet Nagle

The global rollout of 5G, the replacement for the existing 4G mobile communications network, will cost service providers the enormous sum of US\$325Bn by 2025. Millions of dollars have already been spent to tout the benefits 5G will deliver to individual and commercial users, but little attention is paid to the role of 5G in the future world of defence and national security.

Glimpses of that future are beginning to be seen through the smoke of the conflict between the US and Huawei, the telecommunications giant created by communist China to dominate the manufacturing and implementation of 5G networks.

## A Keystone of Future Technology

Many see 5G as an incremental step in the technical evolution of mobile communications, but its speed and ability to carry much more data, its lower latency (network response time) and its greater stability will fundamentally transform mobile digital communications. 5G data is transmitted at 10 gigabytes per second, and latency is less than a millisecond, a hundred times faster than 4G. These attributes will connect multiple sensors and allow unmanned air, sea, subsurface and ground vehicles to become effectively autonomous. Significantly, 5G will also greatly enhance connectivity in the future internet of things (IoT).

"Internet of things involves close-range telecommunications technology to connect and exchange information between two devices, and 5G is the fastest data transmission method to realise it," said Zhou Zhaoxiong, an engineer at China Mobile IoT Company. He added that military equipment embedded with communication devices can also form an internet of things. With 5G, communication is possible from device to device and platform to platform, without needing satellites or communications relay aircraft. Because of such capabilities, 5G will become a keystone of future military technology.

## Machine-to-Machine Communication

No one describes how 5G would operate in battlespace more dramatically than Liu Zhen, who wrote in the South China Morning Post in January:

"Imagine a group of skirmishers in a jungle. They are moving forward speedily with a distance from one another of a few hundred metres. Each of them wears a wristwatch that displays fellow members'

enemy. An ambulance helicopter arrives to evacuate the injured soldier while auto-driven armoured vehicles come to reinforce – guided by devices on each soldier and antenna arrays nearby.

Photo: US Army



***In the future, battlefield superiority will depend on harnessing the enormous potential of unused and dedicated computing power in many connected devices and using this knowledge to influence future events.***

positions. This is not satellite positioning, because reception in the tropical forest is unstable; it's machine-to-machine communication.

"Suddenly one soldier, ambushed by an enemy combatant, is shot and loses consciousness. His smart wearable device detects his condition via sensors, immediately tightens a belt around his wounded thigh, injects an adrenaline shot and sends an emergency alert to the field hospital as well as the entire team.

"Having received the signal on their wristwatches, the team switches to a coordinated combat formation and encircles the

## Artificial Intelligence

"Or, imagine a street battle with a group of terrorists in a city. There is a power blackout and terrorists hide in an empty office building. A counterterrorism technician hacks into the building's audio control system and collects high-sensitivity soundwaves using the microphones on surveillance cameras – the system is still running thanks to the devices' low power consumption and long endurance.

"After the acoustic data are sent back, artificial intelligence (AI) analysis determines the locations of the terrorists. A drone is

Photo: A4-Nieuws / Flickr



**The war on Chinese communications giant Huawei is gathering steam.**

called from nearby, enters through a window and fires a minigun at them. These are not movie plots, but technologies already or about to be developed, as the internet of things – built on 5G and AI technologies – reshapes warfare.”

In her article, Liu Zhen quotes Dr Clark Shu, AI and telecommunications researcher at the University of Electronic Science and Technology of China as saying, “The 5G network and the internet of things (IoT) enlarge and deepen the cognition of situations in the battlefield by several orders of magnitude and produce gigantic amounts of data, requiring Artificial Intelligence (AI) to analyse and even issue commands.”

Dr Shu is correct, of course, and since the US is a world leader in the AI sector we are beginning to see IoT scenarios develop. At sea, the US Navy is designing and building small armed unmanned autonomous ships. Under the ocean, DARPA and other defence agencies are experimenting with autonomous drone swarms, and the US Air Force has demonstrated deployment of a swarm of autonomous drones from a fighter aircraft. AI is critical in all of these scenarios because of the extremely high data rate and the need for rapid analyses and commands.

## Battlespace Scenarios

With the advent of 5G technology and advanced AI, it is possible to envision other scenarios in battlespace. For example:

The captain of an aircraft carrier is advised an unidentified submarine is in his vicinity just as the Combat Information Center reports detection of a torpedo racing toward the carrier. The captain launches missiles that splash down between the carrier and the torpedo that release swarms of autonomous underwater vehicles (UUVs) that form barriers to intercept and destroy the inbound torpedo. Ashore, a long-range

ASW patrol plane takes off to drop canisters at the approximate location of the submarine. They release dozens of explosive UUVs that hunt the submarine for days.

That night the captain is notified of a missile launched from an island 100 miles distant that is on a high arching course toward the carrier. An aircraft is launched that climbs to altitude and releases a cloud of drones that form a barrier above the carrier that follows it as it evasively manoeuvres below. The incoming missile is deflected and falls into the sea.

An AEGIS missile defence radar near Hawaii reports an ICBM heading toward the US west coast. A ground-based interceptor missile is launched and, instead of attempting to hit the incoming warhead in mid-course, releases a swarm of manoeuvring satellites in near space that form a shield on the warhead’s course that intercepts and destroys it.

Photo: US Navy



**5G and AI technologies will reshape warfare: An X-47B unmanned combat aircraft conducting a touch-and-go landing on the aircraft carrier USS GEORGE H.W. BUSH.**

These science fiction scenarios in battlespace will be made a reality by 5G, IoT, and AI, and the Peoples Republic of China and Huawei have a deep, detailed, and long time awareness of that reality. In fact, China already aggressively markets armed autonomous drones.

## A Digital Silk Road

While most nations in the west view 5G as a valuable extension of 4G, China sees 5G technology as an adjunct to its belt-and-road initiative (BRI). The BRI is China’s international infrastructure project designed to expand Beijing’s interests on a global scale and make China the world’s leading economic power by 2049, the 100th anniversary of the founding of that communist country.

Implementing 5G to be part of the BRI is called the “Digital Silk Road”; Beijing’s plan is to deploy Chinese 5G systems in every country that is now part of that initiative. As part of the digital road, China is also finishing installation of the “Big Dipper” precision navigation system. It is designed to replace the American GPS system. When the digital road is completed, the BRI will enable China’s 5G, AI and precision navigation systems to monitor and dominate the IoT, digital communications, and commercial and political developments in every nation in the BRI. The initiative will become China’s global version of the Greater East Asia Co-Prosperty Sphere.

Beijing has made it very clear that its economic plans are integrated with its national security plans. In October 2017, at the 19th Congress of the Communist Party of



China, President Xi Jinping incorporated his new ideology into the Chinese Constitution. That ideology includes economic initiatives like the BRI as well as a powerful military to defend territorial claims in the South China Sea. That means the BRI and 5G system are projects of the Communist Party, and indicates how important they are to the communist leadership and its intention to become the leader of a new international order.

## A New International Order

In view of the long history of 5G, the BRI, and Chinese military territorial aggression in the South China Sea, it is disingenuous for any communist official in China to differentiate between a Chinese company like Huawei and the Chinese Government. That notion founders on the fact that China has a centrally managed economy like every communist nation, and Huawei is too important to be an independent company. This fact was recognised by the US as early as 2012, when the US House Intelligence Committee released a report stating that Chinese telecoms equipment makers like Huawei and ZTE posed a threat to America's national security because of their close relationship with the Chinese Government. In fact, China's 2017 National Intelligence Law requires Chinese companies to cooperate with the government on issues that affect national intelligence matters.

Since then, US resistance to Chinese telecom and computer products has been conducted quietly, primarily by government agencies like the CIA, FBI, NSA, and the Defence Department. Those agencies do not allow use of computers or digital communications devices that are manufactured in whole or in part by China, or that contain Chinese components. In a congressional hearing last February, intelligence officials, including heads of the CIA, FBI, NSA, and the Director of National Intelligence, stated that they would not advise American citizens to buy Huawei devices or services.

## Weaponised Cities

Subsequently, Bloomberg News acquired a memo by retired Air Force Brigadier General Robert Spalding that noted, "The more connected we are, and 5G will make us the most connected by far, the more vulnerable we become." Spalding, who retired after serving on the National Security Council last year, wrote that once China controls the IoT in America, it will be able "to weaponise cities," adding, "Think of self-driving cars that suddenly mow down unsuspecting pedestrians. Think of drones that fly

into the intakes of airliners." Nevertheless, Spalding's initial NSC plan to ban Chinese telecoms equipment was resisted by the US wireless industry.

Then came the disruptive "pivot to Asia" by the Trump administration and the arrest in December 2018 of a senior Huawei executive, Chief Financial Officer Ms Meng Wanzhou, by Canadian authorities at the request of the United States.

## Criminal Indictments

The US case against Huawei was revealed in criminal indictments that lay out 23 charges alleging that Huawei violated sanctions and stole intellectual property while engaging in a pattern of lies to US authorities and

procurement of all Chinese telecoms products. Britain's Vodafone, the world's biggest mobile service provider outside China, is halting purchase of Huawei components. Germany's Deutsche Telecom is debating whether to restrict Huawei from its 5G network, and France's Orange said it would not have Huawei build its 5G network.

Canada is studying security risks of 5G networks despite threats from China's ambassador, and even after a Chinese court retried a Canadian who had already been jailed for drug smuggling and sentenced him to death. Richard Fadden, former head of Canada's Security Intelligence Service from 2009 to 2013, said there was mounting evidence for blocking Huawei.



Photo: US Army

***The 5G network and the internet of things (IoT) will deepen battlefield awareness by several orders of magnitude.***

business partners for more than a decade. Prosecutors also alleged that Huawei gave bonuses to employees who stole the most valuable information and posted it on an internal website. Besides the legal battle, Washington is ramping up an international effort to curtail sales of telecoms products of Huawei, the world's largest manufacturer of network infrastructure, the No.2 maker of smartphones after Samsung, and the major player in the implementation of 5G networks. Even in the midst of complex trade negotiations with Beijing, the campaign has been remarkably successful. For example:

"Five Eyes", the intelligence alliance of the US, Britain, Australia, Canada and New Zealand, has joined forces with Japan, Germany and France in an agreement to step up countermeasures to cyberattacks by countries like China. Like Australia and New Zealand, all have banned Huawei products or are reviewing whether to do so. The Japanese Government has ended

The Czech Republic Tax Office has banned Huawei products after Czech cybersecurity officials warned for years that Huawei equipment and software could be used to collect data on Czech citizens. Norway's intelligence service is saying that Huawei's close ties with the Chinese Government sparks security concerns and they are exploring ways to limit exposure.

Polish authorities arrested a former Polish security official and a Huawei sales director and charged them with spying for China. Warsaw will prohibit Huawei from its 5G network and is asking its NATO allies to join the ban.

The Trump administration's message is that China poses a direct threat to the US national interest – economically and militarily. Other nations will soon recognise the security threats posed by 5G systems built by China.

It will happen when they realise that the dragon waiting in the digital shadows is China's plan for battlespace dominance. ■



# Viewpoint from Paris



## Paris and the Gilets Jaunes

David Saw

On 11 November 2018, major world leaders, including Trump, Putin and Merkel, gathered in Paris to commemorate 100 years since the armistice that ended the First World War. Hosting the proceedings was Emmanuel Macron, the president of France. France and Macron at the centre of world events was fundamental to the vision that he had developed since winning the presidency in May 2017. After all, there was no real domestic political opposition as Macron's political party and its allies dominated the French National Assembly. All of this meant that Macron could focus on what he saw as key issues, such as greater European integration, the environment and globalisation. There were also new possibilities emerging for Macron in Europe, that, if all went well, could give France more of a leading role. At the end of October 2018, German Chancellor Angela Merkel had announced that she would only remain as Chancellor until the next German elections in 2021. With Merkel's aura of invincibility punctured, the impression in Paris was that Macron would be her natural successor as 'the' European leader.

While the French Government might have been dreaming dreams of European leadership, elsewhere in France something totally unexpected was happening and it would turn into the first serious challenge to be faced by Macron. On 17 November, there were anti-government demonstrations in Paris and across France; this was the start of the Gilets Jaunes (yellow vests) protests and became known as "Gilets Jaunes Acte I". At the time of writing, "Gilets Jaunes Acte XIII" on 9 February has just finished, marking 13 consecutive Saturdays of protest in France.

The intensity of the first Gilets Jaunes demonstration in Paris caught everybody by surprise. Protestors marched up the Rue Saint-Honoré in the centre of Paris heading for the Élysée Palace, the presidential palace, and were only halted by riot police firing tear gas. Saint-Honoré is considered, along with Fifth Avenue in New York or Bond

Street in London, one of the great shopping streets in the world; those seeking "retail therapy" would not normally expect to confront a riot and tear gas!

The Gilets Jaunes would never get as close to the Élysée as they did during "Acte I"; access to the area around the Élysée would subsequently be blocked by police vehicles and barricades. Then on 24 November came "Gilets Jaunes Acte II". This time, the demonstration was expected and the police had closed off the Place de la Concorde and blocked access to the bottom of the Champs-Élysées. At 09:30 that morning, everything was calm; demonstrators gathered in numbers at the Champs-Élysées, then matters took a turn for the worse and by 10:30 the first tear gas grenades were being fired by the police. Another Saturday, another demonstration, but there was nothing particularly dramatic or threatening from the events that took place during "Acte II". The next Saturday was a very different proposition.

### People and Protests

The author of this article lives in the centre of Paris, just off the Place de la Concorde and minutes from the Élysée, and frankly, the first two Gilets Jaunes events really passed without much notice or disruption to daily life. It was "Acte III", on 1 December 2018, that showed that Gilets Jaunes was becoming a real challenge to the government.

**French President Emmanuel Macron is facing a sustained challenge from the Gilets Jaunes movement. He is now attempting to connect with voters through events such as Le Grand Débat National held at Bourg-de-Péage in southeastern France in January.**

Photo: Élysée Palace





That Saturday morning, I walked past the Gare Saint-Lazare, one of the main railway stations in central Paris, and a crowd of a couple of hundred Gilets Jaunes was gathered outside the station, many of them from the Seine-et-Marne department not that far from Paris. They would then move off towards the Champs-Élysées, a 20-minute walk, via the streets left unblocked by the police. There was nothing threatening about these people and they were in good humour.

I then moved off towards Saint-Augustin, some five minutes' walk from Saint-Lazare. Here walking along the Boulevard Malesherbes, the Gilets Jaunes were out in full force; I would estimate that I saw Gilets Jaunes in their high hundreds or more heading for the Champs-Élysées.

The extraordinary thing about these Gilets Jaunes was how ordinary they actually were, from the look of most of them, you would have been far more likely to see them at a supermarket than a demonstration. And yet here they were, marching towards the Champs-Élysées and knowing they would face riot squads and the Police Nationale, who would use tear gas and other measures against them. For people to take to the streets and accept the risks involved, it is evident that there is a substantial disconnect between many ordinary French people and their government.

By the end of Acte III, the Arc de Triomphe had been vandalised, cars and motorbikes burnt, property damaged and windows broken. Some 10,000 grenades had been fired by riot police, these included 7,940 MP7 type tear gas grenades, 800 grenades "désencerclement" otherwise known as STING-BALL grenades, a fragmentation-type grenade with a payload of three rows of six hard rubber balls, 339 GLI-F4 grenades, these are combined effects grenades containing CS gas and a TNT bursting charge that generates flash, smoke and a loud explosion generating 165 dB at five metres, and 776 FLASH BALL grenades; these 44mm projectiles are rubber bullets and are manufactured in France by Verney Carron. The police also used water cannon and media reports state that 140,000 litres of water was used by these vehicles.

It is important to state that the Gilets Jaunes are in the main not a violent movement; most of the violence was caused by external actors. Both extreme left and extreme rightist groups have used the demonstrations to cover their own activities. The attacks on banks and businesses, along with the vast increase in anarchist graffiti in central Paris are proof of one source of extremist violence. However, it is also not unknown for demonstrations in Paris to attract those just looking for a fight, the opportunity to destroy things or the possibility of looting. The police have come in for criticism over their response to the Gilets Jaunes demonstrations, in particular through the use of gas grenades and non-lethal munitions. During the afternoon of Acte III, the police fired gas and other grenades into demonstrators near the Madeleine; this caused a large cloud of tear gas and pyrotechnic smoke to spread over the surrounding area. The author lives some 500 metres from the Madeleine and the gas cloud penetrated into the building where he resides and the tear gas was still fully functional.

The use of STING-BALL and FLASH BALL grenades has proven controversial; during Acte XIII in Paris, a demonstrator lost a hand to a rubber projectile. Others have lost eyes and in Bordeaux in January, a protestor was hit by a FLASH BALL projectile and had to be placed in an induced coma. Both Amnesty International and Human Rights Watch have criticised French policing methods as regards the Gilets Jaunes.

## Responses

Demonstrations continued and on 10 December, Macron gave a televised address in which he stated that tax increases on fuel due to come into effect in January 2019 would be halted and the minimum wage would be raised. These concessions did not win over the Gilets Jaunes and protests continued, but the government reaction saw more aggressive policing towards the demonstrations. December also saw police salaries raised. The government strategy evolved in January, with the Grand Débat National where Macron went to town hall style meetings across France, responding to questions from "ordinary people", in reality a pre-selected audience with pre-selected questions. There were also reports that the government might even be open to staging referendums on certain issues.

What is happening in France is a reaction to a heavily centralised government, an arrogant president and the feeling that the government was out of touch with the needs and aspirations of the people. This reflects a perception of a democratic deficit, something increasingly common in Europe, where the belief is that elite interests are privileged over those of ordinary people, leading to a populist backlash. There are real issues that need to be confronted in France, such as an insensitive government, failure of salaries to keep pace with prices, under-employment and unemployment. Scratch the surface and there is anger in France. Riots on the Champs-Élysées are not unusual. Nevertheless, the Gilets Jaunes are a remarkable phenomenon. They are a true mass protest organised from the bottom up using social media, with no centralised leadership.

As to the future? Potentially one significant development was the participation of the 'Gilets Jaunes' in the demonstrations surrounding the grève générale (General Strike) on 5 February organised by the largest trade union confederation in France. The grève générale was called to protest for wage increases and for 'fiscal justice' via increasing wealth and corporate taxes. There were marches all over France and the demonstration in Paris is credited with having 14,000 participants. There is much common ground between the Gilets Jaunes, the trade unions and the traditional political left, and if this relationship continues it could evolve into a political threat to Macron.

The only certainty in all of this, is that every Saturday will continue to see Gilets Jaunes protests. The government hopes that the Gilets Jaunes movement will eventually lose momentum, a process that it hopes to speed up through political concessions and aggressive policing. For now the protests will continue, with the only clear winners being those companies that supply tear gas to the French riot police.



Photo: Anna Saw

***The violent side of the Gilets Jaunes protests: A BNP Paribas branch in central Paris saw its ATM machines destroyed. The bank had its exterior windows smashed and damage to the exterior walls. Anarchists, other extremists and looters used the Gilets Jaunes protests as a cover for violence.***

# The “Daesh Phenomenon”

**Andreea Stoian Karadeli**

**Daesh set new standards for any terrorist organisation around the world, and especially for those religiously inspired. Its current territorial loss, however, does not spell its end.**

An insight into the Daesh phenomenon should provide the necessary knowledge to understand the enemy, Daesh's perspective and its current position and to anticipate the path it could take after the defeat in Syria and Iraq.

## History of Terrorism

The history of terrorism is bound to the history of humanity, dating back to the first community of people. Terrorism seems to perfectly embody the legend of the phoe-

enix. The group set a precedent for all Salafi Jihadist terrorist groups: it proclaimed the Islamic Caliphate on 29 June 2014.

A complete picture of Daesh is the key to combat the group and, more importantly, its idea or the phenomenon. This article analyses the Daesh phenomenon, based on contextual knowledge of its roots, development, current stage, strengths, weaknesses, opportunities and threats to its survival.

## Why is Daesh a “Phenomenon”?

According to the Cambridge Dictionary, the term “phenomenon” refers to “someone or something that is extremely successful because of particular qualities or abilities” or “someone or something special, especially because it is completely different or extremely unusual”. Daesh, supposedly the greatest terrorist threat to global security, is neither an entirely new terrorist formation nor did it suddenly emerge. Its emergence, development and characteristics result from a unique combination of three main factors: the Salafi Jihadi ideology, supported by the strategic potential of the old Baath structure and its considerable economic power, reinforced by a powerful propaganda strategy. These factors allowed Daesh to skilfully manipulate the context and seize the opportunity to evolve from an insurrection into a proto-state with a semi-conventional army with global repercussions, making it the wealthiest and most violent terrorist group in modern history.

In short, Daesh is a phenomenon because, regardless of the brevity of the caliphate's life, it has achieved its main goal, gained global support through powerful global propaganda and radicalisation, received the affiliation of 30 terrorist groups and the support of 12 others, created a proto-state structure that imposed taxes on the population and economically exploited the natural resources (in particular oil and gas) of the territory it controlled, and dealt in cultural artefacts, hostages and weapons. Daesh continues today in various forms, including the “Virtual Caliphate”,



Photo: Operation Inherent Resolve

**Italian trainers and Peshmerga soldiers advance on a target during a combined arms training exercise near Erbil, Iraq. The exercise was part of Operation Inherent Resolve which aimed to enable indigenous forces to take Daesh head on.**

## Author

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nix bird that rises from its own ashes, each time stronger, more defiant and harder to fight. Just like in the legend of the phoenix bird, terrorist groups are never completely defeated, and their remnants go under-cover waiting for the chance to come back in an updated form.

One of the most recent and dreaded forms of terrorism – that perpetrated by the Islamic State of Iraq and Syria (ISIS), or the Islamic State of Iraq and al-Sham (ISIL), or the Islamic State, or DAESH, or ad-Dawla al-Islamiyya fi al-'Irak wa-sh-Sham – is the embodiment of a reborn Salafi Jihadism in a form adapted to contemporary society, using the advantages of modern means





**During Operation Inherent Resolve coalition members from 14 nations trained 17,541 Iraqi Security Force personnel, including Peshmerga and tribal forces, to increase their capability to defeat Daesh.**

which proves that its existence did not end with territorial defeat and that the organisation is still a lingering threat throughout the world.

## The Roots of Daesh

Daesh was the result of an extended struggle and a vivid example of the phoenix bird as it drew on similar predecessors such as JTJ (Jama'at al-Tawhid wal-Jihad – Organisation for Monotheism and Jihad, also known as Tawhid wal-Jihad), AQI ("Al-Qaeda in Iraq", with the full name Tanzim Qaidat al-Jihad fi Bilad al-Rafidayn, or Al-Qaeda – Base Organisation for Jihad in Mesopotamia), and ISI (Islamic State of Iraq). In short, Daesh has his roots in the Al-Qaeda offshoots in Iraq and in Abu-Musab al-Zarqawi and his extremist perspective on the Salafi Jihadist ideology.

Daesh's founding was that of an organisation that sought a comeback and made skilful use of the local context. This context was created by the US intervention in Iraq without a viable strategy and the withdrawal of American troops from the territory, without ensuring the balance of forces and the necessary security, the unrest during the Arab Spring and the increasing instability in the Middle East and North Africa, but especially in Syria, where Zarqawi had begun since 2000 to

gradually build up the local jihadist infrastructure, make efficient use of the resources available in the territory, break into several prisons in Iraq where former members of the Baath Party and members of Saddam's security apparatus were held, including Abu Ghraib (2013), and finally the slow reaction of the international community.

## The Evolution of Daesh

If one follows the development of Daesh, six main stages can be outlined. At each stage the organisation showed that it understood the context, adapted its strategy accordingly and turned obstacles into opportunities for a comeback.

The first phase was the time when the organisation's father, Abu Musab al-Zarqawi, played an important role in the creation of the JTJ and its transformation into AQI to fight against US intervention in Iraq and its coalition with the Shiite population. At that time, Al-Zarqawi's fighting did not have the expected effect, because he was deceived by the Sunni tribes of the region who had decided to join the US coalition and then defeated the al-Qaida organisation in Mesopotamia, forcing them to hide in the desert and killing al-Zarqawi in June 2006. The second phase lasted five years (2006–2011), from the death of Al-Zar-

qawi to the withdrawal of US troops from the region. Daesh had learned from the mistakes of the past and, after returning, attached particular importance to the tribes in the region to ensure that no more betrayals would take place. During this time, ISI, the Islamic State of Iraq, was founded as an "umbrella organisation" for various jihadist organisations that continued to fight against the United States, coalition allies, and Shi'a. Even after the United States had finally won the support of a large section of the Sunni population, which should have weakened the terrorist organisations in the region, the US Army could not restore the level of security necessary to prevent a return of extremism, which in fact had never completely disappeared. Thus, in 2011, the US troops left behind an unstable state and a power vacuum, aggravated by the Arab spring.

The third stage was therefore the result of the unrest in Tunisia, Egypt, Libya, Yemen and Syria. In contrast to the al-Qaida mother organisation, Daesh used the Arab Spring in its favour to stage a comeback. Between 2012 and 2014, Daesh was founded in Syria with the help of the Islamic State of Iraq and the Resistance Front (al-Nusrah Front, Jabhat al-Nusrah). The two organisations had only been linked for two months at the time and their paths split just before

al-Baghdadi declared the formation of the Islamic Caliphate and himself a caliph. The fourth phase in Daesh's development began in June 2014, when the organisation took control of Mosul, the second largest city in Iraq, from which al-Baghdadi proclaimed the Islamic Caliphate. The fall of Mosul occurred between 4 and 10 June 2014, when Daesh insurgents led by Abu Abdulrahman al-Bilawi defeated the Iraqi Army led by Lt.Gen. Mahdi al-Gharrawi. In the fifth phase from 2015 to 2018, the self-proclaimed Caliphate began to lose ter-

terrorist partners and sympathisers around the world. Virtual interaction remains an important activity of the group, which continues to recruit supporters through online propaganda. On the internet, the terrorist militia is inspiring a new generation of jihadists, making Daesh a lingering threat. Bearing in mind the words of former FBI agent Ali Soufan: "ISIS is not over, it will take another form", the international community must understand that Daesh has never limited itself to territorial organisation in Iraq and Syria, but is a transnational

images that garnered global support, local context knowledge in formulating its strategy, psychological warfare, abundant financial resources, a network of foreign terrorist fighters, and on lone wolf attacks around the world.

### Ideology

For Daesh, ideology is a marketing tool; it emerged in the early 2000s with the arrival of the first generation of jihadists in Iraq, of whom al-Zarqawi was the most influential. He contributed two main pillars to Daesh's ideological extremism: an extreme anti-Shi'ism and a special importance attached to the formation of the Islamic Caliphate. Daesh's ideology differs from that of Al-Qaeda in three main points: the meaning and ultimate goal of Jihad - while ISIS prioritises power consolidation, Al-Qaeda places more emphasis on enemy injury; the concept of the enemy - while Al-Qaeda focuses on some distant enemy, ISIS tends to blur the distinction, with the group focusing more on the nearby enemy; and the strategies to practice al-wala' wa al-bara' and win people's hearts and minds - Al-Qaeda prefers to remain more cautious and conscientious while ISIS advocates more violence.

### Structure

Daesh is not a random group of barbaric ideologues, but its personnel consists of former Baath Party technocrats from the security apparatus of the Saddam regime who were waiting to take revenge for the humiliation and torture in prison, but who were well trained to form state organs. Since Daesh was not a network, it made the establishment of the caliphate and the conquest of large and well-populated areas and subsequent governance a major challenge. The architect of the Islamic State was Haji Bakr, a former colonel of the Iraqi Army under Saddam Hussein, who served as advisor to Abu Bakar al-Baghdadi. Daesh's structure was carefully constructed so that if one official was captured or killed, another trained person could immediately assume his responsibilities. Beyond the caliph and his deputies, the Daesh leadership level consisted of the Military Council and a governing body - the Shura. They supervised 10 departments regulating state functions such as protection, communication, manipulation of foreign fighters, education, law, health, environment, taxes, infrastructure, consumer protection and price control. Daesh's military organisation has provided local and regional commanders with considerable operational flexibility in implementing decisions of the Military Council.



**Graffiti of Daesh sympathisers in a French suburb**

ritory and resources despite fierce fighting against the anti-Daesh coalition (supported by the US), the Assad regime (supported by Russia and Iran), Kurdish militias and Turkey. The sixth phase of the Daesh phenomenon is the current struggle to remain present in Syria, to hide as an underground organisation in Iraq, to seize the opportunities for a comeback in other parts of the world confronted with power vacuums, and to continue their existence online as a virtual caliphate.

### Daesh Today

At present, Daesh has only 1% of the originally conquered part in Syria. The group still controls territories in northeastern Syria and the Middle Euphrates River Valley along the Iraqi border. In Iraq, Daesh continued its underground activities by reintegrating into the population and reuniting in some provinces such as Anbar, Diyala and Salah al-Din and conducting guerrilla attacks. At the same time, official sources point to some 30,000 Daesh members still alive in the region, while the number of returnees to their homelands is difficult to estimate. The global brand created by Daesh has survived due to an unknown number of

expression of Salafi Jihadism and a developed form of a global neo-Jihad wave as defined by Sageman; it may lose power and territory, but it does not end there. It lives on in various forms - in its infamous online activities, in underground cells, or in small controlled areas where terrorists are waiting for the opportunity to stage a comeback. Interpol chief Jürgen Stock warned that Daesh might return as ISIS 2.0 and threaten the West and the world with new attacks.

If we are to continue this struggle, a deeper understanding of Daesh is necessary and as a first step this article includes a SWOT analysis of the organisation based on the contextual information from the first phases of its development.

### A SWOT Analysis of Daesh

#### Strengths

Various strengths have helped Daesh to develop and survive in the local, regional and international environment: the Salafi Jihadi ideology as the fuel for a global neo-Jihad, the creation of a proto-state with the Baath command structure that used local intelligence and manipulated the population, its ubiquitous online propaganda and brand



## Propaganda

Daesh's propaganda strategy revolves around three axes: an alternative narrative to mainstream news media and to fire media "projectiles" against the enemy. At the same time, it used virtual interaction to strengthen convictions, create legitimacy for future attacks, spread propaganda and raise money. Daesh created a "brand image" and its media strategy included publications, videos and music in various languages that were broadcast around the world.

If you analyse the radicalisation by Daesh, you will find a variety of reasons why people are fighting for the organisation. Factors such as lack of knowledge about religion, lack of education or career prospects, and historical, social, economic, political, and psychological factors all have different implications depending on the geographical origin of the recruits.

Daesh understood how important the local context is for his message to convince recruits. Instead of trying to identify a consistent radicalisation profile, we have to understand that Daesh did not follow a consistent strategy, but rather manipulated the local context. For example, Daesh exploited sectarian fault lines in societies and adapted its narrative and approach to the specific social and historical context of each country. And that makes it difficult for us to create a counter-narrative.

### Psychological Warfare

On the psychological level, Daesh used the longing for personal recognition felt by its supporters, and it provided an ideological narrative that offered a positive symbolic justification for violence and a narrative for a shared social life in an ideal Islamic community.

### Economy

Daesh is considered the richest terrorist organisation, although it has never been possible to accurately estimate the value of its financial resources. The main sources of income of the group were taxes and fees, trade in natural resources (oil, gas and minerals) and criminal activities such as theft, confiscation, hostage-taking, and trafficking in cultural artefacts.

Colin Clarke, the author of the book "Terrorism, Inc.", calculated that Daesh owned about US\$400M at the time of the collapse of the pseudo-caliphate, a figure that intelligence officials regard as a reasonable estimate. Much of the money was laundered and secretly distributed to bank accounts and the investment sector.

According to Clarke's research, Daesh members have transferred money through



Photo: Operation Inherent Resolve

***An anti-personnel obstacle breaching system destroying ordnance during APOBS tools and methods training at Al Asad Air Base, Iraq. The training was part of Operation Inherent Resolve.***

straw men and agents to correspondent banks. However, as intelligence officials admit, it is becoming increasingly difficult to detect and stop Daesh's illegal money flows as the group disappears from sight. The al-Rawi network in Iraq functioned as a legitimate financial services provider for years before Kurdish investigators discovered it was being used by Daesh terrorists. Officials are afraid that Daesh could become a shadow organisation which, while powerful and deadly, is now more difficult to tackle.

### Weakness

The weaknesses are the lack of a long-term strategy to achieve goals, the need for continuous conquest in order to survive, territorial defeats, violent intolerance and brutality, mistreatment of the local population while foreign terrorists were given preferential treatment, a decreasing number of fighters, lack of military experience of foreign terrorist fighters, massive population migration from Daesh-controlled areas, lack of popularity among the Muslim population, and delusions of omnipotence. While al-Qaeda pursued a long-term strategy, Daesh followed a fast track approach and declared a caliphate they were able to control at first. But as the international opposition grew stronger and the struggle harder, the area became more difficult to control and spending increased while revenues declined.

### Opportunities

Defeated on the ground, Daesh could seize the opportunity to expand its activities and focus on other power vacuums in the world

where they can exploit sectarian fault lines and political turbulence (e.g. Yemen, Libya, Northern Nigeria, Tunisia, the Philippines) to reunite in Afghanistan after the US troop withdrawal, expand their online propaganda and carry out similar underground activities as before 2014, and use its global network, returned terrorist fighters, and sleeper cells to carry out new attacks around the globe.

### Threats

The most important threats to Daesh are an efficient global early-warning system against terrorist activity, a deeper understanding of Daesh networks in different corners of the world, a strategic counter-narrative tailored to ethnographic factors, and good governance in Daesh's former territories in Syria and Iraq and in potentially dangerous regions around the world.

### What's Next?

Daesh might well be a lasting phenomenon that we must analyse and understand in order to fight and defeat it. A complete picture of Daesh can only be obtained through an in-depth analysis of Daesh-related activities worldwide, which provides the contextual knowledge necessary for a successful anti-Daesh strategy. The only way we can predict their movements is by knowing and understanding the way they think and act and their perceptions. It is about empathy and imagination combined with contextual research and analysis. There is still a long way to go, but the commitment to creating a better world for future generations should definitely be a motivation to try to listen and to understand. ■

# Defence Materiel Modernisation in Austria

**Georg Mader**

**Will the encouraging turnaround in 2015, which reversed decades of decline in Austrian defence spending, continue? Despite the election promises made by Mario Kunasek, Defence Minister of the now co-ruling right-wing populist Freedom Party, to spend 1% of GNP or €3Bn on the Bundesheer (ÖBH), Chancellor Sebastian Kurz and his Austrian People's Party (ÖVP) are far less enthusiastic.**

**F**or the first time in decades, the government has focused on zero new debt. In addition, the clever Chancellor Kurz is well aware that defence – with the exception of disaster relief – has a low priority in the eyes

as the curve – from today's perspective – points downwards again from 2021. It is likely that the lean 2010–2016 times will return, when the armed forces were forced to cut €571M after the 2008 Great Reces-

decision for the future of the 15 Austrian EUROFIGHTER jets has been postponed once more. However, there are several acquisitions and ongoing replacements, the most important of which are listed below.



Photo: ÖBH

***Dismounted Austrian mechanised infantry supported by an ASCOD ULAN vehicle***

of the public, most of whom have never taken the "hard" side of neutrality seriously. And this is despite Austria's promise in 1955 to follow the "Swiss example". The best outcome of the government negotiations now underway on the budget for the next two years could therefore be to maintain the gains achieved since 2016 for the ÖBH, which are the highest ever: €2.3Bn. However, this is highly uncertain,

as the curve – from today's perspective – points downwards again from 2021. It is likely that the lean 2010–2016 times will return, when the armed forces were forced to cut €571M after the 2008 Great Reces-

## A Partial Renewal

Defence Minister Kunasek claims that he is making intensive efforts to increase defence spending from 0.58% to 1% of Austrian GDP by the end of the current legislative period in 2022. He has done several publicity stunts when he introduced new hardware ordered by his predecessors, but he has also initiated important modernisations of defence equipment. The unpleasant but "sticky"

## Helicopters

In August 2018, the government decided to replace the 21 remaining Aerospatiale ALOUETTE III helicopters introduced in 1967 with three Sikorsky S-70 BLACK HAWKS, which will complement the fleet of nine helicopters that have already performed 25,000 accident-free hours since 2002. In January 2019, more than €300M was pledged to purchase 15 helicopters, including 12 light multipurpose helicopters and the three additional S-70s. The Ministry of Defence wants the latter to join the fleet in 2021.

This is ambitious, because ACE AERONAUTICS from Huntsville, AL, is currently modernising the avionics and cockpit of the other nine BLACK HAWKS. Another BLACK HAWK is located in the USA as a validation/prototype model and is scheduled to return in summer 2019. ACE has also been contracted to buy three more BLACK HAWKS on the US market – probably A models to be converted to the -L standard – and to bring them to the same equipment level as the other nine helicopters. Work on the remaining eight should now have started at their Langenlebarn Air Base north of Vienna, but is expected to continue until 2022.

As regards light multipurpose helicopters, the Austrian authorities hope to acquire them under an intergovernmental agreement to exclude costly intermediaries and are confident that deliveries can start two years after the conclusion of the contract. The Ministry

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Photo: Zinner

**The Pilatus PC-7 with its unguided 7.5 cm rockets is the only air-to-surface resource of the Austrian armed forces.**

of Defence had previously undertaken to retire the obsolete ALOUETTE aircraft by 2023. In the past, these single-engine "legends" were praised for their high-altitude power in mountainous regions, which is why Chancellor Kurz justified his decision to modernise these old helicopters with the demand to support the country's emergency services in disaster operations. In January 2019, the MoD

deployed 1,100 soldiers for snow-clearing efforts across the country, which included using helicopters to blow snow from trees, for aerial supply and avalanche control. On the quiet, some officers have complained that even under this government, outdated military hardware can only be replaced by selling it to the public as disaster tools and Red Cross equipment.

Nevertheless, weaponisation will be a central issue, and twin engines and IFR will be another. Potential candidates are the Airbus H-145M, partly with H-FORCE armament, the Bell Model 429 with a weaponised version yet to come, and the LEONARDO AW109M TREKKER skid model. It has been discussed, but not yet decided, whether Austria will require bidders to offer six single-engine light training helicopters.

The same applies to the 11 minigun-armed OH-58Bs in use since 1976, which are to be replaced. In 2018, the author witnessed the minister asking about the age of these helicopters and replying: "What? They are as old as me!" Only slightly younger are 23 AB-212s from 1980, which were cockpit-modernised and equipped with NVGs and self-protection a few years ago. Their two units in Linz-Hörsching suffer from a shortage of pilots and technicians, as some of them preferred to take a job at civil rotary operators like the Austrian Automobile Club ÖAMTC.

### Training Aircraft

In May 2018, the Austrian Air Force received the first two of four DIAMOND DA40 single-engine aircraft at the Zeltweg, which

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were handed over by Minister of Defence Kunasek and Minister of Transport and Aviation Norbert Hofer. The aircraft will be used for cost-effective flight aptitude selection of potential military pilots and IFR training. Care has been taken to ensure that the flight characteristics are simple and forgiving and that the student is clearly visible to the instructor. Another important aspect was the implementation of a single fuel concept: every aircraft type in the Austrian fleet can now be operated with the same propellant.

## Vehicles

The 106 new ÖBH armoured fighting vehicles (AFVs) ordered in 2016 by former Social Democratic Defence Minister Hans Peter Doskozil cost €256M; deliveries will be completed in 2019. As already mentioned, the Austrian Ministry of Defence was forced to phase out 750 AFVs from its fleet of 1,150 vehicles. This massive reduction of various armoured vehicles – mainly Saurer types – saved €30M.



Photo: Georg Mader

**Austria's current administration has reversed decades of decline in defence spending. From left to right: Defence Minister Mario Kunasek, Chancellor Sebastian Kurz, and Vice Chancellor Heinz-Christian Strache**

A turning point on 4 June 2018 was the presentation by Defence Minister Kunasek of the first new AFVs in the inner courtyard of the MoD in Vienna. During the presentation of three series of AFVs

for mountain troops, engineers and foreign missions, Kunasek said: "The protection of soldiers will continue to be an essential part of our investments in the future. Particularly during missions abroad, our soldiers are exposed to many dangers, which is why it is important to continue investing in protected mobility".

The PANDUR EVOLUTION (EVO) 6x6 armoured personnel carrier (APC) was then shown to the public for the first time. These are the first AFVs manufactured by General Dynamics Steyr Land Systems in Vienna, and 34 will be delivered to the ÖBH. This new version of the PANDUR has a more powerful 455 hp engine, increased mine protection, more interior space, an anti-lock braking system for more driving safety, a nuclear, biological and chemical (NBC) protection system and more capable electronics. Its two-stage transfer gear can be shifted on the move; the 100% locking differentials, the Automatic Drivetrain Management and the Central Tire Inflation System (CTIS) are also adjustable on the move which guarantees exceptional off-road mobility. The vehicle is operated by a crew of three and can transport eight soldiers. The total acquisition costs amount to €105M. The EVO complements the Austrian fleet of 68 older PANDURs, which were delivered to the military 22 years ago and upgraded in 2017. The upgrade included the installation of the same ELBIT laser warning system installed in the Austrian IVECO Light Multipurpose Vehicles (LMVs). Kunasek also presented two KMW DIN-GO 2 reconnaissance vehicles, of which Austria has purchased a total of 40 for €64M, delivered since September 2018 at a rate of four vehicles per month.

Photo: RMMV



**Austrian Defence Minister Mario Kunasek visiting the RMMV truck plant.**

Photo: ÖBH



**The "Jagdkommando" Special Forces is the first unit to receive the Steyr-Mannlicher SSG M1 rifle in 8.6x70mm/.338LM calibre.**



The DINGO 2 is equipped with an ELBIT remote weapon station with an MG74 machine gun, laser rangefinder, thermal imaging device and digital measuring station. A new three-coloured camouflage scheme replaces the previous RAL olive green. These vehicles complement the 18 DINGO 2 vehicles already delivered to Austria until 2017 and the fleet of the older DINGO. On 12 February 2019, the Minister handed over the first new vehicles in the Zwölfaxing barracks.

A third officially introduced vehicle was the BAE Systems HÄGGLUNDS BvS10 Mk 2B all-terrain rubber tracked vehicle. For the 2nd Engineering Battalion and the Mountain Battalion 23 in Absam and Saalfelden, 32 vehicles with trailers were ordered at a price of €85M, which will be delivered until mid-2019. Within the framework of the EU Defence Initiative Permanent Structured Cooperation (PESCO), these Austrian units are earmarked for a competence centre for mountain warfare. In addition to mine and NBC protection, the first vehicle shown in Vienna carried a large snow plough.

When it comes to road mobility, a "Mobility Package" for disaster relief – the misleading name has been chosen to secure public support – launches the



Photo: Georg Mader

**Austria bought 32 HÄGGLUNDS BvS10 Mk 2B all-terrain rubber tracked vehicles for €85M.**

renewal of the ÖBH's truck fleet. For €30M, Austria will buy 40 all-terrain trucks, 50 off-road multi-functional vehicles, four tractor units, 20 low- and hook-

loaders and cranes. Noteworthy are eight new RMMV HX 8x8 high-mobility trucks equipped as MAMMUT NBC-decontamination stations. Almost all of them are



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based on RMMV trucks from the plant in Vienna. And in December 2018, the minister handed over the first 50 out of 140 MAN 14.280s driving school equipped off-road trucks with interchangeable payload, to replace the obsolete 12M18s. The rest of the 14.280s are due to follow until mid-2019.

## Small Arms

With regard to the small arms segment, the new sniper rifles for the Austrian Special Forces need to be highlighted. In November 2018, Mario Kunasek handed over new sniper rifles and a new building with an indoor training hall to the "Jagd-

kommando" Special Forces unit in Wiener Neustadt. The highly respected élite unit was the first to receive the Steyr-Mannlicher SSG M1 rifle in 8.6x70/.338LM calibre (a multicalibre rifle unveiled in 2018) with a range of 1,200 metres. The MoD bought 120 such medium sniper rifles for €1.6M. ■

## What is the Situation with Austria's EUROFIGHTERS?

As far as the most prominent, urgent and expensive aspect of defence equipment modernisation is concerned, Austria is still involved in a legal dispute with Airbus (as successor to EADS) initiated in February 2017 by former Defence Minister Hans Peter Doskozil. After years of investigation by a secretive MoD task force under General Hamberger and Werner Peschhorn, Head of the Federal Prosecutor's Office, the two accused EADS of "fraud and deliberate deception" in connection with an order of 18 EUROFIGHTERS worth €1.95Bn. They accused the consortium of having defrauded Austria with regard to price, equipment and delivery capability. They accused 17 former EADS managers up to Airbus CEO Tom Enders, who together with legal advisors Peter Kleinschmidt and Peter Gauweiler rejected all accusations. Two years later, the trial has not made any real progress. The case was recently referred to another prosecutor.

On 27 September 2018, an expert study commissioned by the Austrian Attorney General and led by Jürg Weber, former Director of armasuisse, supported the jet manufacturers and concluded that "the former EADS consortium was able to deliver the aircraft with the original subsystems. There were no delivery problems. Eurofighter/EADS always has the necessary know-how to successfully conclude its contracts and deliver its products to the customer in the contractually agreed quality, on the contractually agreed dates and at the agreed costs".

The type was chosen in July 2002, but at that time the Austrian Ministry of Defence – the postponed elections caused a delay of one year – signed the contract for 18 single-seaters in July 2003, when the four Eurofighter nations and NATO Eurofighter and Tornado Management Agency (NETMA) had not yet reached agreement on Tranche-2. While Austria was informed about the progress of the completion of Tranche-2, the contract was not signed until December 2004. In the original contract, Austria therefore initially accepted jets of Tranche 1/Block 5, which were later to be upgraded to "certain capabilities of aircraft of Tranche 2/Block 8".

Photo: ÖBH



The first six of these T1/B5 jets were delivered on time from July 2007. It would definitely have been very difficult for EADS to deliver 18 Tranche 2/Block 8 aircraft by 2009. After a change of government, the new Defence Minister Norbert Darabos took the lonely decision in June 2007 to renegotiate with the Eurofighter consortium to reduce the number to 15 aircraft of Tranche 1/Block 2R-5, including six used German Air Force aircraft. These aircraft continue to perform their daily duties, responding to 60 to 70 "Red Alpha" alerts registered each year, mostly against "No Comm" airliners and deviations from flight plans. Major events such as the annual World Economic Forum in nearby Davos, Switzerland, are regularly protected by up to eight of the 15 operational aircraft available. Since February 2019, agreements have been in force with Switzerland and, in preparation, also with Germany to enable interceptors to enter each other's airspace. Nowadays, however, the 15 old EUROFIGHTERS are increasingly expensive to operate, and their electronic equipment is outdated; they do not even have radar warning receivers. This is why the current government is looking for upgrade solutions or alternatives. In 2017, Saab and Lockheed delivered quotations for prices for new-build JAS-39C/D and F-16V fighters, respectively. Eurofighter, the UK Royal Air Force (RAF), and the Italian Air Force (AMI) were also consulted on how to reduce flight-hour costs. The RAF offered its TYPHOON Total Availability eNterprise (TyTAN) concept to Austria, while the AMI proposed to take over the logistics of the 15 Austrian jets. A decision on an upgrade or a new platform is expected by mid-2019. However, it must be stressed that only IFF transponders of type 5/Mode-S need to be installed for €500,000 per aircraft in order to continue to operate. Despite the litigation, AIRBUS says they remain interested in supporting the former OEM customer with an upgrade.

Much more urgent is the replacement of the obsolete 12 Saab 1050Es, which were delivered from 1970 onwards and which still account for 40% of the air policing for a reported €18,000 per flying hour. They are currently scheduled to be phased out by the end of 2020. Their successors could be M346FT/FAs, HAWK T2s or – if they do not need to perform an air policing role – the Aero L-39NGs or M345HETs. The latter, however, would mean adding their 40% on the remaining 15 EUROFIGHTERS. But then these EUROFIGHTERS with their 16 or 17 pilots (in comparison, the 14 Czech GRIPEN C/Ds are operated by 28 pilots) would have to fly up to 2,000 expensive hours per year, well above their current ~1,100 flying hours. All this means that the urgent decision on the Saab 1050Es has to wait for the third EUROFIGHTER parliamentary inquiry, which hopefully will be completed in summer 2019.



# “You Can Count on Our Army”



Photo: Bundeswehr / Marco Dorow

## Interview with Lieutenant General Jörg Vollmer, Chief of Staff, German Army

**ESD:** Do the deployments challenge the Army?

**Vollmer:** The Army delivers and accomplishes its missions. You can rely on us, despite personnel and material gaps. I am proud of our soldiers. Deployments are part of our core mission.

**ESD:** What will happen in Lithuania and the Enhanced Forward Presence initiative?

**Vollmer:** This will most likely develop into a permanent task. The Netherlands and Norway are always present. It has been a good assignment for us to practise our core business of “Mechanised Combat”. Now we are focusing on improving the framework conditions.

**ESD:** How do you assess the current status of the VJTF 2019 (L)?

**Vollmer:** Good! Here, too, we operate with the Netherlands and Norway as framework nations. TRIDENT JUNCTURE was a complete success, but a feat of strength with effects on the entire Army. But VJTF 2023 must bring a system change!

**ESD:** Do you mean the “Standard Brigade VJTF” system of the Minister of Defence?

**Vollmer:** Exactly. The lead unit PzGrenBrig 37 will be fully equipped by 2021 and will then provide the VJTF 2023 army share from its own resources. In parallel, the material growth of the next brigade will be taking place.

**ESD:** What else is necessary for this?

**Vollmer:** Step 1: More money in Section 14 with decision on basic parameters in 2019. Step 2: Establishment of a plan-

ning ceiling for Land in Section 14. Step 3: Elimination of material shortages brigade by brigade.

**ESD:** And what will be the final result?

**Vollmer:** A division fully equipped, modernised by 2027, capable of national and alliance defence. Supplemented with two further divisions digitised by 2032. This enables us to implement the capability profile and respond to NATO requirements.

**ESD:** Could you briefly elaborate on the subject of digitisation?

**Vollmer:** Digitisation is inevitable! It is a major topic! The Army, the Joint Support Service, the Medical Service and the Cyber and Information Space Command (CIR) have set up experimental forces. As of 2019, they will be tested, tactically, with their own soldiers. Our objective: to increase speed.

**ESD:** Which topics are you concerned about, apart from material issues?

**Vollmer:** More beds for commuters are planned. Basic training has been adapted and modernised. In the future, the training of officer cadets will be carried out with stronger ties to the different branches of the armed forces.

**ESD:** Please name three fictitious headlines that you would like to read in 2019 and three that you could do without in 2019?

**Vollmer:** I would like to see the following headlines, which should reflect the results of our work:

**1) Breakthrough in Procurement Policy** In a creative and innovative approach, the Bundeswehr has succeeded for the first time in organising the complex armament process for land forces in such a way that the required equipment status can actually be achieved. “The best army ever financed costs only €3Bn more,” is the catchy formula used by the Army. With the establishment of a virtual ceiling in the defence budget to eliminate material deficits in the Army, the Joint Support Service, the Medical Service and CIR, the MoD's leadership has created planning secu-

rity for all actors and broken through the Gordian knot that has been tied down for decades.

## 2) The Army: An Oasis in Germany's Digitisation Desert

The test and experimental forces jointly set up and operated by several organisational units of the Bundeswehr in Munster, Lower Saxony, have proved to be a magnet and gravitational centre of digitisation. The soldiers, who are moving in a digital room during basic operations as well as during battle trials, are enthusiastic. “Here I see, feel, live and work every minute after entering the barracks, as in the future,” a corporal is pleased to say. “I had never thought this would be possible in the Bundeswehr.”

Photo: Bundeswehr  
**Engineers of the German VJTF Brigade during Exercise Trident Juncture in Norway in November 2018**

## 3) “You Can Rely on Our Army”

This is the result of a nationwide representative survey. When a poll asked which organisations were most trusted and believed to be capable of fulfilling their mission even under the most adverse circumstances, the Army ranked second after the fire brigades. Jörg Vollmer, Chief of Staff of the Army, said: “I don't really like being second, but in this case I'm proud of it.”

**The interview was conducted by Dorothee Frank.**



# Viewpoint from Berlin



## Turning, Slowly

### Re-establishing the Bundeswehr as a Fighting Force

**Wolfgang Labuhn**

In 2014, the German armed forces (Bundeswehr) were in no position to contribute considerably to NATO's 'Readiness Action Plan' agreed at the Alliance's Wales Summit. However, Germany met an earlier commitment by accepting the role of lead nation for the first Very High Readiness Joint Task Force (VJTF) to be deployed in the eastern part of Alliance territory at short notice. The German mechanised infantry battalion designed to be at the core of VJTF 2015 was not combat ready but had to be equipped with material from a number of other units throughout Germany.

At this year's Munich Security Conference, Minister of Defence Ursula von der Leyen reminded her audience that during the decades preceding the Ukraine crisis of 2014 the Bundeswehr had to endure enormous cuts: "Missions abroad had priority. National and Alliance defence capabilities had suffered massively. When I came into office, the Bundeswehr received hardly any new material. This has totally changed."

#### The Turnaround

But has it really? VJTF 2019 sees Germany again as its lead nation, this time with a tank battalion as the core unit. And again, battle readiness could only be achieved by "borrowing" LEOPARD 2 main battle tanks plus other vital equipment from other units. But thanks to her own triple action plan for 2016, Mrs von der Leyen sees a silver lining on the horizon; it was her aim to achieve the turnaround in the face of declining staff numbers, a lack of equipment and declining defence budgets.

Germany's defence spending has since risen considerably, reaching €43.2bn in 2019 compared to €38.5bn in 2018 – a rise of 12.2% in just one year. However, this increase still amounts to only 1.35% of the German GDP, thus falling well short of the 2% target agreed by all NATO member states at the Wales Summit. And at present, only 15.7% of the German defence budget is spent on procurement, whereas the Alliance aims for 20%. On the other hand, the German Government has assured NATO repeatedly that it will raise defence spending to 1.5% GDP by 2024. At the Munich Security Conference in February 2019, Chancellor Angela Merkel reiterated this pledge in public, although the Social Democratic Party (her partner in the Berlin coalition government), is opposed to further increases in defence spending.

#### Procurements

Meanwhile, the material turnaround has begun in earnest. For instance, the German Army will get an extra 100 LEOPARD 2 tanks that had been mothballed by manufacturers and that are currently being modernised to the highest standard. The



Photo: Bundeswehr/Torsten Kraatz

**The MARS II artillery system firing during Exercise Trident Juncture 2018**



Luftwaffe will be using all 53 Airbus A400M transport planes originally ordered, rather than selling on 13 planes. The German A400M fleet currently numbers 25, with a further seven aircraft due to be delivered this year. The Ministry of Defence has also announced that the 33 oldest EUROFIGHTERS will be replaced by the latest version. The German Navy will receive five additional K130 class corvette battle ships and next-generation multipurpose MKS 180 battleships to replace the ageing frigates from 2023 on. A submarine joint venture with Norway means two additional Type 212 CD submarines for Germany.

## Recruitment

The Bundeswehr is also growing in numbers again. After falling to its lowest level of 176,000 active soldiers in 2016, it currently has over 181,000 active soldiers, including some 22,000 women. Current personnel planning targets 203,000 active soldiers by 2025. Since military conscription was suspended in 2011, however, the Bundeswehr has had problems recruiting

new soldiers on the labour market, where urgently needed IT specialists, for example, receive significantly higher salaries than professional soldiers. In 2018, the number of new recruits fell to 20,000, the lowest figure ever. The overall increase in the number of soldiers is mainly due to the extension of existing contracts and not to the recruitment of new soldiers.

Current military planning in Berlin aims to establish a fully equipped combat-ready battle brigade by 2023, when Germany will be the VJTF lead nation again. By 2027, two more combat ready battle brigades are to follow. Only then will there be a fully equipped German Army division for the first time in decades. By 2031, the Bundeswehr hopes to have three battle-ready army divisions again, comprising eight combat brigades in total. By then, the Federal Government will have changed several times and, maybe, the ambitious plans to modernise the German armed forces as well as the willingness to spend a lot more on defence, too. However, if present planning is realised, over the next decade or so, the Bundeswehr might well become a formidable fighting force again.



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# Finnish Air Force Modernisation

**Alan Warnes**

**Russia and Finland share a 1,400 km-long border. Since the security environment changed in 2014, the Finnish Air Force has been busy monitoring Russian fighters and bombers.**

Russia plays a major role in Finland's military strategy, and it is not surprising that Finland's air force is mainly prepared for air defence. Nowadays, the fleet of 62 F-18 HORNETs is engaged in surveillance of Russian fighters and bombers. In February 2018, Finnish Defence Minister Jussi Niinistö described

Russian sorties in close proximity to Finnish borders as the "new normal" and added: "We must ensure that our armed forces have the equipment they need to carry out their tasks".

Russian operations in international airspace over the Gulf of Finland are at the same level as in 2014, when the secu-

is why Finland is concerned, because it is not a NATO member and still depends on conscripts and almost 300,000 reservists in its military, and it would be no match for the Russian military.

## EU Defence Instead of NATO

After joining the European Union in 1995, Europe's northernmost state became part of the Common Security and Defence Policy (CSDP). Defence cooperation in the EU serves two purposes: to strengthen the EU and to use scarce resources to relieve the financial burden on nations. These are the advantages enjoyed by Finland together with other EU members, Austria, Ireland, Malta and Sweden, which are not bound by a military alliance.

Finland does not want to join NATO, and it probably holds the organisation in lower regard than any other EU country; recent surveys show that less than 20% of the population want to join the Alliance.

However, like its Nordic allies, Finland believes in a strong military force and the Finnish Air Force is very powerful. In 1992, when Finland wanted to join the EU, it ordered 65 F-18C/D HORNETs, which were delivered between 1996 and 2000.

They helped revolutionise Finnish air defence and, as part of the offset deal, Finnish Patria Aviation assembled 57 of them in Halli, Jamsa.

The HORNETs continue to serve with two units: The 11th Lapland Wing Squadron at Rovaniemi Air Base and the 31st Satakunta Wing Squadron at Kuopio-Rissala Air Base. A third unit, the Air Combat Centre, also operates some HORNETs together with HAWK Mk51/51As and L-70 VINKAs in Tampere-Pirkkala.

## HORNET Upgrades

For the integration of the AGM-158 JASSM, the Finnish Air Force handed over two F/A-18C HORNETs to Naval Air Weapons Station (NAWS) China Lake in 2016, resulting in two firings on 5 and 9 March 2018. Everything went as planned, with both missiles destroying their targets. The



Photo: USAF

**The Finnish MoD has launched the HORNET Replacement Programme (HX) to replace its 64 F/A-18C/Ds by 2021. Under the terms of HX, the first aircraft should be delivered from 2025 through to 2030.**

## Author

**Alan Warnes** is a journalist specialising in military aviation and has travelled to over 60 countries researching articles and taking action photos for his work. For 12 years, he was the Editor of AirForces Monthly magazine in the UK, before opting to go freelance. He has also written several books, including two on the current Pakistan Air Force in 2008 and 2017, and the most recently on 100 years of Aero Vodochody.

rity environment changed. The Finnish Air Force announced on 10 January that the Russians had not violated Finnish airspace in 2018. However, the Russians had increased operations over the Gulf of Finland by 25% in 2018 compared to 2015, which serves as the benchmark. This is still 15% less than 2017, the most active year of Russian operations since the end of the Cold War.

Both sides share a 1,400 km-long border, and as we have seen in Syria and Ukraine, Russia cares little for world opinion and is willing to do anything to achieve its long-term strategic goals. This



test demonstrated the technical functionality of the JASSM missile system and its task scheduling software in the F/A-18 fleet to enable Full Operation Capability (FOC). In addition, MLU 2 introduced modern self-protection, communication and information distribution systems.

Since being introduced into service, the jets have been systematically updated in two different phases. The first upgrade, called Mid-Life Upgrade 1, was completed in 2006–2010, while the second phase, called Mid-Life Upgrade 2, took place between 2012 and 2016. The upgrades were carried out in connection with planned maintenance at Patria's Halli facility.

MLU 1 focused on revamping the air-to-air capability of the aircraft, giving it a head-start in today's counter-air operations. The integration of a helmet-supported sighting system in conjunction with the state-of-the-art AIM-9X SIDEWINDER IR rocket provided better close air combat performance. The second mid-life upgrade focused on the acquisition and integration of air-to-ground weapons. Due to the MLU 2, the Finnish HORNETs were renamed to F/A-18C/Ds as they now had an attack function in a multirole capability. The Finnish HORNETs' air-to-ground weapon suite now includes the Joint Direct Attack Munition (JDAM) precision-guided bombs, the Joint StandOff Weapon (JSOW) medium-range glide bomb and the long-range Joint Air-to-Surface Stand-off Missile (JASSM). The electro-optical LITENING Targeting Pod was also installed.

## HORNET Replacement (HX)

The Finnish MoD initiated a HORNET replacement (HX) programme, with a budget of between €7Bn and €10Bn. This money

will come from a special fund set up by the government. The objective is to find a multirole fighter best suited for Finland to replace the HORNET fleet after 30 years of service. The Request for Information (RFI) documents sent out in April 2016 to the governments of Britain, France, Sweden and the US led to five manufacturers responding. A preliminary Request for Quotation (RfQ) issued in April 2018 was submitted in January 2019.

Following the general elections in April, the new government will confirm the budget and perhaps issue more guidelines. In the second half of 2019, the government will issue a second RfQ requesting more precise information from the manufacturers. In the second phase of negotiations, the final content of the procurement packages is then determined with each candidate.

The aircraft will fly to Finland next winter to be assessed and then receive a "best and final offer" from the candidates in 2020. The Finnish Government will take a decision on procurement in 2021. Delivery of the new fighter aircraft will start in 2025, with the operating costs coming from the FAF budget and not exceeding 10% of the total Finnish defence budget.

Fighter aircraft under consideration are the Boeing F/A-18E/F SUPER HORNET Block 3; Dassault RAFALE; Eurofighter TYPHOON (with BAE Systems taking the lead), Saab GRIPEN E/F and the Lockheed Martin F-35 LIGHTNING II.

Former Finnish Air Force Commander and HX programme director at the Finnish MoD, Major General Lauri Puranen, told the author: "It's critical we get the best military capability for Finland."

Photo: Lockheed Martin



**The Lockheed Martin F-35A is considered to be a strong contender in the HX programme.**



Photo: Boeing

**One of the five jets being considered under the HX programme is the Boeing F/A-18E/F SUPER HORNET, which some might consider as the favourite.**



Photo: G4NG3r

***Not surprisingly, neighbouring Sweden is also pitching in with its JAS 39E/F GRIPEN. It is also among the front runners, not just because of its capabilities, but because Sweden and Finland want to cooperate more closely politically and militarily.***

## Military Capabilities

This HX competition is not comparable to other European competitions, which are generally decisions informed by coalition warfare. Since Finland is not in NATO, it does not have to buy the same jets as other air forces to fit into the alliances or to simply fly the flag. The Finnish defence strategy is much more independent than that. There is still conscription and the mentality of the whole country towards defence is crucial. Already in 1992, when everybody bought or upgraded F-16 aircraft, Finland opted for the F-18C/D HORNET. An aerospace insider told the author: "Finland will not buy a jet that is not suitable for Finland; it will buy the asset that is most suitable for it."

The requirements for the HX were defined as part of the strategic planning process of the armed forces. The aim is to comprehensively predict the requirements for a multirole fighter in the operational environment of the 2030s.

The capability requirements see the HX system conducting air operations across five scenarios: counter-air, counter-land, counter-sea, intelligence, surveillance and reconnaissance (ISR) targeting, and long-range strike.

Counter-air is the most important; it is an aircraft's ability to perform well in combat alongside other fighter aircraft and ground-based air defences.

Major General (ret) Puranen who commanded the FAF in 2012–2014, continued: "Counter-air is critical. The multirole fighter could be engaged in air combat or be attacked by ground-based air defence

in addition to other tasks. Provision of support also plays an important role in the evaluation and in terms of operations; the flexibility and capability of support provision contributes to the results of each scenario."

The winning HX candidate will need to implement the Finnish Air Force's agile air warfare system from dispersed air bases, with varying levels of equipment and within the range of long-range enemy strikes. In response to the RfQ, HX candidates should have achieved the end results required in the scenarios by producing desired impacts with selected solutions.

Puranen added, "It will be up to the main contractors to provide the Finnish MoD with solutions for the scenarios set and the weapons needed to fulfil the missions. They will negotiate with the companies and be responsible for the integration of the weapons, which will then be included in the costs paid by the Finnish Air Force for the HX."

MBDA is offering weapons and air-to-air missiles for all four platforms. The five campaign teams are very secretive to make sure no one knows the details of their offers. Puranen continued, "We will evaluate every aspect of the capability – sensors, missiles, electronic warfare, and so on. Needless to say, everything will have to work in a network-centric environment alongside army and navy systems to exchange information. The training systems also need to be on a very high level and take into account all the capabilities on offer. In the 30 years in which the HX will

be in operation, the aircraft must continue to develop with the latest technologies."

## Industrial Participation (IP)

Defence Minister Jussi Niinistö has set the obligatory local content for the HX programme at least 30% of the total contract value. In the last 20 years that the F/A-18C/D HORNET has flown, Boeing has been able to establish an industrial network in Finland that could give them an advantage. Boeing's Alain Garcia said, "Our current participation in the legacy HORNET has enabled us to achieve a local commitment of US\$3Bn, well above what we originally committed ourselves to. Over the past 20 years, we have also worked with around 220 local Finnish companies. We have no doubt that we can meet their industry requirements."

Saab wants to establish more than just an MRO as Boeing did for the HORNET; Saab wants Finland to work with them to further develop the GRIPEN over time by establishing a GRIPEN System Centre like the one in Brazil.

Saab's HX Campaign Director Magnus Skogberg told the author, "We can ensure that local capacity covers any cut-off scenario during a crisis or war when Finland has to do everything alone, without an online data connection out of Finland." He continued, "GRIPEN is designed for the Finnish task – the kind of threats and climates; everything regarding conscripts, road base ops and the sensors needed for this area."

The Swedish aerospace giant clearly wants a long-term commitment with its Finnish neighbours. The political ambition of both Sweden and Finland to deepen bilateral defence cooperation would be greatly enhanced if both countries used the same aircraft.

## HX Highway Ops

Major General (ret.) Puranen also told the author: "We want to rely on the existing infrastructure and build as little as possible". This could be a problem for some of the bidders. As we saw with the F-35 acquisitions in Italy, Norway and the UK, a lot of new construction had to be done at the airbases to accommodate the F-35. The main reason for these constructions is safety, and Finland has such a long border with Russia that airbase reconstructions will be of importance when it comes to assessing the offers. In Finland, underground bunkers the size of the F/A-18 HORNET have been built, and these may be too small for the larger F-35 Joint Strike



Fighter and the F/A-18E/F SUPER HORNET. When it comes to highway operations, the Finns will not be keen to alter the way they do things. The principle of dispersing the jets and using their assets to their tactical advantage is unlikely to change.

According to Alain Garcia, Boeing's Director for International Fighter and Sales Marketing, the F/A-18E/F SUPER HORNET is a great fit for the road-base requirement. "While it is slightly bigger than their current legacy HORNET, little of the infrastructure would need to be changed." Garcia, who spent 11 years flying on aircraft carriers, continued: "The SUPER HORNET was designed specifically to operate from remote locations like aircraft carriers and in harsh environments. The landing gear is very robust; it was made for these kinds of ops and there are two nose wheels instead of one, which means it can be manoeuvred very well in a controlled environment. And of course it has the tail hook, so you can stop very quickly. The jet has a very short take-off, and while the catapult assists during carrier ops it has a better take off performance than the classic HORNET."

Saab undoubtedly has a lead on the road base operations requirement, because they are part of the Swedish Air Force operational concept with their GRIPENS. Skogberg explained why Saab has an advantage: "Road bases and harsh Nordic climates are nothing new for the GRIPEN. It has been built to cope with these conditions and to be easily maintained by conscript mechanics [Finland is one of only a handful of European forces that still use conscript mechanics] in a very short turnaround time. One technician and five mechanics can turn around a GRIPEN in ten minutes, while an engine change will take less than an hour." He added, "We can support a higher sortie generation rate and together with the serviceability of GRIPEN carry out ops at road bases all around Finland. GRIPEN does not need fixed installations; it is very self-sufficient and operates from 800 m-long highway strips. We feel very comfortable with this type of use." There is no doubt that the EUROFIGHTER has a bigger battle ahead when it comes to this type of operation. Paul Hitchcock, BAE Systems' HX Campaign Manager, told the author, "While they are called road bases, they do not have any infrastructure around them. It isn't a million miles away from our dispersed operations in the Falklands. We have

visited the road bases, and we have offered a proposal that we believe fits in with all the Finnish requirements." Hitchcock provided further insight into BAE Systems' bid. "The requirements they have put down fit with what our current air force operators are doing

the HAWKs. We will use more synthetic training as well that has been integrated with F/A-18s and the HAWKs." According to the Finnish Air Force, the HAWKs are scheduled to remain in service until the 2030s or beyond. From 2019 onwards, FAF will fly a fleet of 31 HAWKs

Photo: FAF



**The GROB 115Es trainers formerly used by three UK armed services have replaced the Valmet VINKAS which had been in service since the 1980.**

with EUROFIGHTER now and in the decades to come, covering ISTAR, network centric, communicating seamlessly with ships at sea, ground forces, with other aircraft and assets." He added, "We have looked at their systems and know we have the technologies to provide the enabler to join them all up through web-enabled technology. HX is just part of an overall defence capability that Finland is building. The Navy's new Squadron 2020 requirement coupled with missile systems they might buy has to be joined up, and if we couldn't have done that we wouldn't have bid." BAE Systems, Boeing and Saab have been impressed by the HX Programme management office's continuing dialogue to ensure they understand the requirements. Dassault Systems didn't respond to the author's request for an interview, and Lockheed Martin missed the editorial deadline.

## Trainers

With the HX coming online in 2025, you could be forgiven for thinking the Finnish MoD is also looking for a new fighter trainer. "No, we are not," Major General Puranen told me. "We acquired [18] low-houred HAWKs from Switzerland [in 2007] and upgraded them [between 2011 and 2013] with two-way data link systems and transferred a lot of the training from the HORNETs to

with cockpits upgraded by Patria. The cockpit upgrade programme includes the replacement of analogue cockpit instruments with modern displays, which narrows the gap between the instrument layout of the HAWK and the HORNET. In the first phase, all 18 HAWK 66s, seven 51As and a single 51 received the cockpit modification. A further seven HAWK 51s, which were in long-term storage should have been upgraded by now.

The medium airlift capability is covered by three Airbus C295M tactical transports, although one of them is used as an ELINT/COMINT platform for eavesdropping. On 12 February 2018, the Finnish Air Force announced that Lockheed Martin's DRAGON SHIELD roll on/roll off system was now operational on the aircraft. There are also three LEARJET 35s, with one dedicated to ELINT and the other two to target towing, aerial cartography, and light transport duties, while six PILATUS PC-12NGs fly light personnel and cargo missions.

Air Force pilots commence their flying career on one of the 28 indigenous Valmet L-70 VINKA primary trainers delivered from 1980 onwards. However, they are now being replaced by 28 GROB G 115Es that became surplus in the UK when the GROB 120TP was purchased.

Air surveillance radars used for monitoring Finland's airspace and a range of training simulators play a major part in the air force's overall capability. ■

# The Development Plan for the Royal Malaysian Air Force

**Dzirhan Mahadzir**

**Most of the Malaysian fighter aircraft fleet is ageing, and the government is reluctant to address this issue. Now the new government has presented a long-term capability development plan.**

Despite a change of government in May 2018, prospects for the pressing modernisation of the Royal Malaysian Air Force remain bleak due to several factors. The current Pakatan Harapan government has little inclination to defence and is at the moment unwilling to address the issue of the RMAF's lack of combat aircraft and

itself on the fiscal situation of the nation. Initially, following the election, the Pakatan Harapan government claimed that the country's fiscal situation was poor owing to mismanagement and corruption by the previous government. However, in recent months and due to the reaction of the financial markets which responded nega-

ture of his successors (and predecessors at the same time) Abdullah Badawi and Najib Razak. Little also is to be expected from Defence Minister Mohamad Sabu, whose stewardship of the Defence Ministry has been underwhelming, to say the least, with many outstanding matters in the MoD remaining unaddressed, such as the upgrade programmes of the BAE HAWKs, Lockheed Martin C-130 HERCULES and Sikorsky S-61 NURI helicopters. In July 2019, Mohamad Sabu told Parliament that only four of the RMAF's 18 Sukhoi Su-30MKMs were able to fly; both he and the RMAF subsequently explained that the problems were due to the lack of funding by the previous government, although since then not much has come out as to whether the problems have been solved satisfactorily. At the same time, Mohamad Sabu has said little about how to address the various problems of the Malaysian armed forces, ranging from degrading and obsolete equipment to capability deficits, while costs and budgets are rising. The RMAF has published a development plan called "Capability 55", which postulates a final target for a certain troop level by 2055, although this plan has a number of weaknesses, which are discussed below.



Photos: via author

***The Royal Malaysian Air Force operates 18 Sukhoi Su-30MKM aircraft. Questions arose regarding their serviceability, following the Defence Minister's revelation in 2018 that only four aircraft were operational.***

the growing obsolescence of much of its fleet. What is more, the government's fiscal position also precludes any actions being taken on modernising the RMAF, though it is difficult to ascertain what the situation is, as the government has been contradicting

tively to such announcements, the government has somewhat softened its tone and has assured the public that despite the fiscal situation inherited by the previous government, Malaysia was now fiscally stable and would improving its finances in the future. As a result, the true fiscal situation of Malaysia and the availability of funds for air force modernisation remain unclear.

What is clear, however, is that for the immediate future, RMAF modernisation is not on the table. Prime Minister Mahathir has not shown any inclination to boost Malaysia's military capabilities, despite the fact that much of the nation's key military capabilities have degraded during the ten-

## The "Capability 55" Plan

Released in July 2018, the Capability 55 Plan seeks to postulate a development plan for the RMAF with an envisaged force structure by 2055. Beyond the 2055 end goal, no timeframe is given for how this force structure will be developed. The plan calls for the RMAF's current five fighter and lead-in fighter trainer types, namely the Su-30MKM, F/A-18 HORNET, Mig-29, BAE HAWKs and Aermacchi MB339CMs that form five squadrons and a lead-in fighter training flight to be transformed into two types, namely a Multi Role Combat Aircraft comprising two squadrons and a Light Combat Aircraft comprising three squadrons which will also carry out the lead-in fighter trainer role. For the transport squadrons, the four RMAF transport squadrons comprising one A400M squadron, two

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C-130 squadrons and a CN-235 squadron are to be transformed into a single strategic airlift and multirole transport tanker squadron and two tactical airlift squadrons. For the RMAF's aerial C4ISR assets, which currently consist of three Beechcraft 200T Maritime Patrol Aircraft in a single squadron, the RMAF plans to have a squadron each of Maritime Patrol Aircraft, UAVs and Airborne Early Warning and Control aircraft. The RMAF's four helicopter squad-

dedicated a minimum of six MRCA squadrons would be required to adequately cover Malaysia's airspace, and at the same time, the RMAF has not indicated in its Capability 55 Plan how many aircraft would constitute a squadron. It does not bode well for the plan that it will take 37 years for the RMAF to reach a fighter fleet strength that is no better than that of today. At the same time, so far the RMAF has not received any financial commitment from

## Fighter Aircraft

One of the key problems facing the RMAF is its declining fighter fleet. In 2018, the RMAF finally called time on the operations of its MiG-29 fighters. The fleet had already been reduced by then to around four operational aircraft from the original complement of 18. The Sukhoi squadron remains at 18 aircraft, despite questions of how many aircraft are operational. The



**All four RMAF A400Ms have been operating smoothly in the RMAF since delivery of the fourth and final aircraft in March 2017.**

rons comprising S-61 and H225M helicopters will be transformed to two squadrons of a single type Combat Search and Rescue helicopter. The plan calls also for nine new radar stations and a ground-based air defence regiment as well.

## Planning 37 Years in Advance

The transformation plan has its weaknesses. The 37-year timeframe has led to ridicule among various professional defence analysts and observers as well as the public, given the fact that technology and capabilities may have significantly changed throughout that period. To give an example, if one took the eve of the First World War in 1914, it would mean the UK would be formulating an air force development plan based on the technology and capability existing in 1914 and taking that it stay largely the same until 1951, while actually, airpower technology and capabilities had changed significantly in that period. At the same time, the long period does not seem to convey any sense of urgency or priorities and may lead the Malaysian Government to taking the attitude that since the end goal is 2055, the issue of RMAF modernisation is thus not a pressing one.

The other problem is the numbers. Two MRCA squadrons are hardly enough to cover Malaysia. Past RMAF Chiefs have in-

the government in regard to the plan. Defence Minister Mohamad Sabu and Deputy Defence Minister Liew Chin Tong have made public statements in support of the plan, but there has been no indication that the Malaysian Government as a whole will support the plan and provide financial resources for it. The picture may be clearer when the Defence White Paper, the first in Malaysia's history, comes out in September 2019, though it remains to be seen if the Defence White Paper will touch on the core issues and put forward a properly funded defence development plan with a timeframe or just a general policy document. Perhaps the major issue at hand is that the RMAF should be concentrating on how to solve several pressing issues in the next 5–10 years rather than putting forth lofty development plans. RMAF officers have informed the author that the Capability 55 Plan is intended to enable RMAF to advance development plans and that the timeframes for achieving the Capability 55 objectives are earlier than 2055 and that more detailed plans exist than what has been published. Nevertheless, the fact remains that there seems to be no fiscal support and that the RMAF has not clearly formulated its needs, which go beyond the defence of the nation, but which do not make clear from what the nation is defended and how this is related to the development goals of the RMAF.

lack of operational aircraft stemmed from the fact that several aircraft were undergoing or about to undergo a mid-life refit programme, while others were actually capable of flight operations but placed on inactive status while awaiting funding to put them on the refit programme being carried out at the ATSC facilities located on the Sukhoi's home base at RMAF Gong Kedak. The RMAF F/A-18 HORNETs remain at the eight aircraft originally purchased, though the small numbers make operations challenging for the fleet. Thus overall, the RMAF has only a total of 26 fourth-generation fighter aircraft, in contrast to the fleets of Thailand, Indonesia (both of which hover around the 50 aircraft mark) and Singapore (around 100 aircraft). And given the development of China's island facilities in the South China Sea to allow it to field both fighter and bomber aircraft from there, which can range over Malaysia's claims in the Spratly Islands along with a significant portion of Malaysian territory in East Malaysia, this should have provided impetus for Malaysia to bolster its air capabilities. This has not been the case though, with the key weakness being an overreliance by the Malaysian Government on the assumption that Malaysia will be able to maintain neutrality irrespective of any situation and Malaysian diplomacy will avert any conflict or crisis.





**An RMAF BAE HAWK 208. The upgrade for the HAWK 108 and 208 fleet has been pending since 2014 and may not be carried out in light of the RMAF considering a Light Combat Aircraft programme to replace the HAWKS and MB-339CMs.**

Meanwhile, Malaysia's light fighter aircraft and its lead-in fighter fleet also face their own problems. The HAWK 208 fleet currently stands at 12 aircraft from an original total of 18 purchased in 1994, and five out of ten HAWK 108s purchased at the same time, with all the other aircraft lost in crashes. The HAWK 108s are used for lead-in fighter training, together with the Aermacchi MB-339CM, of which seven remain from a total of eight obtained in 2009. The availability of these aircraft has been limited due to a cost saving measure of the Malaysian Government in using the engines from its MB-339As, which had been phased out. The engines were overhauled and then placed into the airframe of the CM models purchased by Malaysia and, as a result, are nearing the end of service life given their prior existence

in the MB-339As, which had been operated by Malaysia since 1983. An upgrade programme was supposed to be undertaken on the HAWK fleet, but this had been stalled by the previous administration since 2014, and so far the current government has not shown any intention to proceed with such. At the same time, the RMAF's Capability 55 announcement of wanting a Light Combat Aircraft gives rise to the fact that the HAWK may be on the way out of the RMAF, and thus an upgrade programme will be moot. Still, the issue is that the RMAF has not clearly defined its LCA requirements, for example, a type similar to the HAWK such as the KAI FA-50 and T-50s or a class such as the TEJAS, JF-17, F-16 or GRIPEN. Fundamentally, the RMAF appears to be unaware that pushing the LCA requirement may lead it to having to

forgo the MRCA requirement, given the fact that to the ruling government politicians and Finance Ministry officials, fighter aircraft are all the same. So if the RMAF gets approval for LCAs, there's no need for another fighter aircraft type. If the RMAF ends up settling for a GRIPEN or F-16 for an LCA, then forgoing the MRCA would not be a problem, though it should not go for the TEJAS or JF-17, given the logistical support issues involved in contrast to Western manufacturers. However, opting for a light fighter such as the FA-50 and forgoing an MRCA would not exactly boost the RMAF capabilities. The MRCA requirement, which now exists, continues with uncertainty, a state that has existed since 2006 and now with the fourth RMAF chief. Given the current government's promise to ensure transparency and openness, save for a government to government deal, a procurement of MRCA will have to be done on an international open tender if the government intends to keep its word on open and transparent procurement. As it is, the long nature of the MRCA requirement and the lack of any actual financial commitment have led to the major fighter aircraft manufacturers being disinterested in Malaysia.

## Maritime Patrol Aircraft

Currently, the maritime patrol aircraft fleet consists of three Beechcraft 200Ts, following the loss of one aircraft in a crash in December 2016. In October 2017, the Malaysian Government under the Barisan Nasional coalition announced that funding was allocated for initial evaluations and assessments of suitable maritime patrol aircraft for Malaysia. However, Barisan Nasional was defeated in general elections held in May 2018, and the current government stated in August 2018 in a written parliamentary reply by Defence Minister Mohamad Sabu, that the MPA programme was cancelled but might be reconsidered in the future if the MoD saw it as a priority. It remains to be seen if the MPA requirement will become a priority, though it has to be said that given the Malaysian Navy's problems in regard to sufficient ships and an ageing fleet, an MPA might be moot if the RMN is not in a position to react to the information gathered by such aircraft. Furthermore, in a conflict situation, an MPA would be vulnerable without adequate fighter cover or escort.

## Transport and Helicopters

The bright side for the RMAF has been its fleet of four A400M aircraft, which has been operating smoothly in both the logistical transport and air-refuelling role, though the RMAF is still waiting for manufacturer Airbus



**The RMAF currently operates both the Airbus H225M and the Sikorsky S-61 though the S-61 fleet now averages 40 years of service.**

# Masthead

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to give the clearance for dropping paratroopers. The RMAF operates 14 C-130s and 7 CN-235s. An upgrade programme for the C-130s continues to be in limbo since 2014, and the current government has given no indication of any intention to proceed. Under the Capability 55 Plan, the C-130s and CN-235s are to be replaced by a tactical transport, and it would probably make sense for the RMAF to forgo the C-130 upgrade and instead purchase new C-130Js, given that the C-130 fleet dates back to the 1990s. Funding could be possible if a slow purchase of two aircraft a year is made, allowing a steady phasing out and replacement of the existing fleet. Similarly the RMAF should probably abandon the S-61 helicopter upgrade programme which also dates back to 2014. With the RMAF agreeing in 2015 to transfer 12 of its 24 S-61 helicopters to the Malaysian Army and many of the helicopters dating back to the late 1970s and the RMAF and Malaysian Army being two of the last few operators in the world, it would make more sense to phase out the S-61s and purchase additional H225Ms for the RMAF to add to the 12 already in service and having some of the additional ones purchased possessing the full CSAR capabilities that the RMAF has to forgo in its original purchase. A single-type helicopter fleet for the RMAF would simplify logistics, training and reduce costs in the long term.

## Conclusion

The primary issues facing the RMAF are the lack of funding and the disinterest of the government in regard to modernising the RMAF. The difficulty is compounded by the fact that Defence Minister Mohamad Sabu seems to be unable to get a proper grasp on the problems in regard to Malaysia's defence and the Malaysian Armed Forces. While the RMAF has attempted to highlight its needs via the Capability 55 Plan, the plan itself, from what has been seen publicly, seems to be somewhat poorly thought out. Of particular concern are the lack of justification for the 37-year timeframe and at the same time not really stating the rationale for the RMAF to have particular aircraft and particular numbers of aircraft. Given the current government's emphasis on being public friendly and listening to public opinion, the RMAF's current presentation of its requirements via the Capability 55 Plan is likely to backfire on it, as the public will question the need to purchase expensive military equipment at a time when much of the Malaysian public faces issues of higher cost of living, decreased government subsidies and public assistance and health facilities that are not meeting the needs of the public. It remains to be seen how much the Defence White Paper that will be released in September 2019 will address some of these issues. At the same time, the RMAF will have to fundamentally reconsider how it can save costs via cutting on non-essential requirements and possibly phasing out some of its aircraft and helicopters to allow funding for new equipment. At the moment, the outlook for air force modernisation is bleak for Malaysia irrespective of which political party runs the government. Not only within the RMAF but also within the Malaysian Armed Forces as a whole, there is a stark reluctance to point out the facts to the government that the Malaysian Armed Forces are largely facing a shortfall in capabilities and that the increasing aggressiveness of China over the South China Sea means that Malaysia needs to beef up its airpower and seapower as a deterrent measure. So far, Malaysia's military has largely failed to press their concerns, and the result has been a regression in capabilities that looks to be continuing even though the government has changed. ■



# Self-Propelled Artillery in US Land Forces

**Sidney E. Dean**

The return of a great power rivalry and sophisticated enemy air defence systems are forcing the US forces to fight their enemies at a much greater range than previously assumed, which is why the US Army is modernising its long-range artillery systems.

The US Army has designated Long-Range Precision Fires (LRPF) as one of its six modernisation priorities. The return to major-power competition and the development of sophisticated adversarial air-defence systems will require US forces to engage enemies at much greater range than previously assumed; ground-based artillery will be especially critical during early days of a conflict, during which US and allied forces will have to focus on degrading enemy air defences and establishing air superiority. Unlike in Afghanistan and Iraq, where tactical aircraft played the role of “artillery on demand”, ground artillery may be the only available support for frontline ground troops during the early phase of a major war. The Pentagon has determined that it currently lags behind Russia and China in terms of ground artillery deployment and capability. Recently initiated modernisation efforts are directed towards improving range, accuracy, volume and lethality of fire, as well as networking with other weapons and a multitude of sensor platforms. Tube or cannon artillery is one element of the LRPF portfolio; the other two elements are rocket artillery and tactical missile artillery. This article will deal exclusively with self-propelled tube artillery.

## 155mm M109 System

The M109 Self-Propelled Howitzer (SPH) is the backbone of US Army field artillery. The 155mm weapon provides indirect-fires for the brigade combat team and the manoeuvre division. As a tracked armoured vehicle, the M109 can in principle traverse the same terrain as Main Battle Tanks (MBTs) and Infantry Fighting Vehicles (IFVs), although the howitzer has – until very recently – lacked the speed and mobility of these combat vehicles.

### Author

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The first M109 SPH was produced in 1963. Equipped with a 3.56-metre barrel, the original variant achieved a range of 14,600 metres. The improved M109A1 introduced the 6.18-metre barrel, increasing range to 18,000 metres. Increasingly capable variants were developed in the 1970s and 1980s.

rounds per minute for up to three minutes is possible. The on-board magazine can accommodate a mix of 39 conventional, rocket-assisted and precision munitions. Defensive armament consists of a roof-mounted, crew-served 12.7mm machine gun or (less frequently) a 40mm grenade launcher.



Photo: Staff Sgt. Richard Wrigley / US Army

**M109A6 PALADINs currently make up the bulk of US Army self-propelled field artillery.**

The currently deployed variant is the M109A6 PALADIN, introduced in 1994. A total of 950 were delivered to the US Army. The M109A6 has a larger turret than its predecessors, and it features the day-and-night/all-weather capable M284 cannon fitted onto the M182A1 gun mount. Depending on munitions, the maximum range is between 22,000 and 30,000 metres. Minimum engagement range is 4,000 metres. The howitzer has a servo-driven, computer-controlled gun drive with manual backup. The fire-control system is also fully automated to provide accurate position location, azimuth reference and on-board ballistic firing solutions. Loading is semi-automatic. The SPH is ready to fire within 60 seconds of stopping. The sustained rate-of-fire is one round per minute. A higher rate of four

PALADIN incorporates major improvements over previous variants, including: upgraded armour protection; improved nuclear, biological and chemical protection; improved engine, track and diagnostics which enhance performance and ease maintenance; GPS-aided self-location; night-vision capability; SINCGARS tactical radio system for networked voice communications; and a commercial off-the-shelf-based computer processor.

The combat-loaded SPH weighs 32 tonnes. Top speed (on road) is 60 kilometres per hour. The SPH has a crew of four: commander, driver, gunner and loader.

Each “A6” howitzer is paired with an M992A2 munitions carrier with 93 rounds of reserve ordnance. The M992A2 is officially designated as a Field Artillery Ammunition Support Vehicle or FAASV, and it is

Photo: US Army



**An M109A6 howitzer sends a round downrange during combat operations in Fallujah, Iraq, 6 November 2006.**

alternately known as the CAT (Carrier, Ammunition, Tracked). The armoured M992A2 is built on the same chassis as the M109A6, but is extended by approximately 60 centimetres. Ammunition is transferred under armour from the FAASV to the SPH via a conveyor; alternately it can be transferred by hand. In addition to the main engine, the ammunition carrier also is equipped with a small diesel generator to produce electricity for itself and the SPH when both vehicles are stationary. This obviates the need to idle the main engines to produce power. The FAASV has a crew of five.

## M109A7

The latest iteration of the Army's 155mm self-propelled artillery system is designated the M109A7. While it retains the M109 family designation, the "A7" variant incorporates so much new technology that it is frequently regarded as a new weapon system. The new M109A7 SPH is paired with the new M992A3 FAASV. For procurement and deployment purposes, a vehicle set consists of one howitzer and munitions carrier.

The development contract for the "A7" was awarded to BAE Systems in 2009. Low Rate Initial Production (LRIP) was authorised in 2013, with BAE delivering the first production sets in April 2015. In December 2017, the army ordered the third and final LRIP lot. Full Rate Production (FRP) was formally approved following the Initial Operational Test & Evaluation (IOT&E) conducted in March 2018. The IOT&E successfully tested the weapon system in various intensive tactical scenarios to evaluate the vehicles for effectiveness, suitability and survivability in a fully operational environment. The current FRP option calls for procuring up to 60 vehicle sets per year for three years.

Contracts for additional howitzers are expected to follow, for a total of 556 sets. Eighteen sets equip one field artillery battalion.

The new SPH directly utilises the cab structure and gun assembly of the current "A6" version, including the M248 cannon, but places them on a new chassis derived from the BRADLEY M2 IFV. For each M109A7 being built, one M109A6 is disassembled. The cab, turret, gun mount and cannon are overhauled and enhanced with new technology before being re-mounted on the new chassis. Weapon system upgrades include: electric motors to replace the turret's hydraulic systems; a new semi-automated loader and electric ramming system for the cannon; and a new electric gun-drive system for elevation and azimuth, replacing the hydraulic gun-drive of the "A6". The loader can sustain an indefinite rate-of-fire of one round per minute; for short periods

this can be increased to four rounds-per-minute. Some of the SPH's new technology has been carried over from cancelled artillery development programmes such as the XM2001 Crusader SPH and the Future Combat System (FCS) Non-Line-Of-Sight Cannon (NLOS-C).

The "A7" SPH utilises the entire chassis structure, tracks, engine, transmission, suspension, and steering system of the M2 BRADLEY. Many of these components, including the engine and transmission, were designed for the new M2A4 variant of the BRADLEY, ensuring that the PALADIN will feature the most modern drivetrain technology. The new chassis and additional armour increase combat weight to 40 tonnes. However, the more efficient engine and drivetrain compensate for the additional weight. Cruising range is 320 kilometres, with a maximum speed of 61 kilometres per hour. Incorporation of the BRADLEY IFV drivetrain and suspension enhances off-road manoeuvrability and will significantly improve the howitzer's ability to keep pace with the armoured combat vehicles it supports.

The new, 600-volt on-board power system produces 70 kW of electricity, nearly four times as much as the power system on the "A6". This is more than sufficient to satisfy the increased energy requirements of today (for example, in support of the battlefield network and for IED jammers) and is designed to accommodate emerging technologies of the future. The "A7" has already added a number of new electronic systems to enhance performance. An on-board positional navigation system and a digital fire control system enable the SPH to receive targeting input electronically and via secure voice commands, from a variety

Photo: Larry Furnace / US Army



**An M109A7 PALADIN firing a 155mm artillery round while undergoing an Initial Operational Test at Fort Riley, Kansas, in March 2018**



of external sources. A blue-force tracker to provide situational awareness and prevent friendly fire incidents has been added. An on-board computer with comprehensive diagnostics software monitors the condition of the vehicle and its subsystems to identify problems requiring maintenance before they become critical. Modularity enables the vehicle's crew to perform some maintenance themselves in the field via plug-and-play.

The upgraded electronics give the M109A7 a faster response rate than previous SP artillery. The targeting computer can receive a fire order and calculate azimuth and trajectory while the vehicle is moving. The gun barrel can also be unlocked and aimed while the vehicle is still in motion, enabling the SPH to fire for effect almost immediately upon stopping, in as little as 60 seconds after receiving the target coordinates. After firing, the vehicle can immediately relocate to avoid counterfire.

Upgraded force protection equipment includes: a Crew Remotely Operated Weapon System (CROWS) mount for a 12.7mm machine gun; an Automatic Fire Extinguishing System (AFES); enhanced applique armour; and an underbelly armour add-on kit. Crew size remains at four soldiers.

The M109A7 SPH's partner vehicle, the 37-tonne M992A3 FAASV, is constructed on the same M2A4 BRADLEY chassis as the howitzer and displays the same speed and manoeuvrability. The cab and cargo area will be taken from older M992A2 CATs and refurbished. Like its predecessor, the M992A3 carries 93 artillery rounds and has a crew of five.

## Extended Range Cannon Artillery

The M109A7 is expected to remain in service until circa 2050. However, it does not constitute the last word regarding US Army field artillery. As part of the Long-Range Precision Fires modernisation the service is pursuing Extended Range Cannon Artillery (ERCA). According to the army, it will further enhance the M109 capabilities beyond the "A7" level: "Building on mobility upgrades, Extended Range Cannon Artillery will increase the lethality of self-propelled howitzers. Extended Range Cannon Artillery provides a '10x' capability through a combination of an increased range, increased rate of fire, increased lethality, increased reliability, and a greater survivability."

ERCA will increase the howitzer barrel's length from currently 39 calibres (6.18 metres) to 58 calibres (9 metres). This will have some drawbacks. The weapon will be more unwieldy and perhaps slower to set up and



Photo: Sgt. Quentin Johnson / US Army

**Artillerymen move an M992A2 Field Artillery Ammunition Supply Vehicle across a range to provide support during a PALADIN live-fire exercise at Fort Hood.**

withdraw. However, the performance enhancement is thought to well outweigh the negative factors. Colonel John Rafferty, head of the Army's long-range precision fires cross-functional team, confirmed in October 2018 that the longer barrel will enable a range of 70 kilometres when utilising a new projectile and a new propellant. The army is also developing a fully-automatic loading system for the ERCA in order to boost sustained rate of fire. ERCA, which underwent initial test firing on an M109 platform in March 2018, is expected to enter service in 2023.

## Long Range Ordnance

Of course, artillery is useless without munitions. The Pentagon's 2019 budget proposal included a staggering 795% increase in 155mm shell procurement. This reflects the conviction that current stockpiles are woefully inadequate for prosecuting a major war. In addition to buying currently produced munitions, the army is researching performance-enhanced ordnance.

The currently deployed M795 standard 155mm round has a maximum range of 22 km and a circular error probability (CEP)

Photo: Capt. Jonathan Camire, US Army



**An M992A2 Field Artillery Ammunition Supply Vehicle resupplies an M109A6 PALADIN artillery system with ammunition during a gunnery qualification training event in Yeoncheon-gun, South Korea.**

Photo: AM General



**A HMMWV-mounted HAWKEYE 105mm gun**

of 267 metres. In 2013, the army introduced the M1156 Precision guidance Kit (PGK) which improves CEP to between 10 and 50 metres. Designed by the army and produced by Orbital ATK, the M1156 consists of a combined fuse, a GPS guidance system and flight control fins. It can be mounted in the field prior to firing. To date more than 25,000 have been produced. The M982 EXCALIBUR round has a maximum range of 40 kilometres when fired from the M109A6 or M109A7 SPH (over 50 kilometres from ERCA). The shell features a single multifunction fuse which can be set for air-burst, impact-detonation or delayed detonation after target penetration. First fired in combat in 2007, the EXCALIBUR reduces CEP to under five metres

by introducing GPS guidance and folding glide fins. Raytheon is currently developing a laser-guided variant capable of engaging moving targets.

The M549 Rocket-Assisted Projectile (RAP) introduced in the 1970s currently achieves a range of 30 kilometres. The XM1113 RAP round is being developed by the US Army's Picatinny Arsenal (supported by Norwegian ordnance specialist NAMMO) as a replacement. It will have a maximum range of 40 kilometres when fired from the M109A7 and 70 kilometres from ERCA. The improved range is the result of a more powerful rocket engine delivering more than double the thrust of the M459's rocket, and a more streamlined shell. In addition to improved range, the XM1113 will replace the TNT currently used in high-explosive rounds with a more stable explosive insensitive to external shock or high heat. The new round will be compatible with the M1156 PGK. It is expected to enter LRIP in 2022.

Later in the 2020s, the army hopes to introduce hyper velocity rounds and ramjet rounds. Fired from the ERCA gun – which will feature improved metallurgy enabling the barrel to withstand greater pressure than current howitzer barrels – these advanced munitions are expected to achieve a range of 100 kilometres. The hyper velocity projectile, originally designed for rail-guns, is currently in testing at Yuma Proving Grounds. For deployment on 155mm artillery the conical round, which relies on kinetic energy rather than explosives to destroy targets, is placed in a casing to fit the tube diameter.

## Miscellaneous Systems

While the M109A7 and ERCA will enhance fire support for armoured and mechanised forces, they are not attached to light infantry units. These are currently equipped with towed M119 howitzers (105mm). The US Army is increasingly aware that these guns will be exposed to fast-reacting counterfire batteries in any future conflict against a modern, well-equipped opponent. For this reason, the army is currently evaluating highly mobile 105mm and 155mm howitzers mounted on wheeled tactical vehicles capable of the so-called "shoot and scoot" tactic employed by self-propelled howitzers.

The weapon prototypes were developed by Illinois-based Mandus Group. The lighter system is designated HAWKEYE. It consists of a 105mm gun mounted on the bed of a HMMWV. The heavier system, designated BRUTUS, mounts a 155mm howitzer on a 6x6 Medium Tactical Truck. Both guns are equipped with what the firm calls soft recoil technology. This permits the carriage structure to be made 50% lighter than on conven-

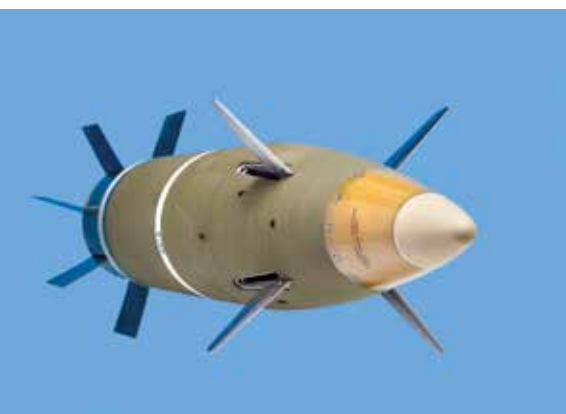


Photo: Raytheon

**EXCALIBUR's exceptional precision – a CEP of only two metres during testing – is achieved through the combination of GPS guidance and pop-out fins. The munitions can be used against targets which are only 150 metres from friendly forces. Manufacturer Raytheon states that, on average, it can take at least 10 conventional munitions to accomplish what one EXCALIBUR weapon can.**



Photo: US Army

**An M712 COPPERHEAD cannon-launched laser-guided projectile striking the target, an M47 medium tank. The M109A6 and M109A7 routinely carry a small number of M712 rounds for use against high-value hardened targets such as tanks or self-propelled howitzers.**



tional artillery. However, recoil is still strong enough to require vehicle stabilisers to be deployed before firing. The concept would allow the weapon to be mounted on a variety of light to medium vehicles including pickup trucks (105mm only). The weapon breach extends beyond the bed of the truck to facilitate loading. The gun is mounted on a rotating plate to ensure a 360° field of fire. Maximum range of the Hawkeye as configured would be 11.6 kilometres with conventional shells and 19.5 kilometres with Rocket Assisted Propulsion (RAP). No details have been provided regarding BRUTUS' range, but the standard towed 155mm howitzer used for the mounted weapon achieves a 32 kilometre range. Unlike the US Army, the US Marine Corps (USMC) currently eschews self-propelled gun artillery. The primary reason is mobility. Heavy self-propelled systems such as the M109 take up too much space aboard an amphibious ship, are difficult to transport ashore, and might be unsuitable for certain landing zones. While even the eternally "light" USMC uses the ABRAMS M1 MBT, a self-propelled howitzer has been viewed as more of a liability than an asset. The Marines have been satisfied with their towed M777 155mm gun, which can be sling-loaded by heavy lift helicopters. Of



Photo: Lt. Andrew Mayville / US Army

***The M1156 Precision Guidance Kit is mounted in the fuse well of conventional 155mm artillery shells. It reduces circular error probability by 80%, from 267 metres to 50 metres at maximum range.***

course, serial introduction by the army of a truck-mounted gun might cause the Corps to rethink this issue.

The USMC does have a limited self-propelled firepower capability in the LAV-M variant of the amphibious Light Armoured Vehicle. The LAV-M features a mounted M252 mortar (81mm) as a fire support weapon. The mortar is carried internally. Before firing, the weapon is extended through doors installed in the passenger-

section roof. Only fifty were purchased. The US Army has its own self-propelled mortar systems. The M121 Battalion Mortar System consists of an M298 mortar (120mm) mounted on an M1064 Armoured Personnel Carrier (itself a M113 variant). The same weapon is mounted on the army's STRYKER Mortar Carrier introduced in 2005. The M298 mortar has a maximum range of 7,240 metres and a four-round-per-minute sustained rate of fire. ■



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# Quick, Accurate Engagement

## Cross-Sectional Optics for Hand Weapons

**Jan-Phillipp Weisswange**

The old military tenet "He who shoots faster and better wins the battle" is still valid. Today, however, it might be elaborated: "Whoever shoots faster and more accurately, engaging a clearly identified target with an effect appropriate to the threat, can cope with all forms of conflict".

The soldier must recognise, detect and identify potential threats at an early stage in order to be able to neutralise them if necessary - and to rule out the risk of collateral damage or blue-on-blue / friendly fire. In addition, powerful optics and electronics help to shoot quickly and in a controlled manner and to hit precisely. Many armed forces today use lightweight, compact and robust reflex or red dot sights, primarily to reduce training time and to engage targets quickly. These sights can also be used with other components such as magnifying optics and night vision devices.

Photo: Smart Shooter



**SMARTSHOOTER's SMASH is an electro-optical fire control system that transforms basic rifles into smart weapons. An add-on system consisting of a smart sighting unit and a grip, which can be assembled and fitted to existing and future rifles in minutes, SMASH ensures first-round hits on static and dynamic targets, day or night. The user activates SMASH with a single switch controlling a simple three-step process: acquire, lock and fire. The user "paints" the target, squeezes the trigger and the weapon fires at the moment the system identifies the correct moment to fire.**

### Reflex- and Red Dot Sights

Reflex and red dot sights have little or no magnification. The shooter picks up the target via a red point or a small reticule. The shooter can keep both eyes open, the field of view remains almost unlimited and situational awareness is maintained. Such sights are significantly less susceptible to tilting and can be used in almost all weather conditions. The shooter hits where he can see the red dot - assuming correct adjustment of the sight as well as correct triggering. Since the late 1990s, reflex or red dot sights have become the military standard for general-issue rifles, carbines and sub-machine guns. Thus the G36, introduced by the Bundeswehr in 1997, carried the HKV main combat sight from Hensoldt above the 3x4° triple-magnifying target optic, which, according to today's interpretation, would probably be referred to as a reflex sight. In the same year the US Army ordered Aimpoint optics from the

### Picatinny Rails

Since the mid-1990s the cross-grooved "Picatinny Rail" has been the preferred choice for flexible modification of handguns with attachments for different deployment scenarios. The name refers to the Picatinny Arsenal, where the research and development centre for the armaments of the US Army is located. The Arsenal established the rail as the "MIL-STD 1913" military standard and NATO adopted it as a standard accessory rail in the scope of the STANAG 2324 standardisation agreement. On 8 May 2009, a NATO working group then defined the properties for the "NATO Accessory Rail" in a new STANAG 4694. This rail not only looks very similar to its predecessor, but is also retroactively compatible with it. In the longer term, these fastening rails will also be used as "power rails" to supply power to the peripherals. Irrespective of this, the term "Picatinny Rail" is still used colloquially today.

In order to save weight, hand guards with integrated attachment systems have been developed in recent years that allow shorter rails to be mounted at the required location. Prominent examples are Key-Mod, HKey and M-LOK.

At the beginning of 2019 the US Army certified the intelligent T-Worx weapon rail. This not only serves for mounting, but also provides power supply and data interfaces for any attached devices.

(ww)

### Author

**Jan-P. Weisswange PhD** is a communications manager in the defence industry. This article reflects his personal opinion.





Photo: Bundeswehr

**German mountain infantry with ZO 4x30 and RSA reflex sight on G27**

Swedish red dot pioneers for the first time on a larger scale. In the meantime, the number of Aimpoint products (especially the M4 and MICRO T1 models) has reached millions in the US Army alone. Only recently, the Swedish company introduced the new COMP M5 model, which has already been ordered by the domestic as well as the French armed forces.

The holographic EoTech sights from L3 Communications are still models widely in use. These use not only a red dot, but a reticule. The current EXPS3-0 model is extremely short and compact. It is in use with many armed forces and has just been selected by the Bundeswehr as the standard sight for the German G95K alias HK416A7 special forces assault rifle.

The Israeli Zahal has used the Meprolight M21 MARS for more than 20 years. In November 2015, the Israel Defence Force commissioned Meprolight to supply the newer M5 model, which in the meantime also gained a foothold with a special force unit in Europe. Other examples of modern reflex sights are the Leupold Carbine Optic (LCO), the Steiner Micro Reflex Sight and the brand new DRS1X from the same company or the Trijicon Advanced Combat

Optical Gunsight (ACOG) series. SIG Sauer also offers a complete range of optics as a consequence of its self-image as a small arms system house. As a military reflex sight, the company launched the Romeo 8T this year.

A side note: optical sights are increasingly used for pistols, too. This facilitates the use of pistols with night vision technology. The main challenge here is the strain on the optics, which follow the movements of the breech lock during firing.

### Magnifiers for Longer Ranges

In some battlefield environments even the average rifleman has to fight at greater distances than before. And he must be able to become aware of threats early and to clearly identify his targets. For most reflex sights there are, therefore, additional devices offering triple or quadruple magnification. Examples for those magnifiers are the G33 from L3/EoTech and the Hensoldt VGN 3X magnification kit.

Alternatively, some armed forces provide optics with a lower magnification and a smaller red dot sight on top – the

Bundeswehr, for example, with the Hensoldt ZO 4x30 target optics with the RSA reflex sight. For the new German "System Sturmgewehr Bundeswehr" standard assault rifle the German armed forces are currently looking for an ITAR-free combined target optics package. This requires either 1x or 4x magnification. The tender allows either a "tower solution" with magnifying optics and reflex sight mounted on it or a switch-over solution. Other requirements include compatibility with STANAG 4694 rails and a service life of 15,000 rounds. €125M have been budgeted for the project.

The ZO4x30 sight and its version with illuminated reticule ("ZO4x30i") offers a much larger field of view and a larger exit pupil compared with the old standard scope (Zielfernrohr/ZF) of the G36, which allows much faster target acquisition. Other features include significantly better luminous intensity and twilight performance. With the K4i, Austrian company Kahles now offers a 4x30 target optic. Leupold offers the "Mark 4 High Accuracy Multi-Range Riflescope (HAMR, 4x24)" in this category. The portfolio also includes the Dual-Enhanced View Optic (D-EVO)



Photo: Bundeswehr

**This paratrooper has mounted the G33 magnification kit behind his L3 EoTech EXPS3-0.**

Photo: Jan-P. Weisswange

**The Falke L.E. reflex sight mounted on a Schmeisser M4 PDW is waterproof and requires a standard CR2(3V) battery.**



**Modern handgun optics must correspond with other equipment elements. German combat divers use the Aimpoint COMP M3 on G36K and MP7 in combination with laser light modules and the QUADEYE.**

6x20, which is suitable as a supplement to reflex sights. German company Steiner also offers similar sights with the triple magnifying S332 and the quadruple magnifying S432.

The US Army and US Marine Corps are introducing the Trijicon TA31RCO ACOG for their M16A4 assault rifles (AN/PVQ31-A/M150) and M4 carbines (AN/PVQ-31B), respectively. Similar to the Me-

prolight M21, the quadruple magnifying Trijicon optics have a reticule illuminated by a tritium source and/or a reticule illuminated by optical fibre and therefore do not require a battery.

Other manufacturers have developed optics that can be switched between none and a lower magnification. The models of the Elcan SPECTER series may serve as prominent examples.

## Compact Scopes for Patrol and Combat

Another option is to integrate a red dot sight and a rifle scope into one device. Such compact scopes with red dots in the reticule or illuminated reticules offer excellent characteristics for close-range combat. In addition, there are good magnification ranges suitable for practical use by designated marksmen and all this with compact dimensions and low weight. A further advantage remains common to all low magnification optics: The shooter can keep

Photo: SIG Sauer



**The new SIG Sauer ROMEO8T has a 38mm target window and a 2MOA red dot.**

## Red Dot and Reflex Sights

	Aimpoint CompM5	Falke L.E. QL2	Hensoldt RSA	L3 EoTech EXPS 3-0	Meprolight M5
					
<b>Magnification</b>	1x; 3x and 6x-magnifier available	1x, 3x and 5x magnifier available	1x; 3x magnifier available	1x; 3x magnifier available	1x; different magnifiers available
<b>Brightness Settings</b>	6 day 4 night	10 day 10 night	automatic and manual setting; daylight collector	20 day 10 night	n/s
<b>Waterproof Depth</b>	45 m	10 m	yes, n/s	10 m	yes, n/s
<b>Power Supply</b>	1 x 1.5 – 5 V AAA	1 x CR2	1 x CR2032	1 x CR123 V	1 x AA
<b>Battery Life</b>	50,000 h	Up to 1,000 h	n/s	600 h	n/s
<b>Dimensions (L x W x H)</b>	85 x 40 x 71 mm (with integrated mount)	107 x 51 x 54 mm	63.5 x 36 x 34.5 mm	91.4 x 60.9 x 71 mm	n/s
<b>Weight</b>	238 g (with mount)	271 g	100 g	317 g	280 g



## Rifle Optics with Magnification

	Elcan SPECTER DR 1x/4x DFOV14-C1	Hensoldt ZO 4x30	Leupold D-EVO 6 x 20	Steiner Intelligent Combat Sight	Trijicon ACOG 4x32
					
<b>Purpose</b>	Rifle sight (5.56x45mm)	Modular standard sight	Rifle sight	Rifle sight with integrat- ed laser range finder (800m) and ballistic computer (5.56x45, 7.62x51, .300 WinMag, .300 BLK)	Standard rifle sight
<b>Magnification</b>	1x and 4x	4x; FOV 8° (140m/1000 m)	6x	6x	4x; FOV 7°
<b>Brightness Settings</b>	5	"i"-version contains illuminated reticule	-	4	automatic
<b>Waterproof Depth</b>	20 m for 2h	n/s	20 m	10 m	n/s
<b>Power Supply</b>	1 x 1/3 AA Lithium	EVersion "i": 1 x AA (1.3 – 3.5 V)	-	1 x CR123A	Tritium
<b>Length</b>	155mm	138.5mm	117mm	199mm	147mm
<b>Weight</b>	670 g	430 g	391 g	766 g	448 g (with mount)



Photo: Jan-P. Weisswange

**Schmidt&Bender 1-8 x 24 PM II Dual CC for the G28 patrol kit of the German Armed Forces.**

both eyes open when aiming to maintain a better situational awareness. Examples of optics in this category include models such as the Steiner M5Xi 1 -5 x 24, the Kahles K16i 1-6 x 24, the Minox ZP 1-8 x 24 or the Schmidt & Bender models 1.5-8 x 26 PM II Short Dot and the new 1-8 x 24 PM II Short Dot CC. The latter offers an illuminated reticule in the first focal plane and an illuminated red dot in the second focal plane, which is why the latter retains its dimensions at higher magnifications. Scopes with illuminated reticules or red

dots usually have several night and daylight settings. If required, attachments can also be used. One of the lightest of its kind is the TIMRO-X thermal imaging multifunction device from Andres Industries, which can also be used as a night vision goggle, hand-held or stationary device. The Berlin-based company has also developed adapters to use its TILO series thermal imaging devices as attachments.

### Optics with Integrated Ballistic Computers

The still fairly new Steiner Intelligent Combat Sight (ICS) 6x40 is also quite compact. It has an integrated laser range finder and a ballistic computer and can store ballistic data from up to 50 cartridge types in different calibres. The shooter measures the distance to the target and the ICS adjusts the correct aiming point for the selected ammunition. The optics are well suited for multi-calibre systems or heavy assault rifles and designated marksman rifles. However, the increasing networking of different weapon optics and other sensors to form command and engagement networks is progressing. Examples would be Beretta and Intellitronika with the I-PROTECT, Colt Canada with the SOLDIER WEAPON & OBSERVER RECON DEVICES

(SWORD), FN Herstal with the TARGET ACQUISITION & SITUATIONAL AWARENESS MODULE (TASAM), Meprolight with the FORESIGHT and SIG Sauer with the BALLISTIC DATA EXCHANGE PACKET BDX.

Nevertheless, despite all the innovations in fire control sights, the same rules apply as they do in general for red dot and reflex sights: If technology fails, solid tools and ballistic expertise are required. Therefore it makes sense to continue to train aiming with conventional mechanical sights, which as Back Up Iron Sights (BUIS) will continue to serve as a final reserve solution.

### Summary

Modern optics, rifle scopes and night vision devices make it possible not only to apply effect to the clearly identified target at an ever earlier stage and with greater accuracy, they also shorten training time and increase effectiveness. Meanwhile, modularity is the standard for target optics. A mixture of daylight vision, image intensification and thermal imaging technology, adapted to the respective weapons and applications, seems promising. In this way, effect and coverage can be effectively combined – and any opponent can be confronted with appropriate intensity. ■

# Precision Ammunition for Defence and Security

## The Logistics of Precision Ammunition

**Thomas Nielsen**

An old military proverb attributed to Napoleon and General Omar Bradley, among others, has it: "Amateurs discuss tactics, professionals discuss logistics". At the heart of this is the fact that armed forces are largely dependent on their logistical support system for their effectiveness.

Therefore, the military and security forces try, albeit not always successfully, to keep the logistical footprint as small as possible. One way to achieve

this is to limit the number of different ammunition calibres and types in use. Maintaining a constant supply of one or two types and calibres of ammunition

### Old School

Military snipers are originally and traditionally armed with standard infantry



Photo: Thomas Nielsen

*The Haenel line of sniper rifles, one of which has been adopted by the Bundeswehr as the G29*

### Author

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

is easier and simpler than maintaining a supply of eight or ten types; even if the total quantity of ammunition to be supplied is the same.

As a consequence, militaries around the world are wary of introducing new calibres and/or ammunition types. Since snipers and designated marksmen almost always use special ammunition anyway, even if it is still nominally in a standard calibre, the introduction of a new calibre specifically for precision use does not increase the logistical burden as much as it otherwise would.

weapons modified for higher precision, such as longer barrels, bipods for stability and improved sights. This also offers certain advantages in terms of commonality of spare parts and training. As a result, snipers have used ammunition of the same calibre as infantry, but often with specific loadings optimised for precision.

Starting at the lower end of the calibre scale, the 5.56x45mm Mk262 Open Tip Match round was adopted by the US armed forces in 2002, to increase the effective range of the 5.56x45mm rifle.



This was done by using a projectile which is heavier than the standard SS109 ball round (77 grains vs. 69 grains), and which therefore retains more energy at range, and which is optimised for precision for the US Navy Mark 12 Mod 0/1 Special Purpose Rifle (SPR) and the US Army Squad Designated Marksman Rifle (SDM-R). While the effective range of the 5.56x45mm, using standard SS109 ammunition, is generally considered to be about 300 metres, there are reports of successful engagements using the Mk262 for up to 700 metres.

When it comes to the larger 7.62x51mm calibre, the classic example is the M118 Special Ball, using a 173-grain full-metal-jacket boat-tail projectile; it dates back to the mid-1960s.

The largest of the three "traditional" sniper calibres is the 12.7x99mm heavy machine gun round, alias the .50 Browning. The first recorded use of this round for precision engagements was, to the best of the author's knowledge, during the Vietnam War, using Browning M2 machine guns fitted with telescopic sights. The impressive effective range and ditto terminal effects of the 12.7x99mm have made it an increasingly popular sniper calibre, both for anti-personnel and for anti-materiel use. Another reason is that the projectile fired from the 12.7x99 is large enough to make armour-piercing incendiary and armour-piercing explosive projectiles a practical option, as demonstrated by the Nammo RAUFOSS multi-purpose round, which is also available in a precision version.

The .300 Winchester Magnum (WinMag) is a medium-calibre round and the traditional choice to close the gap between the 7.62x51mm/.308WIN and the 12.7x99mm. Originally designed as a flat-shooting long-range hunting cartridge, the .300WinMag has the advantage of offering a significant increase in effective range over the .308WIN, with only a small increase in the size and weight of the weapon.

The biggest disadvantage of the calibres mentioned so far is of course that none of them were designed for sniping.

## The Designer Solution

The fact that the traditional sniper calibres are not purpose-designed and are more or less compromise solutions is of course well known to the sniper community, as is the fact that the introduction of a new sniper calibre is less of a logistical headache than that of a general service calibre. A first consequence was the introduction of the .338 Lapua Magnum (LM) as



Photo: Thomas Nielsen

**The recently-introduced Sellier & Bellot line-up of 6.5 Creedmoor ammunition.**

a medium-sized sniper calibre, replacing the WinMag .300, from about 1990 until today. In comparison, the .338 LM offers increased energy and a larger projectile than the .300 WinMag, the disadvantage being both the larger and heavier weapon and ammunition.

The fact that more and more armed forces are replacing their .300 WinMag sniper weapons with .338 LM would seem to indicate that this seems to be a worthwhile trade-off. For example, in 2016, the German Bundeswehr decided to supplement their G22 sniper rifle (Accuracy International Arctic Warfare Magnum) in .300 WinMag with the G29 (Haelen RS9) in .338 LM, initially for use by the Special Forces. In return for an increase of the weapon weight by 1 kg (6.5 kg vs. 7.54 kg) the G29 achieves an increase of the effective range by 400 metres, or approx. 35% (1,100 m vs. 1,500 m, based on the effective ranges specified by the Bundeswehr).

The fact that the .300 WinMag is not yet dead can be seen from the fact that the Bundeswehr not only kept it in service (at least for now), but also upgraded it to the G22A2 standard.

Also for longer-range use, as a substitute for the 12.7x99mm, at least as an anti-personnel calibre, the recent past has seen an upsurge in the interest in and (if persistent rumours are to be believed) the use of such calibres as the .375 CheyTac and the .416 CheyTac. To the best of the author's knowledge, use of these calibres is currently limited to Special Forces, but considering that the CheyTac cali-

bres and similar calibres offer the same or even superior anti-personnel range to the 12.7x99mm, their employment elsewhere may well be a matter of time.

In calibres even larger than the 12.7x99mm, and intended firmly for anti-materiel use, we are likewise seeing the introduction (in production, if not in official service) of precision rifles in calibres such as the Russian 14.5x112mm or the 20x110mm Hispano. While the effective range of these calibres is not significantly greater than that of the 12.7x99mm, the effect on target most decisively is.

While the 12.7x99mm fires a ball round of approximately 45 g or an armour-piercing explosive incendiary round, the 20x110mm Hispano launches a 110 g



**The Truvelo CMS 20x42mm anti-materiel weapon.**

high-explosive projectile. Of course, such performance comes at a cost; the single-shot bolt-action NTW-20 rifle by Denel Land Systems, which handles multiple calibres including the 20x110mm, weighs almost 30 kg, whereas a bolt-action 12.7x99mm rifle, such as the Accuracy International AX50 tips the scale at less than half of that, at 12 kg.

An interesting outgrowth of this trend is the Truvelo CMS bolt-action anti-materiel rifle in 20x42mm calibre. This calibre, originally developed for the novel Ne-

opup shoulder-fired semi-automatic grenade launcher, fires what is essentially the same projectile as the 20x110mm, including high-explosive, at a significantly lower muzzle velocity. The 20x42mm CMS weighs in at 11.5 kg, including optics, and Truvelo claims an effective range of 1,000 metres. It is questionable of course whether this is in fact a "genuine" sniper rifle, but the author is still curious to see whether this concept will catch on.

In the short-to-medium-range calibre scene, we have seen much of the same development as described above, notably a shift towards purpose-designed calibres.

## The 6.5 Creedmoor

The big news in this field was the 2018 announcement by the US Special Operations Command that they will phase in the 6.5 Creedmoor to replace the .308WIN for shorter-range sniper applications, starting in 2019. The 6.5 Creedmoor was introduced by Hornady Manufacturing Company in 2007, as a precision competition cartridge. It is based on the .30 Thompson-Center, which is itself based on the .308WIN. As such, the 6.5 Creedmoor will fit and

is generally considered to be approximately 1,000 metres, as opposed to 500-600 metres for the .308WIN. And all this with weapons of the same size and less felt recoil.

According to data on the website of one producer of both .308WIN and 6.5 Creedmoor ammunition, the .308WIN launches an 11 g hollow-point boat-tail projectile at 801 m/s, with an energy of 3.497 J. At 400 metres, velocity remains at 542 m/s with a retained energy of 1.601 J. In contrast, the 6.5 Creedmoor from the same producer fires a 9 g full-metal-jacket boat-tail projectile at 810 m/s, with a muzzle energy of 2.985 J. At 400 metres, however, the 6.5 Creedmoor still has a velocity of 594 m/s and 1.608 J of energy, thereby surpassing the .308WIN beyond this range.

The author has also noted that more and more manufacturers of ammunition and rifles are turning their attention to the 6.5 Creedmoor, so it appears that this cartridge may have a bright future ahead of it.

## Fire Control Systems

Another current development, which will almost certainly have some influence on the world of sniper rifles and ammunition.



Photo: TrackingPoint Inc.

**The TrackingPoint Mi8 rifle, in 7.62x51mm.**

function in a .308WIN-size platform, including semi-automatics.

The cartridge case of the 6.5 Creedmoor is shorter than that of the .308WIN which leaves more space for the projectile (within the same cartridge overall length). As such, the 6.5 Creedmoor launches an approx. 9 g/140-grain projectile, with a ballistic coefficient significantly superior to that of even a precision .308WIN projectile. At a range of 400 metres to 500 metres, depending on the exact loadings being compared, there is little ballistic difference between the "upstart" 6.5 Creedmoor and the traditional .308WIN. However, due to the superior ballistic coefficient of the 6.5 Creedmoor, it rapidly outpaces the .308WIN in terms of retained velocity and energy, as well as susceptibility to wind drift. In fact, the effective range of the 6.5 Creedmoor

has nothing to do with ammunition. In 2011, the company TrackingPoint Inc. of Texas, USA, launched their Precision Guided Firearm; a rifle fitted with an integrated fire control system that, supposedly, allows the operator to precisely engage point targets at extended ranges. The system functions by the operator identifying the target through an optical sight and locking the sights' optical tracking system to the target. The sight will then combine tracking information with range data from an integral laser rangefinder and ballistic data for the ammunition being used, to develop a continuously updated ballistic solution. The sight will then provide the operator with aiming cues, to ensure that the rifle is pointed correctly to ensure a hit. The operator pulls and holds the trigger, and keeps aiming the rifle as directed, and the fire control system releases the shot when it detects that the rifle is pointed exactly right.

According to the company website, the 7.62x51mm Mi8 rifle has a lock-on range of approx. 700 metres; at this range it has a first-shot hit probability of up to 89%. The system is also available in semi-auto and bolt-action platforms, in calibres from 5.56x45mm, via 6.5 Creedmoor, .300 Blackout, 7.62x51mm and .300 WinMag up to .338 LM.

If the performance claimed for the system stands up to real-world testing, TrackingPoint has the potential to give the "average" infantry soldier the performance of a sniper, in terms of first-shot hit probability.

Of course, that's not the whole story. Even if TrackingPoint and similar systems can give the operator sniper-like precision with a 5.56x45mm or 7.62x51mm weapon, precision is just one of the skills of a sniper. In fact, one could argue, just as the author does, that marksmanship is the least critical part of a sniper's skills. It seems that the snipers as a discipline are immune to the encroachments of technology, at least for the foreseeable future.

In addition, the TrackingPoint system is, at present, relatively bulky and heavy. However, when the first laser sights came to the market around 1980, they were also bulky and heavy. Today, laser sights are compact and light enough to be integrated into the grips of a revolver, or the recoil-spring guide rod of a pistol. Applying the

same timeline to small arms fire control systems like TrackingPoint, the author would not be surprised to see such systems with the size and weight of present-day red-dot and holographic sights in widespread use by 2050.

Snipers and the ammunition and weapons they use are becoming increasingly important, not least because of the nature of the military operations that today's armies are experiencing. Due to the operating environment and the political objectives of the operations, the prevention of collateral damage is of paramount importance. And snipers are the perfect tool for that. ■

*Disclaimer: The opinions expressed in the present article are those of the author and do not represent the opinions or standpoints of the NATO Support and Procurement Agency or associated entities. The mention of specific products or producers in the present article is not to be taken as an endorsement or recommendation by the author, the NATO Support and Procurement Agency or associated entities.*



# Advances in Mortar Technology

**Tamir Eshel**

Originally used in siege warfare, mortars have been employed for hundreds of years. A simple yet devastating weapon, a mortar fires bombs at tactical ranges, from a few hundred metres to several kilometres.

Its elliptical ballistic trajectory flight makes indirect mortar fire accurate and effective, with aiming adjustment relatively simple and immediate. However, modern fire location and tracking capabilities make mortars predictable and vulnerable to counterfire. For hundreds of years, mortars and artillery were developed along parallel paths. By the mid-1800s, both weapons evolved to monstrous sizes, and some of these were fielded in WW I and WW II. Today, both guns and mortars have returned to reasonable sizes, with artillery mostly deployed as medium-range weapons on self-propelled platforms, where they are fielded in dedicated formations (artillery regiments, corps). Mortars are deployed as organic support, combined arms formations, at the battalion and brigade level. Smaller mortars operate primarily with airborne and light forces (mostly the 60–81mm mortars) using ammunition and components that can be transported and carried by an individual soldier, enabling soldiers to backpack and carry mortars in dismounted operations. The heavier mortars (120–240mm) are towed or self-propelled on vehicular platforms. Both types are used at short range and with relatively large warheads, delivering effective fires, well within the tactical formation's ability to observe, target and adjust fires.

Mortar fire provides tactical formations with the means to engage the enemy beyond line of sight. Once the first shot is fired, the firing unit can be quickly located and targeted by the enemy. Therefore, the maximum firing rate (which cannot be sustained for a long time) is a critical parameter for fire efficiency and survival. This is particularly important in self-propelled mortars that can open fire within seconds of entering a firing position, but can last at that position for one or two minutes, before being targeted by the enemy.

## Author

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Due to their high ballistic trajectory, mortars become effective in mountain and urban warfare, including targets behind obstacles or in fortifications, where topographical obstacles may hinder the effectiveness of other weapons. That is what made mortars

## Small Mortars for Infantry and Special Forces

Small calibre mortars such as the 60mm M224A1 and M6C-210 are designed for use at the company, platoon and special

Photo: US Army



**US Marines fire a 120mm mortar round during a registration mission in Southwest Asia, 20 December 2018.**

a popular and effective siege weapon. Mortar ammunition is available in high-explosive, smoke and illumination rounds, designed either as fin-stabilised rounds for smoothbore mortars, or spin-stabilised rounds, fired from rifled barrels. Modern types also include enhanced effects rounds (combining fragmentation and blast effect) and guided projectiles, using a laser, or GPS guidance. While the lightweight mortars often fire at targets within line of sight, modern fire control computing used by forward observers and mortar teams enable users to accelerate firing calculations and reduce the chances of error. Designed as applications running on handheld computers or smartphones, such systems help accelerate time to fire by determining the user location, design the fire plan and assist in calculating correction.

operations team level. Operated by a crew of two or three and carried by the soldiers or on a mule vehicle, these mortars are employed as a fire support weapon launching high-explosive time-activated airburst bombs, visible and IR illumination and smoke. The M224A1 is the current version of the mortar in service with the US Army and Marine Corps.

## M6C

Some 60mm mortars are designed with light weight and versatility to meet the requirements of commando units. The M6C manufactured by the Austrian Hirttenberger Defense Systems (HDS) company is one of these mortars. Originally designed as a conventional mortar that

Photo: US Army



**A US Army Soldier carries an M934A1 high explosive 120mm high-explosive mortar round in preparation for a fire mission at Firebase Saham, Iraq, 17 December 2018.**

weighs 23.5 kg, the M6C-210 transforms within minutes into a commando mortar, weighing just over 5 kg; it uses the same barrel, but replacing the base plate and bipod with a handgrip, trigger and carrying belt. According to the manufacturer, the maximum rate of fire is 30 rounds per minute.

## ANTOS Commando

ANTOS developed by the Czech Military Technical Institute (VTU) and VOP Corporation is a man-portable mortar system designed from the start for paratroops and Special Forces. Most of the parts in this mortar are made of aluminium alloys, titanium and plastics, bringing the total weapon weight below 5 kg. ANTOS uses a handgrip and trigger, and a simple sight that uses a liquid display to show the range associated with charge 0 or 1. It can fire mortar bombs in a high or flat trajectory to distances of 80–1,200 metres. Slightly heavier, the 60mm commando mortar from the Spanish company EXPAL weighs 5.6 kg using a 65 cm barrel; it fi-

res mortar bombs to a maximum range of 1,950 metres, using the cartridge with two increment charges. Using a longer (100 cm) barrel, the mortar weighs 10 kg but extends maximum range to 2,460 metres.

With longer and heavier barrels, 60mm mortars can handle higher barrel pressures and deliver fires at



**The THOR munition**

longer range. For example, EXPAL's standard 60mm mortar barrel can take an operating pressure of 73.5 MPa (megapascals), sending bombs to a maximum range of 4,000 metres (with Charge 5).

Israel's Soltam Systems (now a member of Elbit Systems) have also developed 60mm mortars.

Soltam's 60mm mortar is available in a compact Commando-type mortar that weighs

around 7 kg and can engage targets with 1.8 kg mortar bombs at distances from 85 to 1,600 metres using charges 0–2. For extended ranges, it uses a more robust full-length barrel, bipod and baseplate that weighs 26 kg and uses charges 0–6 firing to a reach up to 6,000 metres. Soltam also offers a vehicle-mounted mortar with a breech loading mechanism that enables tank crews to fire the 60mm mortar at ranges up to 4,000 metres while under armour.

## The Classic 81mm: Bigger Punch, Heavier Weight

Heavier mortars used by dismounted units are 81mm mortars (or 82mm pursued by Russian designers). Still considered lightweight and compact, these weapons pack a significant punch with heavier bombs, reaching farther and higher with more energetic charges. Among the most popular systems are the American M252, British L16 and Israeli CARDOM 81 mortar vehicle assembly. The 81mm (3.2 inch) mortar comes in different barrel lengths and in dismounted or vehicular configurations. A typical dismounted configuration is the Hirtenberger 81mm mortar, which has a total weight of 36.8 kg, including a 13.3 kg barrel, 12.5 kg base plate and 12.8 kg bipod. This K-shaped bipod uses an asymmetrical design with built-in shock absorbers to carry the firing load. The shock absorbers reduce the firing recoil and help to maintain weapon stability, contributing to a higher firing rate.

The reduced recoil enables the crew to maintain long-range accuracy at a maximum range of 6,000 metres. The 81mm mortar fires a range of bombs including HE, illumination, smoke and practice, similar to that of the 60mm weapon.

## 2B25 Silenced Mortar

The Russian company Burevestnik has developed the 2B25 – a 'silenced' 82mm mortar system that uses unique ammunition with reduced warhead size to suppress the firing blast. The 3VO35 rounds that are designed to operate in suppressed mode contain the entire propellant burning inside the barrel, thus eliminating the firing blast and reducing the acoustic signature of the fire. This mortar is operated by two crew members that also carry the mortar (weighs 13 kg) and ammunition. The benefit of low acoustic signature comes at a price of reduced range – the 2B25 can fire

### Advantages of Smoothbore Mortar Munitions

Fin-stabilised mortar bombs do not have to withstand the rotational forces placed upon them by rifling or greater pressures. Therefore, they can carry a higher payload in a thinner skin than rifled artillery ammunition. Due to the difference in available volume, a smoothbore mortar of a given diameter will have a greater explosive yield than a similarly sized artillery shell of a gun or howitzer. For example, a 120mm mortar bomb has approximately the same explosive capability as a 155mm artillery shell. Also, fin-stabilised munitions fired from a smoothbore barrel, because they do not rely on the spin imparted by a rifled bore for greater accuracy, do not have the drawback of veering in the direction of the spin





Photo: EXPAL

**EXPAL's 81mm long-range mortar system.**

at 1,200 metres, at a maximum rate of 15 rounds per minute.

A heavier mortar operated by the US Army and Marine Corps is the M252. It weighs 35.8 kg and is operated by a crew of five. This muzzle-loaded mortar is used as a dismounted weapon, firing standard bombs at a maximum range of 5,935 metres.

Although the 81mm mortar can be disassembled and backpacked, users often rely on vehicles for operational support. Using mechanical apparatus to dismount the mortar to the ground, this process requires setup time but may utilise any platform, even a light vehicle, to support the mortar team. When the mortar is required to fire from the vehicle itself, significant shock absorption mechanisms are used to contain the firing loads. Two of the popular mechanisms available for 81mm mortars are Elbit

Systems' CARDOM and EXPAL's EIMOS. Both enable the use of such mortars on light 4x4 vehicles.

### EIMOS

EIMOS provides an automatic aiming and control system that accelerates shooting procedures, enabling the vehicle to rapidly move in and out of positions. In fact, the weapon is ready to fire within 20 seconds from halt, reaching a maximum rate of fire of 15 rounds per minute. The system integrates a hydropneumatic elastic recoil absorbing device that supports automatic control in elevation and 360-degree traverse. The EIMOS supports vehicles with a payload of over three tonnes. The entire system weighs about 800 kg and is operated by a crew of two or four. EXPAL also offers the EIMOS for 60mm mortars.

EXPAL also offers the TECHFIRE weapon control system that runs on standard (or hardened) PCs as a Fire Support Information System. The mortar application is designed as an integrated system for mortars, automating the tasks related to the direct or indirect fire. By integrating communications, data management systems and laser rangefinders, TECHFIRES provides a ballistic solution supporting mortar and artillery units at the single barrel and unit level. The system supports meteorological compensation, ballistic correction and aiming adjustments, as well as mission planning functions such as terrain management. One of the sensors integrated with TECHFIRES is the SHEPHERD-MIL drone, a bird-shaped unmanned forward observer that carries two day/night cameras. The drone weighs 2.85 kg and operates for 60 minutes at ranges up to 15 km.

### Self-Propelled Mortars

#### CARDOM

Elbit Systems is offering the CARDOM vehicular mounted system for 81mm and 120mm mortars. Several hundred CARDOM mortars have been mounted on STRYKER wheeled APCs and deployed wi-

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th the US Army STRYKER brigades. Similar installations were done on Israeli M-113s, supporting mechanised and infantry brigades. These vehicles are expected to be replaced with NAMER and AMPV platforms once the M113s are phased out of service sometime in the mid-2020. CARDOM employs a recoil absorption mechanism to reduce the firing load to a level the vehicle withstands.

As a heavy weapon, the 120mm mortar is bound to a vehicular platform. Such vehicles often become part of a family of combat vehicles forming the combat teams of mechanised and armoured battalions and brigades. Typical



Photo: EXPAL

**EXPAL's SHEPHERD-MIL is an autonomous aerial, silent reconnaissance device shaped like a bird of prey. It incorporates Day/Night cameras and is capable of automatic take-off and landing. SHEPHERD-MIL is integrated into the TECHFIRE fire support information system.**



Photo: EXPAL

**EXPAL's TECHFIRE fire support information system**

mortar-carrying platforms are the US STRYKER, Patria NEMO, Singaporean BRONCO E and Polish RAK, to name only a few.

The STRYKER vehicles in service with the US Army use the CARDOM system from Elbit Systems. The CARDOM is an autonomous, computerised 120mm recoil mortar system that mounts a mortar on light and medium armoured vehicles such as the M113, STRYKER and AMPV. The system weighs 700 kg and uses an embedded fire control system that combines an inertial navigation system (INS), electrical drives for automatic laying, and an onboard ballistic computer integrated with the battle management system. Together, these provide a direct digital link to modern forward-observer target-acquisition sensors. The high-level automation enables the CARDOM to open fire in less than 30 seconds from halt, firing at a maximum rate of 16 rounds per minute. CARDOM was extensively used by the US Army in Iraq and Afghanistan and by Israeli forces in the recent conflict in Gaza.

Photo: Georg Mader

#### SPEAR

A more advanced recoil management system implemented with Elbit Systems' SPEAR MK2 enables the use of 120mm mortars on light trucks and 4x4 armoured vehicles,

without modification to the platform. The upgraded system provides improved situational awareness, wider area coverage, quick deployment and has semi-autonomous or manual activation requiring only two or three crew members. SPEAR MK2 is deployed and can open fire within 60 seconds of halting. Equipped with a command and control system, it also provides battlefield management and situational awareness capabilities, fire mission prioritisation and monitoring of personnel assignments.

#### 2R2M

A different system developed to support the French 120mm rifled mortar system is operated by the French Army. The rifled mortar was developed in the early 1960s by the French weapon manufacturer Hotchkiss-Brandt. It uses pre-rifled ammunition offering higher stabilisation throughout the trajectory, thus achieving higher precision at longer range. For example, the rocket-assisted projectile (RAP) can reach a maximum range of 13 km, about five kilometres beyond the range of equivalent rounds fired by smooth-bore mortars. The mortar's vehicular configuration is the vehicle-mounted 2R2M system that integrates a semi-automatic loading mechanism, fully automatic aiming and elevation functions and hydraulic recoil system. The 2R2M is currently mounted on the French VAB 6x6 armoured vehicles and is expected to move to the GRIFFON VBMR platform as it replaces the VAB in the French Army units. Rifled mortars are also used by the armies of Italy, Oman, Malaysia and Saudi Arabia. The US Marine Corps has recently phased out its mortars of this type.

#### NEMO

The NEMO from Patria uses the chassis of the 8x8 AMV to carry a single or twin-barrel mortar system developed by the company. Mounted in a remotely controlled 360-degree traversing turret that weighs 1.7 tonnes, the 3-metre-long mortar can



**The three types of HIRTENBERGER ammunition approved in Europe**



elevate up to +85 degrees, thus maximising firing agility. The aiming system is fully automatic. The vehicle carries 50–60 rounds and is operated by a crew of four, using an electrically assisted semi-automatic loading system to deliver a sustained firing rate of six rounds per minute. With semi-automatic control, NEMO can fire Multiple Rounds for Simultaneous Impact (MRSI) fire missions, where up to five rounds are fired from the same mortar at different trajectories to hit the target simultaneously. Patria also offers the turret as a coastal bombardment weapon, used on patrol boats, and as a containerised mortar that can deliver deterrent fire defending forward operating bases (FOBs) and expeditionary forces deployed on peacekeeping forces.

#### RAK

Another modern mortar carrier APC is the Polish RAK that mounts the 120mm smoothbore mortar from Huta Stalowa Wola (HSW). The weapon is deployed with the Polish Army on the 8x8 Rosomak platform (AMV) and the tracked 2S1 self-propelled guns modified to use the mortar instead of the 122mm gun. RAK can fire up to 8 rounds per minute at targets up to 10 km away. Both RAK and



Photo: EXPAL

**EXPAL's EIMOS integrated mortar system combines an 81mm mortar and a 4x4 high-mobility vehicle, resulting in a weapon system with firepower and mobility suited to support units on missions, where responsiveness and mobility are crucial.**

NEMO are two options considered by the Czech Army for the procurement of 62 self-propelled mortars.

#### SRAMS

Users prioritising the highest rate of fire would notice the Super Rapid Advanced Mortar System (SRAMS) from Singapore Technologies Engineering (STENG) Land

Systems. Using a semi-automatic ammunition transfer system allows a continuous firing rate of up to 10 rounds per minute. SRAMS is also equipped with a recoil reduction system, enabling its installation on wheeled or tracked vehicles. The system is used by the Singaporean Army mounted on the BRONCO all-terrain articulating vehicle. With a 1.8-metre-long smoothbore

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**HIRTENBERGER and ST Engineering collaborate in the 120mm automatic launcher Super Rapid Advanced Mortar System (SRAMS)**

barrel SRAMS fires standard and extended range (ER) 120mm ammunition at ranges up to 9,000 metres. The autoloading 120mm SRAMS system was used recently by the UAE in the war in Yemen, where it was deployed on the RG31 AGRAB (SCORPION) mortar carrier armoured vehicles.

#### COBRA

RUAG's COBRA 120mm mortar weapon represents another advanced mortar system. Weighing 1.35 tonnes (including autoloader), COBRA features automatic setup and loading, weapon laying with electrical drive, that supports automated functions including MRSI. The COBRA's autoloader ensures quick and accurate loading and a constant firing rate over extended missions. It also improves crew safety by preventing double loadings.

### Developments in Mortar Munitions

While the mortar weapon itself was not significantly updated in recent decades, mortars continue to operate with most world armies, providing affordable, reliable, and simple-to-use firepower for tactical forces. Recent evolution has been made in mortar ammunition, particularly regarding range extension and precision fires. Some advances were introduced in weight saving and optimisation of munitions, particularly by enhanced fragmentation and improved safety, enabling a mortar to fire closer to friendly forces and minimise the risk of collateral damage. Typical enhanced fragmentation rounds include the MAPAM, offered by Saab for 60mm and 81mm mortars. Meanwhile, the M8713 HE-ELMA from IMI supports 120mm mortars, offering enhanced lethality and improved aerodynamic design for accuracy. The introduction of guided munitions promised to be a leap ahead in capabilities. However, since such capabilities come at

much higher costs, require extensive training, skills and qualification, introduction of precision mortar munitions proved to be more complex than anticipated. The Swedish STRIX developed in the 1980s by Saab Bofors Dynamics was the first precision mortar bomb designed as an anti-tank weapon. It used an infrared imaging sensor and guidance to detect and home in on



**The new-generation twin-barrelled AMOS 120mm mortar system is designed for a rapid rate of fire.**

a tank target, while ignoring tank targets that are already destroyed (burning tanks). The Russian company KBP developed the GRAN, the first laser guided mortar bomb designed for Russian 120mm mortars. With a maximum range of eight kilometres, GRAN homes in on a laser spot created by a laser designator illuminating the target. Using four fins for guidance, the bomb can engage targets in complex settings, including in narrow streets and back slopes, in conditions that make it difficult to engage with conventional mortars. Northrop Grumman (through its recently completed ATK acquisition) is providing precision guidance capability for existing 120mm smoothbore mortar munitions.

Originally delivered as a complete precision-guided mortar munition (PGMM) round, the XM395 is delivered today as an add-on guidance kit attached to standard 120mm mortar bombs through the fuse well. The kit combines GPS guidance and computer-controlled directional control surfaces. Replacing the standard fuses with the guidance kit, the mortar bombs transform into precision-guided munitions that are compatible with all 120mm smoothbore mortar systems. As with the GRAN, the guidance kit improves the fire accuracy, particularly in complex areas, such as in reverse slopes, narrow gullies and urban areas, where conventional mortar bombs have difficulty engaging targets with low-angle fire.

The US Army already fielded a couple of thousand XM395 units in 2011 to meet operational requirements in Afghanistan, followed by export sales to Singapore. Yet the army has not pursued full scale production, rather waiting for further maturation of the follow-on XM1160 programme known as High Explosive Guided Mortar (HEGM) munition - a mortar bomb combining GPS guidance

and laser homing for all-weather operation, designed to improve over XM395 in reliability, lethality and range.

The US Marine Corps has also considered fielding a precision extended range munition (PERM) developed by Raytheon and IMI for the Marine Corps' expeditionary fire support system (EFSS), but this plan was cancelled as the 120mm mortar was phased out of service in early 2018. A similar weapon is thought to be in development for the Israel Defense Forces (IDF). The US Army also planned to buy 14,000 XM1160 guidance kits beginning in 2020, but by mid-2018 decided to shelve the Request for Proposal (RFP), leaving the XM395 the only choice for precision mortar fires. ■



# Adding to Infantry Firepower

## Grenade Launcher Options

**David Saw**

**The Russo-Japanese War of 1904-1905 was a harbinger of how the First World War would evolve: A war of movement would eventually become a static war of attrition, with trenches, barbed wire, machine guns and artillery.**

There was also the rediscovery of an old weapon system in the form of the hand grenade; these were field expedient devices but proved rather effective. Of course, what happened in the

The first grenades were replaced by more evolved mass production designs, which were more effective and generally more reliable. Different grenade formats and shapes were developed for easier and safer

tive approaches though. By the early 1930s, the Japanese Army had adopted the Type 91 fragmentation grenade as its standard hand grenade, fitted to a standard rifle equipped with a grenade discharger. It could be used as a rifle grenade and could also be used from a grenade projector. The Japanese had developed the rather unique Type 10 grenade projector. This was a small 50mm-calibre tube, to which was connected a trigger housing containing the firing pin at the top connected into the barrel, the main spring and the trigger, with the housing in turn connected to a small curved base plate. The Type 10 grenade projector could also fire dedicated rounds, including smoke, flare, signal and training. The Type 10 was later replaced by the Type 89 grenade projector. This was similar in format, but the barrel was rifled. It could fire the ordinary Type 91 grenade, plus dedicated 50mm HE, smoke, incendiary and training rounds. Japanese doctrine anticipated close combat in complex terrain. The point of these grenade projectors was to launch a round out to around 200 metres, and they could fire a lot of rounds downrange very quickly. These grenade projectors were often referred to as 'knee mortars' by US soldiers, presumably because it was assumed that the curved base plate was designed to fit over the thigh and be fired from that position. Bad move! The grenade projector was designed to be fired from the ground; firing while it rested on the thigh was more than likely to lead to serious injury!

Post-1945, the rifle grenade still held sway and by this point they had taken on the anti-tank role. A classic example of this application is the Mearc ENERGA rifle grenade that arrived in the early 1950s and could penetrate 200mm of armour. Adopted by the US Army and the British Army amongst others, it was eventually supplanted by systems such as the M72 LAW or the CARL GUSTAF. Mearc still produce both hand and rifle grenades and since 2014 have been part of NEXTER, a KNDS company.



Photo: US Marine Corps

**US Marines attached to the Black Sea Rotational Force (BSRF) working with the M32 40mm Multi-Shot Grenade Launcher (MSGL) on exercise at Mihail Kogalniceanu Air Base, Romania, in April 2018. The M32 was adopted to meet a requirement to put a lot of rounds rapidly into the target area in urban/close combat operations.**

Russo-Japanese War was ignored by the European militaries, until the trenches were being dug in Europe and the first expedient hand grenades were being fielded in a new conflict.

handling, plus the obvious benefit of being able to be thrown further. Inevitably, the next step in the grenade process was a way of launching the grenade to a greater range and this led to the development of the rifle grenade. The concept of the rifle grenade actually predates the First World War, but it was that conflict that saw the design of these systems evolve and then be fielded in large numbers.

Into the 1920s, infantry would have been equipped with standard small arms, hand grenades, and rifle grenades, with extended-range fire support being provided by light mortars (50mm to 60mm) at the platoon or company level. There were alterna-

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## Grenade Launcher Dawn

It was the requirements of the US Army that would lead to the rifle grenade losing its importance. In the 1950s, the US Army had looked to increase the lethality and range of standard infantry weapons. An outgrowth of this effort was called Project Niblick and this led to the development of a grenade launcher requirement. After evaluating a number of options, a design from Springfield Armoury, using 40x46mm grenades, also developed under Project Niblick, was selected; this became the M79 and entered service with the US Army in 1961. The weapon is easy to use; it breaks-open like a shotgun, and was used extensively in Vietnam by the US Army and Marines. It is said that some 350,000 M79s were manufactured in the US, but many were built elsewhere both in licenced and unlicensed production. For example, Vietnam still manufactures its own unlicensed version of the M79 as the SPL40.

The dedicated single-shot grenade launcher continues to have utility both in defence and law enforcement applications. The GL06 single-shot grenade launcher by B&T of Thun, Switzerland, weighs in at 2.1 kg, has an Aimpoint MICRO TL sight and a foldable shoulder-stock. The system is increasingly required for less-than-lethal applications, for which 10 different 40x46mm grenades are available, including the Safe Impact Round (SIR) and the higher velocity SIR-X round to confront rioters wearing protective clothing. The US Department



Photo: British Army

**Field training exercise being conducted by British Forces South Atlantic Islands (BFSAI), note the L123 UBGL under the L85 rifle. British Army L85A2/L85A3 rifles use the L123 UBGL, while their L119 carbines (Colt Canada C8) are equipped with the L17A1 UBGL. Both are variants of the Heckler & Koch AG36 UBGL.**

of Homeland Security (DHS) has ordered GL06 grenade launchers for the Customs and Border Protection (CBP) agency.

The next phase in grenade launcher development was the Under Barrel Grenade Launcher (UBGL), yet another outgrowth of Project Niblick. This saw AAI (now Textron Systems) develop the M203 UBGL. This is a breech-loading system with a rifled barrel that uses the 40x46mm grenade. Targets can be accurately engaged out to 150 metres, while an area target could be engaged at over 300 metres. The 40mm grenade family for these

systems includes HE, HEDP, canister, signal, illuminating, smoke, anti-riot (CS gas) and non-lethal rounds for riot control.

The M203 has been produced under licence all over the world, with unlicensed variants also produced. This UBGL system also inspired Soviet efforts to develop a similar capability and this led to GP-25, GP-30 and GP-34 systems utilising the 40mm caseless VOG-25 and VOG-25P fragmentation rounds that are currently in Russian service. China has also developed its own UBGL systems in the form of the QLG-10/QLG-10A for the QBZ-95 and the QBZ-95-1 5.8x42mm rifles. This system uses 35mm caseless DFS-10 grenades, and these are available in HE-FRAG and HE-DP formats, with training and less than lethal rounds available as well. Vietnam Defence Industries (VDI) has developed an UBGL system that includes elements of both the M203 design and the Russian GP designs, known as the OP-40M in 40x46mm. This UBGL is usually employment on the IWI GALIL ACE weapons manufactured under licence in Vietnam by VDI.

Australia had selected the Steyr AUG as its standard rifle in the 1980s, with the weapon being produced under licence at Lithgow, Australia as the F88 AUSTEYR. Needing an evolved rifle, Lithgow, by now part of Thales Australia, were tasked with developing an improved version of the AUSTEYR known as the ENHANCED F88 (EF88), with the weapon entering service with the Australian military in 2015. The EF88 was to be equipped with a 40x46mm UBGL, and initially this was to be the Madritsch Weapon Technology, based in Vilach, Austria, ML40 system. However, the ML40 was subsequently removed from the

Photo: via author



**The US Army Objective Individual Combat Weapon (OICW) and the resulting XM29 system obviously inspired the Republic of Korea Army, leading to the K11 system developed by S&T Motiv. This combines a 5.56x45 mm rifle with a 20x30mm grenade launcher, and a sophisticated fire-control system, but operational problems persist.**



programme and was replaced by the Steyr Arms SL40 UBGL system. Lithgow offer an export version of the EF88 rifle known as the F90, with the SL40 as the specified UBGL.

Lewis Machine & Tool (LMT) Defense in the US is best known for their rifle systems. In December 2018, they won a contract from the Estonian Defence Force to replace all their existing rifles with a new system based on the LMT MARS rifle system. The MARS system was previously selected by the New Zealand Defence Force as their new rifle system. LMT also supplied the British Army with the L129A1 7.62x51mm rifle for the sharpshooter application. LMT also offers a range of M203 UBGL solutions in seven, nine and twelve inch barrel lengths. The seven-inch barrel is one of the shortest length M203 variants currently available.

## Market Leader

The era of the M203 in the US military is now coming to an end. In 2004, the US Army looked at acquiring a replacement for the M203, with a system that was more reliable and accurate, and in 2005 they announced that they had selected a modified version of the Heckler & Koch (HK) AG36 UBGL that would enter service as the M320. The M320 can fire all current 40x46mm Low Velocity (LV) grenades. One other feature is that the weapon unlocks and is swung open to the left, meaning that extra-length 40mm grenades can be loaded and fired. The weapon is in service and on order for both the US Army and the US Marine Corps.

HK started in the grenade launcher sector with the HK69; this was a single-shot standard 40mm system in the M79 category. They followed this up with the HK79, a UBGL system based on the earlier HK69, and used on the G3 and the HK33 rifles. When the G36 rifle was developed for Germany, a new UBGL was developed in tandem and this was the AG36 (also given the AG-C designator). The AG36 was adopted by both the German and Spanish armies for their G36 rifles, but it has also become a de facto European UBGL standard.

The British Army had adopted the AG36 for its L85A2 and L85A3 rifles as the L123; each eight-man infantry section has two L85 rifles equipped with the L123 UBGL. The L119 carbines (Colt Canada C8) used by British Special Forces and the Royal Military Police (RMP), have their own AG36 UBGL designated as the L17A1. The Netherlands Army uses the AG36 on their Colt Canada C7 weapons, while Norway has the AG36 on their HK416 rifles. France has long been an enthusiast for rifle grenades, but when it decided to replace its existing FAMAS rifles with the HK416 it opted for a version of the AG36 UBGL. France will receive 102,000 rifles in two variants, HK416F-S and the HK416F-C. Of these, only the HK416F-S can be integrated with the HK269G (AG36), of which 10,767 were ordered.

## Future Concepts

The single-shot grenade launcher and the UBGL are only part of the story as far as infantry grenade launchers are concerned. Other avenues have been explored in an effort to deploy weapons offering increased lethality in comparison with current-generation systems. In the mid-1980s, the US had a programme known as the Objective Individual Combat Weapon (OICW) which eventually led to a system known as the XM29. This integrated a 5.56x45mm NATO calibre rifle with a 20- or 30-round box magazine, with a grenade launcher system for 20x85mm HE



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grenades that had a five-round magazine. Leading this programme were ATK (now Northrop Grumman Innovation Systems) and HK.

The XM29 proved to be too complicated. It was therefore decided to split the programme into two, the XM8 rifle and the XM25 grenade launcher. The XM25 had a six-round box magazine for 25x40mm HE airburst grenades. The aim was that the system would be more accurate and more lethal than existing 40mm grenade systems, as well as offering greatly extended ranges: 500 metres for point targets and 700 metres for area targets. The system was later classified as XM25 Counter Defilade Target Engagement (CDTE) system and development progressed, with the XM25 being deployed to Afghanistan 2010 for field trials. When the system lived up to expectations, it was extremely successful. Unfortunately there were reliability and safety issues. Resolving these issues proved impossible and the XM25 programme was terminated in July 2018.

In the Republic of Korea (ROK), S&T Motiv (formerly Daewoo) had developed a

then removed from service, with the intention being to modify them to a usable configuration. The K11 design is still in an evolutionary phase and a full specification in-service weapon is yet to fully emerge. It should also be noted that China has also developed a combined rifle/grenade launcher solution known as the ZH-05. This combines a 5.8x42mm rifle with a 30-round box magazine and a single-shot 20mm grenade launcher linked to an electronic fire control system.

### Six-Shooter

Highly sophisticated solutions to achieving more performance from grenade launchers have not fared that well. Elsewhere, a more simple and direct approach has paid off. Back in 1981, the Milkor company was established in South Africa and they went on to design and manufacture the Multiple Grenade Launcher (MGL), which entered service

as a Multi-Range Grenade Launcher (MRGL). This weapon is able to utilise standard 40x46mm LV grenades, but it can also use 40x51mm Medium Velocity (MV) grenades. The use of 40mm MV grenades offers an effective range of out to 800 metres, double that of the system with a standard 40mm LV grenade.

Milkor is currently delivering 370 SUPERSIX grenade launchers to the South African National Defence Force (SADF). These are equipped with Trijicon optical sights and the contract also includes 15 Canadian Newcon Optik laser rangefinders. Rheinmetall Denel Munition were selected to supply the ammunition, with an initial quantity of 8,748 MV rounds of various natures ordered.

Another South African company, Rip-pel Effect, which was founded in 1995, also offers a complete range of multiple grenade launchers and associated sighting systems for both military and law enforcement applications. Their XRGL 40 system employs 40mm MV grenades and is currently in service with 14 different nations, including two NATO countries. Meanwhile in the US you have Milkor USA in Tucson, Arizona (who have no connection with the South African company), who produce a 40mm Multi-Shot Grenade Launcher (MSGSL) that looks much like the other multiple grenade launchers that we have discussed. Their system has been adopted as the M32 by the US Marine Corps, with the latest version being the M32A1. The weapon fires all standard MV and LV 40mm grenades. Elsewhere, Bulgaria, Croatia, Serbia and Vietnam, with the VDI SPL40L, are a few of the countries that manufacture similarly styled MSGSL. China has produced a number of different MSGSL designs in 40x46mm primarily for export. The Norinco LG4 is the same format as the basic South African MGL, while the LG6 is lighter, offers a higher rate of fire and has drum magazines in five-round and larger capacities.

There is no doubt that the UBGL and the MGL have made and will continue to make a significant contribution to increasing infantry firepower. On the other hand, efforts to develop highly sophisticated integrations of an assault rifle calibre weapon, a grenade launcher and an advanced fire control system have proven, in the main, to be unsuccessful. With existing systems working so well and increasing their capabilities, via 40mm MV grenades for example, there seems little need at this point to search for high risk/high sophistication solutions to meet grenade launcher requirements. ■



**The Milkor SUPERSIX Multi-Range Grenade Launcher (MRGL) is currently being delivered to the South African National Defence Force (SADF). The weapon uses both standard 40x46mm LV and also 40x51mm Medium Velocity (MV) grenades. With MV grenades, range is doubled, enabling area targets to be engaged out to 800 metres.**

system that they described as a 'duel-barrel air burst weapon'. This consists of a 5.56x45mm rifle with a 30-round box magazine, a 20x30mm grenade launcher with a five-round box magazine, integrated with a sophisticated fire control system. The first K11 systems entered ROK Army service in 2010, with some systems being used by Korean troops in Afghanistan. It was also reported that the United Arab Emirates (UAE) purchased an evaluation quantity of the K11 in 2010, with 40 systems being acquired. The K11 is a complex system and the ROK Army encountered numerous problems, including issues with the fire control system and other defects. The weapons were

with the then South African Defence Force (SADF) in 1983. Since that time, Milkor have delivered over 60,000 MGL systems to military and law enforcement customers in 60 different countries. The MGL has a six-round spring driven revolver magazine. This enables it to overcome the main problem of single-shot weapons like the M79 or the UBGL; it can fire six grenades in three seconds and the advantages of the capability to deposit more rounds on target faster are obvious. The MGL family has evolved over the years. For example, longer grenades can be used as the length of the revolver magazine was increased from 105mm to 140mm. The latest MGL variant is the SUPERSIX, which the company describes



# Next Generation Squad Weapons

## The US Army Expands the Scope of its Programmes

**David Saw**

In 2018, the US Army started a competition to develop a squad weapon system, awarding prototype contracts in June 2018 to five different companies. Then in October, they floated an ambitious new requirement to develop a replacement for their main squad weapons. Five months later, what they are attempting could totally redefine the future of modern small arms.

The US Army has developed a list of modernisation priorities amongst which is an increase in what is called 'soldier lethality.' As a part of this process they intend to field next generation individual and squad combat weapons. Assuming that these new generation weapons programmes actually become a reality, the implications are enormous. What the US Army says it is looking for will mark a major change in military small arms and will potentially redefine the sector leaving current generation small arms at a major disadvantage.

Initially, there was a programme known as the Next Generation Squad Automatic Rifle (NGSAR), as we shall see. This effort got underway in early 2018, and by the middle of the year, contracts for prototype weapons had been awarded. There was no doubt that potentially this was a very important programme, but unexpectedly, in October, a new programme emerged known as Next Generation Squad Weapons (NGSW). This calls for a new carbine to replace the M4 and for a second weapon to replace the M249, exactly the same requirement the NGSAR was aimed at. The NGSW is now in competition and it is this programme that could be a revolution in modern small arms.

### We begin with the story of the NGSAR.

In early March 2018, US Army Contracting Command – New Jersey (ACC-NJ) issued a Prototype Opportunity Notice (PON) in



Foto: via author

**A US soldier fires the M249 Squad Automatic Weapon (SAW) at Smarden Training Ground, Romania. The US Army intends to replace the M249 with the Next Generation Squad Automatic Rifle (NGSAR). Five companies have submitted six design concepts for an NGSAR system demonstrator.**

support of PM Soldier Weapons – Crew Served Weapons for the NGSAR programme. The PON document stated that the intention was to award up to five prototype Other Transaction Agreements (OTA), with the goal of developing a system demonstrator representative of a Technology Readiness Level (TRL) 6 and Manufacturing Readiness Level (MRL) 6 system.

TRL 6 is one of nine levels in the Department of Defense (DOD) Technology Readiness Assessment (TRA) architecture. TRL 6 is described as a "system/subsystem model or prototype or demonstration in a relevant environment." In effect this means having a prototype system that is near the desired configuration in terms of performance, weight and volume. The final TRL level, TRL 9, sees a system having successfully completed Operational Test & Evaluation (OT&E) and on the cusp of being fully fielded.

MRL 6 is one of ten levels in the DOD structure that looks to enhance readiness to manufacture a system, while reducing the risks, be they financial or technical, in manufacturing said system. MRL 6 is the capability to produce a prototype system or subsystem in a production relevant environment. Achievement of TRL 6 and MRL 6 puts a system at the point where an acquisition decision can be made to enter the Engineering and Manufacturing Development (EMD) phase of an acquisition programme.

The PON provides an official description of what is being sought: "The NGSAR is the first variant of the Next Generation Squad Weapons. The NGSAR will address operational needs identified in various capability based assessments and numerous after action reports. The NGSAR is the planned replacement for the M249 Squad Auto-

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matic Weapon (SAW) in Brigade Combat Teams (BCT). It will combine the firepower and range of a machine gun with the precision and ergonomics of a rifle, yielding capability improvements in accuracy, range and lethality. The weapon will be lightweight and will fire lightweight ammunition, improving soldier mobility, survivability and firing accuracy. Soldiers will employ the NGSAR against close and extended range targets in all terrains and conditions. The NGSAR support concept will be consistent and comparable to the M249 SAW involving the Army two-level field and sustainment maintenance system."

## NGSAR Acquisition Strategy and Requirement

The acquisition approach is, as previously noted, award up to five independent prototype OTAs with a maximum 12-month period of performance to develop a system demonstrator to the TRL6/MRL 6 level. Following on from testing of the demonstrator, a new full and open competitive PON for a follow-on system integration prototype project could be announced. Participation in the new PON is not limited to those selected for the system demonstrator PON. Assuming the system demonstrator phase is satisfactory, this leads to the Future Follow-On System Integration Prototype Project. Here up to three independent OTAs could be issued. The documentation states that: "The system integration prototype project may include a full system integration, ensure a producible product



Photo: US Army

**Textron has been working with the US Army for many years developing technologies for future squad weapons. Shown here is the Light Machine Gun developed as part of the Lightweight Small Arms Technologies (LSAT) programme. This weapon used a 5.56mm Case Telescoped (CT) round. CT ammunition is a serious contender for the NGSAR solution.**

that is safe, interoperable, affordable and sustainable through modelling, simulation, user evaluation and testing with a goal of delivering production representative system with the goal of achieving a TRL 8 and MRL 8." Deliverables required for the OTA could include over 350 weapons with 'fire control and other enablers,' over 1.5 million rounds of ammunition, spares, special tools and manuals.

The next step is the Production & Deployment (P&D) phase, it is anticipated that by this point up to two further independent follow-on production OTAs or Federal Acquisition Regulation (FAR) based contracts with a period of performance for up to ten

years could be awarded. According to the document, "The P&D effort may include low rate initial production, operational test and evaluation, full rate production, fielding and sustainment capability." At this point deliverables could include more 15,000 weapons with fire control and other enablers, more than 30 million rounds of ammunition, spares, special tools and manuals. As regards the ammunition, there will be a planned transition to production in government-run facilities (subject to the settlement of any intellectual property questions).

What the PM Soldier Weapons - Crew Served Weapons was looking for in terms of NGSAR was defined in the PON. The weapon, consisting of the weapon itself, the sling, bipod and suppressor, with no magazine/pouch, should weigh 12 pounds or less (under 5.4 kg). The ammunition weight, with no magazine, belt, belt components, box or feed systems, should be 20% less than an equal brass cartridge weight volume of the entire cartridge. Dispersion figures were given as semi-automatic, 7 inch (17.78 cm) average mean radius at 400 metres and automatic, 14 inch (35.56 cm) average mean radius at 400 metres. Weapon length with suppressor and buttstock extended should be 35 inches (88.9 cm) or less. Fire control capability, including day/night optics, should weigh three pounds (1.36 kg) or less. Desired rate of fire is 60 rounds per minute for 15 minutes without a barrel change or cook-off. Suppressor performance should reduce flash to 80% less than an unsuppressed M249, with an acoustic signature of 140 decibels or less. As to weapon controllability, a soldier firing standing with an optic at a



Photo: GD-OTS

**General Dynamics Ordnance and Tactical Systems (GD-OTS) is one of the five companies selected for the NGSAR system demonstrator. Small arms experience at GD-OTS is demonstrated by their Lightweight Medium Machine Gun (LWMMG) design that uses the .338 Norma Magnum round.**



50-metre E-type silhouette, given a three to five round burst, must be able to engage in two to four seconds, placing two rounds 70% of the time on target.

## NGSAR Programme Evolution

The NGSAR PON was issued on 13 March 2018, the proposal due date was 9 April and pricing data was due on 16 April. It is understood that ten separate companies responded to the PON. It is worth re-stating the importance of the NGSAR programme, being selected to provide the M249 successor opens the door to an enormous amount of business with the US Army, the other US services and foreign customers. The fact that the NGSAR will also see the adoption of a new small arms calibre is another massive opportunity, as the NGSAR will inevitably be followed by a new assault rifle making the new round the de facto infantry weapon calibre superseding the 5.56mm and 7.62mm NATO rounds.

On 12 July, ACC-NJ announced that it had awarded six prototype OTAs to five separate companies. According to ACC-NJ, "These Prototype OTA's will be for the manufacture and development of a Next Generation Squad Automatic Rifle (NGSAR) system demonstrator representative of a Technology Readiness Level (TRL) 6 and a Manufacturing Readiness Level (MRL) 6. The expected Prototype OTA duration is twelve months after award. The Prototype OTA's were awarded on 25 June 2018." The companies receiving contract awards were FN America, General Dynamics-OTS, PCP Tactical, SIG Sauer and Textron Systems (listed as AAI Corporation Textron Systems in the contracting announcement).

Of the five companies, one stands out due to its background in ammunition, rather than weapons, and that is PCP Tactical. This company has received a number of contracts for .50 calibre lightweight precision ammunition and for lightweight advanced polymer subsonic ammunition; all of these were from Special Operations Command (SOCOM). PCP Tactical is part of the PCP Ammunition Company; their primary field of endeavour is polymer cased ammunition, which they say is 30% lighter than brass cased ammunition. The company says that their polymer cased ammunition is interchangeable with conventional brass cased ammunition meaning that no changes are required to standard weapons.

General Dynamics – Ordnance and Tactical Systems (GD-OTS) has great resources in the ammunition and propellant areas, as well as having a Canadian subsidiary that manufactures small arms ammunition. As far as weapons are concerned the most recent foray of GD-OTS into the small arms sector was Lightweight Medium Machine Gun (LWMMG) in .338 Norma Magnum. The objective was to develop a General Purpose Machine Gun (GPMG), in roughly the same format as the current M240 7.62x51mm system that offered considerably more performance than a conventional GPMG. It should also be remembered that GD had competed for the US Marine Corps Infantry Automatic Rifle (IAR) competition with a proposal based on the ST Engineering Land Systems ULTIMAX 100 Mk5 light machine gun, although the weapon was not selected for the final phase of the competition. Prior to that GD had been a contender for the US Army Lightweight Small Arms Technologies (LSAT) programme, a competition they lost to a legacy company of Textron.

SIG Sauer won the M17/M18 Modular Handgun System (MHS) programme to provide the US Army with a new pistol in early 2017, giving them real credibility as a small arms supplier to the US Army. Their MCX assault rifle design could provide the basis for an NGSAR submission; it is a modular system capable of accommodating different barrel lengths and can convert between calibres such as 5.56mm NATO, 7.62x39mm and .300 AAC BLACKOUT, with integrated or detachable SIG Sauer suppressors available.



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FN America had two proposals accepted to compete for the NGSAR requirement. According to the company these are a lightweight machine gun and with the other being the FN HAMR, a heat adaptive modular rifle. FN also announced that they were also teaming with the Federal Cartridge Company (FCC) to utilise what they describe as 'emerging technologies' to enhance the lethality of their NGSAR submissions. The HAMR is a



Photo: US Marine Corps

***The US Marine Corps also generated a requirement to replace the M249, eventually adopting the M27 Infantry Automatic Rifle (IAR), a development of the Heckler & Koch HK416, and deploying the weapon in Afghanistan in 2011. The US Army NGSAR solution seems likely to be a far more revolutionary design than the IAR.***

variant of the SCAR assault rifle family and was one of the final four contenders for the US Marine Corps IAR programme (won by Heckler & Koch with the M27, a version of the HK416). The unique heat adaptive concept of the weapons sees it switch from closed to open bolt operation as the weapon heats up during firing.

The last contender for NGSAR is Textron Systems who have been involved in a number of programmes related to advanced small arms technology including the US Army LSAT effort. This led to the development of a Light Machine Gun (LMG) that would use Case Telescoped (CT) ammunition, previously caseless ammunition technologies had been looked at. This saw the development of an LMG in 5.56mm CT calibre. The follow-on programme to this was the Cased Telescoped Small Arms Systems (CTSAS), with the aim being to develop a Medium Machine Gun (MMG) and a carbine both using CT ammunition. A 7.62mm CT round was developed for the MMG and a 6.5mm CT

round for the carbine. Indeed the 6.5mm CT carbine was used as a system demonstrator as the US Army developed its NGSAR and other future squad weapon requirements. Textron's proposal for NGSAR will build on their CT experience to develop what they describe as a "high-velocity, magazine-fed system of an intermediate calibre."

## Everything Changes

As of July 2018, five companies and six designs had been selected to be developed as NGSAR demonstrators as part of the process of delivering an M249 successor. Then on 4 October, ACC-NJ issued a new draft PON on behalf of Project Manager Soldier Weapons, for what were described as Next Generation Squad Weapons (NGSW). The plan is to award three prototype OTAs to develop "two weapon variants and a common cartridge for both weapons, utilising Government provided 6.8mm projectiles." The draft PON states that, "the weapons include the Next Generation Squad Weapon-Rifle (NGSW-R) and the Next Generation Squad Weapon-Automatic Rifle (NGSW-AR). The NGSW-R is the planned replacement for the M4/M4A1 Carbine and the NGSW-AR is the planned replacement for the M249 Squad Automatic Weapon (SAW) in the Automatic Rifleman Role in Brigade Combat Teams (BCT)." At this stage, the draft PON is aimed at seeking industry questions and comments on this new small arms strategy.

To be clear about the taxonomy of all of this, the NGSW-AR appears to have superseded the NGSAR as the future M249 replacement. However, the NGSAR OTAs that were awarded are still valid and the continuation of that programme will contribute to the evolution of the NGSW effort. The draft PON defines the NGSW systems as follows: NGSW-R refers to a prototype 6.8mm rifle with sling, flash hider, suppressor, cleaning kit, flash hider/suppressor removal tool, and quantities of magazines required to provide a minimum of 210 stowed rounds. NGSW-AR refers to a prototype 6.8mm automatic rifle with bipod, sling, flash hider, suppressor, cleaning kit, flash hider/suppressor removal tool, and quantities of magazines/drums/belts/other required to provide a minimum of 210 stowed rounds.

The desired characteristics for the two NGSW weapons are as follows: they must allow for ambidextrous operation and controls; include a removable flash hider, suppressor, and a tool for removal after firing or for maintenance; include a tactical carrying sling with quick release attachments; include selection positions for Safe, Semi-Automatic Firing, and Automatic

Firing modes; be resistant to corrosion, abrasion, impact and chemical, biological, radiological and nuclear defence (CBRNE) contaminants, decontaminants, battle-field-chemicals, electromagnetic pulse and cyber-attacks; reduce visual detection via a neutral non-reflective, non-black colour not lighter than Light Coyote 481 and not darker than Coyote 499; function in all environments and weather conditions, including marine, high humidity, rain, and desert conditions; be compatible with combat clothing (including body armour and Modular Lightweight Load-carrying Equipment), CBRNE, wet weather, and cold weather gear; provide interchangeable magazines between both weapons, if NGSW-AR utilises a magazine; include MIL-STD-1913 equivalent rails capable of mounting Rifle Combat Optic, Close Combat Optic, Aiming Laser, Family of Weapon Sights-Individual, Squad-Fire Control and other legacy enablers.

As previously noted, the idea is to issue three OTAs for NGSW prototypes. Each contractor will have to provide 50 NGSW-R weapons, 50 NGSW-AR weapons, 850,000 rounds of ammunition, spare parts, test barrels, tools/gauges/accessories and engineering support. The prototype OTA is expected to last 27 months, including two separate prototype testing events.

The other key aspect of NGSW is that competitors for the programme must develop a common 6.8mm cartridge for both weapons. This aspect of the programme is the only part of the PON where information has been restricted. The contractors will have to offer a new cartridge that utilises government-provided 6.8mm projectiles. A General Purpose cartridge will have to be offered for combat, limited training and basic qualification. There will also be a surrogate cartridge; this will be used for testing, though it might not exactly represent the eventual configuration of the selected combat cartridge. There will also be test and training ammunition, a High Pressure Test (HPT) round to check operating pressure and a Drill Dummy Inert (DDI) drill round.

The NGSW programme is a game changer for US Army small arms with its intention to replace the M4 carbine family and the M249 SAW. Although only a draft PON has been issued thus far, it is quite conceivable that within 36 months the US Army could have prototype NGSW-R and NGSW-AR weapons and a new 6.8mm cartridge family on the verge of entering production and shortly after that entering service. That would mark the beginning of the end of the 5.56x45mm as a standard combat cartridge in the US Army and the beginning of a new small arms revolution. ■



# Poland Gains Long-Range Engagement Capability

Michał Jarocki

With the acquisition of the American HIMARS system, which is to be part of the first long-range rocket squadron under the Homar programme by 2023, the Polish army has reached another milestone in the modernisation of its field artillery. However, the process by which the deal was concluded gives rise to fears that the final procurement costs will simply not be affordable.

Under an agreement signed in Warsaw on 13 February 2019 between the Polish and US governments, Poland will acquire an American M142 High Mobility Artillery Rocket System (HIMARS) consisting of 20 M142 missile launchers (two of

them in a single training configuration), 36 M31 Unitary and nine M30A1 Alternative Warhead GMLRS missile containers (each consisting of six missiles), 30 M57 ATACMS (Army Tactical Missile System) effectors and 20 LCRR (Low Cost Reduced Range) training missiles. The deal also includes a training, support and logistics package. Additionally, Poland will also acquire 19 ammunition vehicles and 18 trailers, as well as 3 technical evacuation trucks and an unspecified number of HMMWV vehicles, although probably fewer than the 35 vehicles originally contemplated. Deliveries of the HIMARS system to Poland should

begin in the coming year and be complete by 2023. It will form the first long range rocket artillery squadron under the Polish Army's Homar programme and should achieve final operational capability (FOC) one or two years later.

The acquisition was made under the Foreign Military Sales programme, which means that the equipment will be manufactured according to US government standards. The structure of Polish HIMARS rocket artillery squadrons will probably be similar to that of the US Marine Corps and should include the future Common Fire Control System as well as the Advanced

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Field Artillery Tactical Data System, which, ironically, does not fully meet the requirements of Polish artillerymen, who prefer a more mobile solution less vulnerable to

benefits for the local defence industry resulting from the Treaty were the area where Poland decided to lower most of its expectations.

possibly resulting in unforeseeable growth of operational costs. According to some estimates, the total value of future maintenance and modernisation of the Polish



**A US soldier demonstrates the operation of the M142 HIMARS to Polish soldiers at Jaworze Training Area, Poland, during Exercise Anakonda 16.**

enemy fire, like the locally developed TO-PAZ Integrated Combat Management System, developed by WB Group, especially considering that the latter is already used by Polish Army's artillery units equipped with, for example, 155mm KRAB self-propelled howitzers or 120mm RAK mortars.

### At What Cost?

According to the Polish MoD, the total procurement cost of the HIMARS system with all auxiliary equipment is set to be US\$414M (without VAT), which is far less than the US\$655M predicted by the Defence Security Cooperation Agency (DSCA) in its notification sent to the US Congress back in 2018. The difference, which in theory works in favour of the Polish client, is most likely the result of a series of government-to-government negotiations held in previous months, during which Warsaw probably made a number of concessions in order to reach the final conclusion. It is understood that in order to scale down the final acquisition cost Poland might have given up on some of the requirements originally stated in the Letter of Request presented to Washington in Autumn 2018, possibly resulting in the procurement of the older version of M31 GMLRS effectors or a smaller number of auxiliary vehicles, like the HMMWVs. However, it is likely that the potential

Procuring the HIMARS system via the FMS procedure means that Poland will not benefit from any kind of offset arrangements resulting from the contract, despite the fact that for many years it was expected that strengthening the local defence industry would be an essential outcome of the Homar programme, just like the 2018 acquisition of the PATRIOT medium range air and missile defence system and, unfortunately, with a similar result. According to previous plans, Polish industry partners were to play a vital role in the procurement of HIMARS, being responsible for delivery of a number of wheeled platforms, such as launchers, ammunition and supply vehicles, or even the manufacture of GMLRS missiles under license from Lockheed Martin. But the thing which is even more troubling is the perspective of additional costs associated with operating the HIMARS system throughout its whole service life, which is estimated to be 30-40 years. Without any technology transfer to Poland associated with the deal, local companies will not gain the knowledge and experience necessary to conduct even basic maintenance and repair services, not to mention any form of modernisation. This will leave Poland fully dependent on US government and American industry partners in this matter, potentially putting Warsaw in a weak negotiating position for future arrangements and

HIMARS system, conducted without the involvement of local companies, might at least double the acquisition cost.

### HIMARS - A First Step

Although deliveries of the HIMARS system to Poland should run through until 2023, training of future operators will most probably start immediately, to ensure that the future HOMAR rocket artillery squadron will be combat-ready by the middle of the next decade. Most likely, the training programme will be simulator based, but at some point it will also require the conduct of live fire drills on selected Polish and/or foreign testing grounds. Although the Polish MoD is still to decide which unit will be equipped with the combat system, it seems obvious that it will not be any of artillery squadrons located in eastern or even central Poland, which are most vulnerable to a pre-emptive strike. Similarly, locating the future HIMARS squadron somewhere in the western part of the country should make it less likely to be neutralised in the early stages of a conflict. Interestingly, until lately it was assumed that each of the three Polish mechanised divisions will be equipped with one HIMARS squadron, making it three long range rocket artillery squadrons in total. However, ever since Poland started



to form the 18th Mechanised Division in 2018, it became obvious that a revision of procurement plans will be necessary and acquisition of a fourth HIMARS based artillery squadron might be in order, simply to provide the new tactical unit with a required combat capability. Without doubt, any decision in this matter would require lengthy debate within the MoD and additional planning for bigger budget appropriations, possibly forcing Warsaw to stretch the acquisition programme over a longer period of time.

Ironically, this situation might work to Poland's advantage: by prolonging the acquisition of additional HIMARS squadrons, Warsaw might win the time to gain essential operational experience, which can then be used to prepare new, better-suited technical requirements for future acquisitions. Additionally, by the time Poland starts procurement of additional long range rocket artillery, the system itself might evolve, adding new or modernised effectors or more efficient fire control and command equipment and so becoming more combat capable and operationally effective.

But above all, the predicted delay in forming additional HIMARS rocket

artillery squadrons will give the Polish Army the time necessary to fill in its own technical gaps, which hinder the whole system, with the lack of sufficient means to provide long range reconnaissance of the enemy's positions, an essential requirement for the use of ATACMS effectors, recognised as one of the main issues. It is expected that without the

procurement of sufficient equipment, such as the MALE (Medium-Altitude Long-Endurance) class of unmanned aerial vehicles, Poland will not be able to provide adequate target acquisition and will remain dependent on help from friendly forces, while at the same time partly devolving autonomy of using its own armaments to a third party. ■

Photos: North Carolina National Guard



**A USMC-operated M142 High Mobility Artillery Rocket System (HIMARS)**

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# Tactical UAS – Robot Spies for Unfriendly Skies

**Doug Richardson**

Unmanned air systems (UAS) team unmanned air vehicles (UAVs) with all the necessary support equipment such as launchers, recovery systems, and ground-based control/communications hardware. The air vehicles fall into four broad categories – lightweight systems of relatively short range and endurance; medium-weight systems able to operate over areas of interest for a longer period; and medium-weight and heavyweight systems that combine long range and the ability to loiter over target areas for many hours. In many ways, however, the second of these categories can be thought of as the 'workhorse' vehicles. Typically these have takeoff weights in the 100-500 kg class and are powered by small piston engines.

Rather than attempting to catalogue the ever-growing number of air vehicles currently on offer, this article will focus on the current technological trends in UAV development, and the ever-increasing role these vehicles perform in today's conflicts.

## Trends

The main trends are:

- The use of vertical takeoff/landing procedures to facilitate front-line or ship-board operations;

operational payload makes it more reasonable to house the powerplant in the rear fuselage. One widely-adopted solution is to use a 'pusher' configuration in which the engine and propeller are located at the rear of the fuselage, a position that is made most practical by either a twin-boom fuselage, or a flying wing layout. Alternatively, the powerplant can be mounted above the fuselage on a short pylon.

Many tactical UAVs have an airframe made from aluminium alloy, but some development teams are using glass fibre or other composite materials, either to make the airframe lighter and resistant to corrosion, or to reduce the vehicle's radar cross-section. Choice of materials is important for UAVs intended for shipboard operation. When developing the S-100 CAMCOPTER, the Austrian manufacturer Schiebel used a structure based on titanium, stainless steel and composites, materials that would be compatible with land and maritime applications.

Although some tactical UAVs are powered by electric motors, most use piston engines that require petrol (gasoline) fuel. This may be considered acceptable for use on land, but is seen as a fire hazard aboard ships, so some manufacturers have adopted heavy-fuel (diesel) engines for UAVs intended to meet naval requirements. Airbus Defence and Space's TANAN rotary-wing UAV was designed from the outset for heavy fuel, and uses an engine developed by Cassidian and the Airbus Innovation Works, while Schiebel opted to re-engine its S-100 CAMCOPTER for the shipboard role, replacing the original 50hp petrol engine with a unit able to use either petrol or heavy fuel. Many tactical UAVs are rail launched using a pneumatic or other form of catapult

Photo: ESD archives



***In order to meet the fuel requirements for naval UAVs Schiebel replaced the CAMCOPTER's original 50hp petrol engine with a unit able to use either petrol or heavy fuel.***

## Author

Following an earlier career in engineering, **Doug Richardson** is a defence journalist specialising in topics such as aircraft, missiles, and military electronics.

- The growing use of heavy-fuel engines;
- An ever-increasing number of development and manufacturing teams.

Although some patterns of UAV retain the conventional layout commonly associated with light aircraft, including a nose-mounted engine and propeller, the need to keep the front fuselage clear in order to install an



system, but others have a fixed undercarriage, a configuration made possible by their relatively modest flying speed. This will allow a conventional takeoff run from a road surface or runway. A UAV with a fixed undercarriage can probably be flown through a conventional landing manoeuvre. One commonly used landing technique for UAVs not fitted with an undercarriage is to allow the vehicle to descend by parachute, but at the moment of landing the vehicle may be swinging and could sustain minor damage on impact.

Another technique is to have the UAV fly into a prepositioned vertical net located either at the planned landing site, or on board a ship. If the vehicle has a propeller located at the front end of the fuselage, its engine will have to be shut down in the final stages of flight so that the propeller is not being powered on arrival at the net. In some cases, a simpler method of catching the UAV has been devised. For example, the Boeing Insitu RQ-21A BLACKJACK that was developed for the US Marine Corps uses a "skyhook" recovery system in which a vertical wire must be hooked onto the wing of the UAV. This sort of complication is avoided by using a rotary-winged UAV able to make a vertical takeoff and landing, but in the case of a shipboard landing the vehicle's final descent must be matched to the pitching

and rolling of the ship's deck. The solution adopted by Schiebel for its CAMCOPTER S-100 rotary-winged offering involves taking information from an inertial measurement unit and GPS subsystem that are mounted on the ship's deck and sending this to the air vehicle's computer, which models the movement of the ship and makes a final descent based on the predictions of that model.

### International Developments

Several examples will illustrate the trend towards rotary-winged vehicles. Leonardo's SD-150 HERO uses a three-bladed rotor driven by a 50hp engine. It weighs 180kg, can carry a payload of up to 70kg, and uses the same ground station as the company's other rotary-wing UAS, the SW-4 SOLO. UMS Skeldar - a joint venture by Saab and the Swiss company UMS Aero - has adopted a rotary scheme for its V-200 and R-350 UAVs. These have maximum takeoff weights of 235kg and 150kg respectively. BLACK EAGLE 50 is another recently-developed rotary-wing UAV. Designed by the Israeli company Steadicopter, it weighs 35kg, and can carry a 3kg payload on missions of up to four hours duration.

At least one design is attempting to combine the virtues of normal wing-borne flight with those associated with rotary-wing layouts. The PD-1 developed by the Ukrainian company Ukrspesystems is based on a composite airframe and uses a piston engine. It was originally offered with a conventional fixed undercarriage, but at India's Defexpo 2018 the company showed a vertical take-off and landing (VTOL) variant. Downward-facing electrically-powered rotors positioned at either end of a long pylon that stretched well forward and rearward of both wings provide the lift needed for the new operating mode.

A similar scheme has been adopted by the Hungarian company Uaviator, which has taken the idea a stage further by testing its 'flying wing' UAVs with a cable tether that can provide power from the ground. Originally conceived as a method of getting the vehicle airborne without drawing on its on-board power, it is now seen as allowing the craft to hover on its tether on order to provide local area surveillance.

*[The integrator of the Serbian defence industry, Yugoimport, displayed a similar concept at IDEX 2019, of a 5-rotor (4 for vertical lift and one "pusher" propeller) UAV with 100% electrical power and one-hour endurance - Ed.]*

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## MANAGEMENT AND DEVELOPMENT



### Wide-area sensor capability for UAS

(sb) In February, Logos Technologies announced the signing of a memorandum of understanding (MOU) with Insitu, a subsidiary of The Boeing Company, to be the preferred provider of wide-area motion imagery (WAMI) sensors for the latter's line of unmanned aircraft systems (UAS).

Photo: Logos/Insitu



This arrangement follows on earlier news that the REDKITE-I, a compact yet powerful WAMI sensor developed by Logos Technologies for the payload bay of the Insitu INTEGRATOR tactical UAS, is an official Insitu product offering for U.S. and international customers.

The REDKITE-I WAMI sensor for the Insitu INTEGRATOR:

- Weighs less than 25 pounds (11 kg);
- Operates a 50-plus megapixel electro-optical camera;
- Has a coverage area of 4 km in diameter, flying on an INTEGRATOR at 12,000 feet AGL;
- Carries a powerful, onboard edge processor for real-time image processing;
- Streams real-time imagery to mobile devices on the ground;
- Records up to eight hours of imagery onboard for real-time forensic analysis.

Photo: Leonardo



**Advertised for civil and homeland security missions, Leonardo's SD-150 HERO can fly autonomously.**

Although the lightest models of UAVs carry a single sensor, most are fitted with a combination of sensors. A steerable under-fuselage spherical housing for sensor hardware is a common feature on many medium-weight UAVs. Typical payloads for steerable housings include one or two TV cameras; a TV camera plus a laser rangefinder/designator; a FLIR plus laser rangefinder/designator; or a FLIR and a TV camera. More sophisticated payloads of the type normally associated with medium and long-endurance vehicles are becoming attractive propositions for their smaller counterparts. For example, the Boeing Insitu RQ-21A BLACKJACK that was developed for the US Marine Corps carries a day/night camera, but future payloads could include a laser designator, a synthetic aperture radar, and a combination of an electro-optical camera, wide area imager, short wave infrared imager, and a high-resolution camera.

A relatively small number of countries have an aerospace industry able to produce combat aircraft, but UAVs do not require such a large spectrum of design and manufacturing skills. UAS are currently being offered by an ever-increasing number of manufacturers and countries. A few recent examples will illustrate this trend.

Weighing up to 700kg at launch, the YASTREB [Hawk] is the heaviest UAV developed so far by the Belarusian Academy of Sciences' Research and Manufacturing Centre of Multipurpose Unmanned Aerial Systems (NPT MBK). Three versions are offered for reconnaissance, targeting, and armed roles, all with a maximum payload of 120kg. A Rotax-912S2/100 engine provides a cruise speed of 120 km/h and an endurance of up to six hours when using internal (Petrol / AvGas) fuel.

Other Belarusian UAVs include the BU-REVESTNIK-MB and BUSEL-MB. BU-REVESTNIK-MB is a twin-boom piston-engined design with a maximum take-off weight (MTOW) of 400kg, and a range of up to 10 hours. This can carry two piston-engined loitering munitions with a payload of 10kg, or 80 mm unguided rockets. The BUSEL-MB reconnaissance UAV powered by two electric motors that provide a speed of 60–120km/h and a range of up to 50 km. It weighs up to 10kg at launch, and carries a TV/infrared camera.

Serbia's EDePro adopted a rotary-wing configuration for its X-01 STRSLJEN (Hornet) UAV. This weighs 750kg at launch, and is powered by a Phoenix-180 turboshaft engine that gives a cruise speed of 120km/h, and maximum speed of 180 km/h. STRSLJEN carries an EO payload, but can be armed with antitank missiles, unguided rockets, or 12.7 mm machine guns.



Hoping to branch out from being a supplier of UAS subsystems, in 2018 the South African company Tellumat announced its first air vehicle. TELUS is a medium-size UAV with a maximum takeoff weight of 92kg and a maximum payload weight of 10kg. It uses a twin-boom configuration and a 'pusher' powerplant.

The Nigerian Air Force (NAF) collaborated with the Portuguese company UAVision to create the TSAIGUMI UAV, which formally entered service in February 2018 to handle EO reconnaissance and surveillance missions. According to the NAF, it weighs 95kg at takeoff, and has a mission radius of 100km. Produced at Kaduna Air Base, the airframe of the TSAIGUMI is of twin-boom form, allowing the use of a 'pusher' propulsion system.

Photo: Ukrspesystems



**At Defexpo 2018 Ukrspesystems introduced the VTOL variant of the PD-1 UAS featuring downward-facing rotors at either end of a long pylon.**

## UAVs in Combat Environments

The downing of a piloted aircraft in of the world's current conflicts can make the news headlines, but the downing of UAVs is a much more low-profile event. One UAV that has never been far from the headlines over the last five years is the Russian ORLAN-10. Developed by the Special Technological Centre of Saint Petersburg, this uses a conventional configuration with a nose-mounted engine and propeller, a high-mounted wing, and a tailplane and rudder of standard form. Catapult launched and recovered by parachute, it weighs 15kg and can carry a 6kg payload at speeds of 90–150 km/h in missions of up to 16 hours duration. Recovery is by parachute.

Another Russian UAV seeing combat use is the FORPOST, a licence-built Russian version of the Israel Aerospace Industries SEARCHER Mk II. Built by the Ural Works of Civil Aviation (UZGA), this has a takeoff weight of 454kg and can carry a payload of up to 100kg. FORPOST currently carries an EO payload, but as a result of the experience gleaned by its use in Syria, Russia is developing a radar that can be carried in a pod mounted under the vehicle's wing or fuselage.

ORLAN-10 and FORPOST are regularly used by Russian forces taking part in the Syrian civil war. Russian UAVs flew about 400 sorties in 2015, the year in which the

Russian intervention began, but by the end of 2017 were flying more than 1,000 sorties a month, monitoring what Russian Defence Minister Sergey Shoygu described as practically the entire territory of Syria.

ORLAN-10 and FORPOST have become a problem for Ukraine during the conflict in the Donbas region of Ukraine. During combat operations in Eastern Ukraine, Russian Forces have used UAVs in order to direct and adjust artillery fire. Once a target has been located and identified by a high level UAS, it will be assigned to a lower level UAS which would be used to determine the target co-ordinates. The low-level UAS can then be used to observe the effects of Russian artillery fire against the target, providing the information needed to correct the fire. According to the US Army's Asymmetric Warfare Group, the entire process can be conducted in 10-15 minutes.

Although factors such as bad weather, loss of communication links, and the inevitable human error by ground controllers impose their share of attrition on UAVs operating over war zones, anti-aircraft guns probably account for many combat losses.

Some UAVs have been shot down by jet fighters. During the 2006 Lebanon War, two Iranian-made ABABIL UAVs used by the Hezbollah were shot down by Rafael PYTHON-5 missiles launched from F-16 FIGHTING FALCONS.

In 2008, Georgia used UAVs to monitor the breakaway republic of Abkhazia, but several were lost in action. Following the second of these incidents, Georgia released a video recording taken by the UAV that showed an unidentified jet fighter attacking it with an air-to-air missile. A subsequent report by the UN Observer Mission in Georgia (UNOMIG) criticised Georgia for



Photo: UMS Skeldar

**In November 2018 the SKELDAR V-200 VTOL UAV was selected for a multi-million Euro contract with the European Maritime Safety Agency.**

Photo: via author



**The FORPOST UAV is a licence-built Russian version of the Israel Aerospace Industries SEARCHER Mk II.**

having flown a reconnaissance UAV over Abkhazia, but concluded that the UAV had been attacked by a MiG-29 or a Su-27 of the Russian Air Force.

On 16 May 2015, Turkish Air Force F-16 fighters used AIM-9 SIDEWINDER missiles to shoot down a Syrian MOHAJER 4 UAV that had entered Turkish airspace.

On 8 June 2017, an Iranian-made SHAHED 129 UAV dropped a bomb near US troops at a location near al-Tanf, a location close to the Syrian, Iraq and Jordanian borders. It was subsequently shot down by a US F-15E STRIKE EAGLE. A second SHAHED 129 was shot down 12 days later as it approached the same area where US advisors were training a local militia. Before engaging, the pilot of the F-15E observed the intruder and established that it had 'dirty wings' (an informal term for being loaded with ordnance).

The first air-to-air kill credited to the Chinese JF-17 THUNDER fighter was an Iranian UAV operating over the Panjgur district of Pakistan in June 2017. It was shot down by a Pakistan Air Force JF-17.

Given the relatively slow speed of many types of UAV, these can be destroyed by gunfire from attack helicopters. On 10 February 2018 Israel announced that one of its AH-64 attack helicopters had shot down an Iranian SAEGHEH (RQ-170 derivative) that had entered Israeli airspace via the Golan Heights. This is reported to have been an armed variant. An Mi-24 helicopter from Ukraine's Joint Forces Operation (JFO) shot down an ORLAN-10 UAV near the town of Lysychansk in Luhansk region in eastern Ukraine on 13 October 2018. The vehicle had been detected by what Ukraine described as "radio-technical facilities".

Israel's weapon of choice for dealing with UAVs entering its airspace seems to be the Raytheon PATRIOT surface-to-air missile, although the cost of a single missile or a two-round salvo is likely to far exceed that of its target. When two UAVs that had entered Israeli airspace from Syria in June 2018 were shot down, the Israel Defence Forces stated that the PATRIOT unit that downed the intruders had made its first UAV interception during the 2014 Israel–Gaza conflict, and had destroyed two more UAVs prior to the June 2018 incident.

The Special Monitoring Mission (SMM) of the Organization for Security and Cooperation in Europe (OSCE) used Schiebel S-100 CAMCOPTER UAVs to monitor the situation in the border area between the breakaway eastern region and the rest of Ukraine, looking for cease-fire violations, and the stationing and movement of prohibited weaponry. These UAV flights had to be abandoned in the autumn of 2016 due to what the organisation described as "a series of hostile acts". Several CAMCOPTERS had crashed due to anti-aircraft fire or jamming. On July 28 2016 an OSCE UAV photographed a Russian R-330ZH ZHITEL communication jamming system positioned near the rebel-held village of Novohryhorivka near Donetsk.

In March 2017 OSCE announced that it was restarting UAV operations. "Given that the Minsk agreements envisage the use of unmanned aerial vehicles and other technology by the OSCE SMM, we expect the sides, as signatories to these agreements, to not interfere, by jamming, shooting or otherwise, with the operation of these UAVs," it stated. This proved a false hope – a UAV was lost on the 27 October 2017 after being heavily jammed. By the spring of 2018, Russia was reported to be using GPS jamming against some US UAVs operating over Syria. (For more details on the OSCE's UAV operational experience in Ukraine please refer to ESD issue 1/2015.- Ed)



Textron Systems

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

## Outlook

Is there a long-term future for the UAV? At a Pentagon briefing in 2009 Lt. Gen. David Deptula, then USAF Deputy Chief of Staff for Intelligence, Surveillance and Reconnaissance ISR, warned that "survivability in a contested and denied airspace, as well as permissive airspace, is something that is part and parcel of the concern as we move into the future, because some of the systems that we have today, you put in a high-threat environment, and they'll start falling from the sky like rain." Like the manned aircraft, future UAVs may need to be protected either by stealth, some form of standoff jamming, or a self-protection suite, yet might still prove vulnerable to gunfire. ■



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# MALE Programmes and Requirements in Europe

**Giulia Tilenni**

Even though the importance of having Medium Altitude Long Endurance (MALE) UAVs in their inventories was recognised some decades ago, European countries are still lagging behind in terms of domestic capabilities, and they still rely on off-the-shelf products. However, this scenario could change in the next decade thanks to cooperative programmes.

The military operations in Afghanistan and Iraq have demonstrated the added value that MALE UAVs can bring to armed forces. Cheaper to purchase and to operate than manned aircraft, and safer due to the lack of onboard personnel, these assets have proven their

However, the willingness to become more independent of Washington has led European countries to undertake joint research in this field. The more European countries will be able to develop EU-produced systems, the more independent they could become of Washington in terms of their

Britain have agreed to develop a joint Future Combat Air System (FCAS) in 2016, but the project is still in its study phase, and its future is increasingly uncertain because of the Brexit.

## From MALE2020 to the European MALE RPAS

Since 2013, the German company Airbus Defence and Space, the French company Dassault Aviation and the Italian company Alenia Aermacchi, now Leonardo, have been expressing their joint interest in developing an EU-made unmanned aerial vehicle. In May 2015, the three countries and Spain (which participates in the programme via Airbus) signed a Declaration of Interest, marking the common willingness to start a two-year €65M definition phase under the OCCAR framework. Finally, the definition study contract was signed on 26 August 2016, kicking off the two phases that define the basic specifications and design of the UAV. In January 2018, the programme has successfully passed the System Requirements Review (SSR), aimed at translating the operational requirements in top-level system requirements. The System Preliminary Design Review (SPDR) was passed in December 2018, leading to a consolidated preliminary design. On 31 October 2018, OCCAR formally launched an invitation to tender for the global contract (production and maintenance) to the potential future prime contractor Airbus Defence & Space GmbH. Airbus Defence & Space S.A.U., Dassault Aviation and Leonardo have been identified as major sub-contractors.

Elettronica, Hensoldt, Indra and Thales signed a Memorandum of Agreement to formalise an offer for a coherent ISTAR functional chain for the programme, also



Photo: OCCAR

**Germany, France, Italy and Spain are cooperating on the European MALE RPAS project.**

remarkable capabilities for ISTAR and armed ISTAR missions. The 2011 military operations in Libya confirmed this added value, but they also highlighted the poor preparedness of European armed forces in terms of ISR capabilities, thus making the deployment of US assets indispensable to fill this gap and achieve the missions' objectives. About one decade later, some European countries have decided to populate their fleets of unmanned vehicles via off-the-shelf purchases of Israeli and US-produced UAVs.

strategic and operational capabilities. However, the European countries quickly understood the benefits that pooling and sharing could bring for the development of the future European MALE. Working on different national products to respond to similar operational requirements would be inefficient. In fact, the limited number of aircraft that each country is likely to buy will not allow economies of scale.

After a decade of R&D on technological demonstrators (such as nEURon), two joint programmes have a chance to succeed in the next decade. The MALE RPAS programme (previously known as MALE2020) would provide Italy, Germany, France and Spain with armed ISTAR capabilities by 2025. France and Great

## Author

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reaffirming their openness to collaborate with other companies.

Should the current schedule be respected, the contract will likely be signed in late 2019 in order to rapidly kick off the development, production and initial in-service support phase. This should allow prototype testing in early 2023 and delivery of the final system in 2025.

As the programme is being developed in collaboration with OCCAR and EDA, other European countries followed the Spanish example and decided to participate. This is the case of Belgium, which obtained the status of observer in 2017. In an attempt to drag other countries into the programme, reaffirm its European dimension, and receive additional funds, the MALE RPAS, also known as EUROMALE, has been included in the second round of PESCO projects, approved by the Council of the European Union on 19 November 2018. On that occasion, the Czech Republic joined the development team via its prime defence contractor Aero Vodochody.

## Defining the Basic Requirements

At the very first stages of the programme, the participating countries agreed on the need to develop a highly capable asset to provide 24/7, day and night Intelligence, Reconnaissance and Surveillance (ISR) in wide areas and in-theatre activities. Other requirements included all-weather capability, efficient maintenance, interoperability with existing and future defence systems, and resilience against cyber attacks.

To respond to these requirements, the MALE will feature a strong mission modularity aimed at enhancing its adaptability

to operational scenarios. This is expected to provide operational superiority, to be reached through a long range of action and wide area coverage, in addition to the ability to operate short transit flights and manoeuvre at high airspeed, including quick altitude changes.

According to the initial tri-national proposal, the MALE RPAS is intended to respond to the issue of sovereignty in different but related aspects.

## Strategic and Operational Independence

The capability to use domestic products – European-produced assets in this case – allows the users to launch military missions accord-

ing to their own foreign policy objectives and in their own areas of interest. Conversely, being dependent on US assets implies following Washington's agenda even when it diverges from national priorities.

Industrial sovereignty, which means the ability to autonomously build assets rather than relying on off-the-shelf purchases from Washington and, in the German case, from Israel (Berlin has decided to extend its weaponisable IAI HERON leasing contract instead of going for the MQ-9 REAPER). This has several consequences; for instance, sales do not have to be approved by the US Congress which is of utmost importance when it comes to armed systems. For instance, Italy had to wait several years before being allowed to buy AGM-114 HELLFIRE missiles to be mounted on its MQ-9 REAPER.

## Sovereign Information Gathering and Intelligence

Using US-produced assets and communication systems means information sharing with Washington, often without receiving anything in return. In a comment released to the author some years ago, an Airbus official stated that the NSA scandal of the early 2010s was a pushing factor for Germany to launch a collaborative effort on an EU MALE.

For the time being, Germany might purchase 21 UAVs, Spain 15, and France eight, while the desiderata for the Italian and the Czech air forces have not been disclosed yet.

Photo: OCCAR



**Secretaries of State of the participating nations, the Director of OCCAR, and the CEOs of the involved companies unveiled a full-size mock-up of the MALE RPAS at the ILA Air Show in Berlin on 26 April 2018.**



Photo: OCCAR

**The European MALE RPAS passed the System Preliminary Design Review in November 2018.**

## Propulsion, Armament and the FCAS/SCAF System of Systems

According to a full-size mock-up unveiled at the ILA Berlin Air Show in April 2018, the MALE RPAS should be larger than the MQ-9 REAPER and might feature a twin-pusher turboprop and a single electro-optical/infrared (EO/IR) sensor. Due to its crucial importance, the choice of propulsion and the option to perform armed missions have been at the core of the initial study phase. Propulsion will determine key capabilities in terms of maximum range and endurance of a single mission. In 2017, the participating countries decided to opt for a twin-pusher turboprop propulsion that will supply ample on-board energy to the mission system and provide proper redundancy to limit restrictions when operating in non-segregated airspaces.

Armament has been a contested issue since the beginning of the programme. When the definition phase was launched, Rome was still waiting for the authorisation to arm its UAVs (still unarmed at present due to budget constraints), and France was evaluating the possibility of

System (FCAS/SCAF), a system of systems that will include the next-generation fighter jet, a joint main battle tank mounting the Common Indirect Fire System, and a new maritime patrol aircraft.

### The MALE RPAS "R&T Constellation"

The MALE RPAS has been conceived as an ITAR-free technology not subject to the US International Traffic in Arms Regulation; this will allow member states to achieve the goal of flying it outside segregated member states. The European Defence Agency (EDA) is considered as the key enabler for the integration of RPAS – both civilian and military – in non-segregated airspaces, as the agency is working on the regulatory aspects of the issue – namely through the recently started ERA programme. Indeed, several collaborative programmes have been launched within the EDA framework in order to hasten the MALE RPAS' development. These include the MIDair Collision Avoidance System, which already entered the Standardisation Support Phase (MID-CAS SSP); the TRAWA – Detect and Avoid – Remain Well Clear; a Demonstration of Satellites enabling the Insertion of RPAS



### The Franco-British UCAV

In 2014, another project to develop a joint MALE UAV was launched in Europe. In November of that year, France and the UK signed a study contract to assess the feasibility of a Future Combat Air System (FCAS). The €150M contract concerning this UCAV, to be completed with a €50M investment per country, was awarded to seven companies: Dassault Aviation, Safran, and Thales for France, BAE Systems, Rolls-Royce and Selex ES (now Leonardo Airborne and Space Systems) for the UK.

The idea of collaborating on the development of a joint UCAV dates back to 2011, when BAE Systems and Dassault Aviation announced the launch of the TALAMOS programme, which was abandoned one year later due to the lack of potential customers. Following this first experience, the two countries have continued to feed their autonomous researches on unmanned combat vehicles thanks to two technology demonstrators: the Dassault Aviation nEUROn, kicked off in 2003 in collaboration with other European countries, and the BAE Systems TARANIS, launched in 2010 with the participation of about 250 British companies.

However, the FCAS programme has been stuck since 2016, and no major news has come out. From a strategic perspective, completing a Franco-British cooperative programme for the development of a UCAV, which is an armed rather than a weaponisable asset as the MALE RPAS is, remains of interest. The two countries are the only European ones that could successfully cooperate on such an asset, as states such as Germany would not fully support its operational concept (due to the harsh debate ongoing in Berlin on UAVs' armament). Moreover, an EU-produced UCAV will likely be the only viable solution for having access to such a technology, as the US will not assent to sharing their knowledge in this domain with their European allies.



**General Atomics' MQ-9 REAPER, armed with GBU-12 PAVEWAY II laser-guided munitions and AGM-114 HELLFIRE missiles**

arming its assets; Paris will finally arm its REAPER starting in 2020. Berlin is discussing the possibility of arming its fleet of HERON TP UAVs. This debate is still a sensitive issue, as the Social Democrats are against the use of armed UAVs. Nevertheless, as Airbus chief confirmed at the ILA, depending on the political sensitivity of the user nation, the MALE RPAS will be able to carry weapons.

The MALE RPAS will be developed as part of the Franco-German Future Combat Air

in Europe (DeSIRE); a Remote Pilot Station Standardisation; Accommodation of MALE-type RPAS: Scenarios and Safety Case Study; and the Military RPAS Airworthiness Certification. The collaboration within the EDA framework also includes the creation of the "European MALE RPAS User Community", a forum established in 2013 to examine options for pooling and sharing in the MALE RPAS domain. It included both MALE users and countries which are considering getting this capability.



Nevertheless, some national and European dilemmas call into question the revitalisation of the programme. At the national level, France could not afford to finance another joint programme and is likely to prefer to continue cooperation with Berlin rather than start a new one with London. On the other hand, the UK will reduce its military budget compared to the 2015 National Security Strategy and Strategic Defence and Security Review, thus being forced to cut some programmes. At the European level, Brexit will make the relationship between Paris and London more complicated, making industrial cooperation more cumbersome.

### Future Perspectives and Wildcards

The full development of EU-produced MALE UAVs will likely reshape the EU internal market, as this could finally provide an alternative to off-the-shelf purchases from Israel and the US and erode the market share of the latter. Indeed, the majority of European countries – namely the UK, Italy, France, and, more recently, Spain – have General Atomics UAVs in their inventories. Moreover, the development of an entirely EU-produced UAV could represent a basis for further cooperation to develop ITAR-free technologies, as well as an opportunity to enhance EU domestic growth by sustaining jobs and capabilities. As for the other parts of the FCAS/SCAF programme, developing the MALE RPAS will provide the opportunity to keep the technological edge, even in times of budget constraints – EU defence budget are rising, but the share devoted to R&D remains lower than needed. It could also represent one of the first successful EU cooperative defence programmes, thus paving the way for the development of further common projects.

Nevertheless, some political and technical issues could still negatively affect the output of the programme, which will heavily rely on the real capabilities that the EU-produced MALE will have, and on the timeframe needed between development and deployment.

The trends to be monitored include the evolution of foreign policy interests and strategic priorities, and, consequently, the operational scenarios in which European armed forces operate. Should the system take several decades before becoming operational, its features could prove obsolete compared to the operational needs of participating countries, which could evolve over the time, something that usually happens with joint defence programmes.

Another trend to have an eye on is the level of political commitment that the countries involved in the programme will hold over time. Again, as is often the case with EU cooperative defence programmes, the fact that successive governments do not necessarily maintain the same political

Another point to look at is the capability to pursue multiple programmes at the same time. Germany and France have decided to launch an extensive defence cooperation consisting of several joint programmes. At present, the MALE RPAS project has not been affected by the countries' participa-



Photo: ESD archive

**An IAI HERON TP operated by the German armed forces**

agenda, the same level of defence spending, and even the same strategic interests could negatively affect cooperation. Italy is a notable example here, as the importance of defence in the political agenda usually changes from one government to another. The current government coalition formed by the Northern League and the 5-Star Movement has decided to reconsider Italian defence spending, with an impact on both R&D and procurement. As far as the MALE segment is concerned, the Italian Government has decided to cancel the purchase of 20 PI-AGGIO P.2HH UAVs, which were finally preferred to the P.1HH HAMMERHEAD version purchased by the UAE due to a higher endurance. In addition to the extremely negative economic impact that this decision had on the company, this will worsen the existing capability gap in this domain. In theory, the fact that Italy will no longer pursue a national solution for its MALE (which some considered as overlapping with European programmes) could end in the purchase of additional MALE RPAS units. In practice, the Italian participation in the project could be put into question in the future, as already happened for other programmes. As tensions between the German parties on defence increase, the post-Merkel era could call into question the European commitments that Germany has made over the last ten years.

tion in multiple cooperative projects, but a reduction of defence budgets or government changes could put the final phases of the MALE RPAS development and the “commercial success” of this programme at risk, should participating states be forced to choose from the planned programmes. More unlikely, still, an eventual revival of the Franco-British MALE programme could end in a reduction of the French commitment to the MALE RPAS project.

Finally, the development of Franco-German defence cooperation in the light of the Treaty of Aachen is another matter that should be kept in mind. With the signature of this new bilateral agreement on 22 January, France and Germany decided to reaffirm their commitment to cooperation, and to formally advance their foreign policy and defence collaboration. The Treaty contains several ambitious objectives, including the definition of common foreign policy goals, a stronger collaboration among armed forces, joint investments in order to better fill operational capability gaps, and the harmonisation of the rules for armaments' export. This latest issue could have an important impact on the MALE RPAS programme. For the time being, France and Germany have divergent export policies, with Germany being stricter in relation to political conditionality criteria. In the future, the two countries could define common rules for exporting joint products. ■

# Harpia: Future Polish Aircraft to Counter Russian Threats

**Georg Mader**

New multirole fighters to be deployed under the Harpia programme are a key element of the future Polish defence system, which should enable effective operations against a stronger opponent. Historically, such an enemy is only in the east of this Eastern European NATO partner. The project seems to have accelerated recently, but there are several options and important decisions which the Warsaw MoD will have to consider.

In the last year, the decision whether to buy new fighter aircraft for the Polish Air Force (Siły Powietrzne RP) or to enter a whole new generation of air and network capabilities has become increasingly important. This has to do with the rapidly outdated MiG-29 fighters and Su-22 strikers, but also with recent reconstruction efforts at the Russian military airbases to the north and east of Poland. In late 2018, the Polish MoD therefore announced the acceleration of the so-called Harpia 1 programme. According to Deputy Defence Minister Wojciech Skurkiewicz, "the end of the analytical and conceptual phase of the process is planned for late February 2019. The delivery of 48 to 64 new aircraft should start by 2024 at the latest. The funds for the procurement were provided under the Polish military modernisation plan for 2018–2022".

A 2018 press release from the Polish MoD read: "Minister Mariusz Błaszczak recommended to the Chief of Staff of the Polish Armed Forces to accelerate the implementation of the programme, which would lead to the procurement of a new-generation fighter aircraft that would herald a new level of air and support operations. The combat aircraft will be deployed in the A2/AD and network-centric areas and will work with Allied aerial assets. Analytical work on the new generation of multipurpose aircraft began at the end of last year. The Harpia programme defined two tasks."

The overriding motivation for all planning is that Harpia – like the F-16C/D52+ project (Jastrząb) a decade ago – should initiate a generation change not only in Polish

Photo: Siły Powietrzne



**The Polish aerial fleet is about to undergo an extensive renewal programme. Up front are the Su-22 FITTER, MiG-29 and F-16 Block 50.**

Photo: Siły Powietrzne



**A Polish MiG-29 acquired from Germany for 1,- Deutschmark per piece**

## Author

**Georg Mader** is a defence correspondent and freelance aerospace journalist based in Vienna, Austria, and a regular contributor to ESD.

## Harpia or Harpy Eagle

The name chosen for the Polish Fighter Replacement Programme comes from the sea eagle, which in turn derives from Slavic tradition. It is the legend of the three Slavic brothers Lech, Czech and Rus. Upon seeing the white eagle, Lech took it as a sign to found Poland, where the white eagle has been on the coat of arms since the Middle Ages and until today. The harpy eagle with upright feathers behind its head is native only to the Americas; next to the condor, it is one of the largest and most intimidating eagle species in the world. Since it feeds predominantly on primates, "Harpy" is well chosen because it means "snapper", which is very similar in meaning to "Raptor".



aviation, but also enable the entire army to assert itself on a future battlefield under conditions of strong enemy resistance. This is going to be quite a challenge. It should be recalled that the introduction of the 48 F-16C/Ds was associated with a systemic change in tactical aviation, logistics support, and so on.

The implementation of Harpia will require similar efforts, at least. Poland's decision will therefore affect not only the air force, but the entire army and the Polish defence sector for decades to come.

### The End for Russia's Iconic Aircraft

In the first years after the fall of the Iron Curtain, people like the author swarmed out to get to long-banned airfields like those of the Russian "Group West" and take a look at all the MiGs and Suchois that would then soon die out, mainly because of the excessive costs, which made these aircraft simply too expensive for the new independent nations in Eastern Europe. This also applies to Poland, where, as in all Eastern European NATO countries – such as the Czech Republic and Romania some time ago or, more recently,



Photo: Sily Powietrzne

**A Polish F-16 Block 50**

Slovakia and Bulgaria – we are witnessing the replacement of what is left of Soviet equipment and which has often been extended in life and "westernised". And now in Poland, the MiG-29s ("Fulcrum-A") will be moved to the museums; the first of them had entered service in 1989 in the 1st ELT (Eskadra Lotnictwa Taktycznego), located in Minsk Mazowiecki 45 km from Warsaw.

In 1995, Poland received another ten MiG-29s in exchange for W-3 SOKOL helicopters from the Czech Republic, and in 2004 Germany sold 22 MiG 29Gs for a symbolic 1 Deutschmark per aircraft. These already westernised aircraft equipped the second squadron, the 41ELT based in Malbork. The primary task assigned to both squadrons is the air defence of Warsaw and Northern Poland. Malbork Airbase is



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located in a strategic area of NATO, only 90 km from the Russian enclave of Kaliningrad, which lies between Poland and Lithuania, with access to the Baltic Sea. Russia has designed its Kaliningrad defence systems in response to NATO enlargement, with the three Baltic republics included. The Russians have deployed their best armaments in the enclave, such as the IS-KANDER-M and Su-27 and, occasionally, Su-35S. But there are also S-400 GBAD systems; in the event of a confrontation, their radars and missiles would enforce a no-fly zone over 1/3 of Polish airspace. Against such threats, the Polish MiG-29 from the 1980s is of little value. The same applies to the legendary, swing-wing Su-22M4 and -UM3K two-seater fighter bombers from the Cold War era. A few years ago, the future of

Photo: Boeing



**The Boeing F-18F ADVANCED SUPER HORNET**

### Slow Renewal Rates in Russian Tactical Aviation

Polish and NATO sources often point to a massive renewal of the Russian Air Force in recent years. While it is true that many Cold War platforms have disappeared or, like the Su-24M, are being converted to Su-34 (both tested in Syria), some aircraft, such as the MiG-31, have received new roles as ALCM carriers for hypersonic weapons such as the KINZHAL.

But really, new Russian aircraft come out very slowly, at least compared to Western numbers. Since the 5th generation of the Su-57 stealth fighter has lost Indian development money, only one first production aircraft will be added to the 10 prototypes this year. Another aircraft will follow in 2020, while a contract over 13 aircraft to be delivered over the next five years is expected for 2019. From these 13 aircraft, only five or six will feature the AGGREGAT 30 engine enabling supercruise.

Another example is the latest sibling of the traditional RAC-MiG, the MiG-35. Based on the two-seat airframe of the naval -K version, four aircraft will be delivered to the Russian Air Force this year, with another 14 aircraft planned to be contracted in 2020. In comparison, 355 F-35s have been delivered since 2011, albeit with considerable problems, and a further 130 aircraft are expected for this year. For aircraft, it is not only about features and sophisticated subsystems, but also about industry/machine capacity and the corresponding skilled manpower potential behind it to ensure series production. In view of the disproportion with future Russian platforms, Poland might have a chance to field a credible defence posture over the next decade.

the 32 remaining Su-22 FITTER aircraft looked bleak; a press release in 2014 stated that the aircraft should retire in 2016 to be replaced by second-hand F-16s. This did not happen, and in April 2015 the MoD announced the provision of €36M for a minor upgrade to 18 FITTERS, extending the life of these 18 FITTERS until 2024. In the same year, the upgrade began at WZL-2 (Wojskowe Zakłady Lotnicze No. 2 – Military Aviation Works No. 2) in Bydgoszcz, and in 2017, the modernised – and now light grey – fleet of 18 FITTERS was put into service. Those not upgraded were retired last year, but the Polish Air Force wants to convince the government to modernise another six aircraft because of the need for a larger fleet and because of the mint condition of these six aircraft. At least that's what Colonel Karol Jedraszczyk, commander of 21 BLT, said.

In December 2017 and July 2018, two MiG-29 fighters crashed, which led to flight suspension and several months of investigations into whether the MiG-29s MiG-29 are still in a sufficiently good condition. In the second incident the pilot, who flew a former German MiG-29, died near Paslek because of a problem with the ejection seat. Therefore, all Russian-built aircraft were grounded, although the Su-22 was up again in the air in September and the MiG-29 in November. This had a negative effect on the deployment planning of the Polish Air Force; the Su-22s did not participate in the "Ample Strike" exercise in the Czech Republic in September 2018. And until January 2019, Poland deployed its F-16s for "Baltic Air Policing" in Lithuania, instead of the MiG-29s.

Photo: Boeing



**The Enclosed Weapons Pod (EWP) of the F-18 SUPER HORNET**



## Political Background

Poland is governed by the Law and Justice Party (PiS), which is critical of the EU while being pro-American and supportive of NATO. NATO and the USA also are highly appreciated by the Polish people, who for historical reasons are sensitive to any kind of foreign domination. There are even calls for US troops to be permanently stationed in Poland. And when PiS Defence Minister Mariusz Blaszczak announced the acceleration of the Harpia programme in November 2018, this means that the MoD wants at least some of the new aircraft operational by 2024, which in turn means that deliveries would have to start one to two years before 2024 and the current administration would have to make a type selection in one year and sign a contract in 2020. The Polish colleagues with whom the author spoke in December have doubts that everything would go so smoothly and quickly, because national elections are planned for autumn 2019. There was even the possibility of early elections in the spring, as the budget proposal was delayed. Some claim that the PiS will hold the elections even before the European

### KRUK – the Polish Combat Helicopter Programme

In parallel to Harpia, there is an ongoing effort to replace the Polish helicopter fleet. The first of the Polish Army legacy Mi-24 HINDs will go out of service by 2022. Therefore, from July to September 2019 and under the programme name KRUK ('Raven'), the Polish MoD wants to get answers to an RfI to select a Western-built replacement. Polish Mi-24s were introduced from the USSR from 1979 on, and in 1995, Germany sold former East-German Mi-24Ds to Poland for the symbolic cost of 1,- Deutschmarks per piece. At present, the Polish Mi-24s do not carry any ATGMs; their armament consists of post-Soviet unguided rockets and 12.7mm machine guns. This renders the platform incapable of fighting tanks and precisely striking most targets, especially the moving ones. Therefore, it is planned to acquire 32 new helicopters in two batches of 16 helicopters until 2022 and 16 helicopters after 2022. Probably only the Boeing AH-64D APACHE and the Bell AH-1Z VIPER will be shortlisted. In mid-2018, Italy-based Leonardo and Polska Grupa Zbrojeniowa (PGZ) signed a Letter of Intent to collaborate for the KRUK programme on Leonardo's AW249 combat helicopter. At the moment, there are legal analyses underway regarding the procurement method, and the Polish Armament Inspectorate is awaiting the results, also with regard to the "Basic National Security Interest" document, which would influence the acquisition.

elections at the end of May in order to bring voters who oppose the nationalist ruling party into line, especially in urban areas. PiS faces criticism from the EU Commission, which has recently withheld EU funding from member states whose national legislation violates or undermines the rule of law.

The PiS, which joins the EU sceptics in the Visegrad Group and Italy, is accused by opponents of turning to authoritarianism, and it has recently softened its tone towards the EU. And while a recent Eurostat survey showed that 70% of Poles want to remain part of the EU, Polish surveys show that the PiS would win 37% if national

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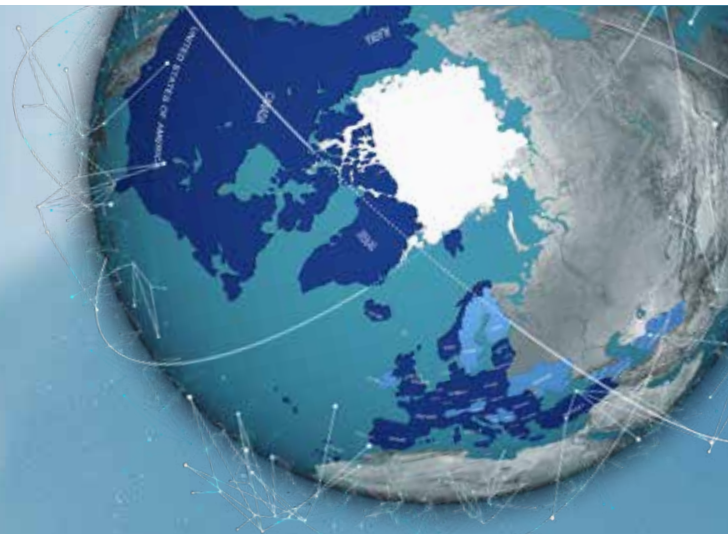
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elections were held now, well ahead of the opposition. All these influences must be seen as political factors when EU-manufactured aircraft compete with the slightly favoured US types.

## The Contenders

Analytical work on the new-generation aircraft began at the end of 2017. Although two tasks have allegedly already been defined, some manufacturers will hesitate until Poland puts down more precise requirements as to which aircraft they should react with, if at all. Obviously, Poland can – at least in part – rely on established and mature aircraft or opt for the introduction of more futuristic platforms. Both options have their own consequences, while all manufacturers of established (gen. 4 and gen. 4+) fighters naturally underline the extent to which the latest versions of their products will extend into the future.

Photo: SPRP



**Polish Defence Minister  
Mariusz Błaszczak**

According to a market analysis of multipurpose combat aircraft manufacturers that might receive a Polish RFP, Saab is expected to offer the JAS-39E/F, Lockheed Martin might offer the F-16/Block-70 or F-35, Boeing the Advanced F-18E/F and Leonardo S.p.A. the latest Eurofighter TYPHOON. Leonardo could also be asked to offer the radar-equipped and armed M-346FA MASTER to replace the Su-22s when it comes to the close air support/precision-strike only. The basic trainer version of the 346 – the so-called BIELIK – is already in service in Poland, with eight aircraft in service and another four aircraft in the pipeline. And then there is the issue of "Fights-On Logistics" which also played a role at the time, when Poland introduced the F-16 jets. It now offers services related to introduction and support of operations of

Photo: Georg Mader



**Roll-out of Saab's GRIPEN-E 39-8**

the new fighter aircraft. When it comes to having advanced electronic counteracting capabilities like heavy jamming or SIGINT, again Saab, Elbit Systems or ELTA Systems might be involved. And this is where Boeing has another advantage with the electronic warfare (EW) version of its EA-18G GROWLER, which has recently evoked Finland's interest. In any case, the 48 to 64 jets to be ordered by Poland should be accompanied by the introduction of a comprehensive logistics package and – another important factor – a range of weapons or the integration of existing ammunition.

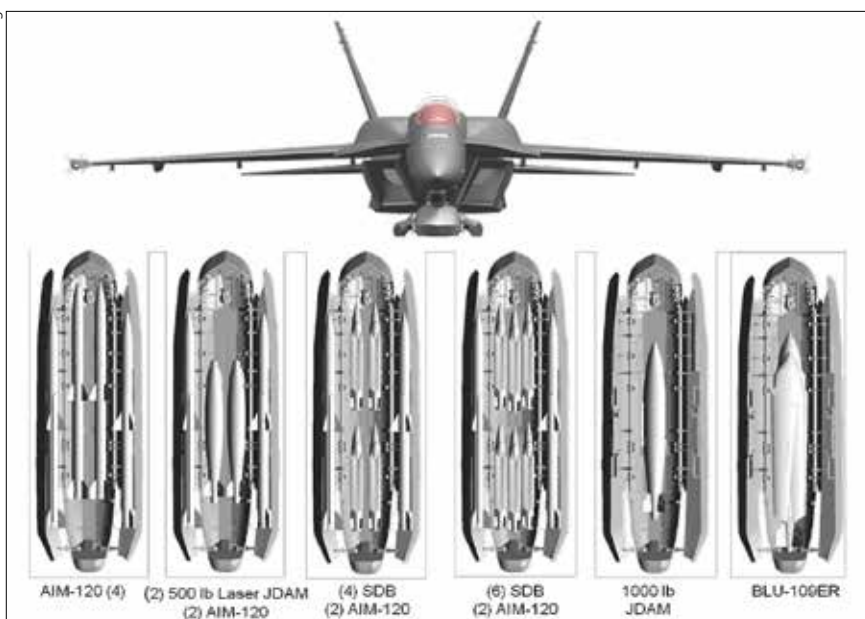
There are several logical reasons why Poland might stay with the F-16, of which it already has 48 in use and whose block 70/72 version (depending on the engine chosen) was officially ordered by Slovakia on 12 December and confirmed by Bulgaria as the preferred platform. In the two NATO partners Bulgaria and Slovakia,

the latest VIPER, which now comes from Greenville, South Carolina, will replace the same MiG-29A/UBs as in Poland.

With 16 aircraft already delivered to Bahrain, all three countries do not have to be launch customers. Block-70 offers a significant increase in combat capabilities compared to the more than 52 machines currently in service in Poland. It is equipped with Northrop Grumman's Scalable Agile Beam (APG-83) AESA radar, a new generation of displays with a large centre-screen, latest communication and data link systems adapted to all activities on the network-centric battlefield. Several solutions – such as the radar – are based on those of the F-35 LIGHTNING II.

On the other hand, the evolution of threats is not taken into account when procuring existing platforms. The Russian anti-access systems in the immediate vicinity of Poland are becoming increasingly sophisticated, with several multi-digit

Photo: Boeing



**Carrying capacity of the SUPER HORNET's enclosed weapons pod (EWP)**



GBAD air defence systems and their tactical aircraft being smaller in numbers yet more efficient. A newer or 5th-generation platform to be procured under the Harpia programme would feature greater survivability in a future high-risk environment. The Lockheed Martin F-35 is the only conceivable platform in this field. Its stealthy features would provide all of Poland's other army branches with an "active, extended sensor", and it would be less susceptible to enemy activity than older platforms. In addition, with the JSF the Polish Air Force could cooperate more closely with Western NATO partners such as Denmark, the Netherlands, Norway and, most recently, Belgium.

However, the JSF is excluded for Poland because of its excessive price tag. While the cost of the latest F-35 is said to have dropped to US\$80M per aircraft, Warsaw, which is not a partner in the JSF programme, would have to bear all costs for the entire ALIS support system and all new facilities for these expensive fighters. Finally, the hangars for the F-35 would have to be hardened, as they are constantly under potential SSM and SRBM threat from Russia. On the other hand, the Eurofighter TYPHOON proposed to Poland by the Italian programme partner LEONARDO would be a genuine and mature multirole air superiority fighter. Originally conceived as an air superiority fighter, it has been continuously modernised over the years to become a fully fledged multirole aircraft with good air-to-air characteristics. It can fly supercruise (going supersonic without afterburner) and has the ability to perform various tasks during a single mission, for example, delivering a "swing role". Expectably, the Polish TYPHOON would be a Tranche-3 aircraft. Like the aircraft delivered to the launch customer Kuwait, the TYPHOON Tranche-3 would feature the E-Scan radar CAPTOR-E, optional saddle-compliant fuel tanks and, of course, the highly regarded European BVR missile MBDA METEOR.

While a TYPHOON armed with ALCMs like STORM SHADOW or TAURUS is thinkable, an open question would be how to integrate the 40 Lockheed Martin AGM-158A Joint Air-to-Surface Standoff Missiles (JASSM) delivered for the Polish F-16s in early 2017 (with a range of 370 km) and the 40 to 70 powered AGM-158B JASSM-ER (with a range of 900 km) approved by the US authorities in 2016. These two standoff missiles might be a unique advantage for all US aircraft. On the other hand, the Eurofighter TYPHOON might come with a comprehensive defence cooperation package, with

Polish industry joining the consortium and being part of the European cooperation system and other projects coming up in the future.

Saab's latest GRIPEN version JAS-39E/F, developed for Sweden and Brazil, is also a European programme, although the platform is equipped with a US GE414 engine. It can do supercruise, integrates METEOR missiles (also in the current MS-20 version of its C/D version) and plans to integrate European air-to-ground missiles, but not yet the JASSM. The aircraft is expected to be marketed in Poland with the lowest operating and life cy-



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cle costs of any competitor. However, in Romania, Slovakia, Bulgaria or Croatia, where Saab held reasonable hopes, this valuable argument did not bear fruit; all

In combination with the massive conformal fuel tanks, the F/A-18H – while looking frontally hunchbacked – could reduce its radar signature by up to 50% and is

tioned earlier, its delivery ‘footprint’ cannot be as massive like that of the FITTER. If splitting the platforms or supplementing the new mainstay would be considered, an armed and radar-equipped LEONARDO M-346FA (Fighter Attack) might also be an option. According to Marco Lupolt, Leonardo’s Warsaw office director, its other advantages are low maintenance costs and the ability to use advanced sensors and on-board systems (multi-mode GRIFO radar, opto-electronic devices, EW). Lupolt also pointed out that such a version is fully compatible with the AJT version of the M-346 already in operation by Poland at the 41st Training Aviation Base in Dęblin.

### Not To Be Underestimated

New combat aircraft require new training systems and infrastructure, which is both time-consuming and expensive. In addition, taking full advantage of the capabilities of platforms that can operate in a network-centric environment means having robust C4 systems that are resistant to an enemy’s countermeasures.

Poland’s location and the role that new fighters will play, especially in the first phase of a conflict and in anticipation of Allied support, cannot be overestimated. Like the WISŁA and NAREW systems (long-range artillery and electronic and cybernetic warfare systems), Harpia is a key building block for Poland’s entire defence posture. It will be crucial for Warsaw to have sufficient capabilities and to make a necessary qualitative leap in aviation, albeit on a larger scale than when the F-16 was introduced a decade ago.

However, Poland’s recent attempt to introduce a completely new system somehow contradicts the need to speed up the existing programme, taking into account not only the production timetables but also the time needed to integrate the new aircraft into the armed forces. Perhaps the Poles will come up with a solution to combine both ways and implement Harpia in stages; first by introducing existing fourth and higher generation aircraft to solve the most urgent operational capacity problems and to ensure continuous training of crews, and later complementing them with newer fifth-generation platforms. Such an approach may also be more advantageous from an economic and political point of view.

One thing is certain: the implementation of the billion-dollar programme Harpia is and will remain for decades the most important priority of the MoD, the armed forces, and the entire nation of Poland. ■

Photo: Georg Mader



**An M-346 FA with ordnance**

these countries have opted for different F-16 versions, although the Croatian-Israeli deal has now collapsed and a new tender is expected. Nevertheless, a certain advantage is that the GRIPEN is built for and operates from prepared Swedish road strips which is a thing the Poles regularly do as well.

described by BOEING as capable, flexible and powerful to fundamentally modernise the air or naval forces of any country. The F/A-18H’s Raytheon AN/APG-79 multimode AESA tactical radar provides passive detection and active radar suppression modes of operation to provide air-to-air or air-to-ground targeting,

Photo: Sily Powietrzne



**Close-up of a Polish F-16C-50**

The latest Block III export version of the old HORNET, marketed by BOEING as the F/A-18H ADVANCED SUPER HORNET, is a large twin-engine, carrier-optimised fighter, but the latter characteristic does not prevent Finland, Malaysia or Switzerland from operating its C/D predecessor from land, and Poland also does not have an aircraft carrier. The speciality of Block III HORNETs are stealthy external weapon pods (EWP) which carry various pieces of explosive ordnance; these pods make the aircraft more aerodynamic and at the same time reduce its radar cross-section.

tracking and self-protection. Earlier SUPER HORNETs feature a Block-I passiveIRST sensor only since 2017, while the latest model will have LM’sIRST21 sensor. Aside from the F-35, the F/A-18H might come with the most advanced cockpit layout of any contender, arranged around an Elbit Systems USA-developed sizeable 10x19 inch HD-display with touch-screen and picture-in-picture capabilities, optimising tactical situation displays, processing advanced applications and providing high-definition formats for advanced sensor-video presentations. As men-



# Royal Netherlands Air Force F-35A on Its Way to Become Operational

Jürgen K.G. Rosenthal

Lieutenant-General Dennis Luyt, Commander, Royal Netherlands Air Force (RNLAf) said: "We want to be among the best air forces of the world, and the F-35 as a platform allows us to do that." On 30 January 2019, Dutch and American political and military officials celebrated the rollout of the first operational F-35A LIGHTNING II for the RNLAf at the Lockheed Martin facility in Fort Worth, Texas. "Receiving this F-35 at Leeuwarden Air Base later this year is going to be a huge driver for change for our air force and will have tremendous impact on the relevance of our air force as part of the coalition."

The first two Dutch F-35As, serial numbers F-001 and F-002, were already delivered by Lockheed Martin in 2013 and are undergoing operational testing. The first operational F-35A LIGHTNING II for the RNLAf, F-003, is scheduled to train and educate pilots at Luke Air Force Base, Arizona, and in 2019 seven F-35As will be delivered to the RNLAf, five of which are for pilot training at Luke Air Force Base and two will be manufactured in Italy and deployed at Leeuwarden Air Base. The F-35A LIGHTNING II is the variant for air forces and thus only suitable for conventional takeoffs and landings on paved surfaces. The Netherlands' total contract volume comprises 37 F-35A. Deliveries will be completed by 2023.

In her address, Marillyn Hewson, Chairman, President and Chief Executive Officer of Lockheed Martin, underlined the significance of the Netherlands assuming an increasingly important role on the European market. This is also reflected by the participation of 25 Dutch defence companies in the production of the F-35, both for the Dutch requirement and for allied forces in Northern Europe. Furthermore, the Dutch industry has positioned itself very well in the areas of maintenance, repair and modernisation to support other European customers. Kevin Fahey, Assistant Secretary of Defense for Acquisition, USA, emphasised the successful cooperation of both nations in the development and pro-



Photo: J. Rosenthal

**Lt. Gen. Dennis Luyt:** "We want to be among the best air forces of the world."

duction of the aircraft. He regards the fighter as the future backbone of the air forces of the western world.

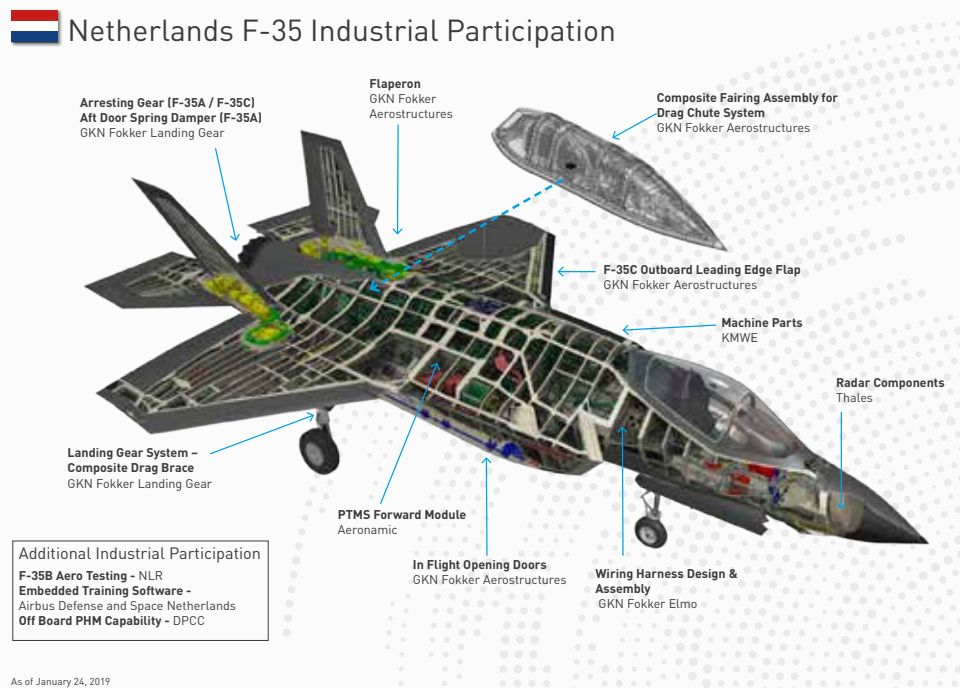
Dutch Minister of Economic Affairs Mona Keijzer explained that the noise generated by a Dutch F-35 gave her the impression of the "sound of freedom". She supports the close

cooperation of the Dutch companies with Lockheed Martin in the F-35 programme and the combat mission of the RNLAf.

Lt. Gen. Luyt emphasised his country's determination to become an outstanding military force in Europe. He said that the F-35A was an important step for the Netherlands to achieve this objective. With the commissioning of the F-35A, GenLt Luyt sees his nation as part of the "Champion's League of the air forces".

The Joint Strike Fighter F-35 LIGHTNING II combines advanced stealth technology in a highly agile supersonic aircraft, which provides the pilot with unprecedented situational awareness and unmatched lethality and survivability. The F-35 sets new standards in the network-enabled mission system, sensor fusion and supportability, and with its advanced sensor package can gather and distribute more information than any fighter before. The F-35 is a powerful force multiplier that enhances all airborne, surface and ground-based assets in the battlespace enabling pilots to execute their mission. In Lockheed Martin's words, the F-35 is more than just a fighter aircraft and redefines the multirole fighter. ■

Photo: Lockheed-Martin



**25 Dutch companies cooperate with Lockheed-Martin in the F-35 programme.**

## Author

**Jürgen K.G. Rosenthal** is Editor-in-Chief of the German military magazine *Hardthöhenkurier*.

## FCAS Concept Study Awarded

(df) France and Germany have awarded the first contract - a Joint Concept Study (JCS) - for the development of the Future Combat Air System (FCAS) to Dassault Aviation and Airbus. The launch of the JCS was announced at a Paris meeting between Defence Minister Ursula von der Leyen and her French counterpart Florence Parly. It has also been announced that Spain is to join

Artwork: Dassault



the project. "The decision is groundbreaking for securing Europe's sovereignty and technological leadership in military aviation for decades to come. The start date for the two-year study is 20 February 2019," both companies wrote in a joint communication. "The planned next-generation weapon system will consist of a powerful, manned New Generation Fighter (NGF) with new and enhanced weapons and a series of unmanned systems (remote carriers). Both are linked by a Combat Cloud and embedded in a System of Systems architecture." This contract is the second step in the agreement that began with Dassault Aviation and Airbus Defence and Space's joint agreement to develop and build the Future Combat Air System in 2018. The aim is to develop basic concepts for key components such as the Next Generation Fighter (NGF), Remote Carriers (RCs) and a System of Systems as well as related next generation services. The concepts thus developed are to be tested for operational and technical readiness as well as programmatic feasibility and lead to the definition of common demonstrators and technical requirements. "FCAS is one of the most ambitious European defence programmes of this century," said Dirk Hoke, CEO of Airbus Defence and Space. Eric Trappier, Chairman and CEO of Dassault Aviation, added: "This next step is critical to securing Europe's strategic autonomy. Dassault Aviation will contribute its expertise in systems architecture and integration to meet the requirements of the countries involved and secure Europe's leadership position in the strategically important field of air combat systems."

## USAF AWACS Aircraft Upgrade

(df) IDE (INTRACOM Defense Electronics) of Greece has announced the signature of a contract with US company Boeing for the

US Air Force (USAF) Airborne Warning and Control System (AWACS) aircraft upgrade programme. Boeing will benefit from association with one of the largest multinational technology groups of Greece: IDE possesses expertise in design, development and manufacture of products and systems that incorporate leading, self-developed technologies in tactical military communications, information security, command and control systems (C2), surveillance, reconnaissance and security systems, hybrid electric power systems, various unmanned vehicles (UAVs and USVs), missile electronics, and military software applications. IDE participates in several other international development and production programmes, as well as in international cooperation for the production and export of defence equipment, and is a registered NATO supplier. Customers and end-user include the Czech Republic, Cyprus, Finland, France, Germany, Indonesia, Lithuania, Luxembourg (NATO/NSPA), Spain, Sweden, the UK and the USA.

## Oshkosh Wins US Army Heavy Vehicle Fleet Contract

(jh) Oshkosh Defense, LLC, an Oshkosh Corporation company, has announced that it has been awarded a US\$232.7M delivery order from the US Army Tank-Automotive and Armaments Command (TACOM) to recapitalise vehicles in the Army's Family of Heavy Tactical Vehicles (FHTV) fleet. Recapitalisation involves vehicles being stripped to the chassis rails, rebuilt to the latest configuration and returned to the fleet in zero-mile, zero-hour condition with the same technology, safety features, bumper-to-bumper warranty and life cycle cost advantages of a new vehicle. The contract covers a total of 407 Heavy Expanded Mobility Tactical Trucks (HEMTT) and Palletized Load System (PLS) trucks as well as manufacturing 601 new PLS trailers. The HEMTT and PLS have been in the Army's fleet since 1981 and 1990 respectively, and Oshkosh has been performing recapitalisation services on these vehicles since 1995: in total, Oshkosh has recapitalised over 12,500 HEMTTs and 3,000 PLS trucks since 1995.

## Tyron Establishes Thai Production Facility

(jh) A new 43,000sq.ft. production facility has been established by Tyron Runflat in Thailand. Called Tyron Rubber and with its own management structure, the production line will enable the company to extend its current production capability for All Terrain Rubber runflat systems by 14,000 units per annum. Previously, Tyron Runflat out-

sourced manufacture of its ATR to a third party; this facility will enable the company to take full control through its new subsidiary and ensure that quality is at the highest

Photo: Tyron Runflat



level. According to the company the new facility allows it to reduce the supply chain distances, and hence its carbon footprint, as it is able to source the staple of its product, natural rubber, from local suppliers. In addition it expects to source quality tooling from Thai toolmakers at 50% of the price in the UK with the result that it can turn a new design from idea to production in less than eight weeks. The Tyron All Terrain Rubber (ATR) runflat is a patented device, in service with several armies. In simple terms it creates a platform for the tyre to run on and it incorporates a beadlock so that in the event of a puncture, blow-out or ballistic attack, the vehicle can continue its mission or get back to base and the tyre does not slip on the wheel and the vehicle maintains mobility. Tyron has tested these against the Finabel standards, the international standards authority, and proven that its runflats are capable of running at 50km/h for over 100 kilometres. For more details see ESD issue 1/2019.

## WFEL Receives Award

(jh) UK military bridge manufacturer WFEL has announced that it has been awarded the Armed Forces Covenant Employer Recognition Scheme (ERS) Bronze Award, which acknowledges WFEL's support to Defence and the wider armed forces community. In 2018, WFEL signed the Armed Forces Covenant, affirming its pledge to uphold the Covenant. This is a promise by the nation, enshrined in UK law, to those who serve or who have served in the armed forces, and their families, that they are treated with fairness and respect in the communities, economies and societies they serve with their lives. WFEL demonstrates its support through a number of initiatives, such as employing former service personnel and also reservists who continue to serve their country, as well as actively supporting Armed Forces charities such as Combat Stress.

## Equipment Contract for Royal Navy

(ck) The UK MoD has awarded Babcock a Configuration Management Contract for



the Royal Navy (RN) and the Royal Fleet Auxiliary (RFA) surface ship fleet. The four year contract, with potential extensions, will see Babcock assume responsibility for the Surface Ship Definition Database (SSDD), a tool used for the management of platform related data. The Master Record Data Centre (Ships), or MRDC (Ships), the core facility for ship configuration services, is to ensure that the necessary equipment is available when and where required to meet RN and RFA demand; it will deliver activities including Equipment Ship Fit Configuration, Ship Datum Document Configuration, and Defect Report Management. The SSDD interfaces with several MoD systems.

### Naval Group and Royal IHC to Partner

(ck) Royal IHC and Naval Group will partner in the bid for the Netherlands' submarine replacement project. Together, they intend to form a core team to which both partners bring their complementary experience and expertise in designing naval defence systems. Naval Group has a track record in building submarines through industrial cooperation with local companies, for example in Australia, Brazil and India, while Royal IHC is an experienced ship integrator. By partnering, the two countries intend to propose a competitive solution to the Royal Netherlands Navy. Naval Group would define the submarine design with the Dutch authorities, while Royal IHC would perform the construction and outfitting of the end product, leveraging the Dutch maritime sector. According to Naval Group, the agreement will allow maximum involvement of the Dutch maritime industry. Over the next months, Naval Group and Royal IHC will review potential building sites in the Netherlands.

### New Appointments to Airbus Helicopters Executive Committee

(gwh) In April 2019, Alain Flourens (left) will take over as Head of Industry on the

for Airbus Helicopters, who will thus move up to the Executive Committee. Flourens was Head of the A380 Programme, the Single Aisle Programme and the Airbus Centre of Excellence at Airbus Commercial Aircraft, where he was Executive Vice President. He joined Airbus Helicopters in 2017. Thomé held several senior positions at Airbus Helicopters before joining Airbus Defence & Space in 2018. From 2013 to 2018, he was Head of Vehicle Integration & Doors Engineering, where he managed all related activities for Airbus Helicopters.

### New FLIR Service Centres

(ck) FLIR Systems has opened regional service centres in Frankfurt, Germany and Dubai, United Arab Emirates, to support its customers that use chemical, biological, radiological, nuclear, and explosives (CBRNE)

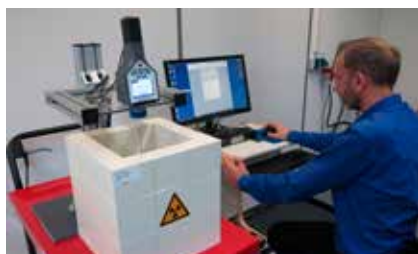


Photo: FLIR Systems

threat detection products. The new service centres will provide FLIR's CBRNE product customers with maintenance and support for specific product families. The Frankfurt facility supports legacy FLIR identiFINDER and identiFINDER-R400 products, formerly known as the identiFINDER-2, while Dubai supports the Fido X2 and X3 products. FLIR's Frankfurt facility will also provide free identiFINDER training courses for customers. The courses will cover radiation detection handheld devices and their related software, and the FLIR RAD mobile app for iPhone and Android devices through a mixture of lectures, demonstrations, and hands-on experience. Courses will begin in the third quarter of 2019.

### FLIR to Buy Robotics Developer

(ck) FLIR Systems will acquire Endeavor Robotic Holdings, Inc., a developer of tactical unmanned ground vehicles (UGVs) for military, public safety, and critical infrastructure markets, for US\$385M. Endeavor's mobile ground robots provide explosive ordnance disposal, reconnaissance, inspection, and hazardous materials support for troops, police, and industrial users at stand-off range. Along with the recent acquisition of Aeryon Labs, FLIR has significantly expanded its capabilities in unmanned systems. Endeavor has sold



Photo: FLIR

more than 7,000 UGVs to customers in more than 55 countries, and is the largest UGV provider to the US DoD. Recently, Endeavor was awarded the US Army's Man Transportable Robotic System Increment II (MTRS Inc II) contract.

### Marshall Containers for Denmark

(ck) The Danish Ministry of Defence Acquisition and Logistics Organisation (DALO) has contracted Marshall Aerospace and Defence Group to provide advanced communications and networking containers as part of its programme to update the Danish Armed Forces deployable infrastructure. Marshall will be supplying more than 40 containers as part of this multi-million Euro contract. The containers will be supplied with air conditioning, electrical power distribution and will be fitted with a full suite of intruder and EMC protection assets. Internally, the containers will be fitted with computer, communications and network equipment.



Photo: Marshall

### MTU AE and Safran to Cooperate

(ck) In the presence of the French and German Ministers of Defence, Florence Parly and Ursula von der Leyen respectively,



Photo: MTU AE

Safran Aircraft Engines and MTU Aero Engines signed a partnership agreement to lead, jointly, the development, the production and the after-sales support activities of the new engine that will power the next-generation Franco-German Future



Photos: Airbus

Executive Committee of Airbus Helicopters. He succeeds Christian Cornille, who has left the Group. Flourens will be succeeded by Stefan Thomé (right) as Head of Technology

Combat Air System (FCAS). The aircraft will enter into service by 2040 to complement the current generation of EUROFIGHTER and RAFALE fighter aircraft. Under the terms of the agreement, Safran will take the lead in engine design and integration, and MTU will take the lead in engine services. MTU will be in charge of the low and high-pressure compressors and the low-pressure turbine, while Safran will be responsible for combustor, high-pressure turbine and the afterburner. The existing joint venture Aerospace Embedded Solutions (AES) will be in charge of the engine control hardware and software. The intention is to achieve a balanced French-German industry programme share.

### NATO Hub for Cyber Defence

(ck) The NATO Communications and Information (NCI) Agency, NATO's technology and cyber agency, has set up a new community for cyber defenders across the Alliance. On 12 February 2019, Allied Computer Emergency Response Teams from the first set of five Nations – Belgium, France, the Netherlands, the UK,

and the US, were connected to NATO's protected business network, which will allow nations quickly and securely to share information with each other, and with the Agency. The network provides an encrypted workspace with secure video, voice, chat and information gathering. Access to the network will roll out to all 29 Nations later this year, which will enable the NCI Agency to begin creating an information hub for Allies called the Cyber Security Collaboration Hub, which is only one of the Agency's recent innovations to better secure NATO's networks.

### Submarines for Australia

(ck) Australia has contracted Naval Group with the design, production, and delivery of 12 submarines. According to the Future Submarine Program Strategic Partnering Agreement (SPA), Naval Group will deliver 12 regionally superior submarines with leading edge capabilities and new technologies and advanced manufacturing capabilities to Australia. The signing of the contract marks the end of a fierce competition for a successor to the six Australian COLLINS class submarines.



Photo: Naval Group

Naval Group was able to prevail against Japanese, Swedish, Spanish and German competitors in a deal worth around €31Bn. Observers suspect that talks between French President Emmanuel Macron and Australian Prime Minister Scott Morrison on the sidelines of the G20 meeting in Argentina in November 2018 ultimately played a decisive role. The first submarine, HMAS ATTACK, is scheduled for completion in the early 2030s. Australia expects knowledge transfer as well as the preservation of jobs in a strongly battered shipyard landscape. The shipyard is expected to be Osborne South Australia, Adelaide. 169 Australian suppliers have been pre-qualified as suppliers for Naval Group. The suppliers of the top five pieces of equipment including the main motor, diesel generators, switchboards, batteries and weapons discharge systems have been reviewed and will be announced in 2019.

## Preview

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